# Installation, Operation, and Maintenance

## Cold Generator™ Compact Chiller Series
## Model CICA

20, 30 and 50 Tons (60 Hz)
R-410A

**⚠ SAFETY WARNING**

**Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.**

November 2015 **CG-SVX028A-EN**

# Introduction

Read this manual thoroughly before operating or servicing this unit.

## Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

**⚠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, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

***NOTICE*** Indicates a situation that could result in equipment or property-damage only accidents.

### Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

### Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

**⚠WARNING**

### Proper Field Wiring and Grounding Required!

**Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.**

**⚠WARNING**

### Personal Protective Equipment (PPE) Required!

**Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:**

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

**⚠WARNING**

**Refrigerant under High Pressure!**

**Failure to follow instructions below could result in an explosion which could result in death or serious injury or equipment damage. System contains oil and refrigerant under high pressure. Recover refrigerant to relieve pressure before opening the system. See unit nameplate for refrigerant type. Do not use non-approved refrigerants, refrigerant substitutes, or refrigerant additives.**

## Copyright



## Trademarks

All trademarks referenced in this document are the trademarks of their respective owners.

# Table of Contents


Introduction . . . . . 2
Warnings, Cautions, and Notices . . . . . 2
Copyright . . . . . 3
Table of Contents . . . . . 4
Model Number Descriptions . . . . . 5
General Information . . . . . 6
Unit Description . . . . . 6
General Data . . . . . 6
Unit Components . . . . . 7
Pre-Installation . . . . . 9
Electrical Data . . . . . 10
Dimensions and Weights . . . . . 11
Unit Dimensions . . . . . 11
Service Clearances . . . . . 12
Weights . . . . . 12
Installation Mechanical . . . . . 13
General Installation Information . . . . . 13
Storage . . . . . 13
Noise Considerations . . . . . 13
Foundation . . . . . 13
Clearances . . . . . 14
Ventilation . . . . . 14
Drainage . . . . . 14
Handling . . . . . 14
Access Restrictions . . . . . 15
Compressor Mounting . . . . . 15
Direct Mounting . . . . . 15
Unit Leveling . . . . . 15
Compressor Nameplate . . . . . 15
Evaporator Nameplate . . . . . 16
Condenser Nameplate . . . . . 16
Unit Piping . . . . . 16
Installation Electrical . . . . . 21
General Recommendations . . . . . 21
Equipment Grounding . . . . . 22
Unit Power Wiring . . . . . 22
Control Power Supply . . . . . 22
External Contacts and Peripherals . . . . . 23
Controls Interface . . . . . .24
Unit Controller — General . . . . . .24
Unit Controller Software Installation and Setup . . . . . .24
Unit Start-Up Procedures . . . . . .26
Pre-Start . . . . . .26
Sequence of Operation . . . . . .26
Checking Operating Conditions . . . . . .27
System Superheat . . . . . .27
System Sub-cooling . . . . . .27
Shut Down . . . . . .28
Normal Unit Shutdown . . . . . .28
Extended Shutdown Procedure . . . . . .28
Unit Restart . . . . . .28
Maintenance . . . . . .29
Periodic Maintenance . . . . . .29
Compressor Maintenance . . . . . .29
Wiring . . . . . .32
Appendix A Warranty . . . . . .36
Appendix B Vendor Data Sheets . . . . . .38
MCS-CT300 Current Sensor Data Sheet . . .39
MCS-667 Pressure Transducer Data Sheet 40
MCS-T100 Temperature Sensor Data Sheet . . . . . .41
Appendix C . . . . . .42
Piping System Flushing Procedure . . . . . .42
Water Treatment Requirements . . . . . .42

# Model Number Descriptions

### Digits 1-4 — Unit Type

CIC = Compact indoor chiller

### Digit 4 — Model

A = Model A
Brazed Plate Evaporator and
Brazed Plate Condenser

### Digits 5-7 — Nominal Tons

020 = 20 nominal tons
030 = 30 nominal tons
050 = 50 nominal tons

### Digit 8 — Unit Voltage

A = 208/60/3
B = 230/60/3
F = 460/60/3
G = 575/60/3

### Digits 9, 10 — Design Sequence

** = Factory Assigned

### Digit 11 — Agency Listing

E = ETL/ETL-C listed to meet US and Canadian safety standards

### Digit 12 — Remote Interface (Digital Comm)

0 = None
2 = LonTalk®
4 = BACnet® MS/TP
5 = BACnet IP
6 = Modbus™
8 = Johnson N2

### Digit 13 — Water Piping Package Evaporator Entering

0 = None — without piping package
1 = 2-inch chilled water piping
2 = 2.5-inch chilled water piping
3 = 3-inch chilled water piping
4 = 4-inch chilled water piping
5 = 5-inch chilled water piping

### Digit 14 — Water Piping Package Evaporator Leaving

0 = None — without piping package
1 = 2-inch chilled water piping
2 = 2.5-inch chilled water piping
3 = 3-inch chilled water piping
4 = 4-inch chilled water piping
5 = 5-inch chilled water piping

### Digit 15 — Water Piping Package Condenser Entering

0 = None — without piping package
1 = 2-inch chilled water piping
2 = 2.5-inch chilled water piping
3 = 3-inch chilled water piping
4 = 4-inch chilled water piping
5 = 5-inch chilled water piping

### Digit 16 — Water Piping Package Condenser Leaving

0 = None — without piping package
1 = 2-inch chilled water piping
2 = 2.5-inch chilled water piping
3 = 3-inch chilled water piping
4 = 4-inch chilled water piping
5 = 5-inch chilled water piping

### Digit 17 — Motorized Control Valves

0 = None — manual balancing isolating valves only
1 = Integral discharge pressure control condenser water regulating valve
2 = Motorized chilled water isolating valve
3 = Both chilled water and condenser water control valves

### Digit 18 — Evaporator Temperature Range

0 = Standard cooling
42 to 60°F (5.6 to 15.6°C)
1 = Standard cooling/ice-making
20 to 60°F (-6.7 to 15.6°C)

### Digit 19 — Power Connection

D = Non-fused disconnect switch
F = 100kA SCWR fused disconnect Switch

### Digit 20 — Sound Attenuator

0 = No sound attenuation
3 = Compressor sound blankets
4 = Factory sound enclosure cabinet
5 = Both sound enclosure cabinet and compressor blankets

### Digit 21 — Power Monitor

0 = None
1 = With power monitor

### Digit 22 — Neoprene Isolators

0 = None
1 = Neoprene isolators (ship loose)

### Digit 23 — Evaporator Fluid Type

0 = Water
2 = Ethylene glycol
3 = Propylene glycol
4 = Methanol

### Digit 24 — Condenser Fluid Type

0 = Water
2 = Ethylene glycol
3 = Propylene glycol

### Digit 25 — Special Options

0 = None
1 = With special option(s)

# General Information

## Unit Description

Model CICA Cold Generator™ Compact Series water-cooled chillers are designed for installation on a prepared surface in a suitable, weatherproof location above freezing (32°F). Each unit consists of a manifolded scroll compressor set piped in parallel, a brazed plate evaporator, a brazed plate condenser and control box with integral control panel—all mounted on a common frame.

Each unit is a completely assembled package that is factory-piped, wired, leak-tested, dehydrated, charged and run-tested for proper control operation before shipment. Water inlet and outlet openings are covered before shipment. CICA units are shipped with an operating charge of refrigerant and oil.

## General Data

**Table 1. General data**

| Size | | 20 | 30 | 50 |
|---|---|---|---|---|
| **Compressor** | | | | |
| Quantity | | 2 | 2 | 2 |
| Nominal Tons @ 60 Hz | tons | 10/10 | 15/15 | 25/25 |
| Compressor Sound Data[a] | dbA | 78 | 81 | 89 |
| Compressor Sound Data with Sound Attenuator[b] | dbA | 72 | 75 | 85 |
| **Evaporator** | | | | |
| Water Storage | gal | 2.4 | 3.2 | 4.5 |
| Minimum Flow | gpm | 30 | 45 | 70 |
| Maximum Flow | gpm | 68 | 102 | 170 |
| **Condenser** | | | | |
| Water Storage | gal | 3.3 | 5.6 | 10.1 |
| Minimum Flow | gpm | 40 | 60 | 100 |
| Maximum Flow | gpm | 68 | 102 | 170 |
| **General Unit** | | | | |
| Refrigerant | | R-410A | R-410A | R-410A |
| Number of Independent Refrigerant Circuits | | 1 | 1 | 1 |
| Refrigerant Charge per Circuit | lbs | 21 | 26 | 44 |
| Oil Type | | Trane OIL00080 | Trane OIL00080 | Trane OIL00080 |
| Oil Charge per Compressor | oz | 112/112 | 122/122 | 228/228 |

(a) Compressor manufacturer sound power is given at rated compressor AHRI conditions measured in free space for tandem compressor sets.
(b) Manufacturer data taken at compressor AHRI conditions measured in free space for tandem compressor sets using compressor blanket option.

# Unit Components

**Figure 1. Unit components - front**

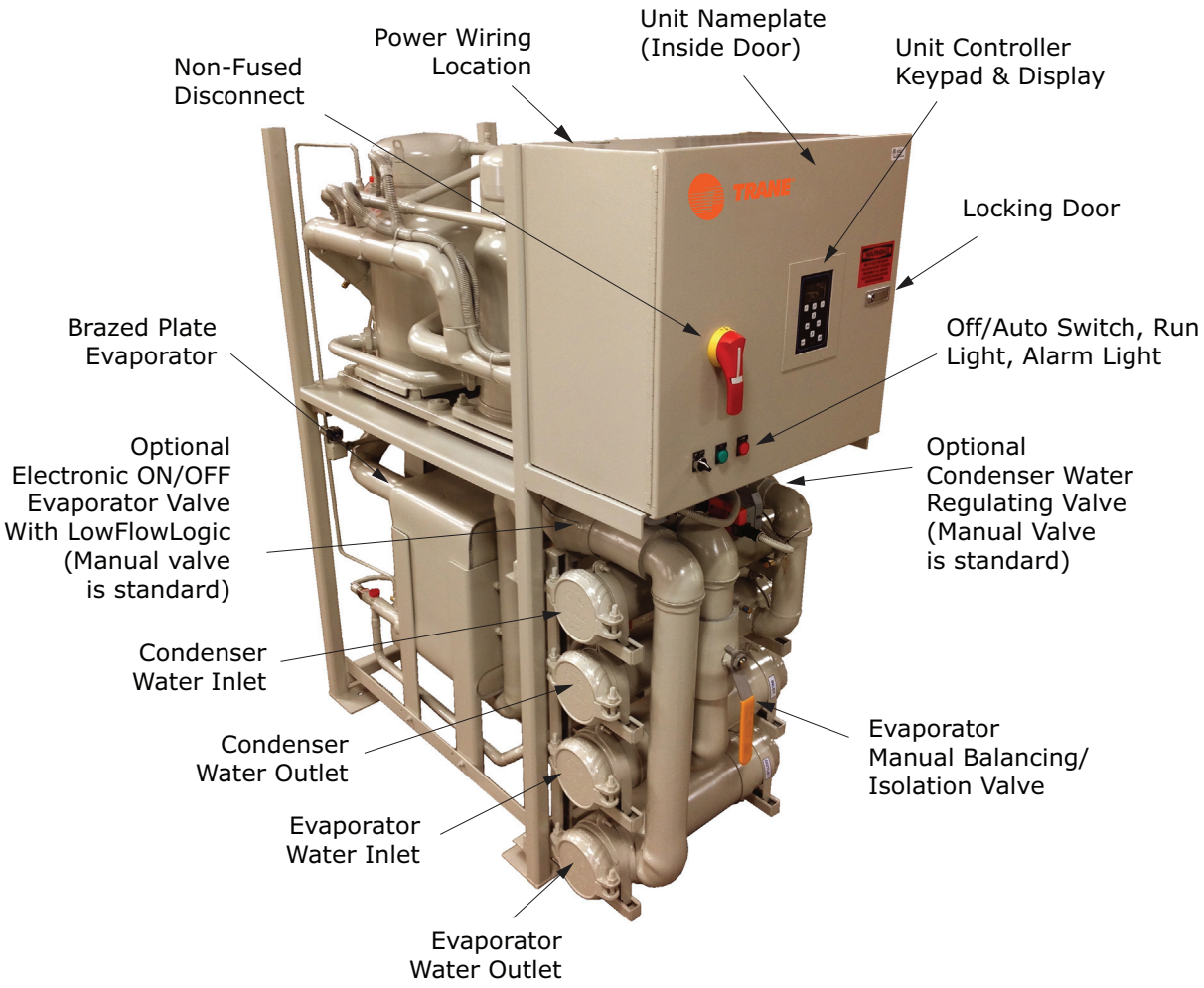
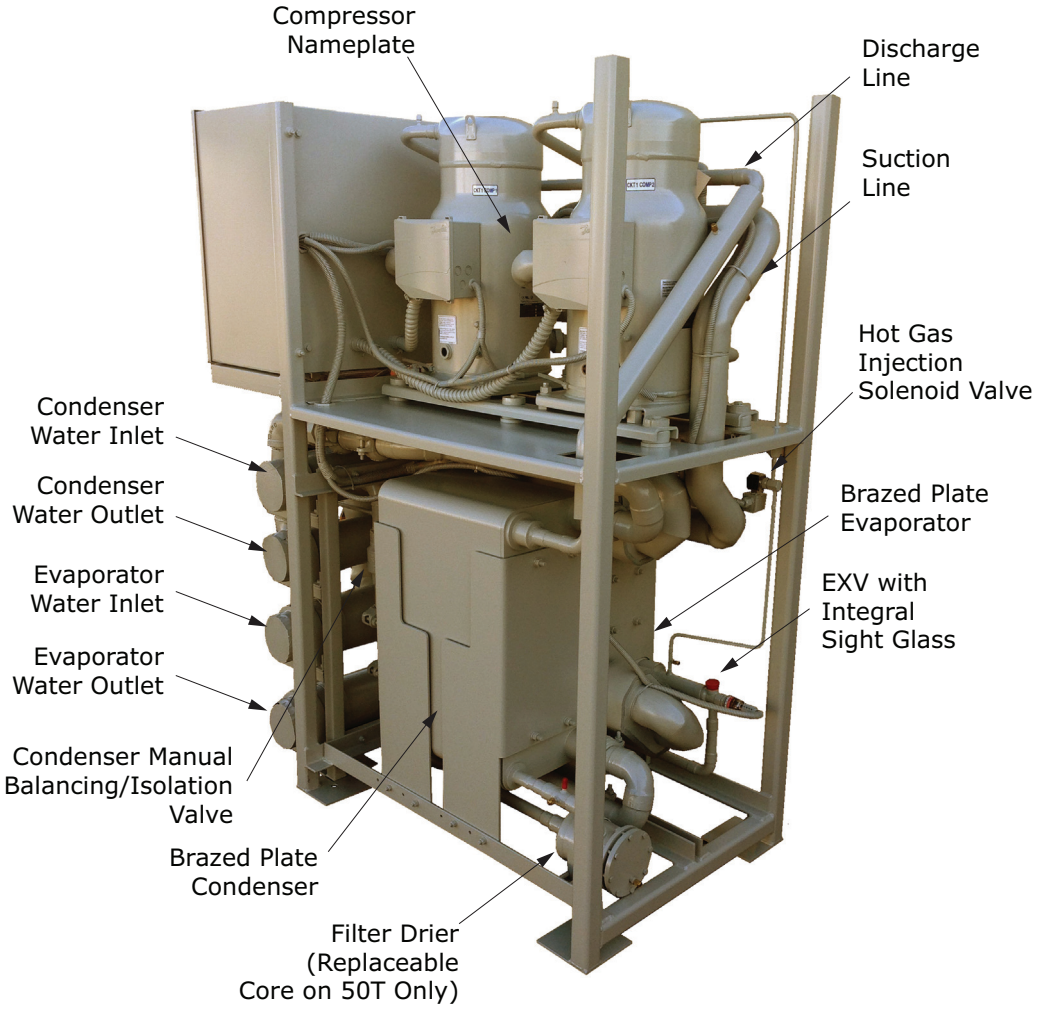


**Figure 2. Unit components - back**



# Pre-Installation

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit. A more in depth list is included with the packing list adhered to the side of the shipping crate.

- Inspect the individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.
- Inspect the unit for concealed damage as soon as possible after delivery and before it is stored. Concealed damage must be reported within 15 days.
- If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged 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 the damage immediately, by phone and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee.
- Notify the Trane sales representative and arrange for repair. However, do not repair the unit until damage is inspected by the carrier's representative.

After completing the inspection checklist, identify the unit with the unit nameplate, packing list and ordering information. The unit nameplate is mounted inside the control box.

See "Model Number Descriptions," p. 5 for additional data that can be found on the nameplate.

Check all items against the shipping list. Verify that it is the correct unit and that it is properly equipped. If optional neoprene or spring isolators (or other ship-loose items) are ordered, they are secured in place on the shipping skid or inside the unit control box.

This Installation, Operation and Maintenance manual, the Controls IOM, checklists and other pertinent documents can also be found in the unit control box. Be sure to read all of this literature before installing and operating the unit.

# Electrical Data

**Table 2. Electrical data**

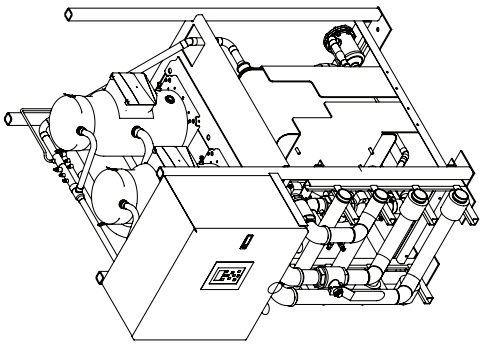
| Size | Rated Voltage | Compressor Qty | Compressor # Refrigerant Circuits | Compressor Nominal Tons | Compressor RLA (each) | Compressor LRA (each) | Control kW | Unit Wiring Minimum Circuit Ampacity | Unit Wiring Max Fuse Size | Unit Wiring Recommended Dual Element Fuse Size |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | 200-230/60/3 | | | | 39 | 267 | 0.21 | 88 | 125 | 100 |
| | 460/60/3 | 2 | 1 | 10/10 | 19 | 142 | 0.21 | 42 | 60 | 50 |
| | 575/60/3 | | | | 15 | 103 | 0.21 | 35 | 50 | 40 |
| 30 | 200-230/60/3 | | | | 48 | 351 | 0.21 | 108 | 150 | 125 |
| | 460/60/3 | 2 | 1 | 15/15 | 25 | 197 | 0.21 | 56 | 80 | 60 |
| | 575/60/3 | | | | 22 | 135 | 0.21 | 50 | 70 | 60 |
| 50 | 200-230/60/3 | | | | 82 | 560 | 0.21 | 185 | 250 | 225 |
| | 460/60/3 | 2 | 1 | 25/25 | 40 | 260 | 0.21 | 89 | 125 | 100 |
| | 575/60/3 | | | | 29 | 210 | 0.21 | 65 | 90 | 70 |

**Notes:**
1. Use copper conductors only.
2. Local codes may take precedence.
3. Voltage Utilization Range: ± 10% of rated voltage. Rated voltage (use range): 200-230/60/3 (180-253), 460/60/3 (414-506), 575/60/3 (517-632).

# Dimensions and Weights

## Unit Dimensions

**Figure 3. Dimensional drawing**



**All Dimensions are for Standard Flowrates***

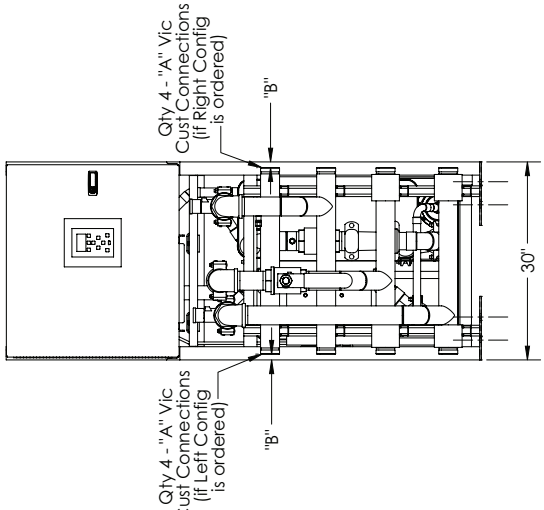
| For Single Chiller | "A" | "B" |
|---|---|---|
| CICA020 | 2" | 1" |
| CICA030 | 2-1/2" | 7/8" |
| CICA050 | 2-1/2" | 7/8" |

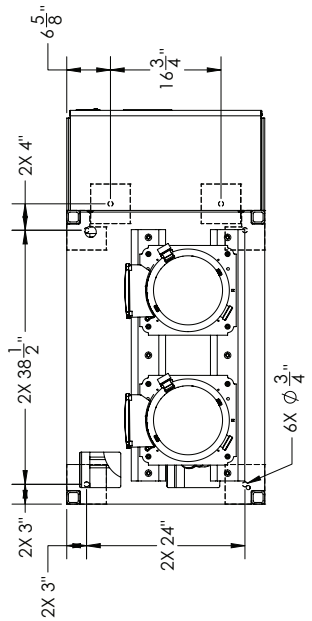
"A" Dimension = Customer connection size (Victaulic Sch 40 Pipe Size) for a single chiller with standard flowrates ONLY*

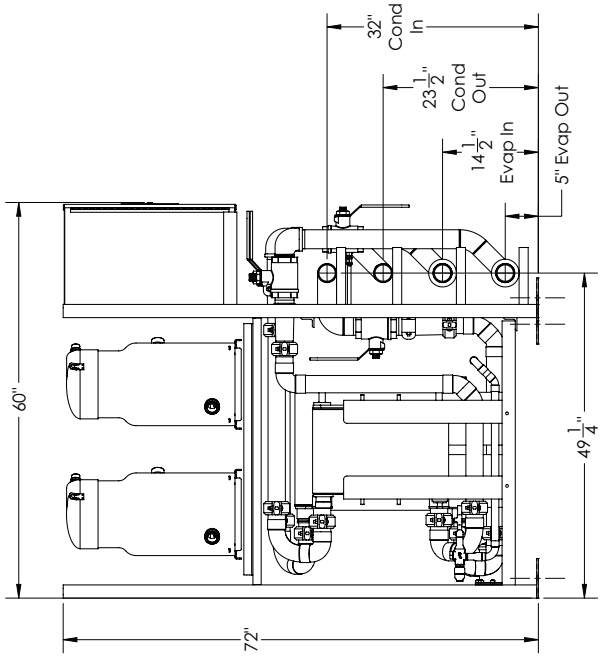
"B" Dimension = When facing the control boxes, dimension from right or left most frame edge to customer connections at the end of header pipes (Right or Left Configuration**)

* Contact Engineering for approval/module header sizes if lower or higher than normal design flowrates needed.

** Header pipes will be sealed on opposite end from customer connections.



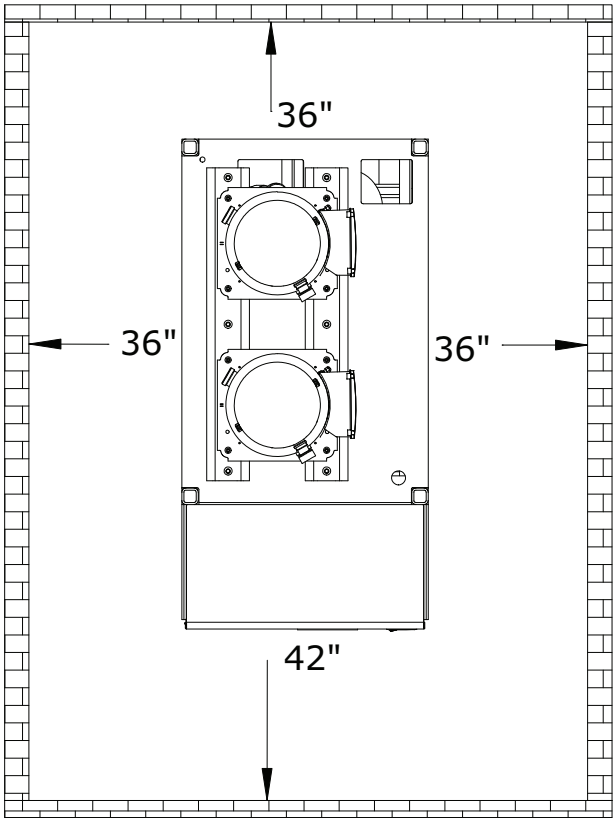

NOTE: Header pipes will be sealed and capped on opposite end from customer connections. In some views, parts may be hidden for clarity.

## Service Clearances

Notes:

- *Clearance of 42" is required in front of chiller to other ground parts.*
- *Two units facing each other or other live parts require a clearance of 48".*
- *Allow 42" clearance above the chiller.*
- *Clearances remain the same when more than one chiller is present.*

**Figure 4. Service clearances**




## Weights

**Table 3. Unit weights — single compact chiller**

| | Shipping Weight | | Operating Weight | |
|---|---|---|---|---|
| Size | lbs | kg | lbs | kg |
| 20 | 1570 | 712 | 1501 | 681 |
| 30 | 1670 | 758 | 1641 | 744 |
| 50 | 2190 | 993 | 2223 | 1008 |

# Installation Mechanical

## General Installation Information

- Please read and take heed of the water piping system flushing procedure and water treatment requirements found in "Appendix C," p. 42 that are necessary to prepare and maintain an efficient and healthy chiller system that utilizes brazed plate heat exchangers.
- Valves in the water piping upstream and downstream of the evaporator and condenser are installed on each CICA chiller to isolate the heat exchangers for maintenance and to balance/trim the system.
- Supply and install condenser water control valve(s). See also Trane publication RLC-PRB021-EN, available from Trane Sales Offices, for additional technical assistance. Provisions must be made for the control of condenser water that results in stable saturated condensing temperature between 80°F and 128°F through all steady state, part load and transient operating conditions. Trane recommends the optional factory-installed integral water regulating valve controlled by the unit controller.
- Supply and install flow switch or other approved flow proving device in the chilled water piping. Interlock this switch with the controller to ensure that the unit can only operate when water flow is established. See wiring diagram for connection point. A switch may be ordered with the unit if desired. It will be shipped loose for field installation.
- When appropriate and needed, supply and install drain valves and vent cocks in the water system piping. Evaporator and condenser drain valves and vent cocks are factory-installed on all CICA chillers.
- Where specified, supply and install strainers ahead of all pumps and control valves.

Note: *CICA chillers are supplied with cleanable, factory-selected Y-strainers to be installed in the field by others for protection of the brazed plate heat exchangers.*

- Supply and install suitable refrigerant pressure relief piping to the atmosphere if required. Follow ANSI/ASHRAE 15-2010 guidelines, relief manufacturer's guidelines, and industry standards when working with relief valving, fusible plugs and/or piping.
- Start the unit under supervision of a qualified service technician.
- Where specified, supply and insulate the chilled water piping as required, to prevent sweating under normal operating conditions. Trane provides factory insulation on evaporator and related components.

## Storage

**NOTICE:**

**Store Units Above Freezing!**

**Store these units in a protected area above freezing (32°F) only. Do not store outdoors with a protective covering such as a plastic shroud. This can result in excessive water condensation that could damage controls and other components.**

## Noise Considerations

Locate the unit away from sound-sensitive areas. If necessary, install isolators under the unit. Install vibration isolators in all piping and use flexible electrical conduit. Consult an acoustical engineer for critical applications.

## Foundation

A base or foundation is recommended for most installations. Provide a level surface strong enough to support the unit. See chapter "Dimensions and Weights," p. 11-12 for dimensions and weights. A flexible (isolated) concrete foundation or footings at each loading point will reduce transmission of vibration. Install anchor bolts in the concrete to secure the unit.

Note: *Use only anchor bolts that are flush with the top of the foundation, not a drive in stud type. An example of an acceptable anchor bolt is Red Head – Multi-Set II Drop In Shell Type. Using a flush type anchor bolt will make removal of a unit easier if required.*

If the floor is warped, uneven or in poor condition, make necessary repairs before positioning the unit. Once the unit is in place, it should be level within 1/8 inch side-to-side (width) and 1/8 inch front-to-back (depth).

## Clearances

Provide adequate space around each unit for unrestricted access for installation and maintenance. Unit dimensions are given in "Dimensions and Weights," p. 11-12. It is critical that adequate space is provided for service and maintenance of evaporator, condenser and compressor. A minimum of 42 inches above the unit is recommended for effective compressor service. A minimum clearance of 3 ft.-6 inches is required to open the control panel door.

Important: *In all cases, local codes will take precedence over these recommendations.*

## Ventilation

Provisions must be made to remove heat generated by unit operation from the equipment room. Ventilation must be adequate to maintain an ambient temperature lower than 125°F.

## Drainage

Locate the unit near a large capacity drain for drain-down during shutdown or repair.

## Handling

CICA units are shipped stretch-wrapped and bolted to a shipping skid unless special packaging is arranged.

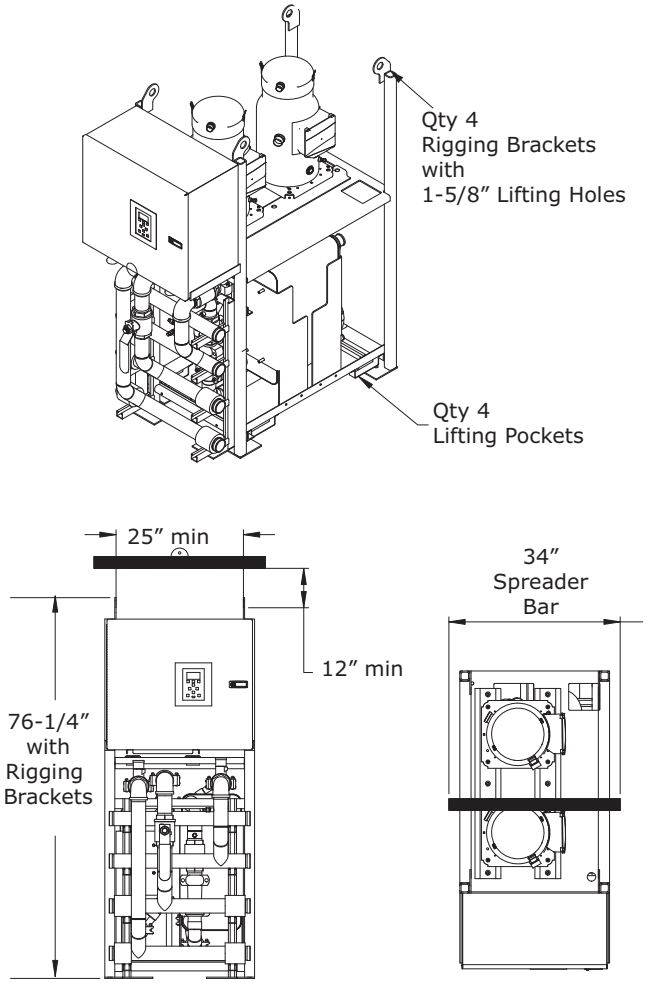
The skidded unit can be moved by using a fork truck of suitable capacity. See "Dimensions and Weights," p. 11-12 for unit weights.

When moving the unit, the lifting forks must be positioned under the shipping skid as wide as possible. Lift the unit and move it to the desired location.

Once the unit is at the installation location, remove the stretch wrap. Inspect the unit for damage and report if damage is found.

Optional "ship loose" items may be inside the control box, attached to the skid or shipped separately depending on options selected.

**Figure 5. CICA rigging, fork lift pockets**




### Forklifting Procedure

**Important:**

- *Optional forklift pockets are required when lifting the unit with a forklift.*
- *Step 1 through Step 4 must be followed to lift unit using a forklift.*

### Steps to be taken when forklift is used:

1. Remove the stretch wrap from the unit as described previously, leaving the unit mounted to the skid.
2. Remove the bolts that secure the unit to the shipping skid.
3. Using a forklift, raise the unit enough to slightly clear the skid, making sure the unit is level when lifting.
4. If the unit is level, lift the unit off of the skid and place in the installation location.

## Rigging Procedure

**⚠WARNING**

**Heavy Objects!**

**Failure to follow instructions below or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles 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.**

**⚠WARNING**

**Improper Unit Lift!**

**Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage. Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.**

Notes:

- *See Figure 5 for reference.*
- *Do not use forklift to move or lift unit unless optional fork lift pockets are installed and used. See "Forklifting Procedure," p. 14 for information.*
- *Do not lift unit from above unless optional rigging brackets are installed and used.*

Optional field installed Rigging Kit consists of four lifting eyes with mounting hardware.

Important:

- *Optional forklift packets are required when lifting the unit with a forklift.*
- *Step 1 through Step 8 must be followed to hoist CICA unit.*

### Steps to be taken when rigging the unit for hoisting:

1. Remove the stretch wrap from the unit as described above, leaving the unit mounted to the skid.
2. Install lifting eyes with the hardware included in the "Rigging Kit". See Figure 5.
3. Install clevis connectors or equivalent in the 1-5/8 inch lifting holes provided on each of the lifting lugs.
4. Attach certified lifting chains (cables) to these points. Each chain (cable) alone must be strong enough to lift the unit.
5. Attach chains (or cables) to a lifting beam. Position the chains (cables) so that they do not contact the unit piping or the unit control panel. Use a suitable spreader bar to ensure proper weight distribution.

***NOTICE:***

**Equipment Damage!**

**To prevent damage, position the lifting beam and chains (cables) so that they do not contact unit piping or control panel.**

6. Remove the bolts that secure the unit to the shipping skid.
7. Raise the unit just off the skid to make sure that the unit is level when lifted. Adjust chain (cable) lengths as required.
8. Lift the unit off of the skid and place in the installation location.

## Access Restrictions

All CICA units are designed to pass through a standard 36 inch doorway. See outline drawings for other important dimensions.

## Compressor Mounting

All compressors are rigidly bolted with compressor isolation mounts to the same compressor mounting frame (rails). No additional isolation or leveling is required. Inspect prior to start up to insure bolts are present and tight, and that no shipping damage has occurred.

## Direct Mounting

The unit can be installed directly on an isolated, rigid mounting surface as long as the surface is level and will support the weight of the unit. A mounting hole is provided at each of the unit mounting locations. See "Foundation," p. 13 for more details. Provide a means of securely anchoring the unit to the mounting surface. Level the unit carefully.

## Unit Leveling

Before tightening the mounting bolts, level the unit. Check unit level front-to-back (depth) by using a level, or by placing a level on the top surface of the unit frame. Unit should be level within 1/8 inch front-to-back (depth). Place the level on the unit frame and check side to side level. Adjust to within 1/8 inch of level side-to-side. Use shims as required to properly level the unit.

## Compressor Nameplate

The nameplate for the hermetic scroll compressor is mounted on the compressor housing, near the motor terminal junction box.

# Evaporator Nameplate

The evaporator nameplate is located on the evaporator under the insulation above the mounting bracket. To view the evaporator nameplate, remove the insulation over the area if covered and spread the insulation. The serial number information is also on record at the factory.

# Condenser Nameplate

The condenser nameplate is located on the condenser above the mounting bracket. The serial number information is also on record at the factory.

# Unit Piping

See "Piping System Flushing Procedure," p. 42 for information on piping system flushing procedure, and water treatment requirements.

## Exchanger Water Pressures

**NOTICE:**

**Vessel Damage!**

**To prevent pressure vessel damage, do not exceed unit nameplate water-side pressures.**

If field installed gauges are used, provide shutoff valves in the line(s) to the gauge(s) to isolate the gauges when not in use.

## Flow Sensing Devices

**NOTICE:**

**Unexpected Chiller Start!**

**An external source (EMS, time clock or any other means) should not be allowed to bring on a pump that would trigger the flow switch to start the chiller. The flow switch is meant to act as a safety switch and not a start/stop mechanism. Failure to follow instructions could cause the chiller to start unexpectedly which could result in equipment or property damage.**

Chilled water flow switch, or other factory approved flow proving device is mandatory; field installation by contractor is required. Flow switch is to be installed and maintained per manufacturer's recommendations and interconnected to the control panel as described on the wiring diagram. To provide additional chiller protection, install and wire the flow switch in series with chilled water pump interlock for the chilled water circuits. See "Required Chilled Water Flow Switch," p. 23. Specific connection and schematic wiring diagrams ship with the unit inside the control box and in this IOM notebook.

## Water Piping Recommendations

All water piping must be cleaned and flushed according to "Piping System Flushing Procedure," p. 42 prior to circulating any water through unit.

Make sure water piping connections to the evaporator and condenser are isolated, and confirm that all piping to unit is supported independently to prevent any load being transferred to the unit. Use unions, flanges or grooved lock type fittings to facilitate service procedures. Use a pipe sealant such as Teflon® tape on all threaded water connections. Use vibration eliminators to prevent transmitting vibrations through the water lines. Construct and install piping in accordance with all local, state and national codes.

Supply and insulate the chilled water piping as required, to prevent sweating and minimize heat gain under normal operating conditions. Chilled water piping must rise above the chiller to insure the evaporator is full of water and void of air at all times. Install thermometers in the lines to monitor evaporator entering and leaving water temperatures.

CICA chillers have manual balancing ball-valves in the entering water lines. They may be used to establish a balanced water flow. Both the entering and leaving water lines have valves that can be used to shutoff/isolate the evaporator and condenser for service.

**NOTICE:**

**Equipment Damage!**

**To prevent equipment damage, you MUST follow instructions below:**

- **Bypass unit when using a flushing agent.**
- **Chilled water piping must rise above the chiller to insure the evaporator is full of water and void of air at all times.**
- **Do not over tighten connections.**

## Water Flow Rates

Establish balanced water flow through both the evaporator and condenser. Flow rates should fall between the minimum and maximum values given in General Data Table 1, p. 6. Flow rates above or below these values can cause equipment damage or improper unit operation. The evaporator water pressure drop is measured using the factory-installed pressure transducers and can be read from the unit controller's keypad/display. The condenser water pressure drop can be read manually using the factory-installed condenser inlet and outlet pressure gauge service ports. Readings should approximate those shown by the pressure drop charts for the individual chillers (Figure 6, p. 17 and Figure 7, p. 17).

Note: *Pressure drop is an approximation and is to be used as a tool to estimate flow rate and as an aid to waterside system piping design. If an accurate measurement of flow rate is required, an accurate flow meter must be installed in the system.*

## Chilled Water System Volume

Minimum system volume requirements are indicated in Figure 4, p. 17. Special applications may deviate from these numbers as directed by Trane engineering. Operation below these volumes will cause unacceptable system control problems and the potential for evaporator failure.

**Table 4. Minimum required system volumes**

| Unit Size (tons) | Volume (gal) |
|---|---|
| 20 | 144 |
| 30 | 216 |
| 50 | 360 |

## Pressure Drop Curves

**Figure 6. Evaporator pressure drop**

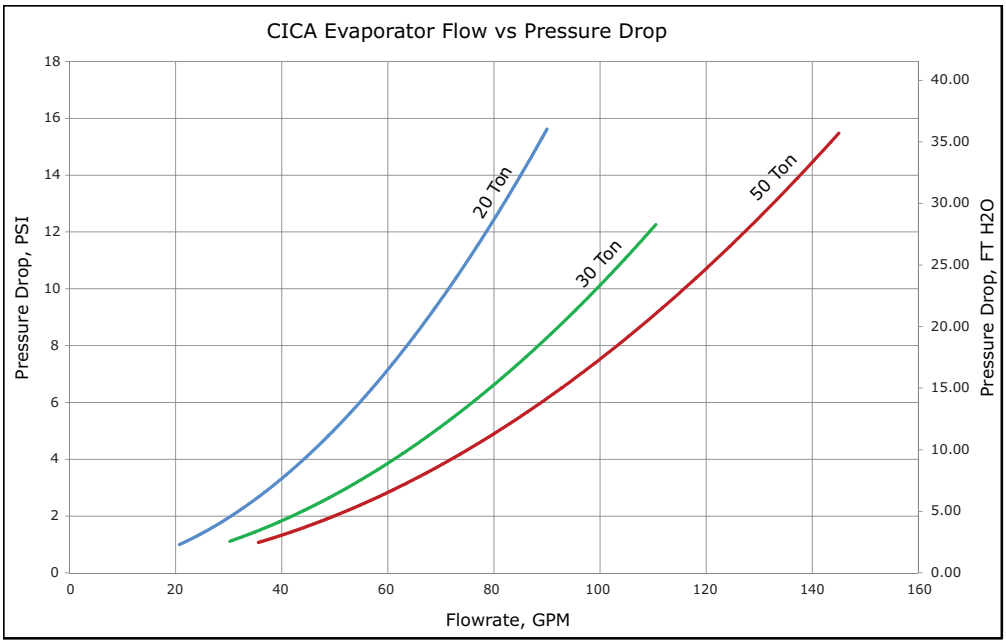
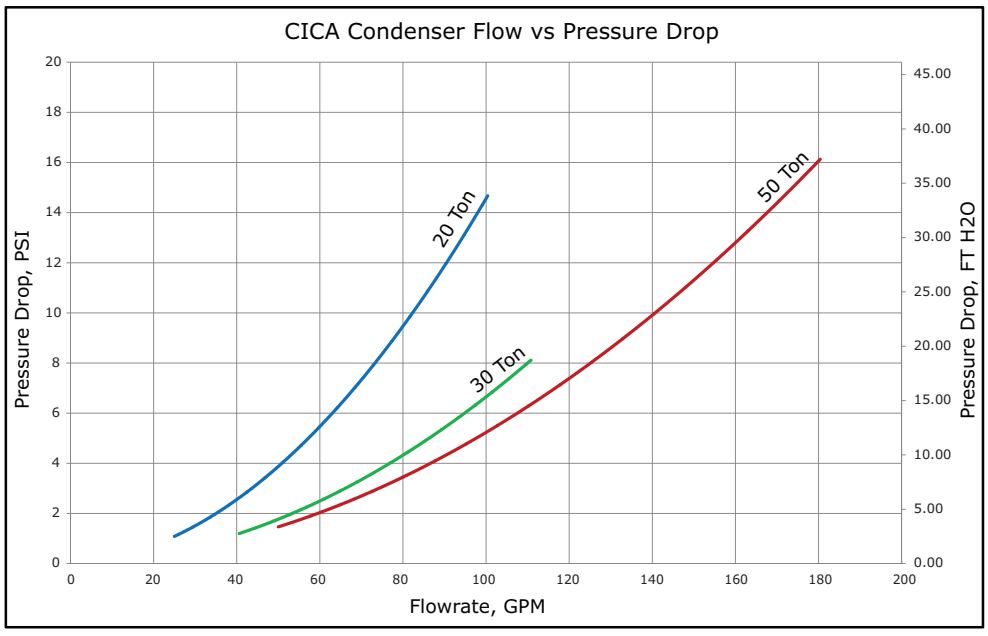



**Figure 7. Condenser pressure drop**



## Water Treatment

**NOTICE:**

**Proper Water Treatment!**

**The use of untreated or improperly treated water could 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.**

Using untreated or improperly treated water in these units may result in inefficient operation and possible heat exchanger damage. Consult a qualified water treatment specialist to determine if treatment is needed. See "Appendix C," p. 42 for water treatment requirements.

## Evaporator & Water Piping

**NOTICE:**

**Water Born Debris!**

**To prevent evaporator or condenser damage, pipe strainers must be installed in the water supplies to protect components from waterborne debris. Trane is not responsible for equipment-only-damage caused by water born debris. Failure to install the shipped-loose supplied Y-strainers or screens will void the warranty on the brazed plate evaporator and condenser.**

CICA chillers are equipped with brazed plate evaporators made of stamped stainless steel plates, furnace brazed together with copper based joints. Because of the small complex geometry of the flow passages, it is imperative customers take all precautions to insure these evaporators are not fouled by large particles or mineral deposits. Chillers are shipped with a factory-provided, 20-mesh evaporator inlet wye strainer that must be field installed. The screen may be removed for cleaning. Operation of chiller without screen in place will void warranty. Chemical treatment of the chilled water loop is required and must be performed by a qualified water treatment specialist.

Chilled water inlets and outlets are grooved-type with the locations provided in "Dimensions and Weights," p. 11-12. Under full-load standard AHRI conditions, the chilled water temperature rise should be approximately 10°F, producing a flow rate in the range of 2.4 gpm/ton. Minimum outlet water is 42°F without freeze inhibitor.

Chilled water piping must be in accordance with all local, state and national codes.

**Figure 8. Chilled water piping**

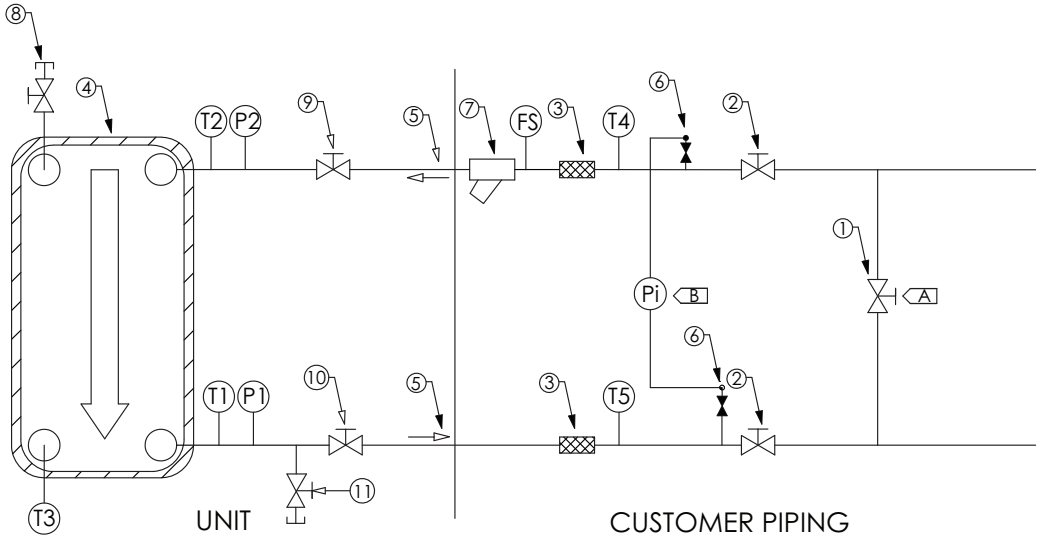



**Table 5. Chilled water piping components**

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Bypass Valve | A | Isolator Unit for initial water loop cleaning |
| 2 | Isolation Valves | B[a] | Arrangement for Measuring Differential Pressure |
| 3 | Vibration Eliminators | FS[b] | Water Flow Switch |
| 4 | Evaporator Heat Exchanger | Pi | Pressure Gauge |
| 5 | Inlet & Outlet Chilled Water Lines | T1 | Evaporator Outlet Temperature Sensor |
| 6 | Valves for Pressure Measurement | T2 | Evaporator Inlet Temperature Sensor |
| 7[c] | Strainer with 20 Mesh Screen | T3 | Evaporator Core Temperature Sensor |
| 8 | Evaporator Manual Air Vent Valve w/ Plug | T4 | Chiller Inlet Temperature Gauge |
| 9 | Evaporator Manual Ball Valve | T5 | Chiller Outlet Temperature Gauge |
| 10 | Evaporator Manual Ball Valve (Motorized On/Off Valve, optional) | P1 | Evaporator Outlet Pressure Sensor |
| 11 | Evaporator Manual Drain Valve with Plug | P2 | Evaporator Inlet Pressure Sensor |

(a) Must account for water head difference when calculating total unit pressure differential.
(b) Chilled water flow-proving device is required.
(c) Strainer is factory supplied and field installed.

## Condenser & Condenser Piping

***NOTICE:***

### Waterborne Debris!

**To prevent evaporator or condenser damage, pipe strainers must be installed in the water supplies to protect components from waterborne debris. Trane is not responsible for equipment-only-damage caused by water born debris. Failure to install the shipped-loose supplied Y-strainers or screens will void the warranty on the brazed plate evaporator and condenser.**

CICA units are equipped with brazed plate condensers made of stamped stainless steel plates, furnace brazed together with copper based joints. Because of the small complex geometry of the flow passages, it is imperative customers take all precautions to insure these condensers are not fouled by large particles or mineral deposits. Chillers are shipped with a factory-provided, 20-mesh condenser inlet wye strainer that must be field installed. The screen may be removed for cleaning. Operation of chiller without screen in place will void warranty. A closed-loop system and chemical treatment is highly recommended for the condenser water loop when brazed plate condensers are used. A closed-loop system protects the quality of the process fluid and reduces system maintenance. It is recommended the chemical treatment be performed by a qualified water treatment specialist.

CICA units are available with factory installed water regulating valve. The optional water regulating valve maintains condensing pressure and temperature by throttling water flow leaving the condenser in response to condensing pressure. It also facilitates condensing pressure stability at full-load, part-load, and transient conditions. Saturated condensing temperature must be maintained between 80°F and 128°F.

Cooling tower systems may include a manual or automatic bypass valve that can alter water flow rate to maintain condensing pressure. Well (city) water condensing systems should include a pressure reducing valve and water regulating valve. A pressure reducing valve should be installed to reduce water pressure entering the condenser. This is required only if water pressure exceeds nameplate maximums. This is also necessary to prevent damage to the disc and seat of the water regulating valve that can be caused by excessive pressure drop through the valve.

Condenser water inlets and outlets are grooved- type with the locations provided in "Dimensions and Weights," p. 11-12. Under full-load standard AHRI conditions, the condenser water temperature rise should be approximately 10° F, producing a flow rate in the range of 3 gpm/ton. Minimum inlet condenser water temperature is 65°F.

Condenser piping must be in accordance with all local, state and national codes.

**Figure 9. Condenser water piping**

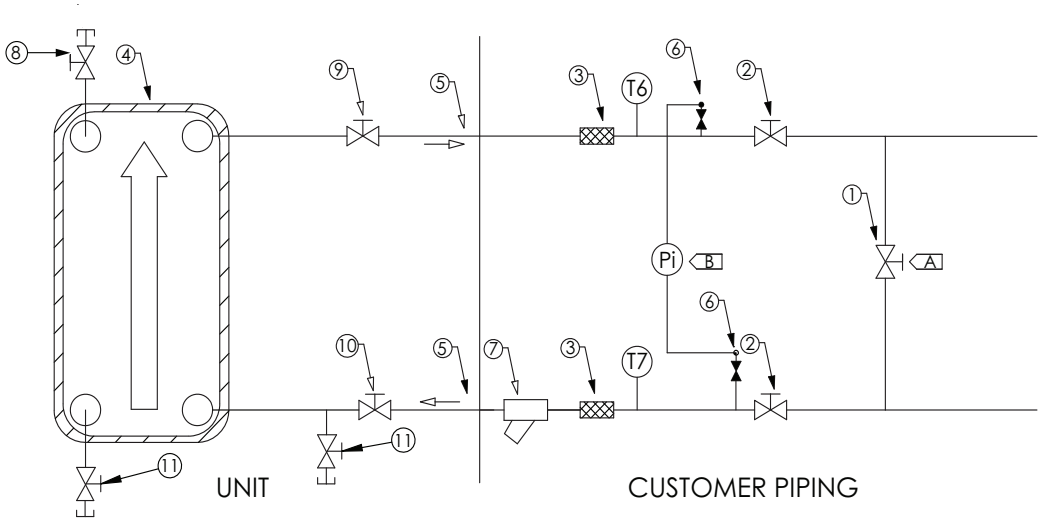



**Table 6. Condenser water piping components**

| Item | Description | Item | Description |
|---|---|---|---|
| 1 | Bypass Valve | 9 | Condenser Manual Ball Valve (Water Regulating Valve, Optional) |
| 2 | Isolation Valves | 10 | Condenser Manual Ball Valve |
| 3 | Vibration Eliminators | 11 | Condenser Manual Drain Valve w/ plug |
| 4 | Condenser Heat Exchanger | A | Isolator Unit for initial water loop cleaning |
| 5 | Inlet & Outlet Water Lines | B[a] | Arrangement for Measuring Differential Pressure |
| 6 | Valves for Pressure Measurement | Pi | Pressure Gauge |
| 7[b] | Strainer with 20 Mesh Screen | T6 | Condenser Leaving Water Temperature Gauge |
| 8 | Condenser Manual Air Vent Valve w/ Plug | T7 | Condenser Entering Water Temperature Gauge |

(a) Must account for water head difference when calculating total unit pressure differential.
(b) Strainer is factory supplied and field installed.

# Installation Electrical

**⚠WARNING**

**Proper Field Wiring and Grounding Required!**

**Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.**

## General Recommendations

**⚠WARNING**

**Hazardous Service Procedures!**

**Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.**
**Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors 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.**

***NOTICE:***

**Use Copper Conductors Only!**

**Failure to use copper conductors could result in equipment damage as unit terminals are not designed to accept other types of conductors.**

The wiring procedures, as described in this portion of the manual, must be accomplished to obtain proper operation of the unit.

All wiring must comply with National Electrical 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.

Minimum circuit ampacity, recommended fuse sizes and other unit electrical data are provided on the unit nameplate.

### Checking the Power Supply

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 tolerances discussed below.

### Total Supply Voltage

**⚠WARNING**

**Live Electrical Components!**

**Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury. When 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.**

Measure each leg of the supply voltage at the line voltage disconnect switches. For units with a nameplate voltage of 208/230 volt, the readings must fall within the range of 180-253 volts. For units with a nameplate voltage of 460 volts, the readings must fall within the range of 414-506 volts. If voltage on any leg does not fall within tolerance, notify the power company and request correction of this situation before connecting to or operating the unit. Inadequate voltage to the unit will shorten the life of relay contacts and compressor motors.

### Voltage Imbalance Between Phases

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 100 times the maximum deviation of the three voltages (three phases) subtracted from the average (without regard to sign), divided by the average voltage.

Example:

If the three voltages measured at the line voltage fused disconnect are 221 volts, 230 volts and 227 volts, the average would be:

$$\frac{221 + 230 + 227}{3} = 226 \text{ volts}$$

The percentage of imbalance is then:

$$\frac{100\ (226 - 221)}{226} = 2.2\%$$

In the preceding example, 221 is used because it is the farthest from the average. The 2.2 percent imbalance that exists exceeds maximum allowable imbalance by 0.2 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.

# Equipment Grounding

**NOTICE:**

**Use Copper Conductors Only!**

**Failure to use copper conductors could result in equipment damage as unit terminals are not designed to accept other types of conductors.**

Provide proper grounding at the connection point provided in the unit control panel.

# Unit Power Wiring

**⚠WARNING**

**Hazardous Voltage!**

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

The installing contractor must connect appropriate power wiring (with fused disconnects) to the unit-mounted, non-fused disconnect in the power section of the unit control panel. Electrical schematics and component location drawings are also mounted on the inside of the control panel door.

The unit power fused disconnect switch should be located in the general area of the unit, to comply with NEC or local codes. Some codes require line-of-sight disconnect locations. The unit mounted non-fused disconnect can be used as an emergency shutdown device.

## Scroll Compressor Electrical Phasing

**NOTICE:**

**Compressor Damage!**

**Operating compressors in reverse rotation will cause damage or failure of the compressor.**

It is critical that proper rotation of the scroll compressors be established before the machine is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the inlet power supply phased "ABC" or "L1, L2, L3".

The order in which the three voltage waveforms of a three-phase system succeed one another is called phase sequence or phase rotation. When rotation is clockwise, phase sequence is usually called "ABC" and when counterclockwise, "CBA".

This direction may be reversed by interchanging any two of the line wires. The possibility of interchanging the wiring makes a phase sequence indicator necessary to quickly determine the proper phase rotation.

## Setting the Proper Electrical Phase Sequence

Proper compressor motor electrical phasing can be quickly determined and, if necessary, corrected before starting the unit. Use a quality instrument, such as an Associated Research Model 45 Phase Sequence indicator or equivalent and follow this procedure:

1. Verify that all operating controls for the unit are in the "Off" position.
2. Turn power to CICA unit "Off" using supply power disconnect **to the unit**. Verify that power to CICA unit is "Off" and that there is no voltage on "Line" or entering side of the CICA panel mounted unit disconnect.
3. Connect the phase sequence indicator leads to the "Load" or leaving side of the CICA unit panel mounted disconnect as follows:

| Phase Sequence Lead | Terminal ID |
|---|---|
| Black (Phase A) | L1 |
| Red (Phase B) | L2 |
| Yellow (Phase C) | L3 |

4. Turn power to CICA unit "On" using the supply power disconnect to the unit
5. Read the phase sequence displayed on the indicator. The "ABC" LED on the face of the phase indicator will glow if phase sequence is ABC.
6. If the "CBA" indicator glows instead, turn power to CICA unit "Off" using the supply power disconnect to the unit, then verify that the power to the CICA unit is "Off" and that there is no voltage on the "Line" side of the CICA panel mounted unit disconnect. Reverse two wires on the "Line" or entering side of the CICA panel mounted disconnect switch. Turn power to CICA unit "On" and recheck phase sequence (Step 5 above).
7. If phase sequence is correct, turn power to CICA unit "Off" using the supply power disconnect **to the unit**. Verify that power to the CICA unit is "Off" and that there is no voltage on "Line" or entering side of the CICA panel mounted unit disconnect. Remove the phase indicator and restore power to the CICA unit.

# Control Power Supply

A fused, panel-mounted control power transformer is standard. Replacement fuse information is listed on the "Fuse Schedule" decal located adjacent to the transformer inside the control box.

# External Contacts and Peripherals

The following peripheral control features and program logic come standard on all CICA compact chillers. Designated terminals on the field connection terminal strip in the control panel are provided for field connection of each. Consult the field wiring diagram and wiring schematic diagram provided in this manual for the connection points. The wiring schematic diagram is also attached to the inside of the control panel door.

## Required Chilled Water Flow Switch

**⚠WARNING**

**Unexpected Chiller Start!**

**An external source (EMS, time clock or any other means) should not be allowed to bring on a pump that would trigger the flow switch to start the chiller. The flow switch is meant to act as a safety switch and not a start/stop mechanism. Failure to follow instructions could cause the chiller to start unexpectedly which could result in equipment or property damage.**

The CICA controller has a required input that accepts a contact closure from a proof-of-flow device such as a flow switch or other factory approved flow proving device. When this input does not prove flow within a fixed time relative to transition from enabled to run modes of the chiller, or if the flow is lost while the chiller is in the running mode of operation, the chiller will be prohibited from running. The installer must provide and install this flow proving device. Failure to provide this flow proving device voids unit warranty.

## Condenser Water Loss of Flow Protection

The CICA controller logic will sense a loss of flow through the condenser. No condenser water flow switches are necessary with the standard standalone CICA controller configuration.

## Pump Control

CICA units have one dry contact relay to start a condenser pump. These chillers also have one dry contact relay to start a chilled water pump. These features are standard but not required.

## Remote Off/Auto

The CICA controller has an input that accepts a contact closure from a remote device such as a toggle switch that can enable or disable the chiller to run. It would be wired in series with the Off/Auto switch located on the control panel door. This feature is standard but not required.

## Remote Alarm

CICA units have one dry contact relay to indicate with a remote light or bell or other device that at least one compressor in the unit has been locked out for whatever reason and needs attention. This feature is standard but not required.

# Controls Interface

## Unit Controller — General

The CICA controller is a rugged microprocessor-based controller designed for the hostile environment of the HVAC/R industry. It is designed to be the primary manager of the CICA product.

The controller provides flexibility with setpoints and control options that can be selected prior to commissioning a system or when the unit is live and functioning. Unit display presents pressure, temperature and alarm information with history in a clear and simple language format, informing the user of the chiller status. See wiring diagram in the wiring section of this manual ("Wiring," p. 32) and attached to the inside of the control panel door.

A password is required to access chiller setpoints. Use password code 2112 to access many of these features. A factory code may be required to allow access to critical areas, and can only be entered by a factory representative.

An RS-485 port is provided for communication with other manufacturers' systems.

Additionally, a built-in RS-485 to RS-232 converter allows communication over the RS-485 network via the RS-232 port.

Other features include the integration of BACnet IP® and MODBUS® into the unit controller. Optional communication cards are available for communication via LonWorks®, Johnson N2 and BACnet MS/TP®.This should be ordered with the chiller if required. An ethernet connection is also provided on each unit. While field changes can be made, please insure that the unit is ordered set up for required communications to insure that factory testing includes end user configuration.

A complete software support package is available for your PC allowing for system configuration, dynamic on-line display screens, remote communication, graphing and more. Downloads for the MCS-Connect software are available at www.mcscontrols.com at no charge. See "Downloading and Installing Unit Controller (MCS-Connect) Software," p. 24 for download instructions. All information needed to run the unit is available from the unit display; however, a laptop computer is invaluable for ease of use of diagnosing or changing the unit setpoints.

Note: *Not all setpoints can be changed with MCS-Connect; some require a configuration change.*

A serial cable is included in each shipment for the convenience of the field technician. If you do not have a laptop with a serial port, you will require a converter such as a Black Box item number #IC199A-R3 serial-to-USB adaptor.

The CICA standard configuration allows for the unit to start at the lowest stage possible, and then add compressors as needed to meet demand.

Important: *All configuration changes need to be done by factory representatives to ensure proper operation of the unit within design parameters. See CG-SVX030*-EN controller manual for sequence of operation and additional details.*

## Unit Controller Software Installation and Setup

### Downloading and Installing Unit Controller (MCS-Connect) Software

Go to www.mcscontrols.com.

Go to the software page and select MCS-CONNECT. Select SAVE. After downloading, open and select RUN. Follow prompts and software will be installed on your computer.

If your computer does not have a serial port, you will need to purchase a USB to Serial adapter. (Computer stores should have this.) Install the software for the adapter. If your computer has a serial port, you will not need an adapter.

You will need to know which Port your computer uses as the COM PORT. In Microsoft® Vista, go to the CONTROL PANEL and select DEVICE MANAGER. Look for PORTS (COM & LPT), expand and you should see a COM PORT number. Windows® 7 is similar.

Start the MCS-CONNECT software. Select SETUP>COMMUNICATIONS and then change LOCAL COM PORT to match your computer. Select SAVE and then OK.

### Connecting to the Chiller

Connect the supplied NULL MODEM cable between your USB adapter or serial port to the chiller. A standard serial cable will not work.

Connection directly through the 100 MBPS Ethernet port on the CICA unit controller or array controller to a PC requires a crossover Ethernet cable. If all controllers in the array are connected to an Ethernet switch, then an Ethernet patch (straight) cable will be used to connect the PC to the Ethernet switch.

Start the MCS-CONNECT software and select LOCAL SERIAL. You will see the site info page. The software should scan and find the chiller. (If you see a Failed to open com port error, or it scans and does not find the chiller, your com port settings are not correct.) Click the 1-CICA tab. The screen shows real time data.

### Setpoint Changes

Click the VIEW ONLY button. Enter the password code 2112. Select OK. Button should say SERVICE. Go to setpoints and double-click on a value. Change and select OK.

## Viewing and Troubleshooting ALARMS

The unit controller will record and store 30-second sensor input data prior to and up to any LOCKOUT ALARM. Select the ALARM tab, then INFO next to the alarm you want to analyze. This will pop up a screen that shows operating conditions just prior to the trip. You can easily determine if the fault was caused by a sudden or gradual change. For instance, a sudden increase in discharge pressure might suggest a condenser pump or fan failure etc. (This data can also be viewed from the chiller LCD screen. Select LOCKOUT ALARMS.)

## Downloading and Viewing Graphs

The unit controller continuously records and stores sensor input and relay/analog output data. This data is collected in 10-second (default) intervals. The controller stores 1008 packets of data replacing the oldest with the newest. With the time interval set at 10 seconds, you can download graph data with a time span of 168 minutes. The time interval is adjustable.

In the MCS-CONNECT software, select GRAPH. Data will be downloaded and then a graph setup page will appear. Select the input and output data you want to look at. Type inY-axis parameters and select OK. Use the scroll bar at the bottom of the graph to view. You can go back to the setup page at any time to change selections. You may save the graph to view later. You don't have to be connected to view a saved graph file. Your saved graph will be located in a folder called GRAPH inside another folder called MCS on your C: drive.

To change the default 10-second interval, make changes and select SAVE and then OK on the setup page. The controller will now record data at this new interval.

To view a saved graph, select LOAD A GRAPH FILE. These files can be e-mailed to us for analysis if needed.

## Updating Chiller Software and Configuration Files

CICA chillers are programmed, set up, and tested prior to shipment. Sometimes after a unit arrives at the jobsite, the customer may want to enable an option such as 0–5 Vdc target reset, etc. These options require a configuration change. We will either have you download the configuration file from the chiller and e-mail it to us where we will modify it and return it to you, or we will modify a default configuration file we have here at the factory and send it to you. Modifying a configuration file you send us will save any setpoint changes that have been made on site. Otherwise, the controller will be set back to default factory settings.

To e-mail a copy of your chiller's configuration file, in the MCS-CONNECT software, establish communication with the chiller and select RECEIVE CFG.
Name it "Unit (*serial number*)" and e-mail to engineering@nappsac.com.

To load a configuration file, turn off circuit enable switches and select TRANSMIT CFG. Locate the new file and press OPEN. The file will be uploaded to the controller. The controller will reboot itself.

Routine software (HEX FILE) updates are NOT necessary. However, if we think a software update is necessary to resolve an operating issue you may be having, we will e-mail the hex file in a zipped folder. Save the zipped folder to your desktop. Right click folder and select EXTRACT ALL. This will create another folder by the same name on your desktop. Inside this folder you'll find the hex file. It should be about 2300 KB. In the MCS-CONNECT software, select TRANSMIT SW. Locate the extracted hex file and select Transmit. Watch the chiller LCD screen. After the file is uploaded, the CICA unit controller will verify that it's a valid file and then erase the flash memory. Next, it will write the new hex to memory. When completed, the controller will reboot itself. This process may take 15 or 20 minutes. After the reboot is completed, close and restart the MCS-CONNECT software to reestablish communication with the chiller.

# Unit Start-Up Procedures

Prior to calling for start-up services or commissioning, *CICA Compact Chiller Installation Completion Check List and Request for Trane Service, CG-ADF003*-EN,* must be completed and submitted. Once that has been completed and submitted, *CICA Compact Chiller Start-up Check List,* CG-ADF004*-EN, must be followed and submitted. A hard copy of each document is sent with the chiller in the IOM notebook.

Start-up and commissioning must be performed by a factory authorized Trane service technician.

## Pre-Start

Complete each step in the "Pre-Start Up Procedures" included in the *CICA Individual Chiller Start-up Check List* and check off each step as completed.

**⚠ WARNING**

**Hazardous Voltage!**

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

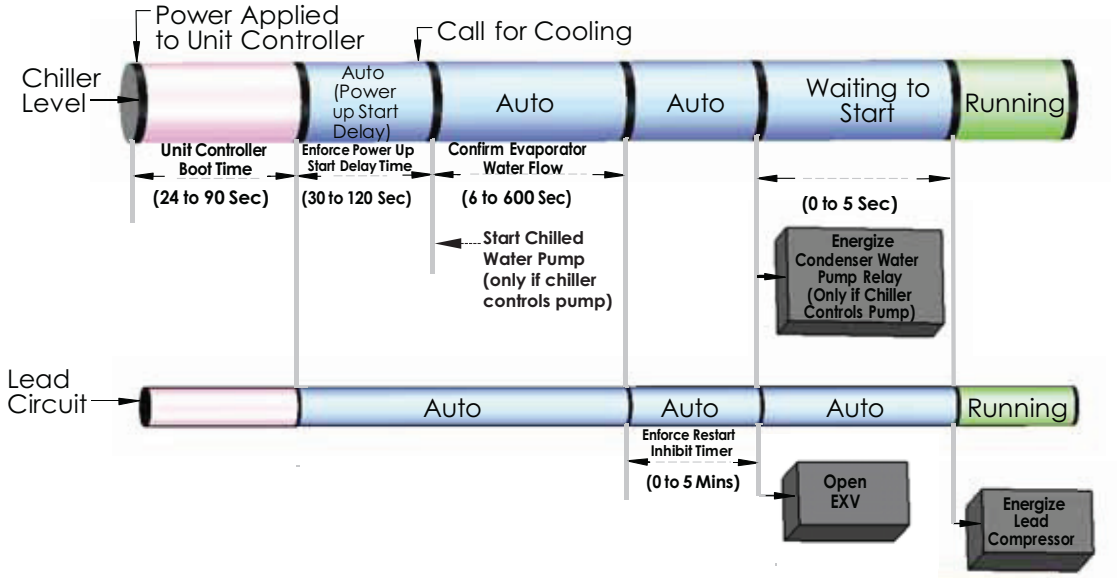
***NOTICE:***

**Equipment Damage!**

- **To prevent overheating at connections and under-voltage conditions at the compressor motor, check tightness of all connections in the compressor power circuit.**
- **To prevent compressor damage, do not operate the unit with discharge or liquid line service valves closed.**
- **The use of untreated or improperly treated water in a Chiller 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.**
- **To prevent evaporator or condenser damage, pipe strainers must be installed in the water supplies to protect components from water born debris. Trane is not responsible for equipment damage caused by water born debris.**

## Sequence of Operation

**Figure 10. Unit power-up**



# Checking Operating Conditions

**NOTICE:**

**Evaporator/Condenser Damage!**

**Water (fluid) flow must be established in evaporator and condenser before adding refrigerant, removing refrigerant, or pulling vacuum to protect heat exchangers from freezing.**

**NOTICE:**

**Compressor Damage!**

**Do not allow liquid refrigerant to enter the suction line as excessive liquid accumulation in the liquid lines could result in compressor damage.**

To prevent compressor damage and ensure full cooling capacity, only use refrigerant specified on unit nameplate.

- If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line Schrader fitting. Do not discharge refrigerant into the atmosphere.
- Once proper unit operation is confirmed, inspect for debris, misplaced tools, etc. Secure control panel doors in place.

Once the unit has been operating for about 10 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

- Recheck evaporator water and condenser water flows and pressure drops. These readings should be stable at proper levels.
- Check suction pressure and discharge pressure.
  - **Discharge pressure:** Take at Schrader fitting provided on the discharge line. Normal discharge pressures are:
    - 275 to 430 psig
  - **Suction pressure:** Take at Schrader fitting provided on the suction line. Normal suction pressures are:
    - 42°F to 60°F LWT: 104 to 155 psig
    - 15°F to 39°F LWT: 60 to 103 psig
- Check compressor oil level. At full load, oil level should be visible in the oil level sight glass on the compressor. If it is not, add or remove oil as required.
- Check the liquid line sight glass. Refrigerant flow past the sight glass should be clear. Bubbles in the liquid line indicate either low refrigerant charge or excessive pressure drop in the liquid line. Such a restriction can often be identified by a noticeable temperature differential on either side of the restricted area. Frost often forms on the outside of the liquid line at this point also.

Important: *The system may not be properly charged although the sight glass is clear. Also consider superheat, sub-cooling and operating pressure.*

- Once oil level, amp draw and operating pressures have stabilized, measure system suction superheat.
- Measure system liquid line sub-cooling.
- If operating pressure, sight glass, superheat and sub-cooling readings indicate refrigerant shortage, charge refrigerant into each circuit. Refrigerant shortage is indicated if operating pressures are low and sub-cooling is also low.

Important: *If suction and discharge pressures are low but sub- cooling is normal, no refrigerant shortage exists. Adding refrigerant, will result in overcharging.*

- Add refrigerant with the unit running by metering liquid refrigerant through the Schrader valve between the expansion valve and the evaporator refrigerant inlet until operating conditions are normal.

## System Superheat

Normal superheat is 10°F to 16°F at full load. If superheat is not within this range, adjust expansion valve superheat setting. Allow 5 to 10 minutes between adjustments for the expansion valve to stabilize on each new setting.

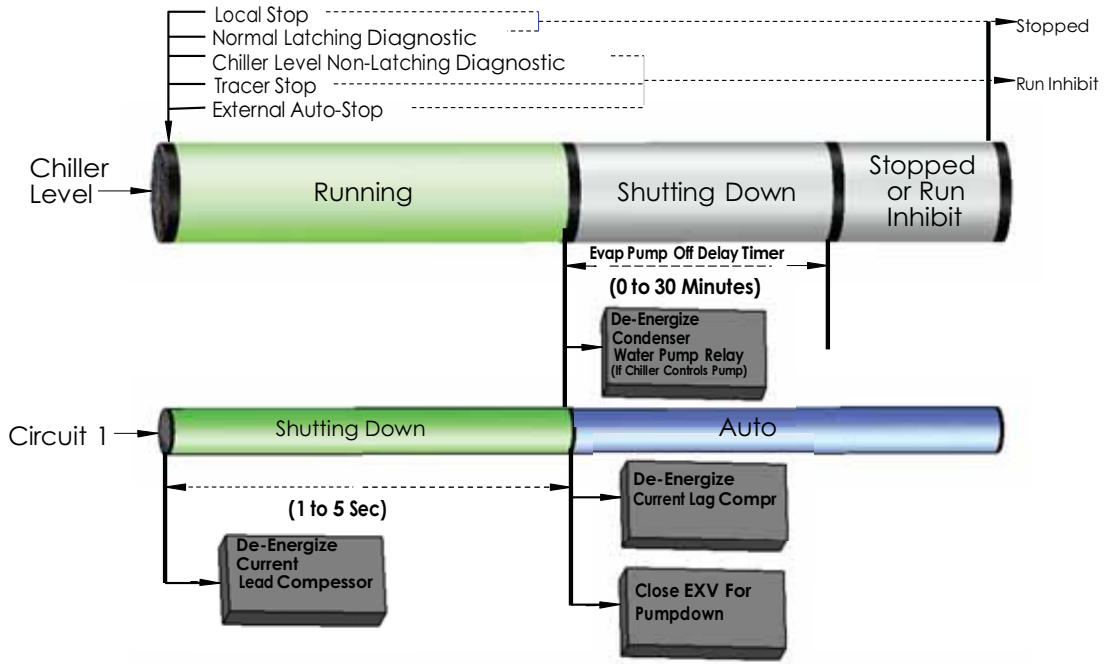
## System Sub-cooling

Normal sub-cooling is 5°F to 10°F at full load where saturated discharge pressure and liquid line temperature are measured at chiller liquid line.

# Shut Down

## Normal Unit Shutdown

**Figure 11. Normal unit shutdown**




## Extended Shutdown Procedure

If the system is taken out of operation for long periods of time, use this procedure to prepare the system for shutdown.

1. Test condenser and high side piping for refrigerant leakage.
2. Open electrical disconnect switches for evaporator water pump. Lock the disconnect in an open position.
3. Open the unit main electrical disconnect and unit-mounted disconnect and lock in open position.

## Unit Restart

### Unit Restart After Extended Shutdown

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

***NOTICE:***

**Compressor Failure!**

**To protect compressors from premature failure the unit must be powered and crankcase heaters energized at least 24 hours BEFORE compressors are started.**

***NOTICE:***

**Compressor Damage!**

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

1. Close the unit main disconnect(s) and the unit-mounted disconnect.
2. Check compressor crankcase oil levels. Oil should be visible in the compressor oil level sight glass
3. Fill the chilled water circuit if drained during shutdown. Vent the system while filling it.
4. Close the fused disconnect switches for the water pumps.
5. Start the water pumps. With water pumps running, inspect all piping connections for leakage. Make any necessary repairs.
6. With water pumps running, adjust chilled water flow and check water pressure drop through the evaporator.
7. Check the flow switch on the evaporator outlet piping for proper operation.
8. Stop the water pumps.
9. Complete each step in CICA Individual Chiller Start-up Check List CG-ADF004*-EN.
10. Energize Crankcase Heaters. (Heaters must be energized a minimum of 24 hours before startup.)

# Maintenance

**⚠ WARNING**

**Hazardous Service Procedures!**

**Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.**

**Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors 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.**

## 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. All maintenance tasks other than recording data must be performed by a qualified service technician

### Weekly Maintenance

Ensure the unit has been operating for about 10 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

- Check compressor oil levels. Oil should be visible in the sight glass when the compressor is running. Operate the compressors for a minimum of three to four hours when checking oil level, and check level every 30 minutes. If oil is not at proper level after this period, have a qualified service technician add or remove oil as required.
- Check suction pressure and discharge pressure.
- Check the liquid line sight glasses.
- If operating pressures and sight glass conditions seem to indicate refrigerant shortage, measure system superheat and system sub-cooling.
- If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not release refrigerant to the atmosphere.
- Inspect the entire system for unusual conditions. Use an operating log to record weekly operating conditions history for the unit. A complete operating log is a valuable diagnostic tool for service personnel.

### Monthly Maintenance

Ensure the unit has been operating for about 10 minutes and the system has stabilized, check operating conditions and complete the checkout procedures that follow.

- Check compressor oil levels. Oil should be visible in the sight glass when the compressor is running. Operate the compressors for a minimum of three to four hours when checking the oil level, and check level every 30 minutes. If oil is not at proper level after this period, have a qualified service technician add or remove oil as required.
- Check refrigerant superheat at the compressor suction line. Superheat should be in the range of 10°F–20°F.

  Note: *A superheat calculated value is incorporated into the unit controller.*
- Check the liquid line sight glasses.
- If operating pressures and sight glass conditions seem to indicate refrigerant shortage, measure system superheat and system sub-cooling.
- If operating conditions indicate an overcharge, slowly (to minimize oil loss) remove refrigerant at the liquid line service valve. Do not release refrigerant to the atmosphere.
- Inspect the entire system for unusual conditions. Review the weekly operating log for conditions history for the unit and take note of any unusual trends in performance. Take appropriate preventative actions if necessary.

### Annually

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 and replace compressor and control contacts if needed.
- If chiller is not piped to drain facilities, make sure drain is clear to carry away system water.
- Drain water from condenser and evaporator and associated piping systems. Inspect all piping components for leakage, damage, etc. Clean out evaporator and condenser supply strainers.
- Clean and repaint any corroded surface.

## Compressor Maintenance

Because scroll compressors are a uniquely different design from traditional reciprocating compressors, their operating characteristics and requirements are a departure from the reciprocating compressor technology.

## Compressor Oil

The R-410A scroll compressor uses POE oil as required by the manufacturer of the compressor. Refer to compressor manufacturer for exact type and amount of oil in the specific model in question.

### Oil Level

While the compressor is running, the oil level may be below the sight glass but still visible through the sight glass.The oil level should NEVER be above the sight glass!

### Oil Appearance

If the oil is dark and smells burnt, it was overheated because of compressor operation at extremely high condensing temperatures, a compressor mechanical failure, or occurrence of a motor burnout. If the oil is black and contains metal flakes, a mechanical failure has occurred. This symptom is often accompanied by a high amperage draw at the compressor motor.

Notes:

- *If a motor burnout is suspected, use an acid test kit to check the condition of the oil. If a burnout has occurred, test results will indicate an acid level exceeding 0.05 mg KOH/g.*
- *The use of commercially available oil additives is not recommended. Liability for any detrimental effects that the use of non-approved products may have on equipment performance or longevity must be assumed by the equipment owner, equipment service technician, or the oil additive manufacturer.*

## Scroll Compressor Functional Test

Since the scroll compressor does not use discharge or suction valves, it is not necessary to perform a pump-down capability test, i.e. a test where the liquid line valve is closed and the compressor is pumped in a vacuum to see if it will pump-down and hold. In fact, this kind of test may actually damage the scroll compressor.

**NOTICE:**

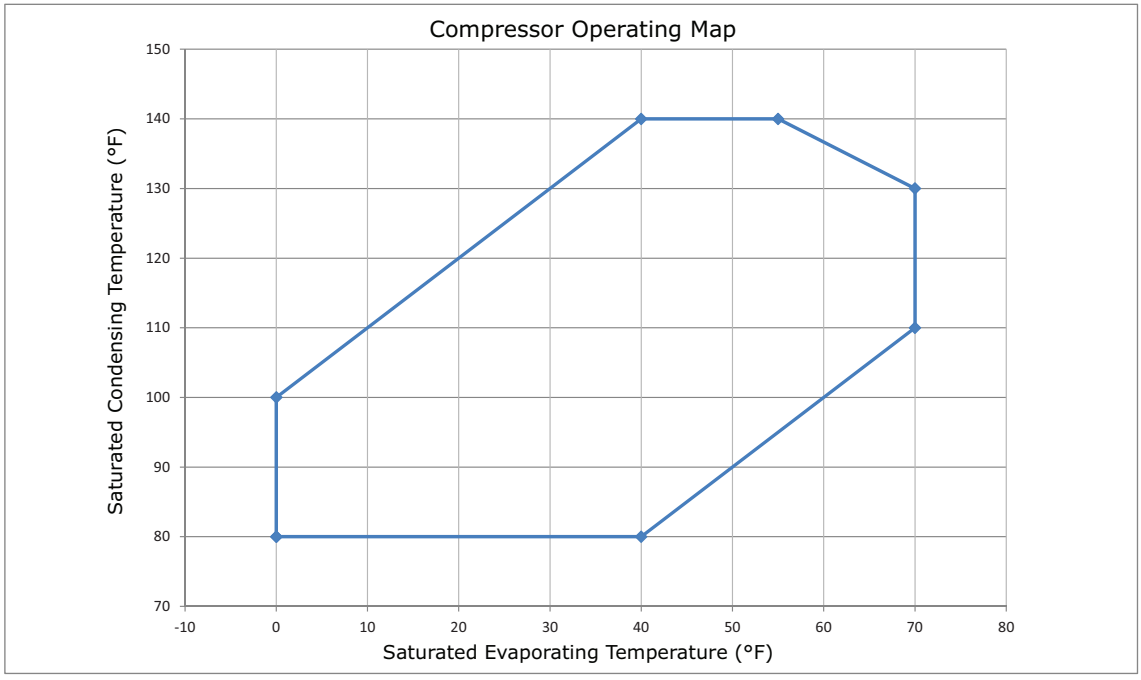
**Compressor Damage!**

**Do not pump the scroll compressor into a vacuum. Scroll compressors can pull internal low vacuums when the suction side is closed or restricted. This, in turn, can lead to compressor failure due to internal arcing and instability in the scroll wraps.**

The proper procedure for checking scroll compressor operation is outlined below:

1. Verify that the compressor is receiving supply power of the proper voltage.
2. With the compressor running, measure the suction and discharge pressures/temperatures to determine whether or not they fall within the compressor operating map shown in Figure 12.

**Figure 12. Compressor operating map**



Normal operating pressures for the unit with a scroll compressor are the same as for a unit with a reciprocating compressor.

## Compressor Operational Noises

Because the scroll compressor is designed to accommodate liquids (both oil and refrigerant) in small amounts without causing compressor damage, there are some characteristic sounds that differentiate it from those typically associated with a reciprocating compressor. These sounds, which are described below, are normal and do not indicate that the compressor is defective.

At low ambient startup: When the compressor starts up under low ambient conditions, the initial flow rate of the compressor is low. Under these conditions, it is not unusual to hear the compressor rattle until the suction pressure climbs and the flow rate increases.These sounds are normal and do NOT affect the operation or reliability of the compressor.

### Excessive Amp Draw

Excessive Amp Draw occurs either because the compressor is operating at an abnormally high condensing temperature OR because of low voltage at the compressor motor.

Motor amp draw may also be excessive if the compressor has internal mechanical damage. In this situation, vibration and discolored oil can also be observed.

### Low Suctions

Continuous low suction pressures are most likely caused by low evaporator load coupled with a system anomaly such as low chilled water flow.

Note: *Operation of the chiller with saturated suction temperatures below freezing will cause damage to the evaporator. If this occurs immediately stop the machine, diagnose and correct the problem.*

# Wiring

**Figure 13. CICA wiring schematic page 1**

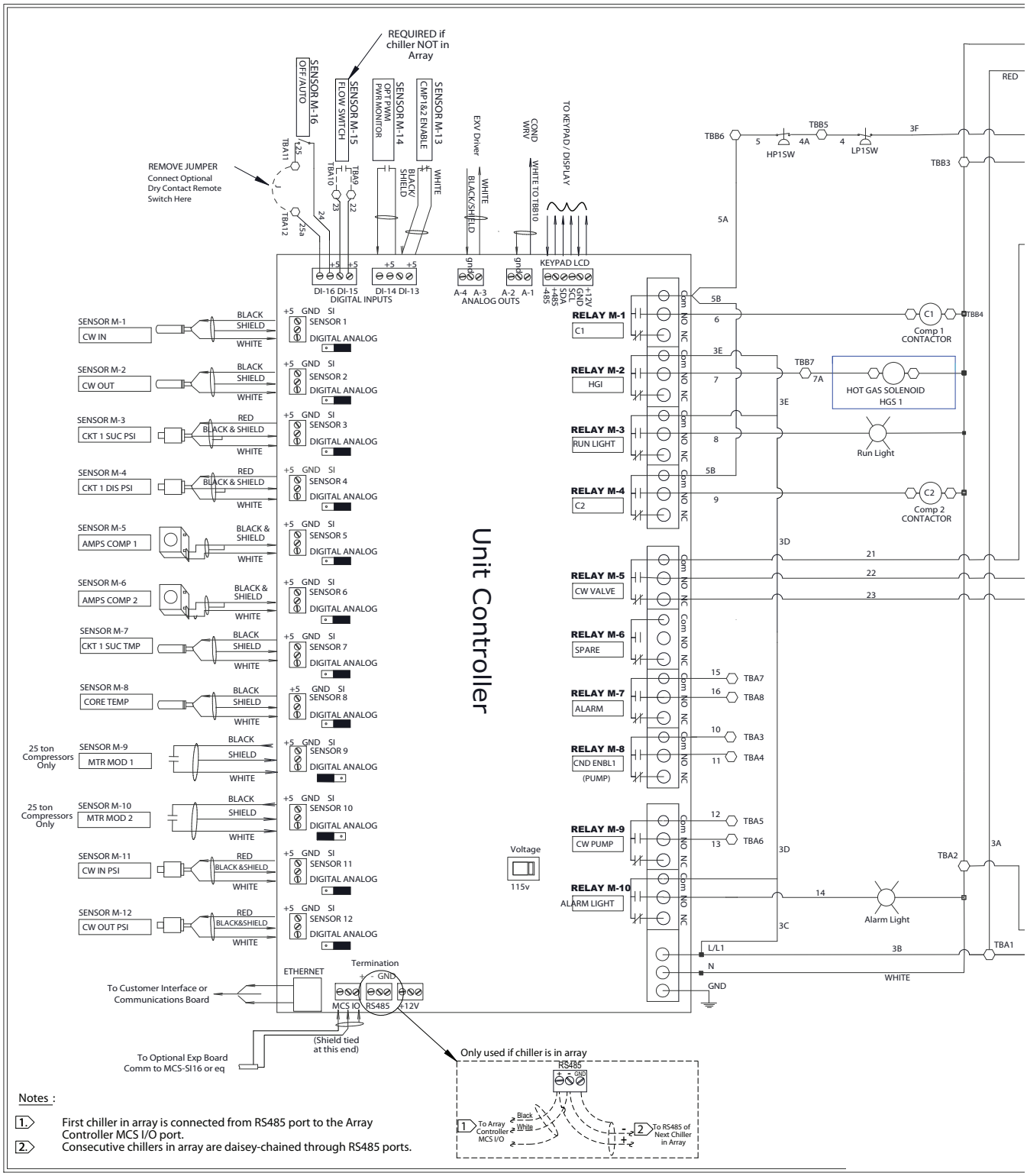


**Figure 14. CICA wiring schematic page 2**

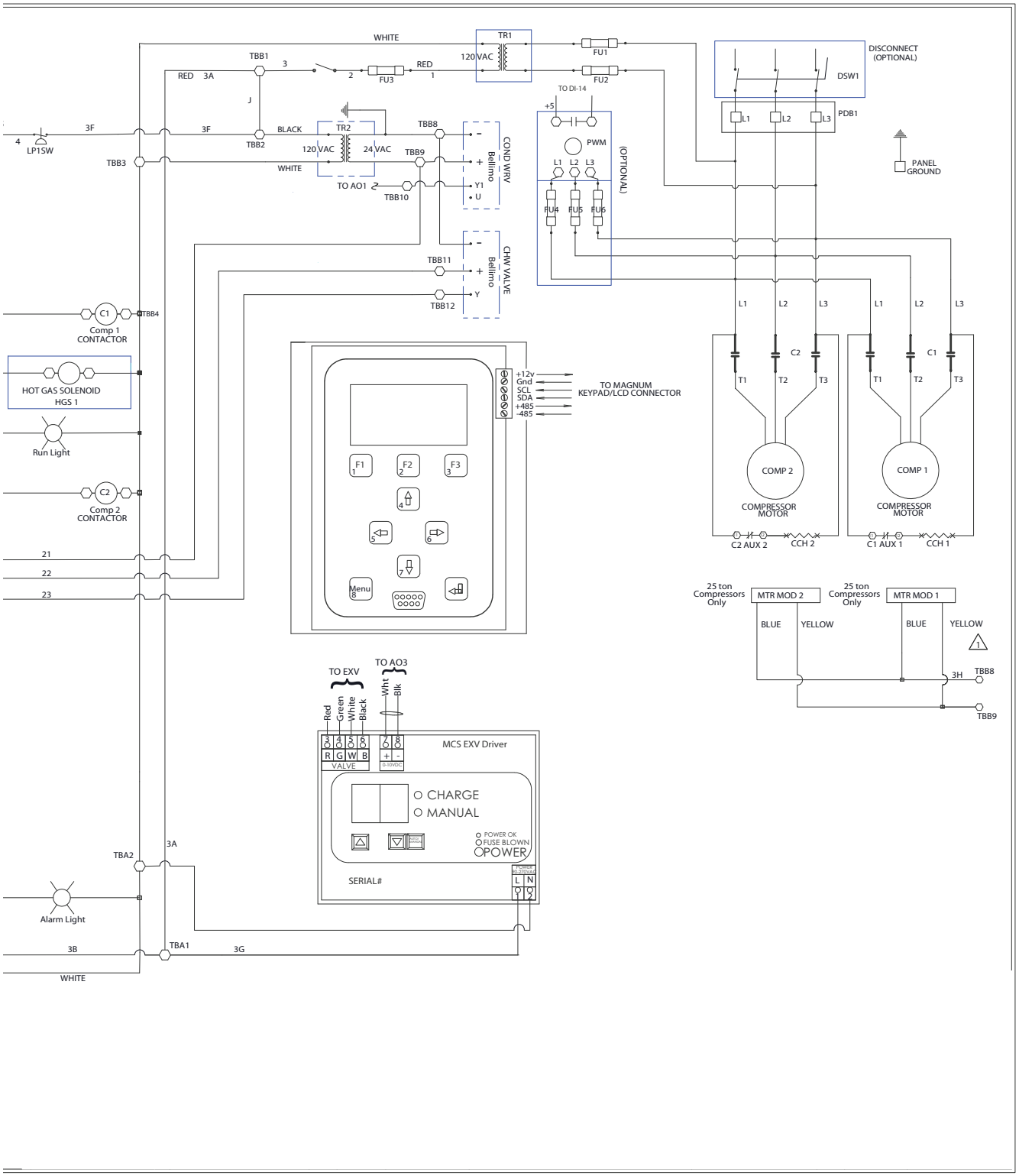
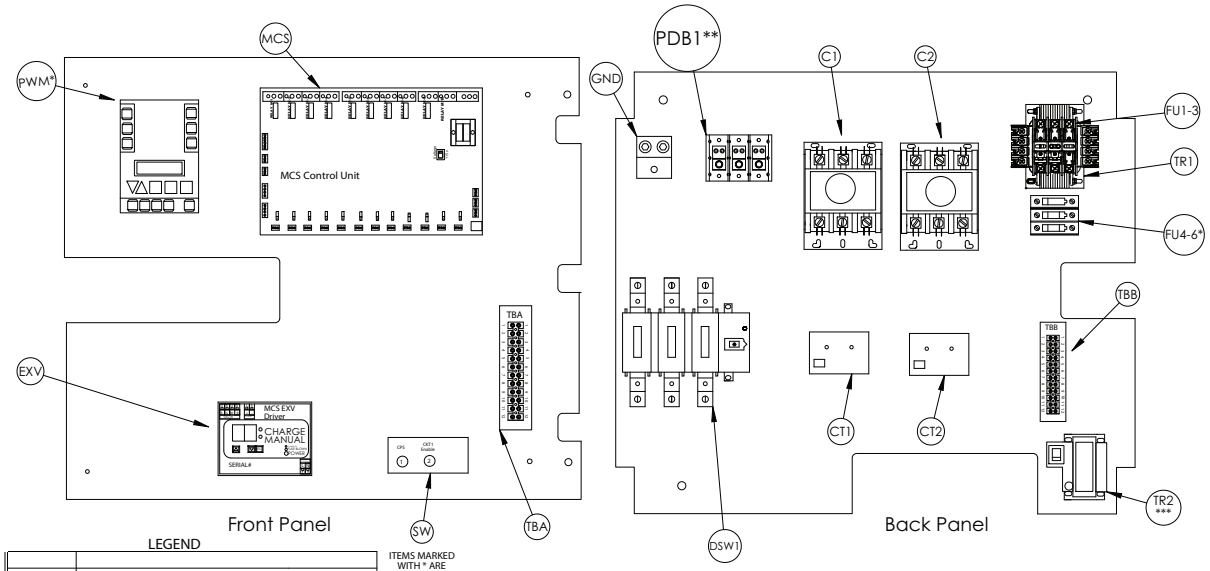


**Figure 15. Control panel layout - typical**




LEGEND

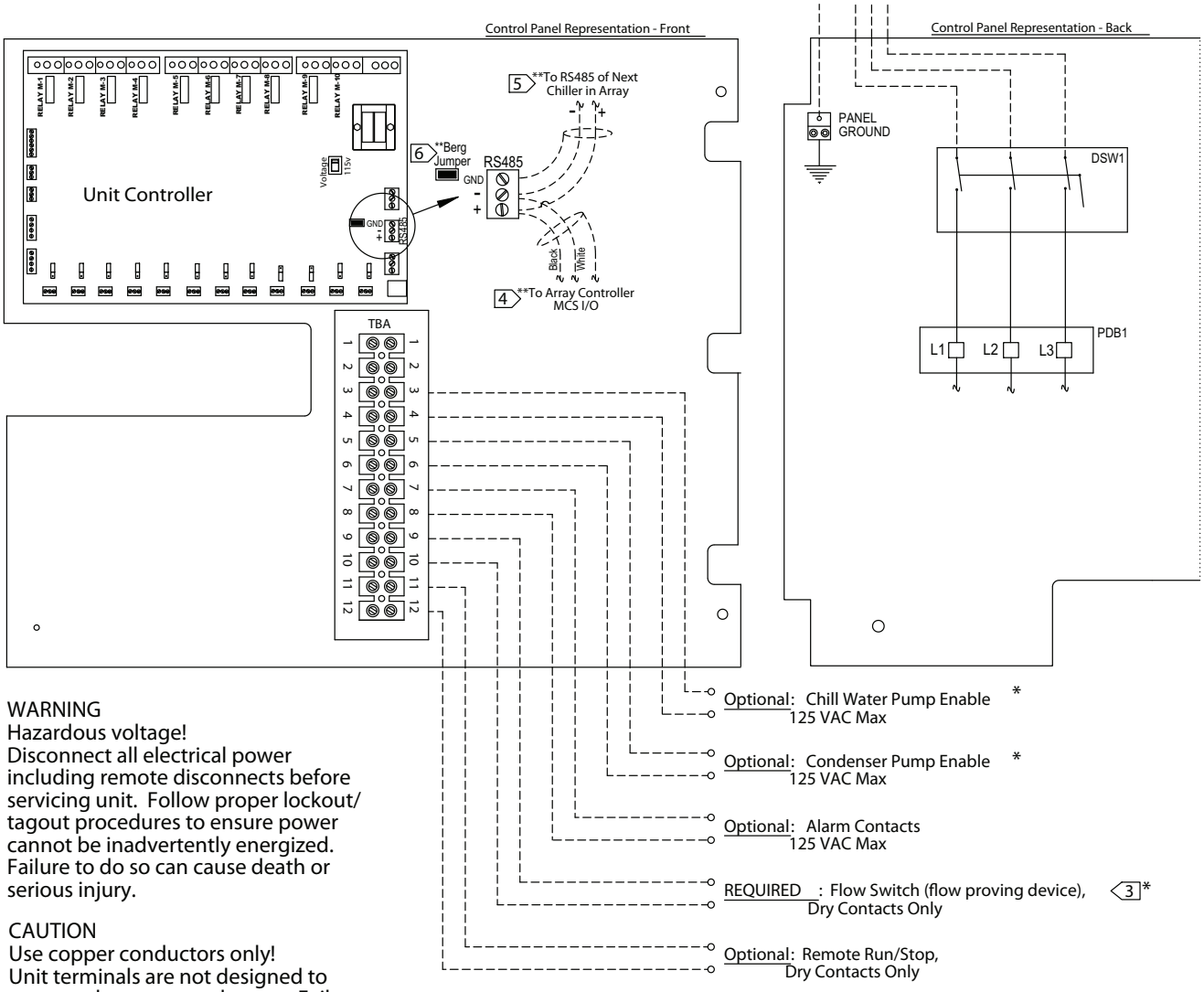
| | |
|---|---|
| C1-C2 | COMPRESSOR CONTACTORS |
| CT1-CT2 | CURRENT TRANSDUCER MODULES |
| DSW1 | DISCONNECT SWITCH |
| EXV | MCS EXV DRIVER |
| FU1,2,3 | TR1 PRIMARY CIRCUIT FUSES - KLDR OR EQ |
| FU4,5,6 * | PWM CIRCUIT FUSES - KTK OR EQ |
| GND | GROUND LUG |
| MCS | MCS MAGNUM DIGITAL CONTROLLER |
| PWM * | DIGITAL POWER MONITOR |
| SW | TOGGLE SWITCHES |
| TBA | TERMINAL BLOCK |
| TBB | TERMINAL BLOCK |
| TR1 | 250 VA TRANSFORMER |
| TR2*** | 24VAC CL2 TRANSFRM FOR COMPR MOTOR MODULE AND/OR OPTIONAL WATER REG VLV |
| PDB1** | POWER DISTRIBUTION BLOCK |

ITEMS MARKED WITH * ARE OPTIONAL AND ARE NOT ON ALL UNITS

ITEMS MARKED WITH ** ARE ONLY ON 460V & 575V UNITS

ITEMS MARKED WITH *** ARE OPTIONAL ON THE 20 & 30 TON ONLY AND ARE NOT ON ALL 20 & 30 TON UNITS

**Figure 16. CICA field wiring diagram**




WARNING
Hazardous voltage!
Disconnect all electrical power including remote disconnects before servicing unit. Follow proper lockout/tagout procedures to ensure power cannot be inadvertently energized. Failure to do so can cause death or serious injury.

CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

CAUTION
Do not energize the unit until check-out and start-up procedures have been completed.

Notes :

1. All customer control-circuit wiring must have a minimum rating of 150V.
2. All field wiring must be in accordance with National Electric Code and State & Local requirements.
*3. (Required) Factory supplied or approved alternate field installed flow proving device connection.
**4. First chiller in array is connected from RS485 port to the Array Controller MCS I/O port.
**5. Consecutive chillers in array are daisey-chained through RS485 ports.
**6. Remove RS485 Berg Termination Jumper if chiller is not the last unit in array.

*Items NOT USED if chiller is in an array

** Items USED if chiller is in an array

# Appendix A
# Warranty

I. LIMITED PRODUCT WARRANTY & SERVICE POLICY

Napps Technology Corporation (NAPPS) warrants for a period of twelve (12) months from date of original shipment that all products, manufactured by NAPPS, with the exception of packaged refrigeration products, are free from defects of material and workmanship when used within the service, range, and purpose for which they were manufactured. Packaged refrigeration products shall be so warranted for a period of twelve (12) months from date of start-up or eighteen (18) months from date of original shipment, whichever may first occur. Service Parts shall be so warranted for a period of ninety (90) days from date of installation, or twelve (12) months from date of original shipment, whichever may first occur.

In case material is rejected on inspection by the buyer as defective, NAPPS shall be notified in writing within ten (10) days from receipt of said material. NAPPS will then have the option of re-inspection at the buyer's plant or its own plant before allowing or rejecting the buyer's claim. Expenses incurred in connection with claims for which NAPPS is not liable may be charged back to the buyer. No claim for correction will be allowed for work done in the field except with the written consent of NAPPS. Defects that do not impair service shall not be cause for rejection. NAPPS assumes no liability in any event for consequential damages. No claim will be allowed for material damaged by the buyer or in transit. Defective equipment or parts shall be returned to NAPPS freight prepaid.

NAPPS will, at its option, repair, replace or refund the purchase price of products found by NAPPS to be defective in material or workmanship provided that written notice of such defect requesting instruction for repair, replacement or refund is received by NAPPS within ten (10) days of determination of said defect, but not more than one (1) year after the date of shipment, and provided that any instructions given thereafter by NAPPS are complied with.

Any products covered by this order found to NAPPS' satisfaction to be defective upon examination at NAPPS' factory will, at NAPPS' option, be repaired or replaced and returned to Buyer via lowest cost common carrier, or NAPPS may, at its option, grant Buyer a credit for the purchase price of the defective article.

Without limitation of the foregoing, this warranty shall not apply to (i) deterioration by corrosion or erosion of material or any cause or failure other than defect of material or workmanship; (ii) the performance of any system of which NAPPS' products are a component part; or (iii) any of NAPPS' products or parts thereof which have been subjected to alteration or repair by anyone other than NAPPS or someone authorized by NAPPS, or subjected to misuse, neglect, free chemicals in system, corrosive atmosphere, abuse or improper use or misapplication such as breakage by negligence, accident, vandalism, the elements, shock, vibration or exposure to any other service, range or environment of greater severity than that for which the products were designed, or if operation is contrary to NAPPS' or manufacturer's recommendation, or if the serial number has been altered, defaced or removed.

Hermetic motor/compressors furnished by NAPPS are subject to the standard warranty terms set forth above, except that the hermetic motor/compressor replacements or exchanges shall be made through the nearest authorized wholesaler of the hermetic motor/compressor manufacturer (not NAPPS' factory) and no freight shall be allowed for transportation of the hermetic motor/compressor to and from the wholesaler. For TRANE hermetic motor/compressors, the nearest wholesaler referred to herein shall be the nearest TRANE PARTS CENTER. The replacement hermetic motor/compressor shall be identical to the model of the hermetic motor/compressor being replaced. Additional charges, which may be incurred through the substitution of other than identical replacements, are not covered by this warranty. Evaporator failure due to fluid freezing that is the result of low fluid flow or inadequate fluid freeze protection, for applications with leaving fluid temperatures below 40° F, is not covered by this warranty

THE WARRANTY PROVIDED ABOVE IS THE ONLY WARRANTY MADE BY NAPPS WITH RESPECT TO ITS PRODUCTS OR ANY PARTS THEREFORE AND IS MADE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, BY COURSE OF DEALING, USAGES OF TRADE OR OTHERWISE, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE OR OF MERCHANTABILITY UNDER THE UNIFORM COMMERCIAL CODE. IT IS AGREED THAT THIS WARRANTY IS IN LIEU OF AND BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTEES OR LIABILITIES ARISING BY LAW OR OTHERWISE. NAPPS SHALL NOT INCUR ANY OTHER, OBLIGATIONS OR LIABILITIES OR BE LIABLE TO BUYER OR ANY CUSTOMER OF BUYER FOR ANY ANTICIPATED OR LOST PROFITS, INCIDENTAL OR CONSEQUENTIAL DAMAGES, OR ANY OTHER LOSSES OR EXPENSES INCURRED BY REASON OF THE PURCHASE, INSTALLATION, REPAIR, USE OR MISUSE BY BUYER OR THIRD PARTIES OF ITS PRODUCTS (INCLUDING ANY PARTS REPAIRED OR REPLACED); AND NAPPS DOES NOT AUTHORIZE ANY PERSON TO ASSUME FOR NAPPS ANY OTHER LIABILITY IN CONNECTION WITH THE PRODUCTS OR PARTS THEREFORE. NAPPS SHALL NOT BE RESPONSIBLE FOR THE LOSS OR REPLACEMENT OF OR THE ADDITION OF COMPRESSOR OIL, OR REFRIGERANT. THIS WARRANTY CANNOT BE EXTENDED, ALTERED OR VARIED EXCEPT BY A WRITTEN INSTRUMENT SIGNED BY NAPPS AND BUYER.

II. LIMITATION OF LIABILITY

NAPPS shall not be liable, in contract or in tort, for any special, indirect, incidental or consequential damages, such as, but not limited to, loss of profits, or injury or damage caused to property, products, or persons by reason of the installation, modification, use, repair, maintenance or mechanical failure of any NAPPS product.

# Appendix B
# Vendor Data Sheets

The following vendor data sheets are attached:

- MCS-CT300 Current Sensor Data Sheet
- MCS-667 Pressure Transducer Data Sheet
- MCS-T100 Temperature Sensor Data Sheet

# MCS-CT300 Current Sensor Data Sheet

MICRO CONTROL SYSTEMS

5580 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

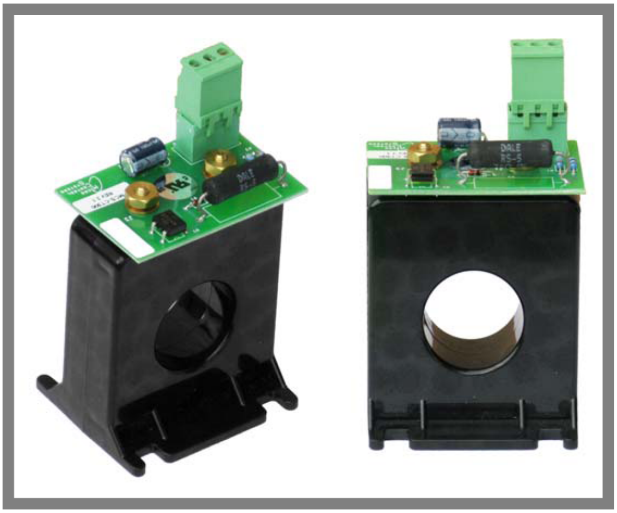
## The MCS-CT300 Specifications & Description

### Product Specifications

Dimensions:
Height ..... 4.00”
Width ..... 2.38”
Depth ..... 1.56”
Wire Hole..... 1.00”

Amperage Rating..... 0-300A
Accuracy..... ± 3 amps
Sensor Output Voltage ..... 0-5vdc
Supply Voltage ..... Induced

Operating Temperature.....-40°F to +158°F (-40°C to +70°C)
Storage Temperature.....-40°F to +158°F (-40°C to +70°C)



Part # **MCS-CT300**

c UL us
File No: E169780

### Product Description

The MCS-CT300 current sensor monitors current flowing to electrical equipment. The magnitude of the current is converted to a linear 0 to 5vdc output signal which can be read as a standard analog input signal. The signal is used by MCS micro controllers for the following:

1 For slide valve positioning on screw machines
2 For high amp motor overload protection
3 For verification of device on / off

The MCS-CT300 is a solid-core version, where the conductor runs through the sensor. No cutting, taping or rerouting is required. It is accurate, reliable, easy to install and requires no service.

The MCS-CT300 has an accuracy of ± 3 amps in the frequency range from 50-60Hz. The sensor outputs a 0 to 5vdc signal. The sensor power is induced from the current being monitored.

On the printed circuit board a resistor is mounted across the CT terminals which eliminates danger from induced current. A removable three-position terminal block is provided for easy wiring.

Two-conductor shielded cable must be used. The shield must be cut at the MCS-CT300 end and tied to ground at the MCS micro controller terminal block.

| Amps | Volts dc |
|---|---|
| 10 | 0.13 |
| 20 | 0.30 |
| 30 | 0.48 |
| 40 | 0.65 |
| 50 | 0.82 |
| 60 | 0.99 |
| 70 | 1.16 |
| 80 | 1.34 |
| 90 | 1.51 |
| 100 | 1.68 |
| 110 | 1.85 |
| 120 | 2.02 |
| 130 | 2.19 |
| 140 | 2.36 |
| 150 | 2.53 |

| Amps | Volts dc |
|---|---|
| 160 | 2.71 |
| 170 | 2.88 |
| 180 | 3.05 |
| 190 | 3.22 |
| 200 | 3.39 |
| 210 | 3.56 |
| 220 | 3.73 |
| 230 | 3.91 |
| 240 | 4.06 |
| 250 | 4.23 |
| 260 | 4.40 |
| 270 | 4.58 |
| 280 | 4.74 |
| 290 | 4.91 |
| 300 | 5.08 |

Revised 2012-10-11

# MCS-667 Pressure Transducer Data Sheet

MICRO CONTROL SYSTEMS
5580 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

## The MCS-667 Specifications & Description

### Product Specifications

Pressure Range..... 0 to 667 psi (Gauge)
Housing ..... 17-4 ph Stainless Steel wetted
Package Protection..... IP66
Operating Temperature .... -40ºF to 257ºF (-40ºC to 125ºC)
Accuracy..... ± 1% -4ºF to 185ºF (-20ºC to 85ºC)
± 2.5% -40ºF to 68ºF (-40ºC to 20ºC)
± 2.5% -40ºF to 257ºF (85ºC to 125ºC)
Agency Approvals.....CE, UL 508, ROHS
Proof Pressure..... 2 x FS
Burst Pressure..... 5 x FS
Random Vibration ..... 20 G @ 10-6670 Hz
Input Voltage ..... 5vdc
Output Voltage..... 0.5 to 4.5vdc (ratio metric)
Connection ..... ¼" SAE Female Flare fitting & Schrader valve; 7/16-20 UNF thread
Cable:
- Connector..... Packard with Neoprene seal
- Length..... 20', 40' or 60' feet
- Type ..... 3-conductor, 20 awg stranded
- Shield ..... Foil shield with 25% overlap
- Drain..... Stranded tinned copper drain

Part number description when ordering (MCS-667-xx)
- xx..... 20' 40' or 60' wire length


Part # **MCS-667**


### Product Description

The **MCS-667** pressure transducer is one of the most economic and durable options on the market for dealing with high-pressure industrial applications.

In addition to being CE and UL approved, the MCS-667 is capable of surviving high vibration. It includes a cavity built out of solid 17-4 PH stainless steel ¼" SAE Female Flare fitting & Schrader valve; 7/16-20 UNF pipe thread which creates a leak-proof, all metal sealed system that makes the MCS-667 ideal for use with rugged HVAC environments. The MCS-667 has an output voltage of 0.5 to 4.5vdc (ratio metric) and is also over-voltage-protected in both positive and reverse polarity, which adds an extra layer of safeguard against short-circuiting caused by unpredictable power surges.

The cable is available in either 20', 40 or 60' lengths with a removable Packard connector to provide easy serviceability. The wire is sealed and crimped to the Packard connector providing a liquid tight environment and strain relief. Media compatibility: Refrigerants (freons) and ammonia.

### PSI to VDC

| PSI | SI (vdc) | PSI | SI (vdc) | PSI | SI (vdc) | PSI | SI (vdc) | PSI | SI (vdc) | PSI | SI (vdc) | PSI | SI (vdc) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.50 | 100 | 1.10 | 200 | 1.70 | 300 | 2.30 | 400 | 2.90 | 500 | 3.50 | 600 | 4.10 |
| 10 | 0.56 | 110 | 1.16 | 210 | 1.76 | 310 | 2.36 | 410 | 2.96 | 510 | 3.56 | 610 | 4.16 |
| 20 | 0.62 | 120 | 1.22 | 220 | 1.82 | 320 | 2.42 | 420 | 3.02 | 520 | 3.62 | 620 | 4.22 |
| 30 | 0.68 | 130 | 1.28 | 230 | 1.88 | 330 | 2.48 | 430 | 3.08 | 530 | 3.68 | 630 | 4.28 |
| 40 | 0.74 | 140 | 1.34 | 240 | 1.94 | 340 | 2.54 | 440 | 3.14 | 540 | 3.74 | 640 | 4.34 |
| 50 | 0.80 | 150 | 1.40 | 250 | 2.00 | 350 | 2.60 | 450 | 3.20 | 550 | 3.80 | 650 | 4.40 |
| 60 | 0.86 | 160 | 1.46 | 260 | 2.06 | 360 | 2.66 | 460 | 3.26 | 560 | 3.86 | 660 | 4.46 |
| 70 | 0.92 | 170 | 1.52 | 270 | 2.12 | 370 | 2.72 | 470 | 3.32 | 570 | 3.92 | 667 | 4.50 |
| 80 | 0.98 | 180 | 1.58 | 280 | 2.18 | 380 | 2.78 | 480 | 3.38 | 580 | 3.98 | | |
| 90 | 1.04 | 190 | 1.64 | 290 | 2.24 | 390 | 2.84 | 490 | 3.44 | 590 | 4.04 | | |

Revised 2014-08-18

# MCS-T100 Temperature Sensor Data Sheet

MICRO CONTROL SYSTEMS
5580 Enterprise Parkway, Fort Myers, FL 33905
Office: 239-694-0089 Fax: 239-694-0031
www.mcscontrols.com

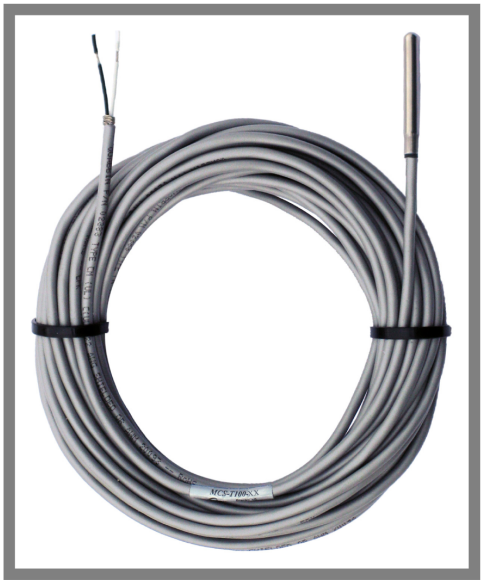
## The MCS-T100 Specifications & Description

### Product Specifications

Standard Temperature Range ..... +32ºF to +158ºF (0°C to +70°C)
Standard Temperature Accuracy .... ±0.36ºF (±0.2°C)
Extended Temperature Range..... -40ºF to +248ºF (-40°C to 120°C)
Extended Temperature Accuracy ... ±1.5ºF (±0.8°C)
Resistance Range ..... 2 Meg to 286 ohms
Response Time (32 to 212ºF)..... 22 sec (in liquid)
Response Time (212 to 32ºF)..... 30 sec (in liquid)
Input Voltage..... 5vdc
Sensor Resistance..... 100,000 ohms @ 77ºF (25°C)
Housing Specifications:
- Dimensions..... 0.187”OD x 1.5”L
- Material..... Stainless Steel
- Environmental rating..... Waterproof to IP68
- Testing..... 10,000 freeze/thaw thermal cycles

Cable:
- Length..... 20’, 40’, or 60’
- Wire ..... 2 conductor 22 awg stranded
- Shield..... Foil shield with 25% overlap
- Drain ..... Stranded tinned copper drain

Part number description when ordering (MCS-T100-xx)
- xx ..... 20’, 40’, 60’, or 100’ wire length



Part # **MCS-T100**

### Product Description

The MCS-T100 is an extremely fast acting temperature sensor built for demanding environments. It is ideal for high moisture locations with continuous freeze and thaw cycles. The sensor is potted with a thermally conductive adhesive to guarantee durability and response. Its high accuracy allows for interchangeability in the field.

The large resistance range allows the use of over 1000’ of cable with no noticeable effect. By placing a 100,000 ohm resister between signal and ground the sensor may be used in a three wire input mode. The table below provides a cross reference between °F /°C, ohms, and vdc at a sensor input pin (S1) of a MCS micro controller.

### Temp to Resist to VDC Chart

| Temp (°F / °C) | Resist (ohms) | S1 (vdc) |
|---|---|---|
| -40/-40 | 4,015,500 | 0.121 |
| -35/37.2 | 3,324,096 | 0.146 |
| -30/34.4 | 2,760,524 | 0.175 |
| -25/-31.6 | 2,299,670 | 0.208 |
| -20/-28.9 | 1,921,640 | 0.247 |
| -15/-26.1 | 1,610,592 | 0.292 |
| -10/-23.3 | 1,353,866 | 0.344 |
| -5/-20.6 | 1,141,345 | 0.403 |
| 0 /-17.7 | 964,963 | 0.470 |
| 5/-15.0 | 818,070 | 0.545 |
| 10/-12.2 | 695,433 | 0.629 |
| 15 /-9.4 | 592,755 | 0.722 |
| 20/-6.6 | 506,560 | 0.824 |
| 25/-3.8 | 434,007 | 0.936 |
| 30/-1.1 | 372,778 | 1.058 |

| Temp (°F / °C) | Resist (ohms) | S1 (vdc) |
|---|---|---|
| 32/0 | 351,020 | 1.109 |
| 35/1.6 | 320,976 | 1.188 |
| 38/3.3 | 293,758 | 1.270 |
| 40/4.4 | 277,040 | 1.326 |
| 45/7.2 | 239,686 | 1.472 |
| 50/10 | 207,850 | 1.624 |
| 55/12.7 | 180,647 | 1.782 |
| 58/14.4 | 166,243 | 1.878 |
| 60/15.5 | 157,353 | 1.943 |
| 65/18.3 | 137,363 | 2.106 |
| 70/21.1 | 120,169 | 2.271 |
| 75/23.9 | 105,347 | 2.435 |
| 80/26.7 | 92,541 | 2.597 |
| 85/29.4 | 81,454 | 2.756 |
| 90/32.2 | 71,838 | 2.910 |

| Temp (°F / °C) | Resist (ohms) | S1 (vdc) |
|---|---|---|
| 95/35 | 63,480 | 3.058 |
| 100/37.7 | 56,200 | 3.201 |
| 104/40 | 51,050 | 3.310 |
| 105/40.5 | 49,846 | 3.337 |
| 110/43.3 | 44,287 | 3.465 |
| 113/45 | 41,290 | 3.539 |
| 115/46.1 | 39,420 | 3.586 |
| 120/48.8 | 35,149 | 3.370 |
| 125/51.6 | 31,399 | 3.805 |
| 130/54.4 | 28,093 | 3.903 |
| 135/57.2 | 25,173 | 3.994 |
| 140/60 | 22,590 | 4.079 |
| 145/62.8 | 20,309 | 4.156 |
| 150/65.5 | 18,284 | 4.227 |
| 155/68.3 | 16,484 | 4.292 |

| Temp (°F / °C) | Resist (ohms) | S1 (vdc) |
|---|---|---|
| 158/70 | 15,500 | 4.329 |
| 160/71.1 | 14,881 | 4.352 |
| 165/73.8 | 13,456 | 4.407 |
| 167/75 | 12,930 | 4.428 |
| 170/76.6 | 12,185 | 4.457 |
| 175/79.4 | 11,052 | 4.502 |
| 180/82.2 | 10,033 | 4.544 |
| 183/83.8 | 9,474 | 4.567 |
| 185/85 | 9,121 | 4.582 |
| 190/87.7 | 8,303 | 4.617 |
| 195/90.5 | 7,567 | 4.648 |
| 198/92.2 | 7,162 | 4.666 |
| 200/93.3 | 6,906 | 4.677 |
| 203/95 | 6,541 | 4.693 |
| 205/96.1 | 6,310 | 4.703 |

| Temp (°F / °C) | Resist (ohms) | S1 (vdc) |
|---|---|---|
| 208/97.7 | 5,981 | 4.718 |
| 210/98.8 | 5,773 | 4.727 |
| 212/100 | 5,573 | 4.736 |
| 215/101.6 | 5,289 | 4.749 |
| 218/103.3 | 5,020 | 4.761 |
| 220/104.4 | 4,849 | 4.769 |
| 223/106.1 | 4,605 | 4.780 |
| 225/107.2 | 4,449 | 4.787 |
| 227/108.3 | 4,299 | 4.794 |
| 230/110 | 4,085 | 4.804 |
| 233/111.6 | 3,886 | 4.813 |
| 235/112.7 | 3,760 | 4.819 |
| 240/115.5 | 3,463 | 4.833 |
| 245/118.3 | 3,191 | 4.845 |
| 248/120 | 3,040 | 4.852 |

Revised 2013-07-19

# Appendix C

## Piping System Flushing Procedure

Prior to connecting the chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130°F) mixture to remove previously accumulated dirt and other organics. In old piping systems with heavy encrustation of inorganic materials consult a water treatment specialist for proper passivation and/or removal of these contaminants.

During the flushing, 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove collected residue. The use of on-board chiller strainers shall not be acceptable. The flushing process shall take no less than 6 hours or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer's instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one (1) hour to ensure that all residual cleaning chemicals have been flushed out.

Prior to supplying water to the chiller the Water Treatment Specification shall be consulted for requirements regarding the water quality during chiller operation. The appropriate chiller manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

## Water Treatment Requirements

Supply water for both the chilled water and condenser water circuits shall be analyzed and treated by a professional water treatment specialist who is familiar with the operating conditions and materials of construction specified for the chiller's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for compact chillers using 316 stainless steel brazed plate heat exchangers and carbon steel headers is maintained within the following parameters.

**Table 7. Water property limits**

| Water Property | Concentration Limits |
|---|---|
| Alkalinity ($HCO_3^-$) | 70-300 ppm |
| Sulfate ($SO_4^{2-}$) | Less than 70 ppm |
| $HCO_3^-$ / $SO_4^{2-}$ | Greater than 1.0 |
| Electrical Conductivity | 10 - 500 µS/cm |
| pH | 7.5 – 9.0 |
| Ammonia ($NH_3$) | Less than 2 ppm |
| Chlorides ($Cl^-$) | Less than 300 ppm |
| Free Chlorine ($Cl_2$) | Less than 1 ppm |
| Hydrogen Sulfide ($H_2S$) | Less than 0.05 ppm |
| Free (aggressive) Carbon Dioxide($CO_2$) | Less than 5 ppm |
| Total Hardness (°dH) | 4.0 - 8.5 |
| Nitrate ($NO_3$) | Less than 100 ppm |
| Iron (Fe) | Less than 0.2 ppm |
| Aluminum (Al) | Less than 0.2 ppm |
| Manganese (Mn) | Less than 0.1 ppm |

Trane optimizes the performance of homes and buildings around the world. A business of Ingersoll Rand, the leader in creating and sustaining safe, comfortable and energy efficient environments, Trane offers a broad portfolio of advanced controls and HVAC systems, comprehensive building services, and parts. For more information, visit www.Trane.com.

Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.


CG-SVX028A-EN 06 Nov 2015
(NEW)

We are committed to using environmentally conscious print practices that reduce waste.