Product Catalog

Cold Generator™ Compact Chiller Series

20 to 85 Tons (60 Hz)
Water-Cooled and Compressor Chillers

March 2022

CG-PRC052G-EN

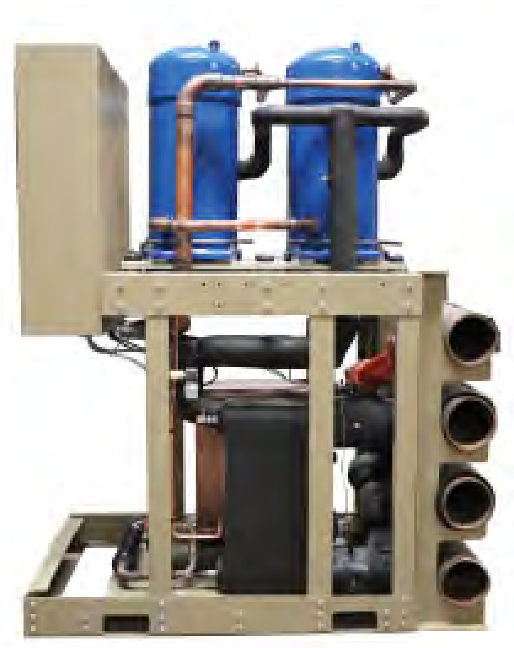
Introduction

Trane® Cold Generator™ Compact Series model CICD water-cooled chillers are designed with flexibility, expandability and serviceability in mind. These high efficiency compact modular chillers provide quiet, reliable operation and are built to withstand demanding continuous duty cycles. Each compact chiller meets or exceeds the ASHRAE 90.1-2016 energy efficiency standard.

Space efficient brazed plate condensers provide lower first cost and high operating efficiency. Optional, mechanically cleanable and serviceable shell-and-tube water cooled condenser makes the compact modular chiller uniquely suitable for open loop cooling water systems with cooling towers.

At the heart of the CICD product line is the highly efficient scroll compressor. Additionally the CICD utilizes single or dual refrigerant circuited brazed plate evaporators and single or dual refrigerant circuited condensers for increased redundancy and serviceability.

CICD water-cooled compact modular chillers can be easily combined to meet higher capacity demands and are easy to install in most building layouts. This makes them the ideal choice for retrofit or new building designs where reliability, serviceability, high efficiency, flexibility, and expandability are critical.



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Revision History

- Updates to Variable Flow Applications section.
- Minor updates throughout document.

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Features and Benefits

Trane® Cold Generator™ Compact Series model CICD water-cooled chillers are complete, factory-assembled units designed for a wide range of comfort and process cooling applications, but also have the ability to be piped into a multistage array of up to ten (10) chillers for much larger capacities.

Standard Features

- All CICD compact chillers meet or exceed ASHRAE 90.1-2016 energy efficiency requirements.
- All CICD compact chillers are AHRI performance certified under AHRI Standard 550/590(I-P)-2015 and ETL safety compliant under ANSI/UL1995, CAN/CSA C22.2 236-11, 4th edition.
- Removable water header section design allows the compact chiller to be pulled out of an array of chillers without disturbing water flow or operation of remaining chillers in the array.
- CICD compact chiller has low pumping power requirements for both chilled and condenser water circuits.
- Factory-assembled CICD compact chillers are pressure tested, dehydrated and charged with operating charge of POE compressor oil and 410A refrigerant before shipment.
- Every CICD compact chiller is run tested over a range of full and part load conditions before shipment, minimizing startup delay. A data log is retained at the factory for each unit shipped.
- CICD compact chiller dimensions:
  - With removable water header section and all standard and optional valving: 32 inches wide X 76 inches tall X 60 inches deep.
  - Without removable water header section: 32 inches wide X 76 inches tall X 48-7/8 inches deep.
- All CICD compact chillers have an option for two (2) independent refrigerant circuits for redundancy. Each circuit has a scroll compressor, a brazed-plate evaporator, a dual-circuit brazed-plate or shell-and-tube condenser, a liquid line filter drier, a liquid line solenoid valve, a sight glass, a thermal expansion valve and active freeze protection, which takes evasive measures to help prevent evaporator freezing.
- Each refrigerant circuit on all CICD compact chillers has four (4) service ports, including one charging port located between the expansion device and the evaporator inlet.
- The standard active freeze protection feature is suction pressure actuated and is provided to stabilize the suction pressure/temperature in the evaporator during transient conditions which potentially avoids nuisance low temperature safety trips.
- Core temperature sensors are installed in every CICD brazed-plate evaporator as a redundant low water temperature safety.
- CICD compact chillers have manual isolation valves and grooved pipe couplings making it easy to isolate the heat exchangers.
- The condenser refrigerant side (shell side) is ASME stamped and the water side (tube side) has a maximum allowable working pressure of no less than 150 psig at 150°F.
- Every CICD compact chiller has a detachable water header section consisting of left-hand or right-hand chilled water or condenser water customer connections. Customer connections are 6 inches grooved pipe and arrive ready for immediate connection to the customer supply/return lines and, if applicable, to other adjacent CICD compact chillers.
- All cold refrigerant and water surfaces are insulated with closed-cell flexible insulation.
- All CICD power distribution and control components are located in a control cabinet with operator keypad/display, alarm light, run light and off/auto switch mounted on the exterior of the control cabinet door.

- The CICD unit controller is a microprocessor based controller capable of performing all of the operational, safety, data retention, communication and fault related functions of the chiller while providing compressor lead/lag logic.
- BACnet®/IP and Modbus™ TCP/IP (or RTU) are standard chiller interface protocols for building automation and control network communication if needed.
- CICD compact chillers come with a complete unit parts warranty (excluding refrigerant) for one (1) year from startup or 18 months from shipment, whichever occurs first.

Factory-Installed Options

- The touchscreen control comes with screens allowing users to acknowledge alarms, change set points and force points on selected screens. Transitioning from screen to screen is fast and easy by tapping the touch screen or using the stylus on the touchscreen. The touchscreen display continuously captures data and provides trending capability for power and chiller performance and chilled and condenser water parameters for precise energy management.
- Mechanically cleanable and serviceable shell-and-tube water cooled condenser makes the chiller uniquely suitable for open loop cooling water systems with cooling towers.
- The integral condenser water regulating valve option is available to stabilize and maintain the refrigerant condensing pressure within the operating limits of the CICD compact chiller. The valve would replace one of the manual isolating valves that come standard on every chiller and would also be used to isolate the condenser from the cooling water circuit when needed.
- A fused or non-fused disconnect with through-the-door operation is available on most CICD models.
- A 100kA SCCR electrical rating is available in lieu of standard 5kA SCCR electrical rating.
- Sound attenuation enclosures are exterior panels designed to completely enclose the CICD compact chiller.
- Compressor blankets are used to dampen the sound produced by the compressors and can be used alone or in combination with the sound attenuation enclosures.
- The factory-installed phase/power monitor is designed to protect the chiller from premature failure and damage due to common voltage faults such as voltage unbalance, over/under voltage, phase loss, reversal, incorrect sequencing and rapid short cycling.
- BACnet® MS/TP, Johnson N2 and LonTalk® protocols for building automation and control network communication are available for the CICD unit controller.
- A controller expansion board can be installed if advanced peripheral control is needed.
- CICD chiller products are available in a compressor chiller version allowing for use with remote condensers.
- The high capacity evaporator option allows for 40F leaving water temperature. Colder water is generally used in wide delta-T systems, reducing the pumping energy required and making it less expensive to deliver cooling capacity over long distances.
- In applications that can cause chemical corrosion, galvanic corrosion and erosion, the CICD chiller is available with a shell and tube condenser that has high-resistance material tubes consisting of cupro-nickel (Cu/Ni 90/10).
- A chiller array can be optionally powered through a field provided single point of power. This is useful in replacement applications where the previous chiller was supplied by a single point of power.The power for all modules is distributed from a factory sized distribution panel and associated wire whips.The wire whips are field installed through factory provided module connections.
- Replaceable core liquid line filter driers capture contaminants that could have entered the refrigeration system, helping to extend the life of the equipment.

- Compressor isolation valves are available for improved service efficiency.
- Wye strainer installation kits provide piping transitions need to easily attach the wye strainer to the chiller.
- LED lighted control cabinet option provides lighting of the control cabinet's interior for easier and safer serviceability.

Factory-Provided/Field-Installed Options

- Wye-strainers with a minimum of 20-mesh are required to be field-installed before the customer connection to brazed plate heat exchanger(s).
- An evaporator flow-proving device is required for all CICD applications. A paddle style liquid flow switch is available with a NEMA Type 4X enclosure for field-installation.
- For critical cooling applications, the "N+1" option allows for a dormant backup chiller to be available in a multiple CICD compact chiller array. If an active CICD compact chiller fails, the "N+1" logic will open the chilled and condenser water valves and enable the backup chiller while closing the chilled and condenser water valves and disabling the failed chiller. The "N+1" option package includes:
  - The array controller package (factory-provided/field-installed)
  - One (1) backup CICD compact chiller to be connected to the "N" number of CICD compact chillers needed to satisfy the design cooling load (factory-provided/field-installed)
  - Array controller "N+1" logic programming (factory-installed)
  - Motorized valves on all CICD compact chillers' chilled and condenser water outlets (factory-installed)
- Neoprene isolator pads can be provided for load bearing points on the CICD compact chillers.
- The wheel kit, containing swiveling casters, is easily installed to factory provided holes in the base of each CICD compact chiller and allows the chiller to be easily maneuvered and rolled into position across smooth surfaces.
- Ice build logic can be factory programmed into the CICD unit controller for use with a field-provided and installed dry contact closure device in ice storage applications. Available for single chiller application only.
- Condenser water temperature sensors allow measurement and monitoring of the condenser entering and leaving water temperatures and can be used in heat recovery applications.
- Ambient temperature sensor allows for measuring and monitoring of ambient temperature.

Other Features and Benefits

Flexibility and Expandability

- Trane® Cold Generator™ CICD compact series scroll chillers were specifically scaled to fit through a standard 36-inch doorway and to fit onto a standard elevator, ensuring fast and easy delivery and installation.
- Because the CICD compact series can be applied as an individual chiller or applied as a high capacity multi-stage, multi-chiller array by using the optional array controller package, the CICD compact chillers can be configured to meet capacity needs ranging from 20 tons to 600 tons.
- The array controller option allows the CICD compact chiller to be an ideal solution for facilities with growing occupancy and structural expansion plans because chillers can be added as capacity needs increase.

Serviceability

- The CICD compact chiller was designed in such a manner that the compressors, evaporator, condenser, refrigerant specialties and water pipe components can all be easily serviced or removed. When installed in an array, these components can all be easily serviced or removed from any one chiller in the array while the other chillers in the array continue to operate.
- Standard, integral valving makes it possible to isolate the CICD heat exchangers for routine maintenance. Once isolated, both heat exchangers have inlet and outlet grooved pipe connections readily accessible to allow for backflushing, chemical cleaning and/or rodding of the shell-and-tube condenser without having to remove the exchanger. If a heat exchanger must be removed and replaced, all necessary work can be performed at the front of the chiller without having to remove other unrelated parts.
- If needed, an entire CICD compact chiller can be removed from an array of chillers by using the integral valving, grooved pipe connections and the detachable water header section. Because the detachable water header section was designed with its own support frame, the water header section can be left in place to feed adjacent chillers allowing them to continue operating.
- In an array application with a supervisory array controller, if the array controller fails or if communication is lost between the individual CICD compact chillers and the supervisory array controller, the individual chillers can be switched to "standalone" mode and continue operating on their own to control the chilled leaving water temperature within the control zone of a pre-set default setpoint.
- The CICD compact controller stores operational and diagnostic information that can be accessed locally using the chiller keypad/display or the PC connection inside the chiller control panel. This information can also be accessed from a remote location using an Ethernet or other type interface.

Single Source Responsibility

Single source responsibility allows the customer to source all building comfort systems through their local Trane Sales Office.

Application Consideration

Unit Location

Trane® Cold Generator™ Compact Series model CICD water-cooled chillers are designed for indoor installations that remain above 32°F and below 125°F at all times. Locate the chiller away from sound-sensitive areas on a level foundation or flooring strong enough to support 150 percent of the operating weight and large enough to keep with service clearances. Also, the chiller foundation or flooring must be rigid enough to minimize vibration transmission. Please see General Data chapter for compressor sound data and Dimension and Weights chapter for unit operating weights and clearances. If necessary, options are available for sound attenuation and vibration reduction.

Water Circuit Requirements

CICD compact chillers are equipped with brazed plate evaporators. The water/fluid circuits to be used with these chillers should be designed and installed following sound engineering practices and procedures as well as any applicable local and industry standards. For the brazed plate heat exchanger circuits, it is imperative the utmost attention be focused on filtration and water quality.

Prior to connecting a CICD compact chiller into a newly installed or existing water piping system, it is required to flush the system with a detergent and hot water mixture to remove previously accumulated dirt and other organics. In old piping systems with heavy encrustation of inorganic materials, a water treatment specialist should be consulted for proper passivation and/or removal of these contaminants.

Filtration — Particulate fouling is caused by suspended solids (foulants) such as mud, silt, sand or other particles in the heat transfer medium. The best way to avoid particulate fouling is to have good water treatment and keep all system water clean and with open loop system water, maintain proper bleed rates and make up water. A strainer with a 20-mesh screen (or screen with 0.5 mm sized openings or less) is required to be installed at the individual compact chiller (or compact chiller array) inlet to protect the brazed plate heat exchangers. Wye-strainers are available as a factory-provided, field-installed option. If an application is highly susceptible to foulant contamination, additional filtration methods should be investigated.

Water quality — Poor water quality can cause another type of fouling called scaling. Scaling is caused by inorganic salts in the water circuit of the heat exchangers. Scaling increases pressure drop and reduces heat transfer efficiency. The likelihood of scaling increases with increased temperature, concentration and pH. In addition to scaling, poor water quality can cause other issues like biological growths and corrosion. Therefore, water quality and water quality control needs to be an application consideration. Please review the water quality requirements for use with the brazed plate heat exchangers on the CICD compact chiller.

Table 1. 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

Table 1. Water property limits (continued)

Water Property	Concentration Limits
Iron (Fe)	Less than 0.2 ppm
Aluminum (Al)	Less than 0.2 ppm
Manganese (Mn)	Less than 0.1 ppm

Evaporator Fluid Temperatures and Flow Requirements

Standard evaporator leaving water temperature range for the CICD compact chiller is 42°F to 65°F. For evaporator loops containing the appropriate amount of glycol, the chilled water leaving temperature range can be shifted to 10°F to 65°F.

The evaporator minimum and maximum flow rates are listed in Table 6, p. 21. Typically, the listed flow rate ranges will develop temperature differentials across the evaporator between 7°F to 20°F. If your application conditions do not fit these requirements, please contact your local Trane representative.

For all CICD compact chiller applications, the flow to the evaporator must be proven using a chilled water flow-proving device. A factory-provided paddle style liquid flow switch is provided with a NEMA Type 4X enclosure for field-installation.

Chilled Water System Volume

A minimum 3-minute loop time is required for the evaporator chilled water system. For your specific application, you can calculate the required chilled water system volume by multiplying the design evaporator flow rate in GPM by 3 minutes. Depending on the system, a tank with baffles for mixing may need to be installed into the loop to meet the required volume.

Condenser Fluid Temperatures and Flow Requirements

Standard condenser entering water temperature range for the CICD compact chiller is 65°F to 125°F. The condenser leaving water temperature (LWT) maximum is 125°F for shell-and-tube condensers and 140°F for brazed-plate condensers, and the condenser LWT minimum is 70°F. When the condenser LWT is lower than 70°F, the refrigerant condensing temperature can drop below 80°F and fall outside of the CICD compressors' operating envelope. For these applications, provisions must be made to control the condenser water that results in a stable refrigerant condensing temperature/pressure that remains above 80°F (235 psig) throughout all steady state, part load and transient operating conditions. The integral factory-installed condenser water regulating valve option is perfect for these applications and is highly recommended.

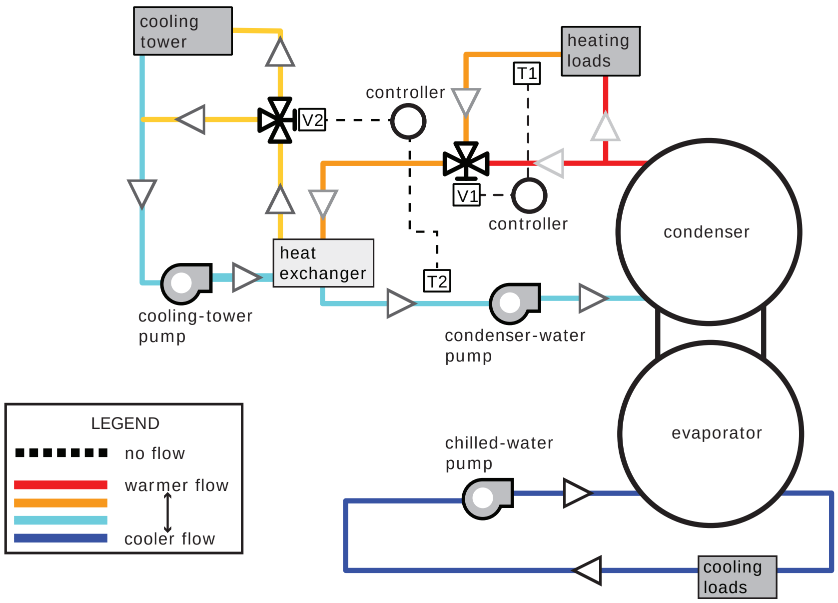
The condenser minimum and maximum flow rates are listed in Table 6, p. 21. Typically, the listed flow rate ranges will develop temperature differentials across the condenser between 5°F to 30°F. If your application conditions do not fit these requirements, please contact your local Trane representative.

Heat Recovery Operation

At a time when energy costs are high and continue to rise, reducing energy usage has become increasingly important. By using a CICD chiller with heat recovery, utilization of energy can be improved by using heat from the condenser that would otherwise be wasted.

The use of heat recovery should be considered in any building with simultaneous heating and cooling requirements or in facilities where heat can be stored and used at a later time. Buildings with high year-round internal cooling loads are excellent opportunities for heat recovery. Heat recovery can be accomplished with the CICD by recovering heat from the water leaving the standard condenser and using it in conjunction with a third party heat exchanger as shown in below figure.

Figure 1. Heat recovery



Heat recovery is designed to capture a portion of the heat that is normally rejected to the cooling tower and put it to beneficial use. With the addition of a heat recovery cycle, heat removed from the building cooling load can be transferred to any heating application. The heat recovery cycle is only possible if a cooling load exists to act as a heat source.

The Trane CICD chiller uses smart control logic to switch the control point between the cooling set point and heating set point, based on the smaller of the loads. This allows the machine to operate in heat recovery mode longer - maximizing the energy saved. In the heat recovery cycle, the unit can control to a hot water set point. During the heat recovery cycle, the unit operates just as it does in the cooling-only mode except that the leaving hot water is the control point instead of the leaving chilled water. Water circulated through the heat recovery heat exchanger (condenser) absorbs cooling load heat from the compressed refrigerant gas discharged by the compressors. The heated water is then used to satisfy heating requirements.

Hospitals dormitories, computer centers, and hotels are opportunities for economical heat recovery due to their needs for hot water for reheat and domestic use, coupled with air-side economizer operation, or in some cases, winter operation of chillers. Heat recovery provides hot water and tight control that minimizes operating costs for the chilled water plant and boiler/hot water heater, while also providing consistent dehumidification. The heat recovery heat exchanger cannot operate alone without a load on the chiller.

Units with a brazed plate heat recovery heat exchanger can produce up to 140°F leaving water temperature and units with the shell and tube heat recovery heat exchanger can produce up to 125°F leaving temperature. For more information see TOPSS™ performance selection program.

Variable Flow Applications

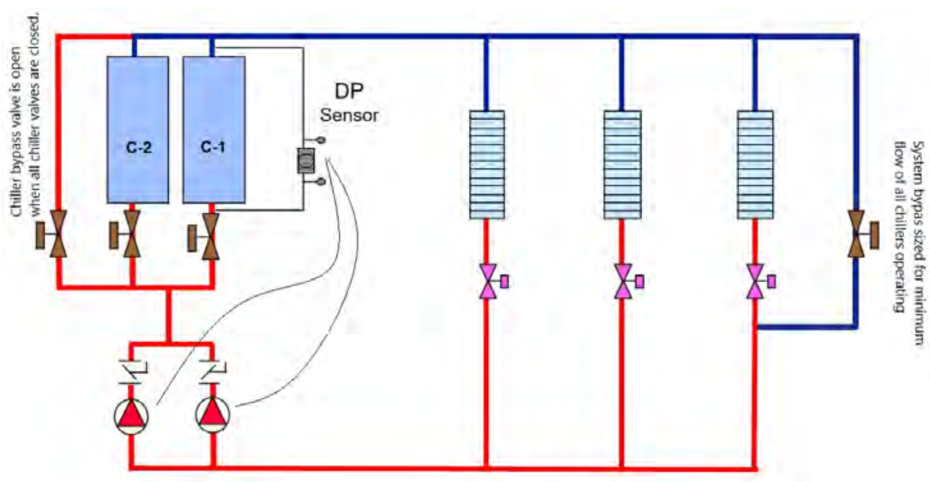
CICD compact chillers can be applied in variable flow applications where the flow is varied and controlled by others. The flow being delivered to the chiller must not go outside the stated minimum and maximum flow rates in “General Data,”. The chilled water system volume should be calculated using the highest evaporator flow rate to be delivered to the chiller, and the rate of change in flow rate must not exceed 10% of design flow GPM per minute. In CICD Series chiller arrays, the chillers are piped with a common header. In Figure 2, *Variable with parallel pumps*, this common header arrangement allows the ability to operate the system in several ways depending on the load and/or current situation. For example, the system can be operated with two pumps and one chiller so that flow out into the system can be increased, without needing to stage on an additional chiller.

This configuration also allows flexible redundancy with commonly headered pumps and chillers. If a pump goes down, the remaining pump can serve one or both chillers and still meet the required load. If a chiller needs service or is turned off, the system can compensate for some of the loss in capacity by increasing flow through the remaining chiller while operating both pumps. However, the flow being delivered to any chiller must not go outside the stated minimum and maximum flow rates.

By maintaining the flow between the minimum and maximum flow rates, the chiller is able to provide proper heat transfer and stable operation at lower flows and avoid eroding the pipes at higher flows.

Variable flow bypass valves — A bypass valve is required at the chillers and the load (air handlers, terminal devices, etc.) in systems with variable flow pumping. The bypass must be piped so the temperature and differential pressure sensors are always sensing active flow.

Figure 2. Variable flow with parallel pumps

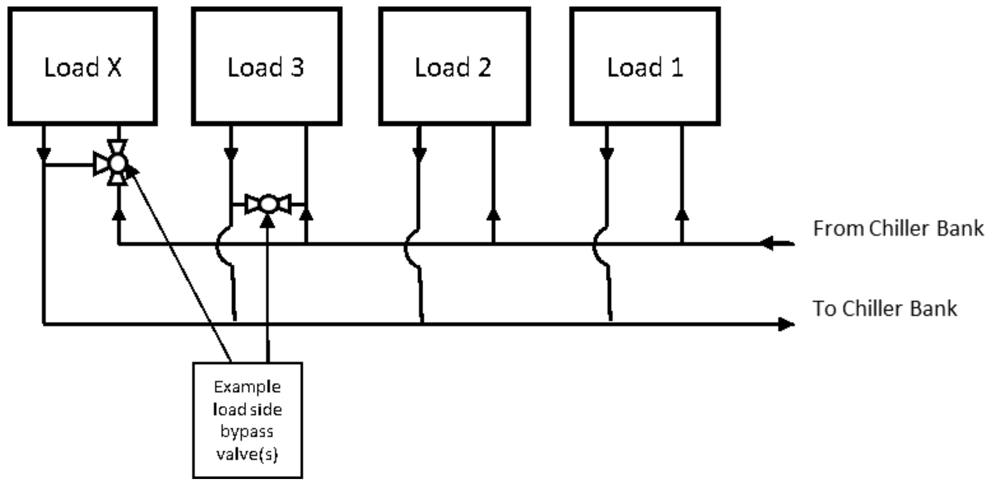


Load bypass valve — If a single load side bypass valve is used, it should be sized to bypass the minimum water flow at maximum chiller load. This size is required because there can be a lag between the load measured at the system load and at the CICD Series chiller bank. This lag can create different flow requirements at the load versus the chiller(s).

An example of this lag is when a building becomes occupied in the morning and the chillers are in a pull-down situation. The air handlers serving the occupied space reach the desired occupied temperature and simultaneously drive their control valves closed. At the same time, the chillers are still in a pull-down mode and running at full capacity to reach the desired leaving water temperature. As a result, the chiller(s) require more flow than the rest of the system until the chiller controls unload the chiller to match the new system load condition. Without a system bypass valve, the system pump(s) will either provide too much flow to the load (air handlers, terminal devices, etc.) or not enough flow the chiller array. The bypass valve also ensures that there is an adequate minimum flow through the pump if all the valves in the load system are closed, otherwise the pumps can deadhead.

Bypass valves at the end of the loop/system, as shown in Figure 3, p. 14, *Example Load Bypass Valve Arrangements*, promotes keeping the overall active loop volume high. Some systems may not allow for an end-of-loop bypass. In these situations the bypass valve may be installed closer to the chiller, provided the minimum system volume equaling a minimum of a 2-3 minute loop time is maintained to ensure proper operation. See "Chilled Water System Volume," p. 11 for more information.

Figure 3. Example load bypass valve arrangements



External chiller array bypass valve — A bypass valve for the chiller array is required so that when the chiller array has reached the desired leaving water temperature, and the motorized valves for each module have closed, system flow remains through the external chiller array bypass valve. The chiller bypass should be sized for the minimum flow of one chiller module or the minimum flow of the system's pumping system, whichever is greater. This bypass is only required to be open when all motorized valves in the chiller array are closed. After the first module is active and the motorized valves are the open, the external chiller array bypass valve can be closed because the active module now provides the water flow path.

Compressor Chillers

Compressor chiller version is available for use with remote condensers. In general, the minimum outdoor ambient temperature for operation of CICD compressor chiller is 20°F. This minimum is driven by compressor chiller starting considerations and not by effectiveness of condenser ambient controls once the system is up and running. Fan cycling and optional low ambient dampers do not mitigate the low ambient starting problem. On a cold day with outdoor ambient temperature below 20°F the liquid line pressure at the expansion valve inlet is extremely low. On start, the suction pressure may plunge into the freezing range causing a nuisance fault. The maximum ambient temperature limit for the CICD is 110°F.

Line Sizing Guidelines

Liquid Lines

Pressure drop should not be so large as to cause gas formation in the liquid line, insufficient liquid pressure and the liquid feed device, or both. Systems are normally designed so that pressure drop in the liquid line from friction is not greater than that corresponding to 1 to 2°F change in saturation temperature.

Sufficient sub-cooling must be maintained at the expansion valve. To provide proper operation throughout the range of operating conditions, the liquid-line pressure drop should not exceed the unit's minimum sub-cooling value less 5°F. To achieve this objective, keep these liquid line considerations in mind:

- Select the smallest, practical line size for the application. Limiting the refrigerant charge improves compressor reliability.
- When designing the liquid line for a typical air conditioning application (i.e., one with an operating range of 40°F to 110°F), remember that every 10 feet of vertical rise will reduce sub-cooling by 2.8°F, while every 10 feet of vertical drop will add 1.1°F of subcooling.
- Provide a 1-inch pitch toward the evaporator for every 10 feet of run.
- If the liquid line must be routed through an area warmer than outdoor air temperature, insulate the line to prevent the refrigerant from flashing. A liquid line filter drier must be installed as close as possible to the compressor chiller. The filter drier should be changed whenever the system is opened for service. CICD Series compressor chillers do not include a filter-drier as standard, but one may be ordered if the installing contractor desires a factory type.
- A moisture-indicating sight glass permits a visual check of the liquid column for bubbles. Sight glasses are included on the CICD Series compressor-chiller. Never use the sight glass to determine whether the system is properly charged! Instead, either charge the system based on the required sub-cooling or calculate the amount of refrigerant needed and add it based on weight.

Discharge (Hot Gas) Line

Limit the pressure drop in the discharge line to 6 psig whenever possible to minimize the adverse effect on unit capacity and efficiency. While a pressure drop of as much as 10 psig is usually permissible, note that a 6-psig pressure drop reduces unit capacity by 0.9 percent and efficiency by 3.0 percent.

Pitch discharge lines in the direction of hot gas flow at the rate of 1/2-inch per each 10 feet of horizontal run. Discharge line sizing is based on required velocity to provide good oil movement. Basic discharge line parameters are:

- Maximum allowable pressure drop 6 psig (°F)
- Maximum Velocity 3500 fpm
- Minimum Velocity (at minimum load)
- Horizontal lines 500 fpm
- Vertical lines (up flow) 1000 fpm.

To design the discharge line properly, follow the recommended guidelines:

- Choose the shortest route from the compressor to the condenser.
- Use different pipe sizes for horizontal and vertical lines to make it easier to match line pressure drop and refrigerant velocity to discharge-line requirements.
- To assure proper oil entrainment and avoid annoying sound levels, size the discharge line so refrigerant velocity equals or exceeds the minimum velocity in Table 2, p. 16, "*Minimum discharge line velocities for oil entrainment*" and remains below 3500 fpm.

Prevent oil and condensed refrigerant from flowing back into the compressor during "off" cycles by:

- pitching the discharge line toward the condenser, and routing the discharge line so that it rises to the top of the condenser, then drops to the level of the condenser inlet, creating an inverted trap.
- Double risers are generally unnecessary. The scroll compressors in CICD Series chillers unload to the extent that a single, properly sized riser can transport oil at any load condition.
- Riser traps are also unnecessary. Avoid using riser traps. If the discharge riser is sized to maintain the proper refrigerant velocity, adding a trap will only increase the pressure drop.

Table 2. Minimum discharge line velocities for oil entrainment

Nominal Pipe Size (in.)	Riser Refrigerant Velocity (fpm)	Horizontal Refrigerant Velocity (fpm)
7/8	375	285
1-1/8	430	325
1-3/8	480	360
1-5/8	520	390
2-1/8	600	450

Table 3. Single circuit line sizing chart

Unit Nom.	Chiller Connection Size (od)		0-50 Equiv. Pipe Length (ft)		50-100 Equiv. Pipe Length (ft)		100 - 150 Equiv. Pipe Length (ft)	
Tons	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)
20	3/4	1-1/8	3/4	1-1/8	3/4	1-3/8	3/4	1-3/8
30	7/8	1-3/8	7/8	1-3/8	7/8	1-3/8	7/8	1-5/8
45	1-1/8	1-3/8	1-1/8	1-5/8	1-1/8	1-5/8	1-1/8	1-5/8
55	1-1/8	1-3/8	1-1/8	1-5/8	1-1/8	1-5/8	1-1/8	1-5/8
65	1-1/8	2-1/8	1-1/8	1-5/8	1-1/8	2-1/8	1-1/8	2-1/8
75	NA	NA	NA	NA	NA	NA	NA	NA
85	NA	NA	NA	NA	NA	NA	NA	NA

Note: Line sizes may differ if unit is equipped with hot gas bypass or unit has operation below 40°F leaving fluid temperature.

Table 4. Dual circuit line sizing chart

Unit Nom.	Chiller Connection Size (od)		0-50 Equiv. Pipe Length (ft)		50-100 Equiv. Pipe Length (ft)		100 - 150 Equiv. Pipe Length (ft)	
Tons	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)	Liquid (in.)	Discharge (in.)
20	5/8	1-1/8	5/8	1-1/8	5/8	1-1/8	5/8	1-1/8
30	3/4	1-1/8	3/4	1-1/8	3/4	1-1/8	3/4	1-1/8
45	3/4	1-1/8	3/4	1-1/8	3/4	1-3/8	3/4	1-3/8
55	7/8	1-1/8	7/8	1-3/8	7/8	1-3/8	7/8	1-5/8
65	7/8	1-3/8	7/8	1-3/8	7/8	1-5/8	7/8	1-5/8
75	1-1/8	1-3/8	1-1/8	1-3/8	1-1/8	1-5/8	1-1/8	1-5/8
85	1-1/8	1-3/8	1-1/8	1-5/8	1-1/8	1-5/8	1-1/8	2-1/8

Note: Line sizes may differ if unit is equipped with hot gas bypass or unit has operation below 40°F leaving fluid temperature.

Multiple Chiller Applications

Anytime more than one (1) CICD compact chiller is piped together (to form an array of chillers) for higher capacity and/or redundant chiller applications, an array controller package must be provided from the factory.

The number of compact chillers that can be physically piped together to form an array and share a common header is limited to approximately 300 total tons or 900 gpm. In general, if the total tonnage is 300 tons or less or 900 gpm or less, one common evaporator supply/return line and one common condenser supply/return line can be used. If the total tonnage needed is greater than 300 tons or 900 gpm, the flow from these common lines can be split between two arrays of chillers. Figure below shows examples of acceptable and unacceptable array piping configurations. For help with determining the most effective array configuration for your application, please contact your local Trane sales representative.

Figure 4. Common supply/return

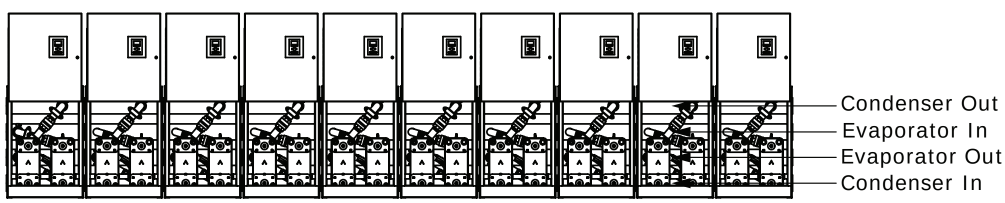


Figure 5. Split supply/return

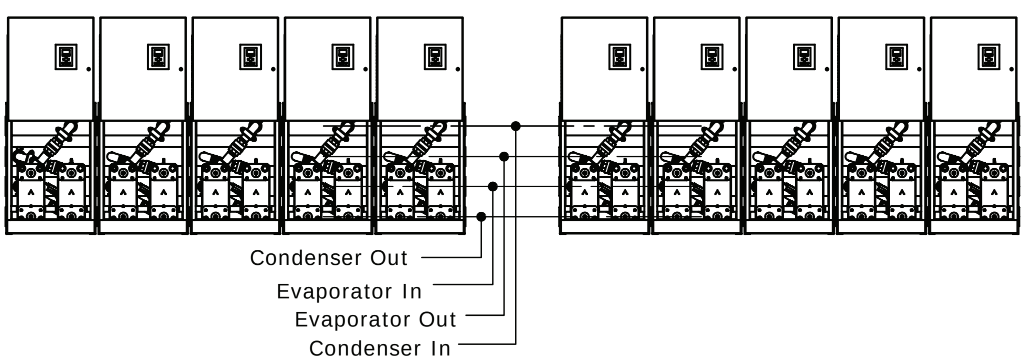


Table 5. Summary table

Nominal Capacity (tons)	Max units operating on COMMON supply/return line	Max units operating on SPLIT supply/return line
20	10	10
30	10	10
45	8	10
55	6	10
65	5	10
75	4	8
85	3	6

Model Number Descriptions

Digits 1, 2, 3, 4 — Model

CICD= Compact Indoor Chiller

Digits 5, 6, 7 — Nominal Capacity

020 = 20 Nominal Tons
030 = 30 Nominal Tons
045 = 45 Nominal Tons
055 = 55 Nominal Tons
065 = 65 Nominal Tons
075 = 75 Nominal Tons
085 = 85 Nominal Tons

Digit 8 — Unit Voltage

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

Digits 9 — Unit Application

A = Water-Cooled Chiller
B = Compressor Chiller with Remote Condenser (40°F to 115°F)
D = Compressor Chiller with Remote Condenser (20°F)

Digit 10 — Refrigeration Style

A = R-410A Scroll

Digit 11 — Number of Circuits

1 = Single Circuit
2 = Dual Circuit

Digit 12 — Efficiency/Capacity

1 = Standard Efficiency
2 = High Capacity Evaporator (allows 40F leaving water)

Digit 13 — Design Sequence

0 = Factory Assigned

Digit 14 — Array System

0 = Non-Array System
1 = Array System

Digit 15 — Evaporator Heat Exchanger Type

0 = Brazed Plate

Digit 16 — Evaporator Fluid Type

0 = Water
2 = Ethylene Glycol
3 = Propylene Glycol

Digit 17 — Evaporator Flow

0 = Constant Flow Primary
1 = Variable Flow Primary

Digit 18 — Evaporator Temperature Range

0 = Standard Cooling 40 to 65°F [5.5 to 18.3°C]
1 = Standard Cooling/Ice Making 20 to 65°F [-6.7 to 18.3°C]
2 = Low Temperature Glycol Process (10 to 42°F) [-12.2 to 5.5°C]

Digit 19 — Evaporator Control Valves

0 = Manual Balancing Isolating Valves
1 = Motorized Chilled Water Isolating Valve

Digit 20 — Condenser Heat Exchanger Type

0 = Brazed Plate
1 = Shell and Tube
5 = Remote Condenser

Digit 21— Condenser Fluid Type

0 = Water
2 = Ethylene Glycol
3 = Propylene Glycol
9 = Not Applicable — Compressor-Chiller

Digit 22 — Condenser Heat Recovery

0 = No Heat Recovery
1 = Full Heat Recovery with Auto Changeover

Digit 23 — Condenser Corrosion Resistance

0 = Standard
1 = Cupro-Nickel (Avail. Shell and Tube Only)

Digit 24 — Condenser Control Valves

1 = Manual Valve
2 = Motorized Head Pressure Control Valve

Digit 25 — Power Feed

0 = Single Point Power (5 kA Rating)
A = Single Point Power (5 kA Rating) + Phase and Voltage Monitor
B = Single Point Power (100 kA Rating)
C = Single Point Power (100 kA Rating) + Phase and Voltage Monitor
D = Power Feed to Each Unit (5 kA Rating)
E = Power Feed to Each Unit (5 kA Rating) + Phase and Voltage Monitor
F = Power Feed to Each Unit (100 kA Rating)
G = Power Feed to Each Unit (100 kA Rating) + Phase and Voltage Monitor

Digit 26 — Power Connection

0 = Terminal Block
A = Non-Fused Disconnect Switch
B = Fused Disconnect Switch
C = High SCCR Fuse Block
D = Distribution Panel Connection = Terminal Block; Module Power Connection = Circuit Breaker

Digit 27 — Service Options

0 = None
A = LED Lighted Control Cabinet

Digit 28 — Panel Ampere Rating

0 = None
D = 250 Amp
E = 400 Amp
F = 600 Amp
G = 800 Amp
H = 1200 Amp

Digit 29 — Control Style

0 = Manager-Subordinate Controller w/ Single Controller per Array
A = Supervisory Array Controller w/ Controller per Module
B = Non-Array, Single Unit Controller

Digit 30 — Local Unit Controller Interface

0 = Keypad with Dot Pixel Display
B = 15.4-in. Color Touchscreen

Digit 31 — Remote BMS Interface (Digital Comm)

0 = None
2 = Lon Talk®
4 = BACnet® MS/TP
5 = BACnet® IP
6 = MODBUS®
8 = Johnson N2

Digit 32 — Blank

0 = Blank

Digit 33 — Blank

0 = Blank

Digit 34 — Refrigeration Options

1 = Active Freeze Protection (All Circuits)
2 = Hot Gas Bypass (All Circuits)

Digit 35 — Refrigeration Accessories

0 = Moisture Indicating Sight Glass
A = Moisture Indicating Sight Glass + Compressor Isolation Valves
B = Moisture Indicating Sight Glass + Replaceable Core Filter Driers
C = Moisture Indicating Sight Glass + Replaceable Core Filter Driers + Compressor Isolation Valves

Digit 36 — Water Connection

0 = Grooved Pipe Connection, Standard Header Length
A = Grooved Pipe Connection, Extended Header Length
D = No Header Piping (Heat Exchangers Only)

Digit 37 — Water Side Pressure

0 = 150 psi
A = 300 psi

Digit 38 — Water Strainer(s)

0 = None
A = Chilled Water Flow Wye Strainer
B = Chilled Water Wye Strainer with Installation Kit
C = Condenser Water Flow Wye Strainer
D = Condenser Water Wye Strainer with Installation Kit
E = Chilled and Condenser Water Nominal Flow Wye Strainer
F = Chilled and Condenser Water Wye Strainer with Installation Kit

Digit 39 — Water Accessories

0 = Chilled Water Flow Switch
A = Condenser Water Flow Switch
B = Analog Water Temperature Gauge
C = Analog Water Pressure Gauge
D = Chilled Water Flow Switch + Condenser Water Flow Switch
E = Chilled Water Flow Switch + Analog Water Temperature Gauge
F = Chilled Water Flow Switch + Analog Water Pressure Gauge
G = Chilled Water Flow Switch + Condenser Water Flow Switch + Analog Water Temperature Gauge
H = Chilled Water Flow Switch + Condenser Water Flow Switch + Analog Water Pressure Gauge
J = Chilled Water Flow Switch + Analog Water Temperature Gauge + Analog Water Pressure Gauge
K = Chilled Water Flow Switch + Condenser Water Flow Switch + Analog Water Temperature Gauge + Analog Water Pressure Gauge

Digit 40 — Blank

0 = Blank

Digit 41 — Sound Attenuator

0 = None
A = Compressor Sound Blankets
B = Factory Sound Enclosure Cabinet
C = Compressor Sound Blankets + Factory Sound Enclosure Cabinet

Digit 42 — Unit Mounting

0 = None
A = Neoprene Pads
B = Leveling Kit
C = Casters/Wheels
D = Neoprene Pads and Casters/Wheels
E = Neoprene Pads and Leveling Kit

Digit 43 — Exterior Finish and Shipping Splits

0 = Standard Paint, Each Module Packaged Separately
B = Custom Paint, Each Module Packaged Separately

Digit 44 — Shipping Options

A = Framed Crate with Plastic Wrap (Non-Shrink)
D = Fully Enclosed Crate

Digit 45 — Warranty

0 = Standard Warranty

Digit 46 — Special Options

0 = None
X = With Specials

General Data

Table 6. General data

Size		20	30	45	55	65	75	85
Compressor								
Quantity		2	2	2	2	2	2	2
Nominal Tons @ 60 Hz	tons	10/10	15/15	20/20	25/25	30/30	30/40	40/40
Compressor Sound Data	dbA	81.0	84.0	89.0	89.0	92.0	93.1	94.0
Compressor Sound Data with Sound Blankets Only[(a)]	dbA	75.0	78.0	85.0	85.0	88.0	89.1	90.0
Evaporator								
Water Storage	gal	9	10	11	12	13	14	14
Minimum Flow	gpm	30	30	40	45	55	60	75
Maximum Flow	gpm	150	150	245	245	250	275	275
Brazed Plate Condenser								
Water Storage	gal	10	11	11	12	13	14	14
Minimum Flow	gpm	50	50	70	85	105	115	135
Maximum Flow	gpm	150	150	245	245	250	275	275
Shell and Tube Condenser								
Water Storage	gal	9	9	9	9	10	10	12
Minimum Flow	gpm	35	35	60	60	85	85	105
Maximum Flow	gpm	150	150	245	245	250	250	250

(a) Compressor manufacturer sound power is given at rated compressor AHRI conditions measured in free space for tandem compressor sets.

Controls

CICD compact chiller control panel is designed to save space and provide one convenient area for all necessary field-wiring. The control panel contains the power and control components.

The power distribution section contains the input power ground lug for customer connection, power distribution block, across-the-line contactors, current transformers and control circuit power transformer with primary and secondary fuses.

The controls section contains the unit controller with expansion board, display with keypad (control panel door), power monitor (optional) and service friendly terminal strips to facilitate circuit diagnosis and connection of field wiring.

Microprocessor-Based Controller

The unit controller is a durable microprocessor-based controller designed to be the primary manager of the CICD compact chiller. The controller is capable of performing all operational, data retention and communication functions for the chiller while providing lead/lag logic to equalize run time on the individual compressors. When necessary, it will perform appropriate evasive actions in the event a sensor input returns a reading that is out of range based on setpoints.

The data retention capabilities of the unit controller includes storage of information that can be graphically presented based on an adjustable, set time interval. The controller also maintains a fault history including the date and time of day for each fault (up to the last 99 occurrences). If a fault results in a compressor lockout, 120 seconds of history prior to the lockout is saved. The history leading up to the lockout gives the technician a clear picture of what the chiller was experiencing just before the failure and is very helpful for diagnosing the causes.

Operator Interface

The unit controller can be accessed using a keypad-display screen or a 15.4-in. diagonal color touchscreen. The color touchscreen options are capable of displaying all unit control set points, fault and alarm conditions with history, operating conditions, schedules, run history, chiller IOMs, and field wiring diagrams. All interfaces use a clear language format for easy interpretation by the user. Each display is mounted to the front of the control panel door along with the optional disconnect switch actuator, off/auto switch, run indicator light and alarm indicator light.

All information needed to run the chiller is available and can be changed and viewed using the keypad-display screen; however, a laptop or PC is invaluable for ease of use, for viewing dynamic on-line display screens, for better graphing capability and for downloading data files. A free PC/laptop software package called MCS-Connect is available for download at www.mcscontrols.com. Once installed, the unit controller can be accessed from the PC or laptop by using one (1) of the four (4) different ports located inside the control panel:

1. RS-485 network access through RS-232 serial port located on backside of keypad-display.
2. RS-485 network access port located on backside of keypad-display.
3. RS-485 network access port located on corner of unit controller.
4. Ethernet port located on corner of unit controller.

Note: *If any of the RS-485 network accesses is used (#1-#3) for BMS communication or for an array controller, the Ethernet port is the only port that can be used for PC or laptop access.*

Building Communications

When the Trane® Cold Generator™ CICD compact chiller is used in conjunction with a building management system (BMS) such as Tracer®, the chiller can be monitored and given input from a remote location. The chiller can be set up to fit into the overall building control strategy by using remote run/stop input, remote demand limit reset and/or remote chilled water reset functions.

As standard, the unit controller Ethernet port is always ready to talk BACnet® IP and Modbus™ TCP/IP (Modbus RTU uses the RS485 network port). BACnet® MS/TP, Johnson N2 and LonTalk® are optional protocols that can be factory-installed. The unit controller can facilitate hundreds of control points, including the following popular BMS communications:

- Remote Off/Auto signal (input from BMS)
- Demand Limit Reset signal (input from BMS)
- Chilled Water Temperature Reset signal (input from BMS)
- Customer Alarm relay (view only)
- Chiller Run Indication (view only)
- Entering Chilled Water Temperature (view only)
- Leaving Chilled Water Temperature (view only)
- Chilled Water Flow Switch input (view only)
- Condenser Pump relay (view only)
- Chilled Water Pump relay (view only)

System Protection

A complete safety lockout system with alarms protects the CICD compact chiller operation to potentially avoid compressor and evaporator failures. The unit controller directly senses pressures, temperatures, amperage, motor faults, etc. All control variables that govern the operation of the chiller are evaluated every second for exact control and protection. The following is an abbreviated list of safeties that are incorporated into the standard chiller algorithm control. For a complete list, please refer to the more detailed controls manual, CG-SVX030*-EN.

- **No Flow Protection** – To protect the chiller from no water flow to the evaporator, the chiller is enabled to run only if the required flow proving device indicates there is flow present. If the chiller is active and flow is lost; the chiller will lock out and an alarm is generated.
- **Low Suction Pressure** – To protect the compressors and evaporator, if the refrigerant suction pressure drops below the set point value for a specified period of time, a safety trip occurs. This safety is bypassed when the compressor is in a Pump Down state.

- **Unsafe Suction Pressure** – To protect the compressors and evaporator, if the refrigerant suction pressure drops below the set point value for a specified period of time, the chiller will immediately lock out, and an alarm is generated.
- **Heat Exchanger Freeze Protection** – To protect the evaporator from low water temperatures, the chilled water temperature is monitored inside the core of the evaporator and leaving the evaporator. If theses temperatures fall below their set point temperatures for the set period of time, the entire system will lock out and an alarm is generated.
- **Active Freeze Protection System** – Working in conjunction with the low suction pressure and freeze protection safeties to avoid nuisance safety trips, the active freeze protection valve is opened when the suction pressure goes below the lower set point value and warms the evaporator until the freeze conditions are abated. The valve will stay open until the suction pressure rises safely above the upper set point level.
- **High and Low Discharge Pressure, High and Low Superheat, High and Low Compressor Amps** – The compressors will be locked out if any one of these control variables rises above the upper set point value or falls below the lower set point value for the set amount of time for each, and an alarm is generated.
- **Optional Phase/Power Monitor** – The factory-installed phase/power monitor continuously monitors the incoming power supply to the chiller for low voltage, phase rotation reversal, loss of phase and phase imbalance. Should one of these parameters be incorrect, the phase/power monitor relay will lock out (de-energize) and the fault LED on the monitor will blink. The unit controller will indicate the lockout, and an alarm is generated.

As an additional layer of system protection, mechanical high and low pressure switches are used in conjunction with the refrigerant circuit high and low pressure transducers and unit controller.

Standard Peripheral Control Features

The following peripheral control features and program logic come standard on all CICD compact chillers. Designated terminals on the field connection terminal strip in the control panel are provided for field connection of:

- **Remote Off/Auto** (dry contact closure from a remote device - input).
- **Required Chilled Water Flow Proving Device** (dry contact closure from a remote device - input).
- **Remote Alarm** (dry contact closure to a remote device - output).
- **Required Chilled Water Pump Enable** (dry contact closure for 1 chilled water pump - output).
- **Condenser Water Pump Enable** (dry contact closure for 1 condenser water pump - output).

Standard Capacity Control

Standard capacity control on the CICD compact chillers is accomplished by staging the scroll compressors on and off. The unit controller will maintain a set point leaving chilled water temperature within a control zone using proportional, integral derivative (PID) logic. If the leaving chilled water temperature starts to decrease and falls below the set point, the unit controller will turn one stage off. A further reduction in temperature will result in a second stage being turned off. The reverse is true as the leaving chilled water temperature increases. Lead/lag logic is used to even the run time on the individual compressors.

Optional Capacity Control

Chilled water temperature reset can be accomplished in two ways. In buildings with a building management system, the CICD unit controller allows the BMS to communicate an offset to the chilled water temperature set point. If a BMS is not being used, the unit controller can accept a field-provided 0 to 5 Vdc analog input signal. As the input voltage varies away from center (2.5V), the chilled water temperature set point will be offset proportionally.

Note: *This control logic is factory-installed and must be denoted at the time of ordering.*

Demand limiting is a form of capacity control that limits the number of capacity steps the compact chiller is allowed to operate. It can be accomplished in the same two ways as the chilled water temperature reset: through BMS or field-provided 0 to 5 Vdc input signal.

Note: *This control logic is factory-installed and must be denoted at the time of ordering.*

Array Control

Trane® Cold Generator™ Compact Series model CICD water-cooled chiller arrays can be controlled by two different array controller configurations, depending on the needs of the application. Both options allow the array to be controlled and operated like a single, higher capacity, multistage chiller. Capacity modulation and equalization of compressor run time is managed by the array controller. The array controller uses the same standard capacity control logic as an individual CICD unit controller but with more stages of capacity.

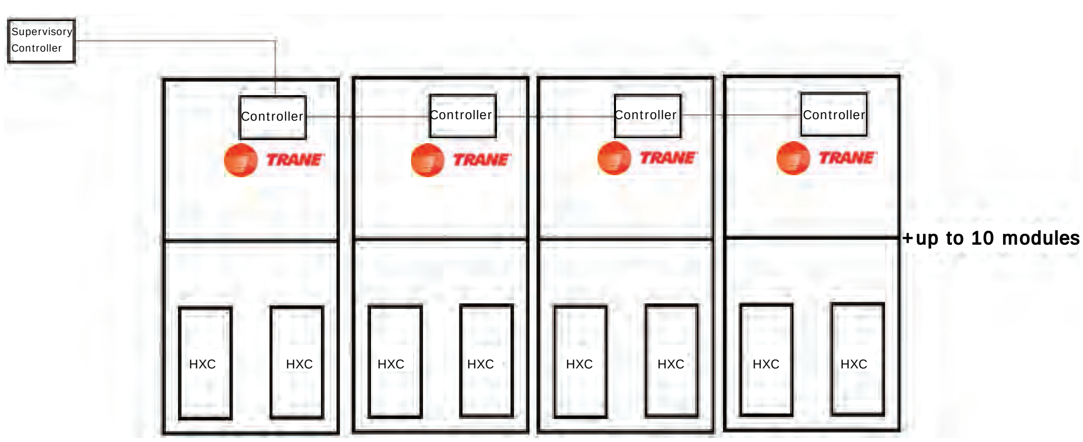
Supervisory Array Controller

This option allows up to ten (10) CICD compact chillers to be controlled and operated. The Supervisory Array Controller requires each module have an individual unit controller. This option is beneficial in applications requiring seven (7) or more modules to be controlled and in applications where chiller uptime is critical.

Power (115 Vac) must be provided to a circuit breaker inside the Supervisory Array Controller enclosure panel to power the Supervisory Array Controller. The Supervisory Array Controller enclosure also contains a field connection terminal strip and door-mounted off/auto switch, run indicator light and alarm indicator light.

The Supervisory Array Controller is accessed in the same manner as the unit controller, through the keypad display or PC/laptop. If communication between the individual CICD compact chiller unit controller(s) and the Supervisory Array Controller is lost, or the Supervisory Array Controller fails, the individual CICD compact chillers can be shifted into manual mode to operate independent from the Supervisory Array Controller and will maintain a “manual mode” default chilled leaving water temperature set point.

N+1 logic can be utilized with the Supervisory Array Controller when each chiller in an array is equipped with optional chilled water motorized on-off valve, optional condenser water regulating valve and a standby chiller is installed in the array.



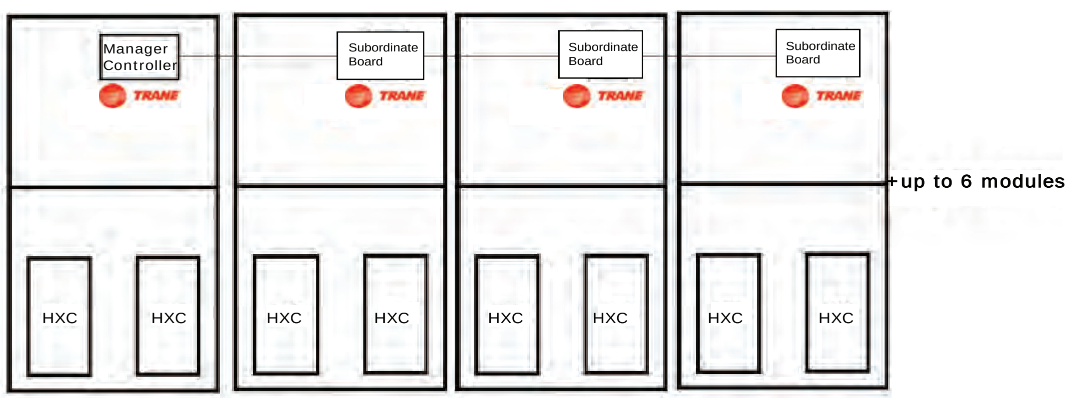
Manager-Subordinate Array Controller

This option allows up to six (6) CICD compact chillers to be controlled and operated. The Manager-Subordinate Array Controller requires only a single controller for the array. This option is beneficial in replacement applications where a single larger chiller, with one controller, is replaced by modular chillers controlled with one controller. The Manager-Subordinate Array Controller is also applicable for chiller applications that do not require redundant operation and first cost is considered an important factor.

The Manager-Subordinate Array Controller is powered from the unit supply power and factory provided transformer. The Manager-Secondary Array control panel also contains a field connection terminal strip and door-mounted off/auto switch, run indicator light and alarm indicator light.

The Manager-Subordinate Array Controller is accessed through the keypad display, touchscreen display or PC/laptop. If communication between the individual CICD compact chiller modules and the Manager-Subordinate Array Controller is lost, that module will be inoperable until communication to the module is restored. The Manager-Subordinate Controller will continue to control the other modules in the array. If the Manager-Subordinate Array Controller fails, the array will be down until the controller is repaired or replaced.

N+1 logic can be utilized with the Manager-Subordinate Array Controller, via the demand limit function, when each chiller in an array is equipped with optional chilled water motorized on-off valve, optional condenser water regulating valve and a standby chiller is installed in the array.



Electrical

Table 7. Electrical data

Size	Rated Voltage	Compressor					Unit Wiring		
		Qty	# of Refrigerant Circuits	Nominal Tons	RLA (each)	LRA (each)	Minimum Circuit Ampacity	Max Fuse Size	Recommended Dual Element Fuse Size
15	200-230/60/3	2	1 or 2	7.5/7.5	28	203	62	80	70
	460/60/3				14	98	32	45	35
	575/60/3				12	84	26	35	30
20	200-230/60/3	2	1 or 2	10/10	39	267	88	125	100
	460/60/3				19	142	42	60	50
	575/60/3				15	103	35	50	40
30	200-230/60/3	2	1 or 2	15/15	48	351	108	150	125
	460/60/3				25	197	56	80	60
	575/60/3				22	135	50	70	60
45	200-230/60/3	2	1 or 2	20/20	67	485	151	200	175
	460/60/3				33	215	74	100	80
	575/60/3				26	175	59	80	70
55	200-230/60/3	2	1 or 2	25/25	82	560	185	250	225
	460/60/3				40	260	89	125	100
	575/60/3				29	210	65	90	70
65	200-230/60/3	2	1 or 2	30/30	109	717	245	350	250
	460/60/3				51	320	114	150	125
	575/60/3				38	235	87	125	100
75	200-230/60/3	2	1 or 2	30/40	109/122	717/1010	261	300	300
	460/60/3				51/68	320/344	136	200	150
	575/60/3				38/46	235/327	95	125	110
85	200-230/60/3	2	1 or 2	40/40	122	1010	274	350	300
	460/60/3				68	344	153	200	175
	575/60/3				46	327	102	125	125

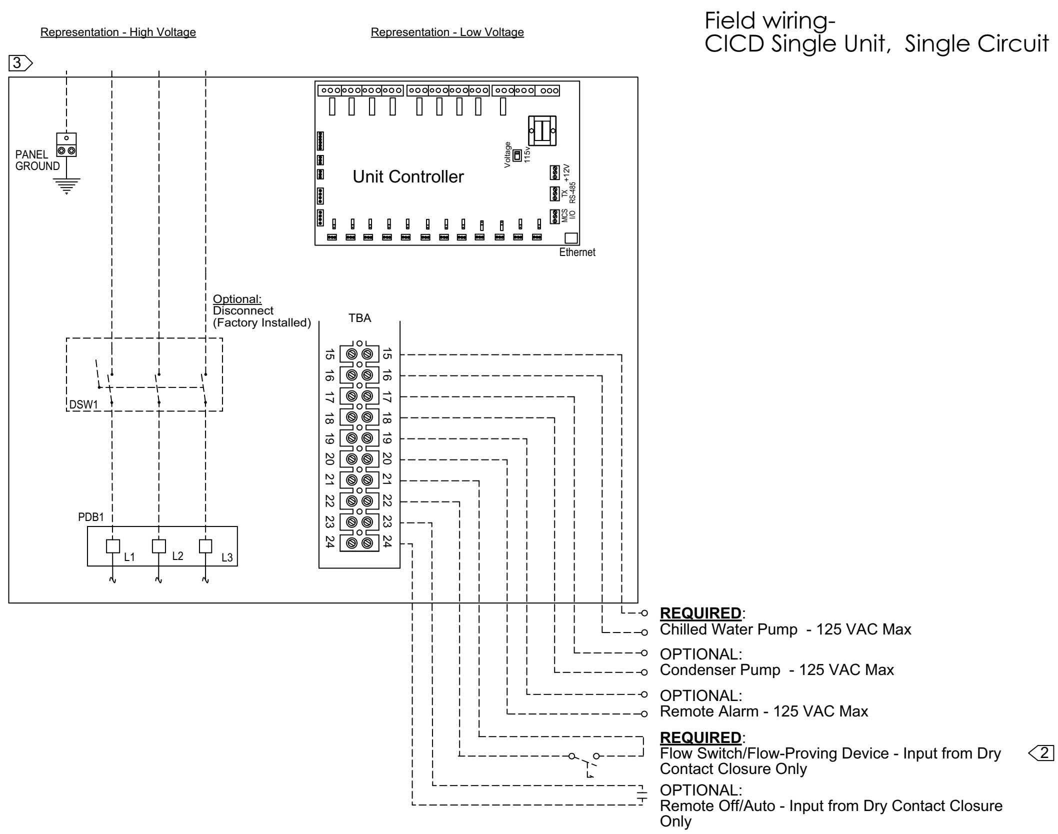
Notes:
1. Use copper conductors only.
2. Local codes may take precedence.
3. Voltage Utilization Range: ± 10% of rated voltage. Rated voltage (use range): 200-230/60/3 (180-253), 460/60/3 (414-506), 575/60/3 (517-632).

To size a field supplied distribution panel for an array of chillers, use the following steps.

1. The Max Fuse or Maximum Overcurrent Protection Device (MOCP) of the electrical distribution panel is as follows:
   a. Sum the Max Fuse size for the individual chillers from the preceding table. This sum is the Max Fuse Size, or MOCP, of the electrical distribution panel associated with this bank of chillers. If this total is not a standard fuse size, select the next size down standard fuse from this value. If the MOCP is less than the MCA then select the fuse rating equal to or greater than the MCA.
   b. Standard Ampere Ratings for Fuses (From NEC Handbook, 240-6).
   The standard ratings for fuses shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000 and 4000 amperes.
2. The recommended fuse size in amps (RFA) is calculated as follows:
   RFA = 1.75* (largest RLA) + (Smallest RLA) for the given bank of chillers.
3. The MCA of the electrical distribution panel is calculated as follows:
   Sum the MCAs of each individual chiller from the preceding table. This is the MCA of the electrical distribution panel associated with this bank of chillers.
4. Wiring for main field supply must be rated 75 C.

Electrical Connections

Figure 6. Field wiring — CICD single unit, single circuit



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.

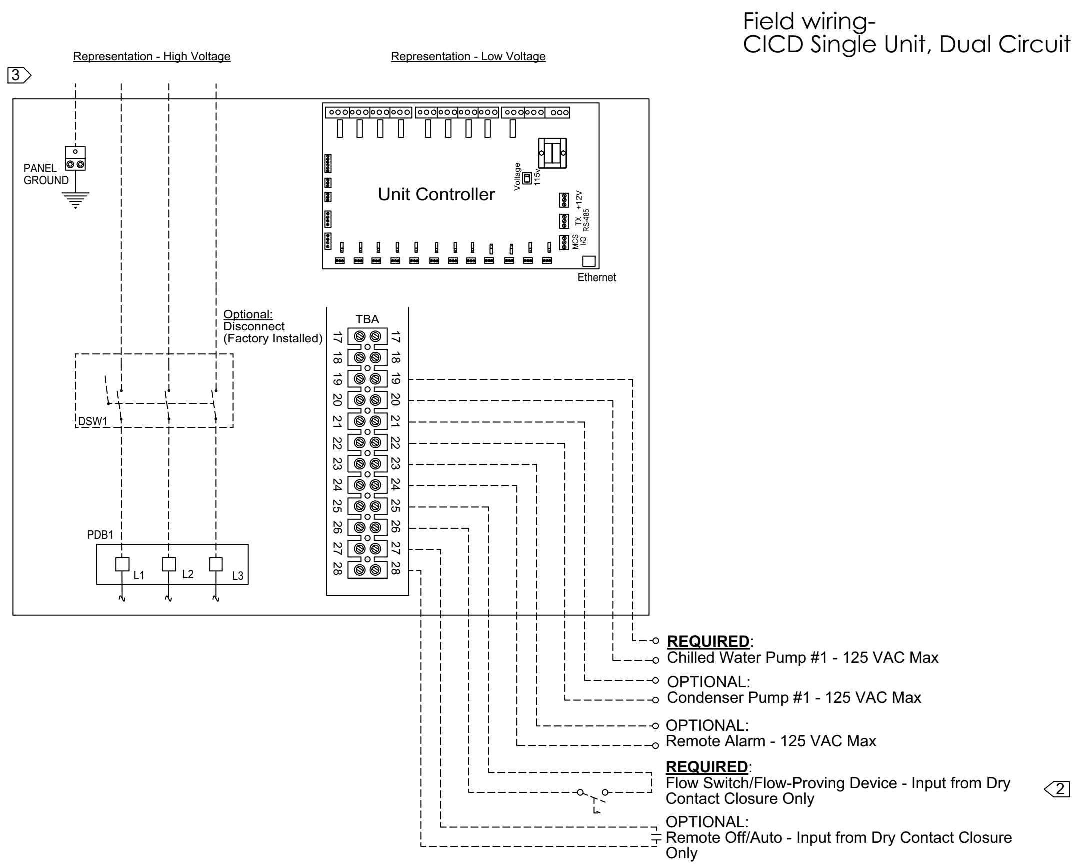
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. (Required) Factory supplied or approved alternate field installed flow proving device connection.
3. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State & Local requirements.

Figure 7. Field wiring — CICD single unit, dual circuit



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.

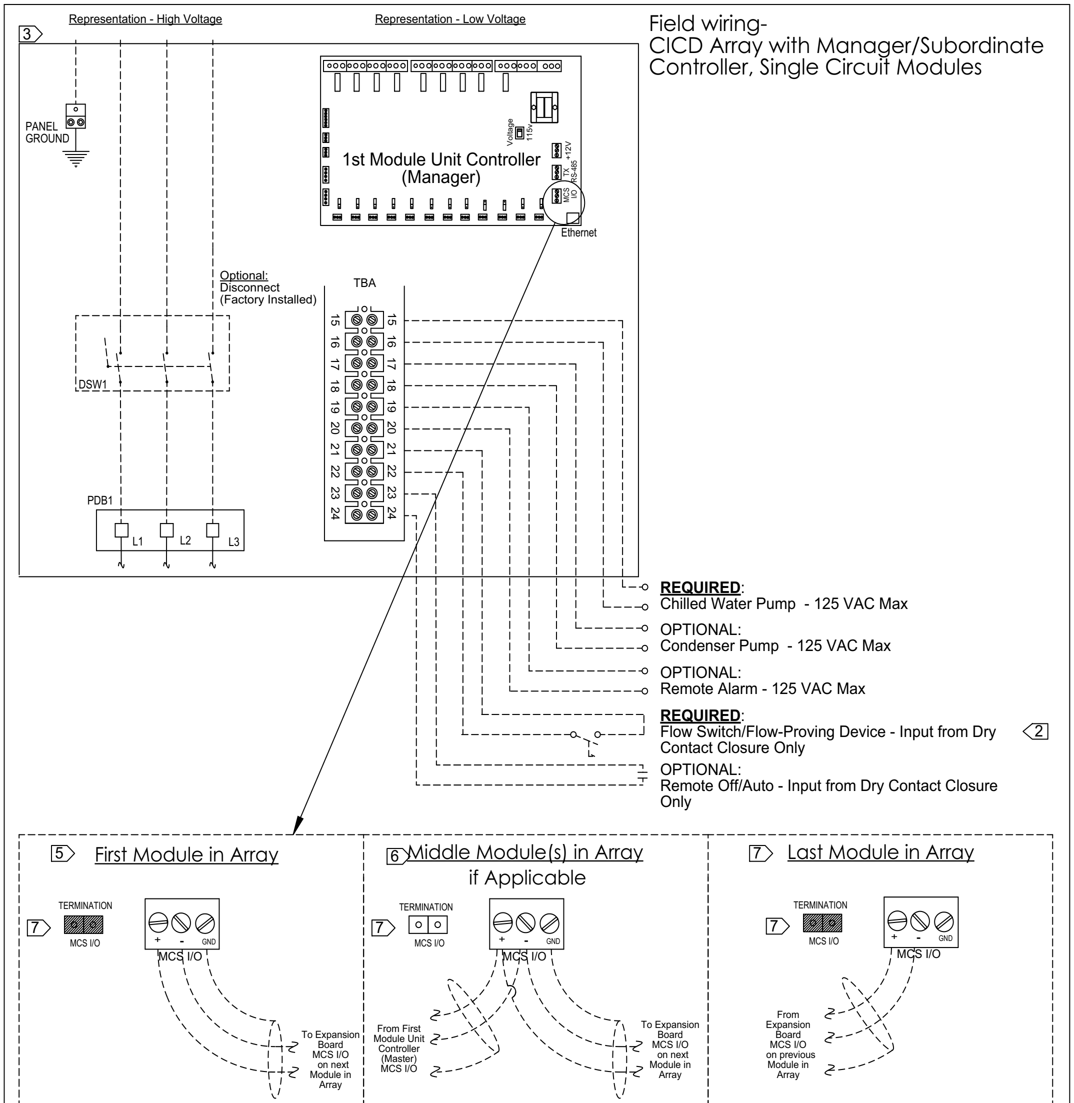
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. (Required) Factory supplied or approved alternate field installed flow proving device connection.
3. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State & Local requirements.

Figure 8. Field wiring — CICD array with manager/subordinate controller, single circuit modules



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.

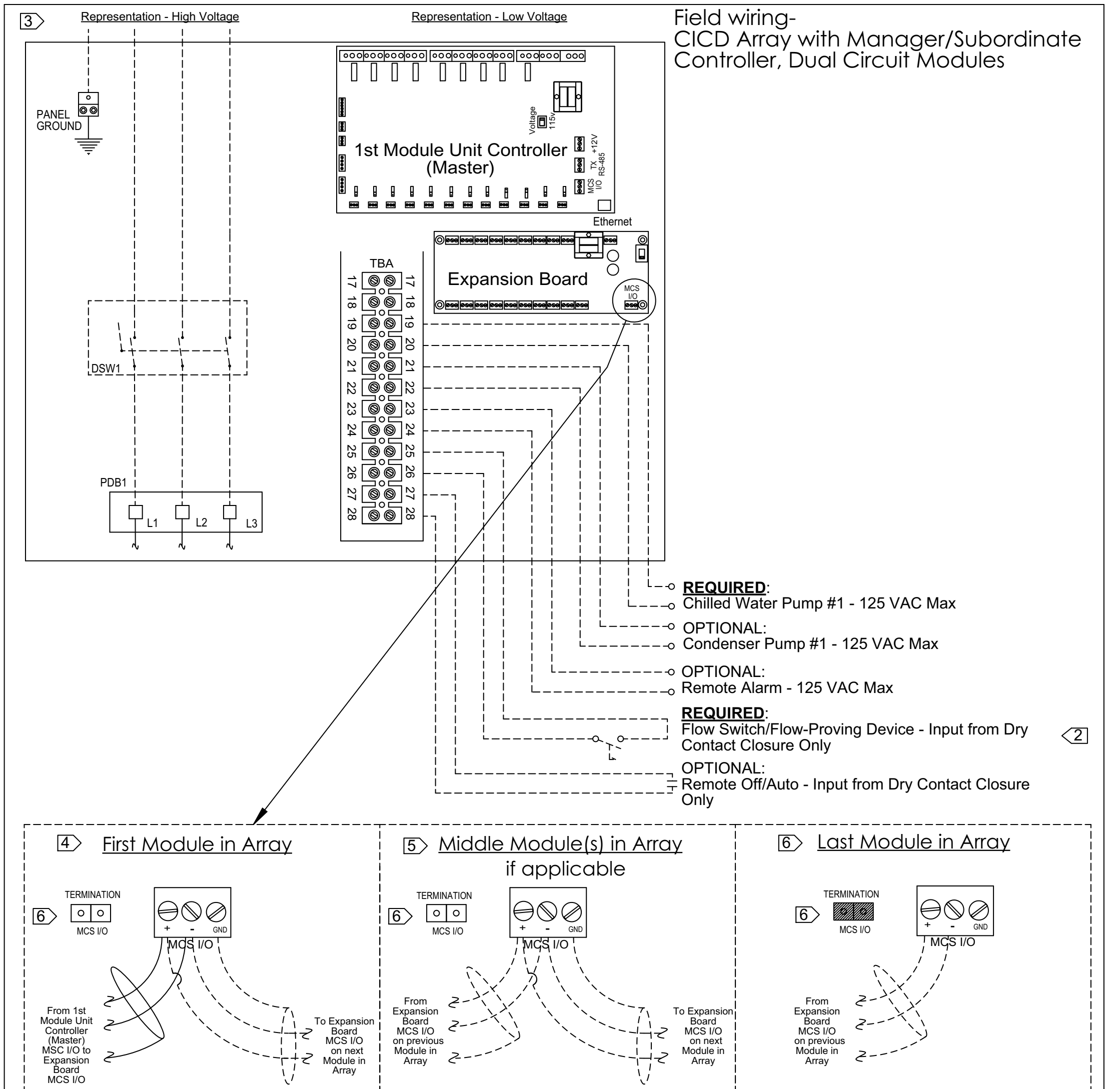
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. (Required) Factory supplied or approved alternate field installed flow proving device connection.
3. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State and Local requirements.
4. Only the first Module in an Array application is connected from the First Module Unit Controller MCS I/O.
5. Consecutive Modules in an Array are daisy-chained to the next Module's Expansion Board MCS I/O.
6. Ensure all MCS I/O Berg Termination Jumpers are removed EXCEPT on the FIRST and LAST Module in the array.

Figure 9. Field wiring — CICD array with manager/subordinate controller, dual circuit modules



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.

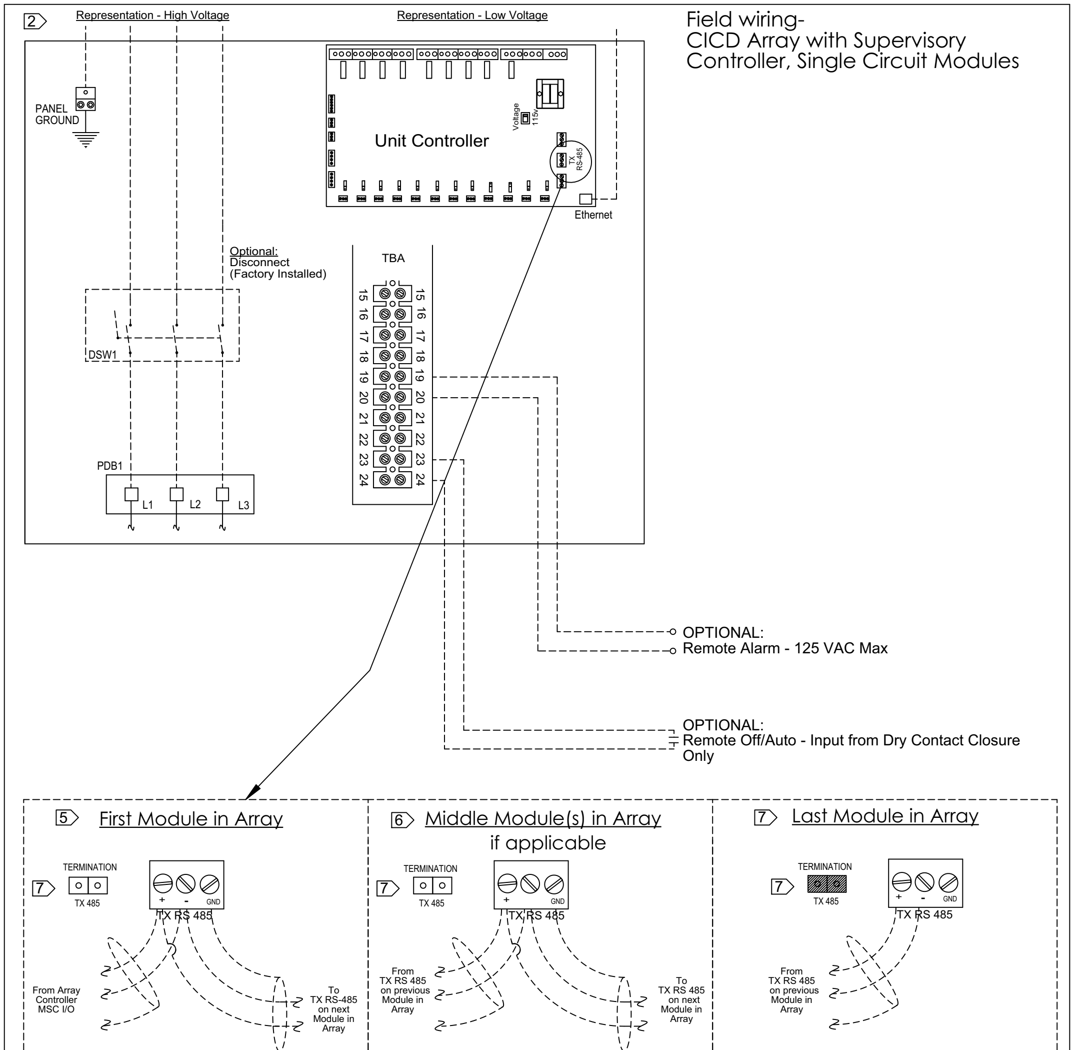
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. (Required) Factory supplied or approved alternate field installed flow proving device connection.
3. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State and Local requirements.
4. The first Module in the Array is connected from the Unit Controller MCS I/O to the Expansion Board MCS I/O.
5. Consecutive Modules in the Array are daisy-chained to the next Modules's Expansion Board MCS I/O.
6. Ensure all MCS I/O Berg Termination Jumpers are removed EXCEPT on the LAST Module in the array.

Figure 10. Field wiring — CICD array with supervisory controller, single circuit modules



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.

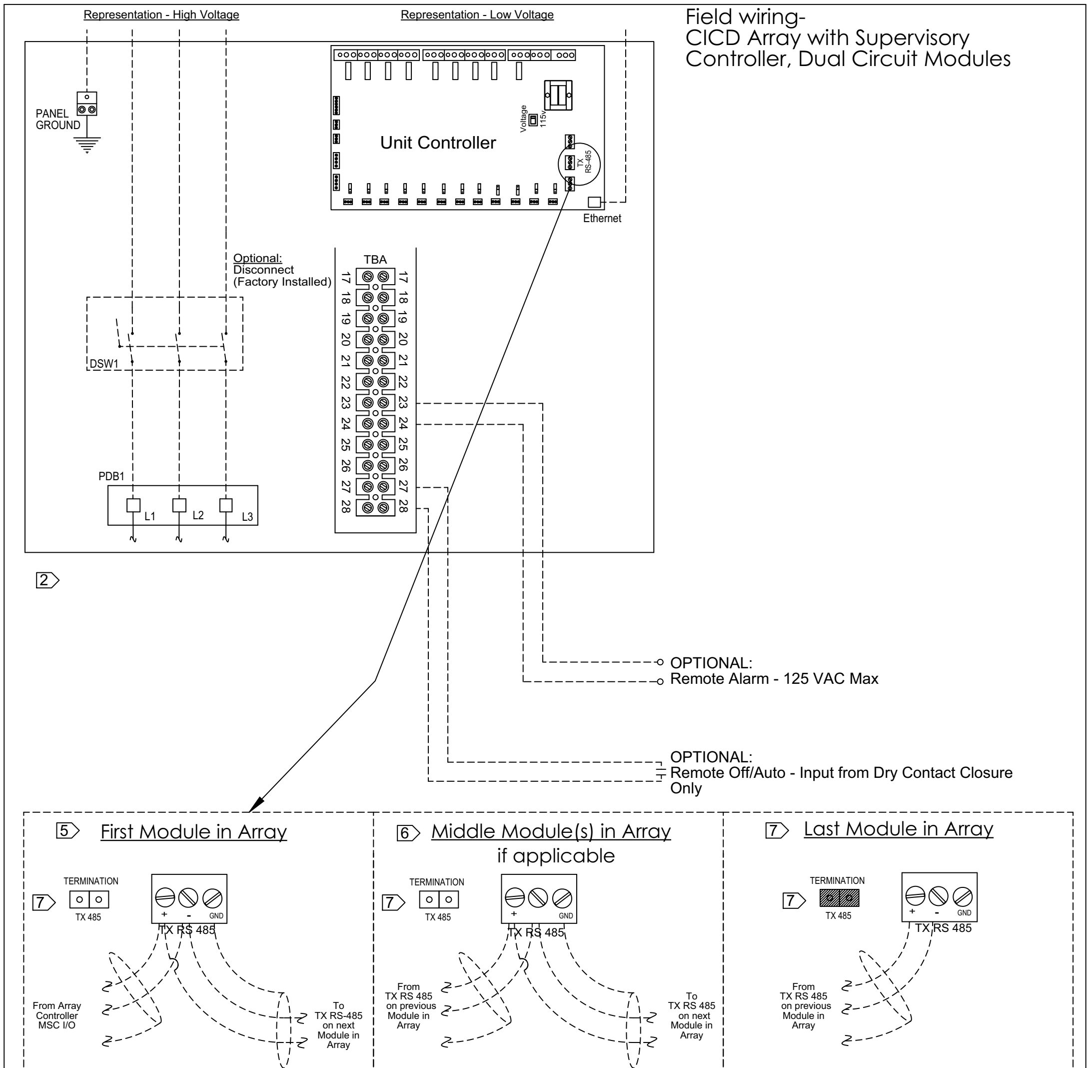
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State and Local requirements.
3. All field provided RS-485 network cable must be 24 GA, shielded, 2-conductor with drain wire (Belden 9841 or equivalent).
4. All field provided ethernet cables must be Cat 5 or higher ethernet straight (patch) cables.
5. Only the first Module in the Array is connected from TX RS 485 port to the Array Controller MCS I/O port in the Array Control Panel.
6. Consecutive Modules in the Array are daisy-chained through TX RS-485 ports.
7. Ensure all TX RS-485 Berg Termination Jumpers are removed EXCEPT on the LAST Module in the array.

Figure 11. Field wiring — CICD array with supervisory controller, dual circuit modules



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.

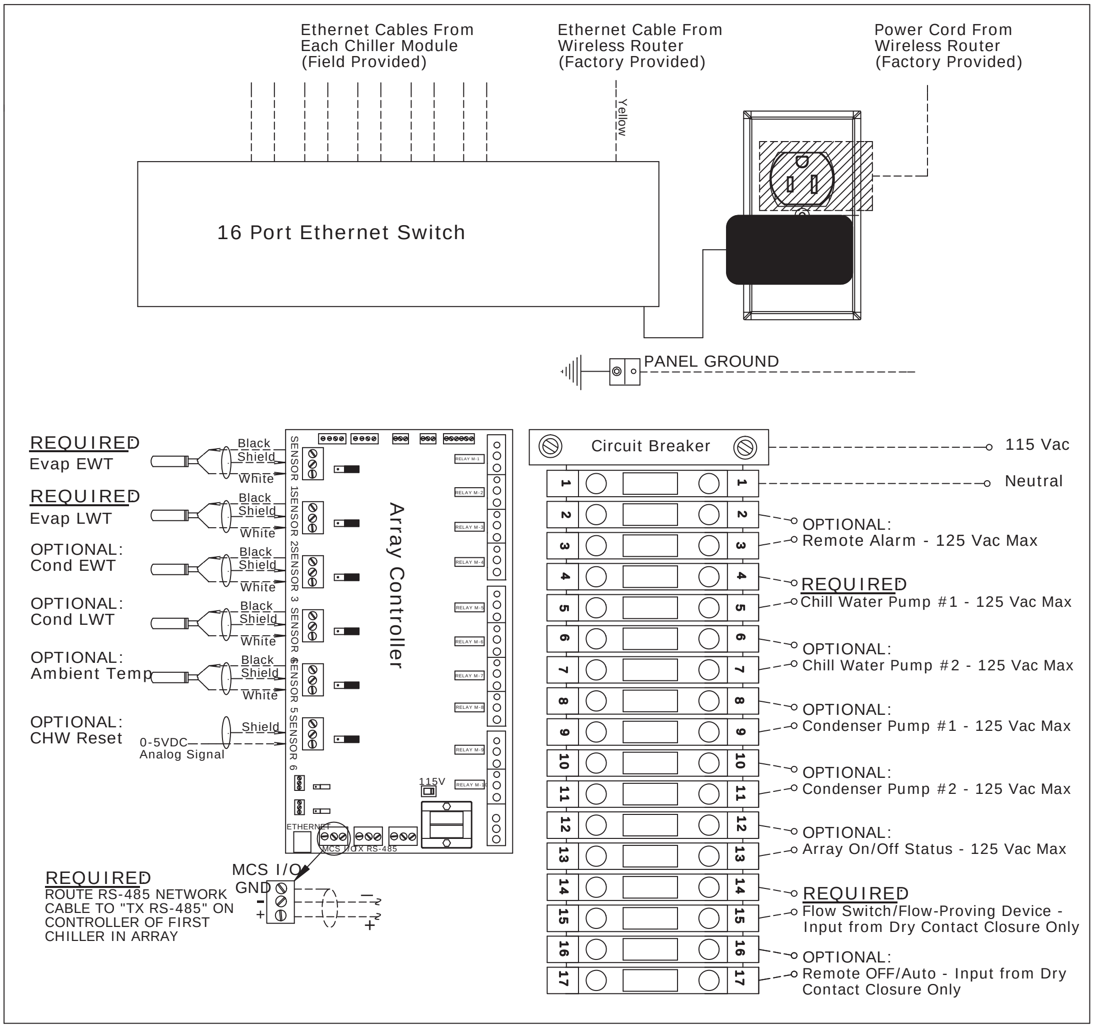
CAUTION
Use copper conductors only!
Unit terminals are not designed to accept other type conductors. Failure to use copper conductors may cause equipment damage.

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. Line voltage options: Single or dual source power may be specified. Drawing covers single source power only. All field wiring must be in accordance with National Electric Code and State and Local requirements.
3. All field provided RS-485 network cable must be 24 GA, shielded, 2-conductor with drain wire (Belden 9841 or equivalent).
4. All field provided ethernet cables must be Cat 5 or higher ethernet straight (patch) cables.
5. Only the first Module in the Array is connected from TX RS 485 port to the Array Controller MCS I/O port in the Array Control Panel.
6. Consecutive Modules in the Array are daisy-chained through TX RS-485 ports.
7. Ensure all TX RS-485 Berg Termination Jumpers are removed EXCEPT on the LAST Module in the array.

Figure 12. Field wiring — CICD array control panel



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 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 field provided control-circuit wiring must have a minimum rating of 150V.
2. All field wiring must be in accordance with NEC, State and Local requirements.
3. All field provided ethernet cables must be Cat 5 or higher ethernet straight (patch) cables.
4. All field provided RS-485 network cable must be 24 GA, shielded, 2-conductor with drain wire (Belden 9841 or equivalent)

Dimensions and Weights

Dimensions

Figure 13. CICD unit dimensions, brazed plate condenser

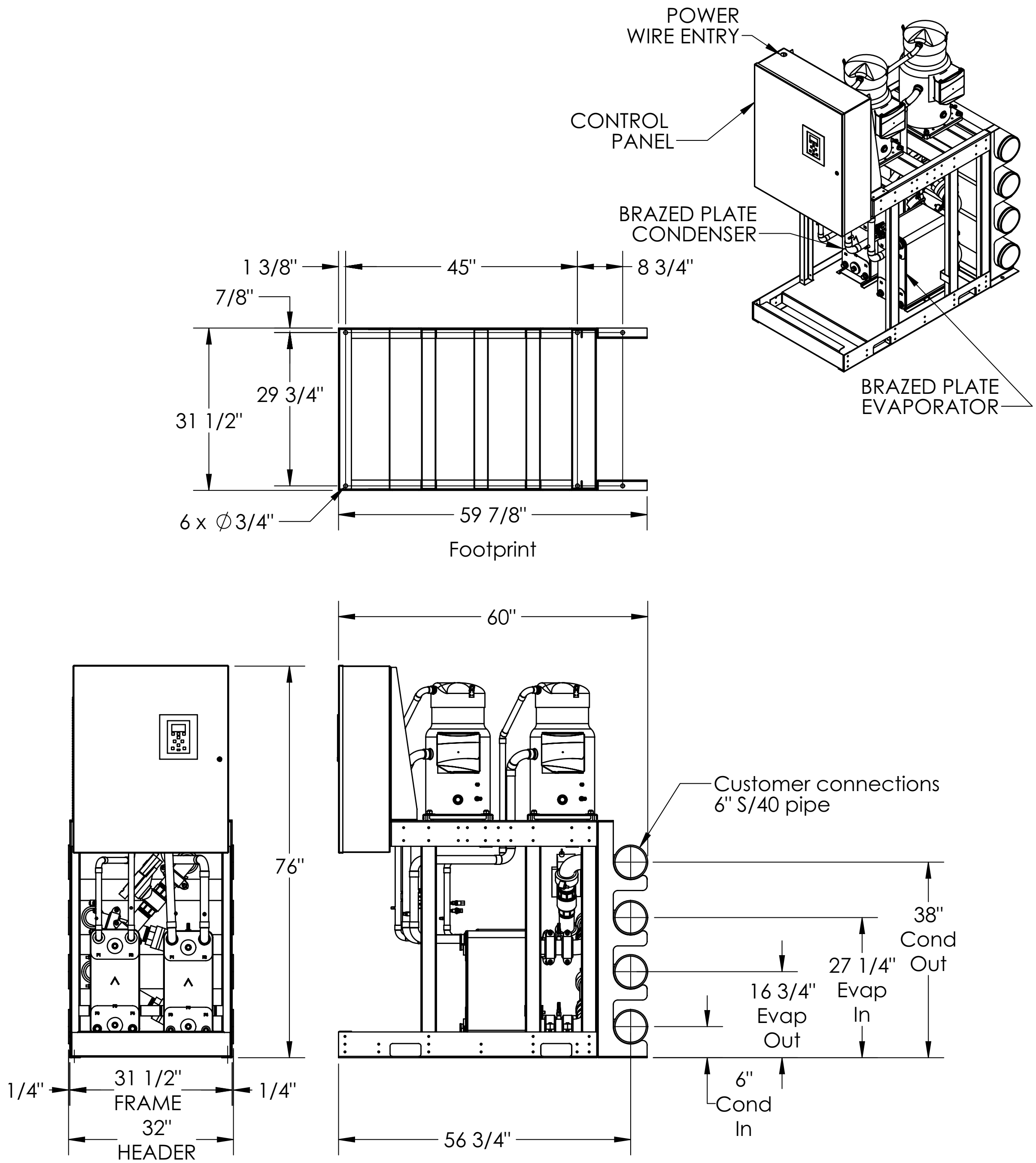


Figure 14. CICD unit array dimensions, brazed plate condenser

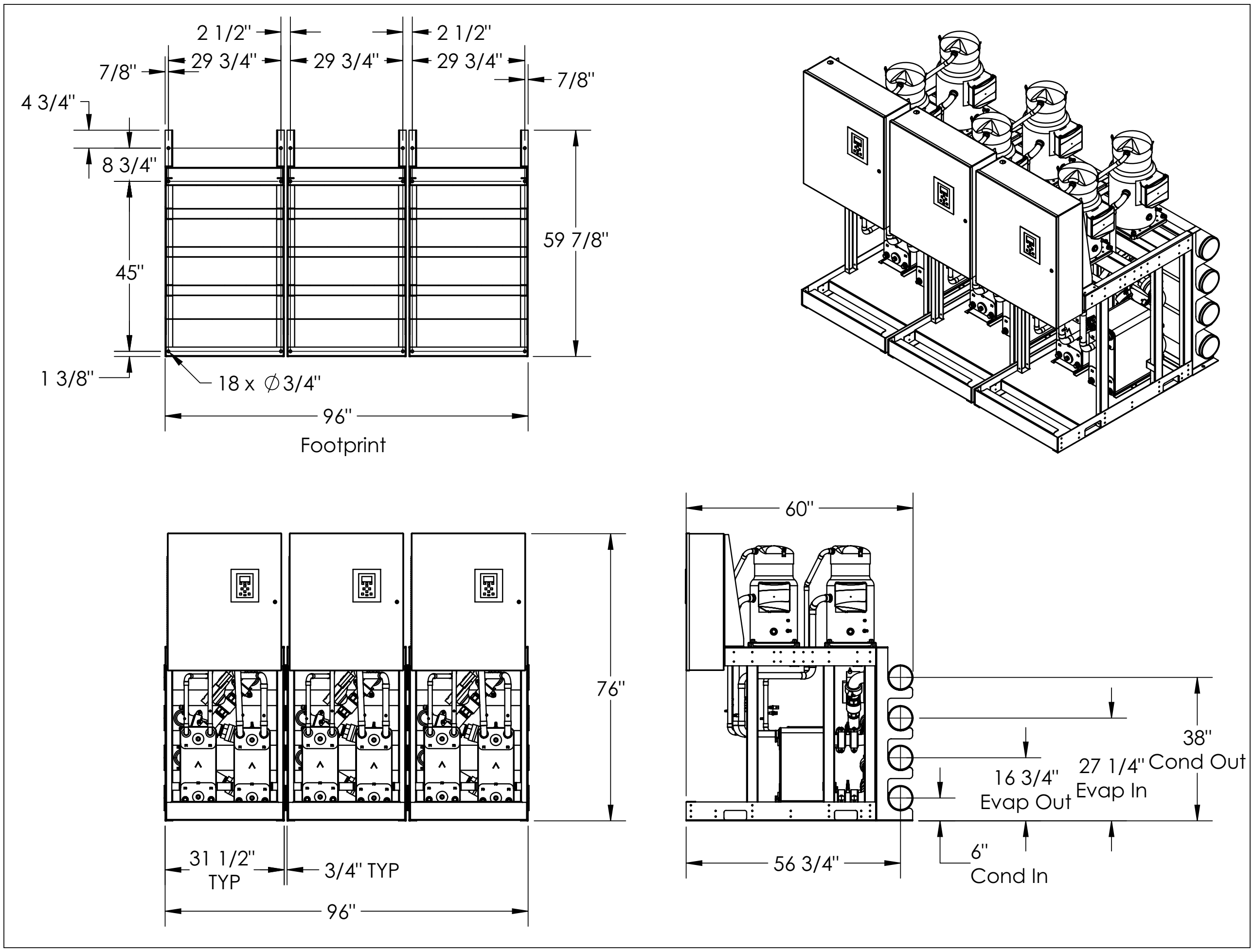
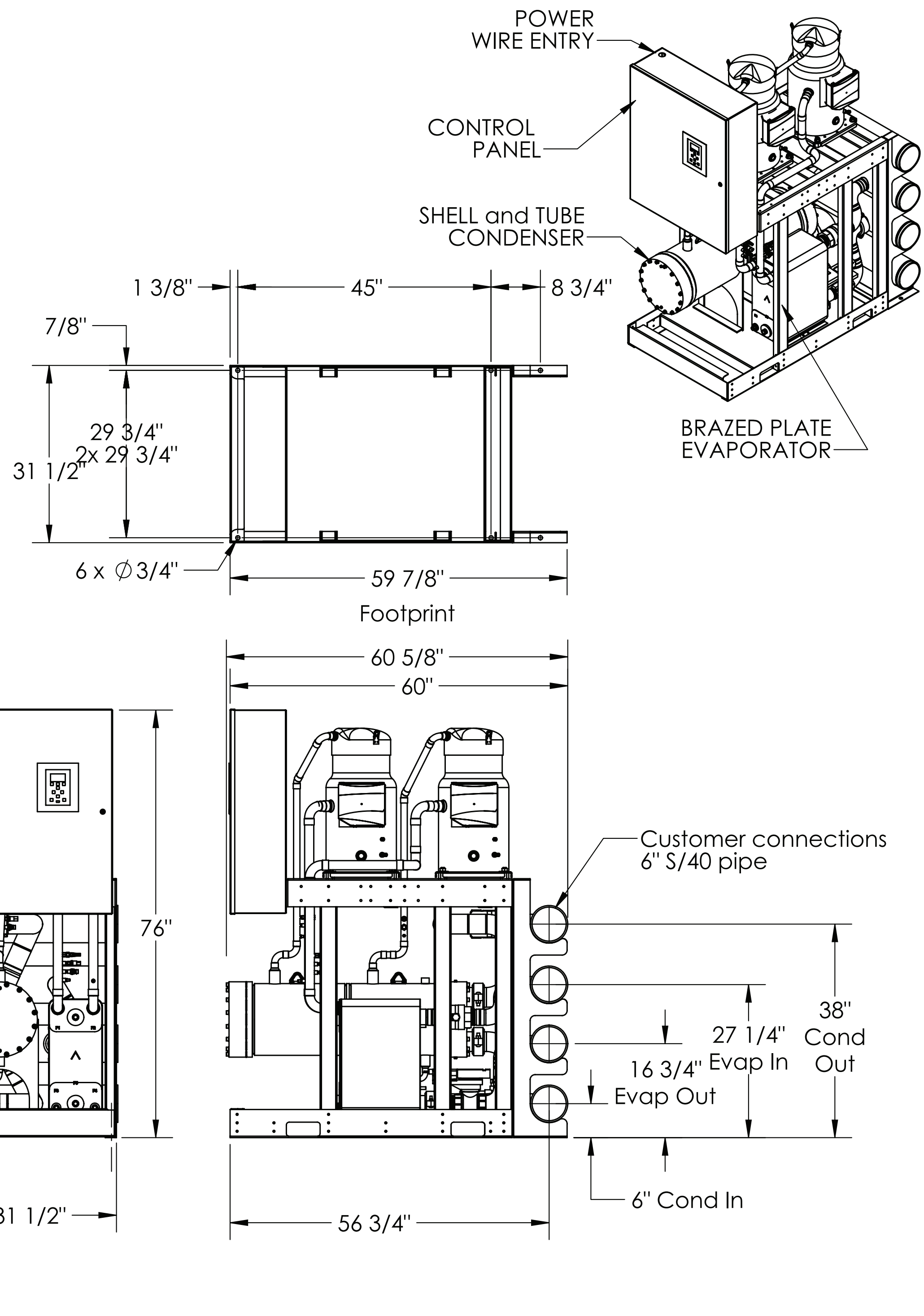


Figure 15. CICD unit dimensions, shell and tube condenser



Dimensions and Weights

Figure 16. CICD unit array dimensions, shell and tube condenser

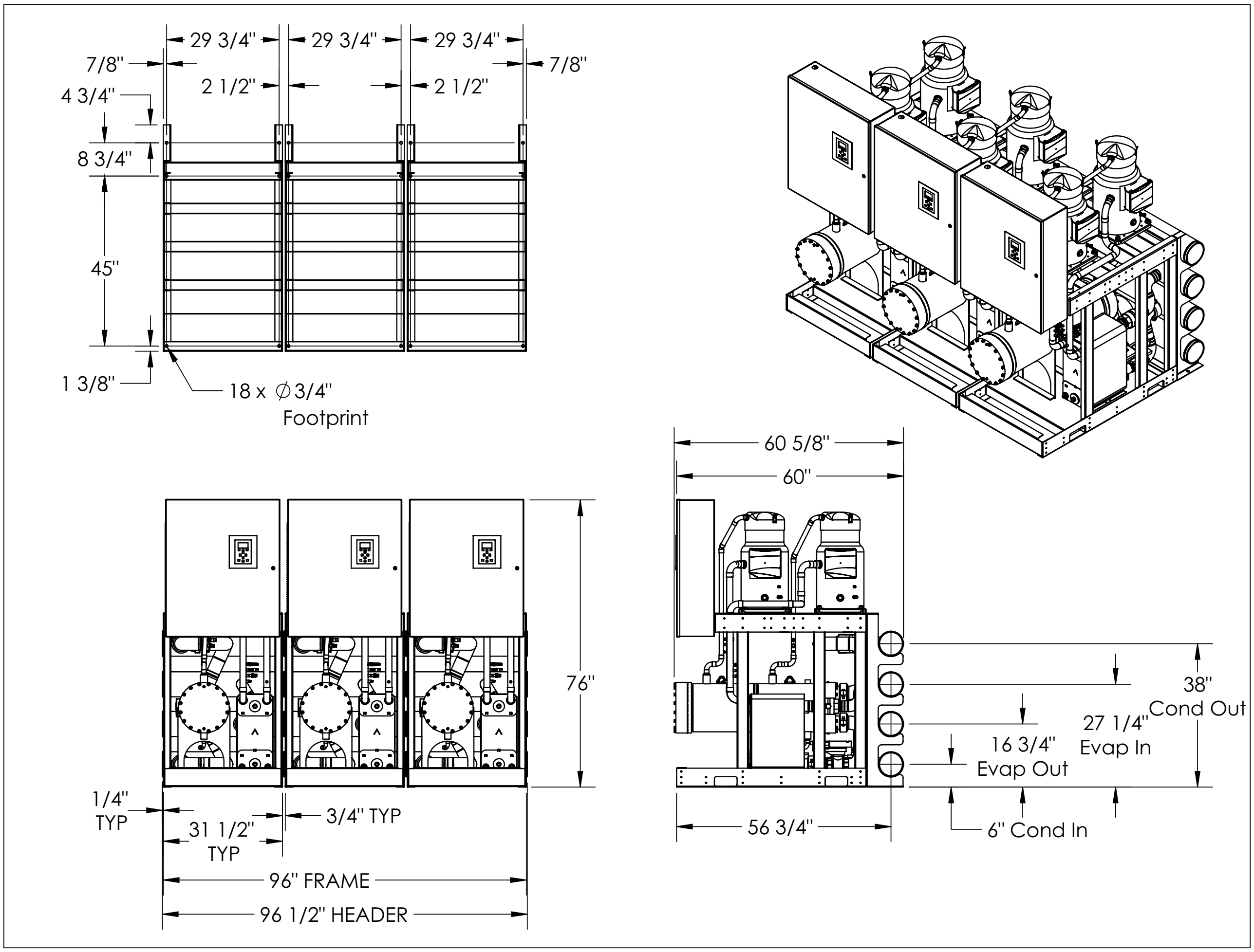


Figure 17. CICD unit dimensions, remote condenser

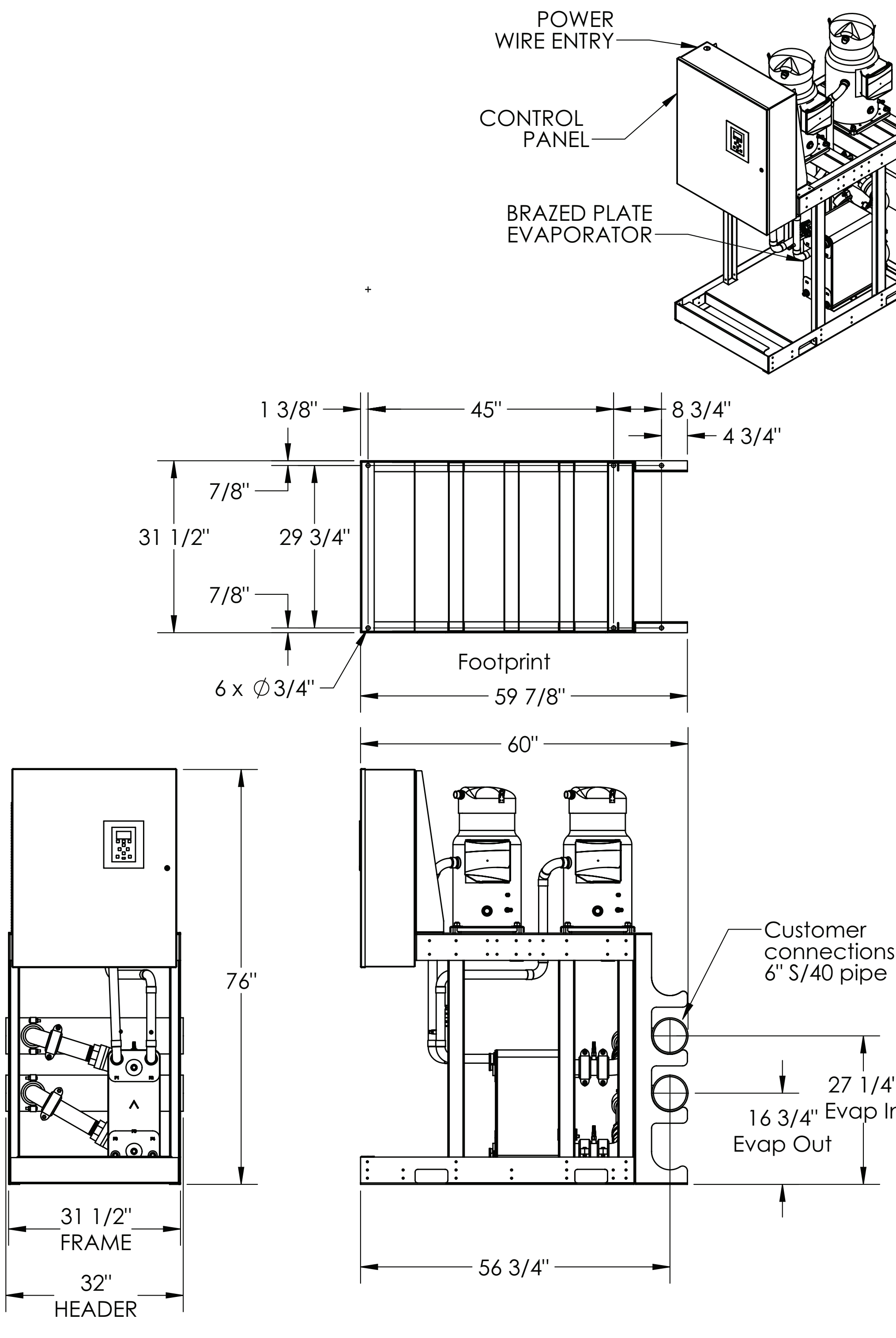
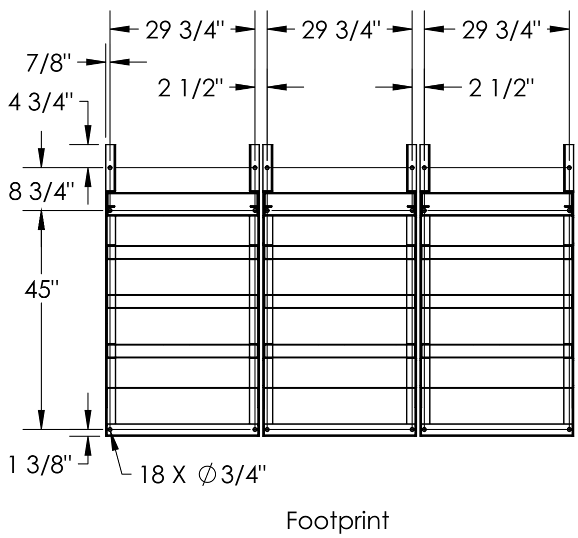
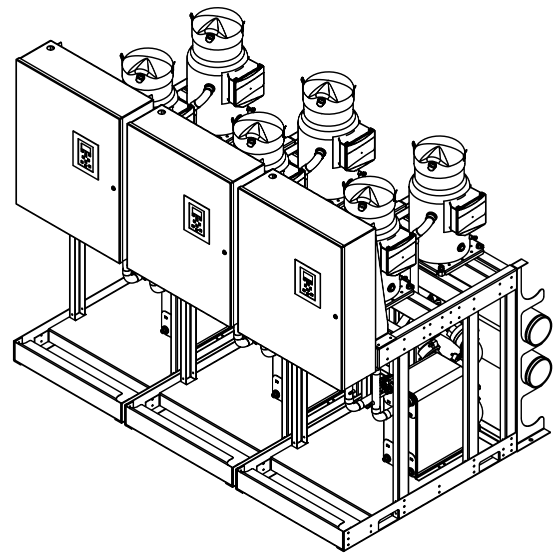
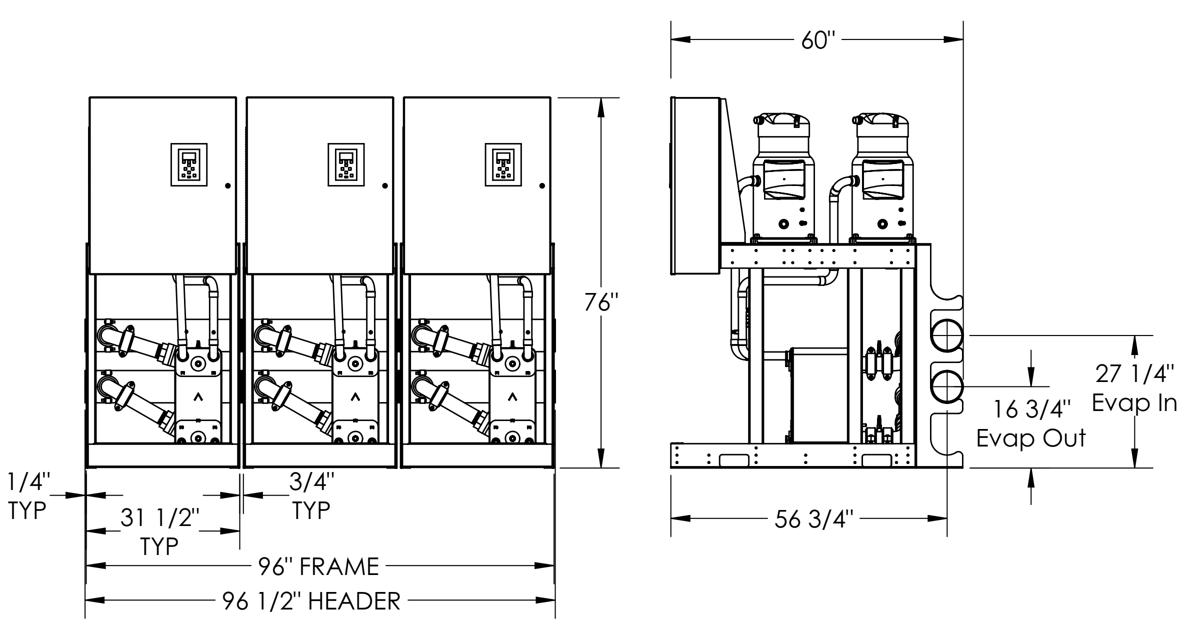


Figure 18. CICD unit array dimensions, remote condenser







Clearances

Notes:

- *Clearance of 42 inches is required in front of chiller to other electrically grounded parts.*
- *Two units facing each other or other live parts require a clearance of 48 inches.*
- *36 inches clearance is recommended above the chiller.*
- *See Figure 20 and Figure 21, p. 44 for recommended clearance requirements for array installations.*

Figure 19. Clearance — CICD single chiller application (all condenser options)

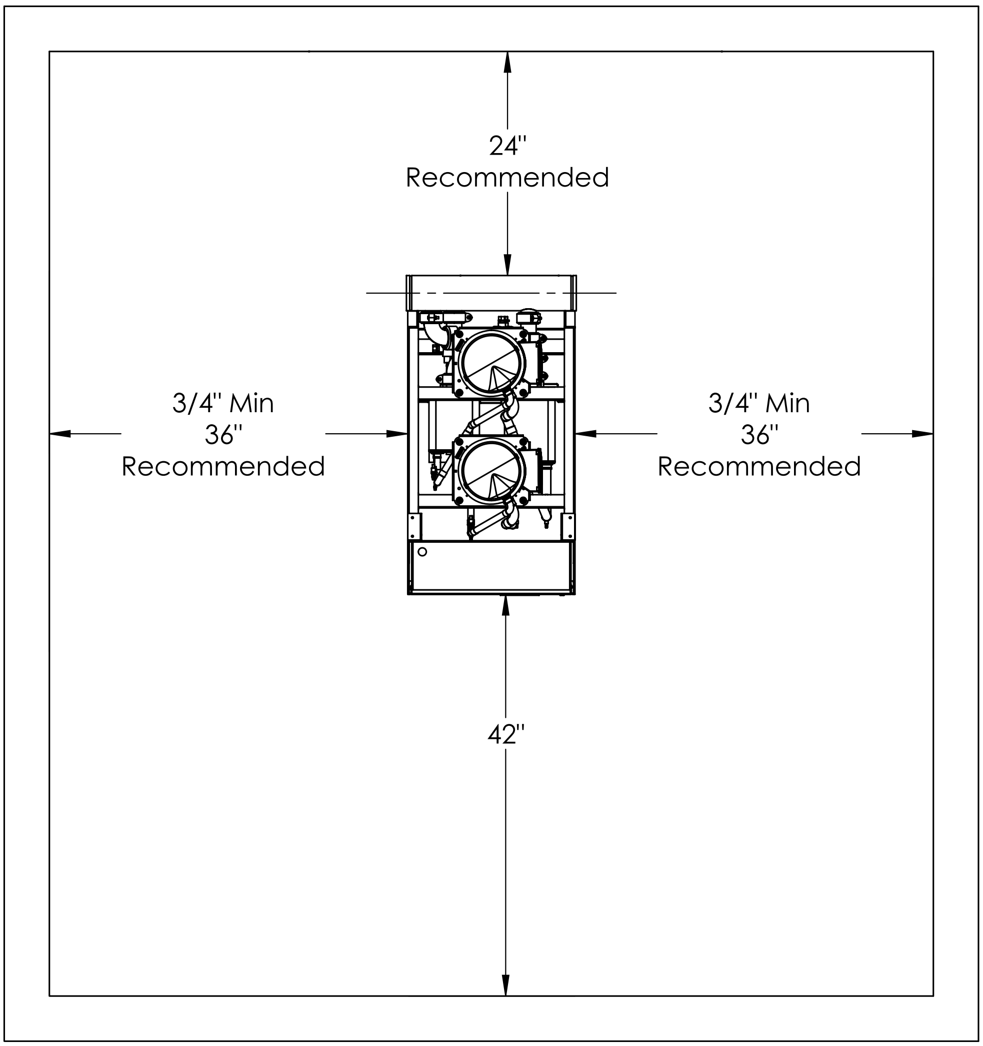


Figure 20. Clearance — CICD array chiller application (all condenser options)

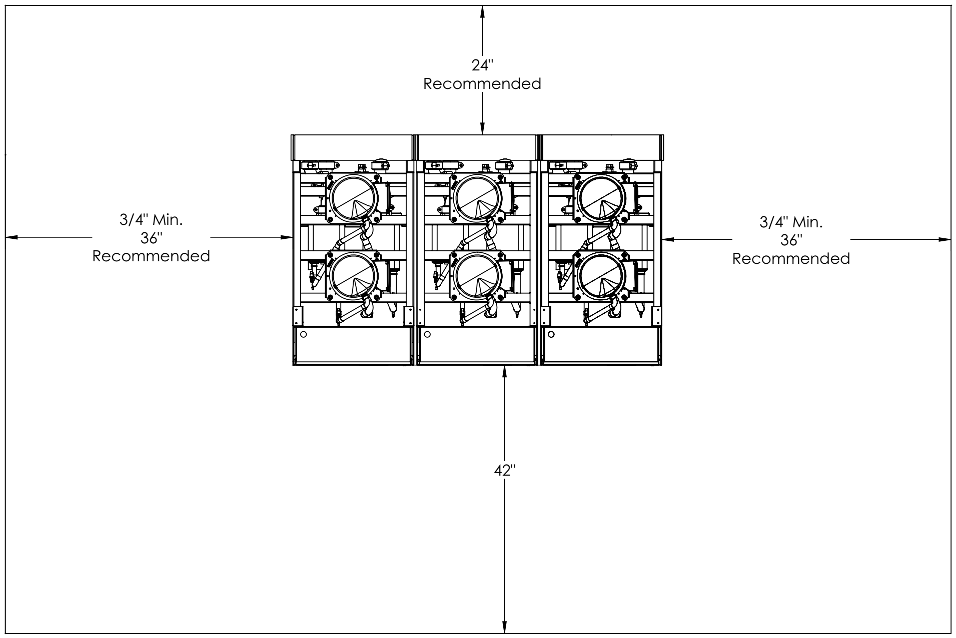


Figure 21. Clearance needed to remove chiller from array— CICD array chiller application (all condenser options)

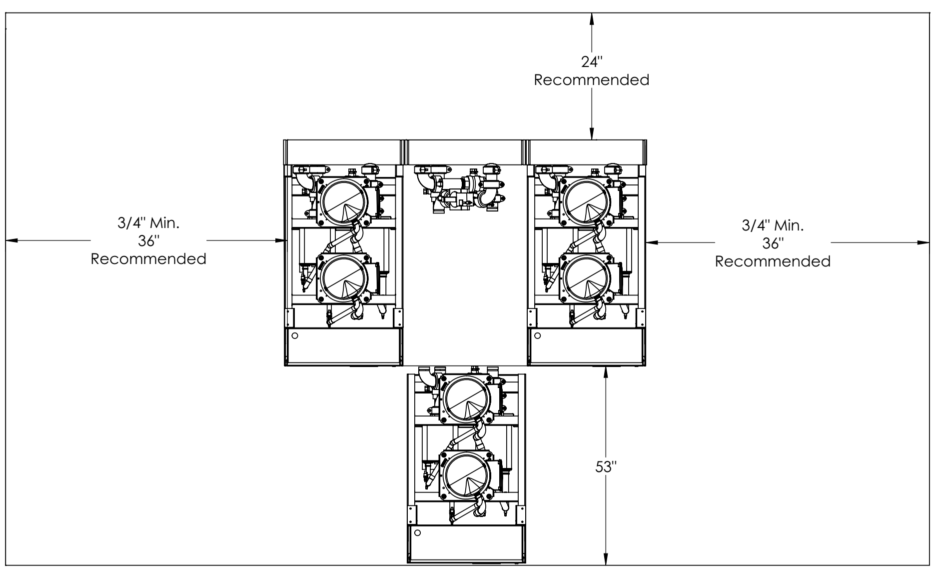
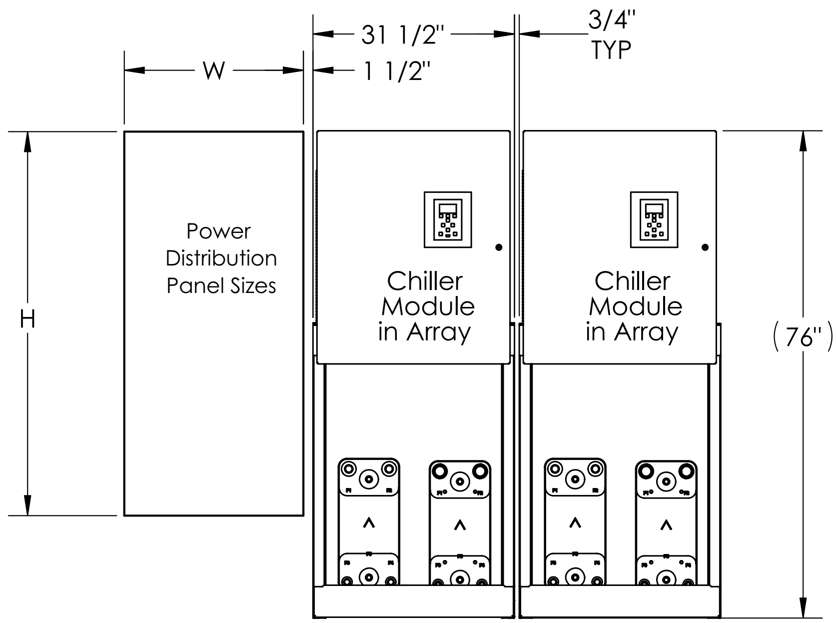


Figure 22. Single point power distribution panel dimensions

Array Single Point Power



Use chart below to
determine panel size

Model	Electrical Power	2 Modules			3 Modules			4 Modules			5 Modules			6 Modules			7 Modules			8 Modules		
		H	W	D	H	W	D	H	W	D	H	W	D	H	W	D	H	W	D	H	W	D
CICD030	200-230/3/60	48.0	20.0	5.75	60.0	20.0	5.75	60.0	20.0	5.75	60.0	20.0	5.75	57.0	24.0	10.40	57.0	24.0	10.40	73.5	36.0	10.40
	460/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75
	575/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75
CICD045	200-230/3/60	60.0	20.0	5.75	60.0	20.0	5.75	72.0	28.0	5.75	72.0	28.0	5.75	73.5	36.0	10.40	73.5	36.0	10.40	N/A	N/A	N/A
	460/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75
	575/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75
CICD055	200-230/3/60	48.0	20.0	5.75	60.0	20.0	5.75	72.0	28.0	5.75	73.5	36.0	10.40	73.5	36.0	10.40	N/A	N/A	N/A	N/A	N/A	N/A
	460/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40
	575/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75
CICD065	200-230/3/60	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	460/3/60	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	57.0	24.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40
	575/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	57.0	24.0	10.40	57.0	24.0	10.40
CICD075	200-230/3/60	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	460/3/60	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	57.0	24.0	10.40	73.5	36.0	10.40	73.5	36.0	10.40
	575/3/60	36.0	20.0	5.75	36.0	20.0	5.75	36.0	20.0	5.75	48.0	20.0	5.75	48.0	20.0	5.75	57.0	24.0	10.40	57.0	24.0	10.40

Note

Contact your local Trane representative if array total amps exceeds 1200 amps.

Weights

Table 8. CICD unit weights

Size	Shipping Weight						Operating Weight					
	Brazed Plate Condenser		Shell-and-Tube Condenser		Remote Condenser		Brazed Plate Condenser		Shell-and-Tube Condenser		Remote Condenser	
	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg	lbs	kg
20	1326	601	1467	665	1069	485	1525	692	1688	766	1168	530
30	1495	678	1760	798	1205	547	1720	780	2025	919	1320	599
45	1775	805	1970	894	1420	644	2040	925	2265	1027	1550	703
55	1795	814	1970	894	1410	639	2065	937	2265	1027	1545	701
65	2230	1012	2640	1197	1770	803	2565	1163	3035	1377	1940	880
75	2235	1014	2640	1197	1775	805	2570	1166	3035	1377	1945	882
85	2487	1128	2925	1327	1963	890	2860	1297	3362	1525	2152	976

Mechanical Specifications

General

Trane® Cold Generator™ Compact Series model CICD water-cooled chillers are designed with high efficiency, reliability, serviceability and expandability in mind. CICD compact chillers can be applied as standalone chillers or in an array of up to ten (10) chillers for a total of 600 ton and controlled by an array controller to form a single high capacity multistage package chiller. The header pipe section is detachable.

Each CICD compact chiller is pressure tested, dehydrated, charged with refrigerant R-410A and POE oil, and run tested at full and part load conditions. Completed chillers are then top coated with industrial two-part epoxy direct-to-metal paint prior to shipment.

Standalone chillers only require field connection of chilled and condenser water piping, chilled water wye-strainer, and power and control wiring to the control panel terminal block / strip. CICD chillers installed in an array require additional coupling of water piping between chillers and mounting and wiring of array controller panel.

Chilled and condenser water inlet and outlet connections are grooved pipe for ease of installation and service. Chilled water flow proving device and chilled water 20 mesh wye-strainer are required and must be field installed.

Certified AHRI Performance

Trane water-cooled chillers are rated within the scope of the Air-Conditioning, Heating and Refrigeration Institute (AHRI) Certification Program and display the AHRI Certified® mark as a visual confirmation of conformance to the certification sections of AHRI Standard 550/590 (I-P) and ANSI/AHRI Standard 551/591 (SI). The applications in this catalog specifically excluded from the AHRI certification program are:

- Custom Units
- Condenserless Chillers
- Evaporatively-cooled Chillers
- Units with evaporators or condensers that use fluid other than fresh water except units containing freeze protection fluids in the condenser or in the evaporator with a leaving chilled fluid temperature above 32°F [0°C] are certified when rated per the Standard with water.

Agency Listing

Each CICD compact chiller is ETL Listed to U.S. and Canadian safety standards.

Compressor – Motor

Fully hermetic direct drive scroll compressors are mounted on vibration isolators. Lubrication system with oil level sight glass is arranged to ensure adequate lubrication during starting, stopping and normal operation. Motor is suction gas cooled, runs at a constant speed of 3600 rpm, has motor protection and is designed for across-the-line start.

Compressor Isolation Valves

This factory installed option provides compressor suction line and discharge line service valves. These valves isolate the compressor from the rest of the refrigerant system. This allows the compressor to be serviced or removed without having to evacuate all the refrigerant in the circuit. These isolation valves reduce service time and expense.

Hot Gas Bypass

This option converts the exclusive Active Freeze Protection system to Hot Gas Bypass operation in order to provide an additional step of capacity control. It is useful if significant run hours at minimum capacity, where the chiller would otherwise cycle on and off, are anticipated.

Evaporator

Brazed plate evaporator is UL Listed for US and Canada. Refrigerant and water side has maximum design/abnormal pressure rating (PS) of 653 psi at of 400°F. Evaporators have one (1) or two (2) refrigerant circuits and one (1) chilled water circuit. Evaporator is insulated with 0.5 inch (12.7 mm) thick closed-cell flexible insulation with a K value of 0.26 BTU/ (hr-ft.-°F) and is furnished with core, inlet and outlet water temperature sensors.

Brazed Plate Evaporator Freeze Protection

Outstanding freeze protection for the evaporator is standard on each chiller. Included as part of the freeze protection system are a well sensor in evaporator, a leaving water temperature sensor and a suction pressure transducer. The brazed plate evaporator also has a top vent that provides a means to purge air or relieve gas binding. An exclusive feature that comes standard on each chiller is Active Freeze Protection. In addition to providing freeze protection for the evaporator, Active Freeze Protection eliminates low suction pressure nuisance trips. If the suction transducer senses a pressure of 101 psig (~32°F), a solenoid valve opens to allow a small amount hot refrigerant gas into the evaporator. When the suction pressure transducer measures 105 psig (~34°F), the solenoid valve closes.

Condenser

Shell-and-tube condenser is mechanically cleanable shell-and-tube type with enhanced copper tube geometry, 0.025 inch tube wall thickness, removable water plates to facilitate cleaning. Shell side (refrigerant) bears the ASME stamp and has a maximum allowable working pressure of no less than 600 psig at 150°F. Tube side (water) has a maximum allowable working pressure of no less than 150 psig at 150°F. The condenser has one (1) four 4-pass water circuit and two (2) refrigerant circuits. Each condenser refrigerant circuit has a pressure relief valve.

Brazed-plate condenser shall be rated for a maximum refrigerant pressure of 505 psig (3482 kPa) and shall be tested for a maximum water-side pressure of 300 psig (2068 kPa). Brazed-plate shall be a single-pass, liquid-cooled, ANSI type 316, stainless-steel brazed-plate construction that shall provide positive subcooling of liquid refrigerant.

A heat load may be connected to the condenser when simultaneous heating and cooling loads exist. A heat recovery machine with brazed plate condenser shall be capable of producing up to 140°F hot water. A heat recovery machine with shell and tube condenser shall be capable of producing up to 125°F hot water. Machine shall control to smallest of heating or cooling load and automatically switch between heating and cooling control set points.

Condenser Relief Valves/Plugs

Each condenser refrigerant circuit has a relief valve (shell and tube) or a fusable plug (brazed plate) to provide pressure relief should the refrigerant pressure exceed safe limits.

Condenser Water Flow Switch

In addition to having a device prove there is flow through the evaporator, it is beneficial to prove that flow is occurring in the condenser. The condenser water flow switch is an optional sensor that is shipped loose for field installation.

Motorized Condenser Water Regulating valves

A compressor's saturated condensing temperature (SCT) has to be maintained within the operating range of between 65°F and 145°F. This requirement is crucial to the longevity of the chiller's compressors. The unit or array controller monitors the SCT. Through all steady state, part load, and transient operating conditions, the controller adjusts flow by modulating the motorized condenser water regulating valve in order to maintain the saturated condensing temperature in the proper range. As a factory installed option this motorized valve replaces the manual leaving water isolation valve on the condenser.

Removable Core Filter Driers

All CICD refrigerant circuits have a filter drier. To remove or replace a standard filter drier, a new filter dryer needs to be to brazed into place. On many CICD chillers, removable core filter driers are a factory installed option. This option allows the filter inside the drier assembly to be removed and replaced without the need to braze a new filter drier into the refrigeration circuit, making filter core replacement fast and efficient.

Compressor Chiller Option

To avoid cooling tower cost, maintenance, or there is a concern about Legionella, the CICD modular chiller can be paired with a remote condenser. A compressor chiller (remote condensed) CICD can be paired with an air-cooled condenser or any other outdoor heat rejection device for refrigerant.

Refrigerant Circuit

All CICD chillers have an option of one (1) or two (2) refrigerant circuits. Dual circuited units will have a single compressor on each circuit, a dual circuit brazed plate evaporator, and a dual circuit brazed plate or shell-and-tube condenser. A single circuited unit will have two compressors on a circuit, a single circuit brazed plate evaporator, and a single circuit brazed plate condenser. All circuits will have a thermal expansion valve, a liquid line solenoid valve, a liquid line filter drier, an active freeze protection system and interconnecting refrigerant copper pipe.

Water Flow Balancing Devices

Water flow through evaporator and condenser of each chiller in an array can be easily balanced by adjusting differential pressure. Condenser water inlet and outlet pressure is measured by using onboard pressure gauge service ports. Water flows can be adjusted by using factory installed manual isolation valves.

Analog Water Temperature Gauges

While the control system continually measures and monitors fluid temperatures for the entire chiller array, it is sometimes convenient to have gauges on the individual chiller modules. This factory installed option adds temperature gauges to the entering and leaving chilled and condenser flow streams.

Analog Water Pressure Gauge

This factory installed option adds water pressure gauges to the entering and leaving chilled and condenser flow streams.

Compact Chiller Control Panel

For modules that have their own single point power connections the control cabinet contains a power distribution section and a controls section. Unit controller is located in the controls section with display mounted on the exterior of the control cabinet door.

Power distribution section contains non-fused disconnect and ground lugs for customer connection, across-the-line contactors, current transformers, and control power transformer with primary and secondary fuses. Power options include Non-fused Disconnects, Fused Disconnects, and high (100KA) SCCR Fuse Blocks.

Note: *Non-fused disconnect lug is an option and not included as part of the base product.*

Controls section contains the unit controller with standard and optional expansion boards, keyboard and display (exterior of control cabinet door), power monitor (optional), service friendly terminal strips to facilitate circuit diagnosis and field connection. If the chiller is operated as a single unit (not in an array with other CICD chillers), provisions at the field connection terminal strip have been made for “Remote Off/Auto” (input), “Remote Alarm” (output), “Remote Chilled Water Pump Enable” for one (1) chilled water pump (output), “Condenser Water Pump Enable” for one (1) condenser water pump (output), and required “Flow Switch (flow proving device)” (input).

The standalone unit controller monitors, displays and logs operating and fault conditions, and provides safety protection for low and high refrigerant operating pressure, low and high refrigerant superheat, low refrigerant differential pressure between low and high side, low chilled water temperature, low chilled water flow, compressor over amperage, and abnormal power conditions when fitted with optional power monitor. Mechanical high and low pressure switches, and compressor thermal protection devices are not located in the controls section, but are monitored and reported by the unit controller.

The unit controller will also stage compressors using lead/lag logic to maintain the chiller’s leaving chilled water temperature set-point in a single chiller application (not in an array with other chillers) or in an array with other CICD chillers if the array controller fails.

When a CICD chiller is being operated as a single unit, the unit controller adjusts the leaving chilled water temperature by staging compressors using proportional, integral, derivative (PID) logic. Unit controller has RS-232, RS-485 and Ethernet communications ports for user interactive communication, or for interface with Building Management Systems (BMS). Controller has standard BMS compatibility with BACnet® IP and Modbus™ RTU and can be fitted with an optional interface gateway for compatibility with Johnson N2, LonTalk® and BACnet MS/TP. The controller is capable of responding to a BMS signal for “Run/Stop”, “Leaving Chilled Water Temperature Reset” or “Demand Limiting Reset”. “Leaving Chilled Water Temperature” can also be reset using a 0 to 5 Vdc input signal.

Digital Power Monitor

The Digital Power Monitor is specifically designed to protect motors and other 3-phase loads from premature failure and damage due to common voltage faults such as voltage imbalance; over under voltage; phase imbalance, loss, or reversal; incorrect sequencing; and rapid short cycling. The monitor is installed inside of the Compact Chiller Control Cabinet. Upon a fault condition this monitor will lock out (de-energize) the chiller. The LED fault indicator on the monitor will blink. The controller for the chiller module will indicate the lockout condition and will generate an alarm.

Array Control Panel

An array control panel (shipped loose) may be used for operation of more than one (1) nested compact chiller. The array control panel contains the array controller, keyboard and display (exterior of control cabinet door), 120 Vac circuit breaker for input power to the panel, and field connection terminal strip for connection of “Remote Off/Auto” (input), “Remote Alarm” (output), “Remote Chilled Water Enable” for up to two (2) chilled water pumps (output), “Condenser Water

Pump Enable" for one (1) condenser water pump (output), "Array On/Off Status" (output), and *required* "Flow Switch (flow proving device)" (input).

The array controller controls the leaving chilled water temperature by staging compressors using proportional, integral, derivative (PID) logic. Entering and leaving chilled water temperature sensors, addressed by the array controller, are shipped loose for installation by others in the common array chilled water lines. One compressor is cycled in each chiller before second compressor is cycled using lag/lead logic. Array controller has RS-232, RS-485 and Ethernet communications ports for user interactive communication, or for interface with BMS. Controller has standard BMS compatibility with BACnet® IP and Modbus™ RTU and can be fitted with an optional interface gateway for compatibility with Johnson N2, LonTalk® and BACnet MS/TP. The controller is capable of responding to a BMS signal for "Run/Stop", "Leaving Chilled Water Temperature Reset" or "Demand Limit Reset". "Leaving Chilled Water Temperature" can also be reset using a 0 to 5 Vdc input signal.

Array Single Point Power

This option reduces the amount of installation labor by eliminating the need to run separate power to each module in the chiller array. A single connection point is provided to power the entire array. With this option, the array of chillers is delivered with a separate power panel enclosure. This separate enclosure includes the electrical lug to land the incoming power cables. The cabinet has circuit breakers for each module in the array. Power wiring will be distributed to each chiller module through a wire chase at the top of each individual chiller control panel. Upon installation, the factory supplied electrical whips will be routed to each module through the top of their control panel. Conduits are also factory provided to encase the power wiring as it is routed between one chiller module and the next.

N+1 Logic

N+1 logic can be utilized when each chiller in an array is equipped with optional chilled water motorized on-off valve and optional condenser water regulating valve, and a standby chiller is installed in the array. In the event of a chiller failure, the N+1 Logic automatically performs the following functions:

- Electrically locks out the failed chiller
- Opens the chilled and condenser water valves in the standby chiller
- Closes the chilled and condenser water valves in the failed chiller
- Enables the standby chiller for normal operation in the array

The motorized condenser water regulating valve and motorized chilled water isolation valve options are required for a critical cooling application where there the need for a redundant chiller or chillers (N+1) exists. When operating with N+1 logic, the controller will close the motorized chilled water and condenser water valves to the disabled chiller module and open valves to the backup chiller module.

Operator Interface

Exterior cabinet door of chiller control panel and array control panel includes a controller interface with keypad, 128 X 64 dot pixel display screen. Controller can be accessed using the local keypad and display screen for all unit control setpoints, faults and alarm conditions with history, and operating conditions in clear language format for easy interpretation by the user / operator. Controller can also be accessed from a remote computer such as a laptop using MCS Connect software having all functions available through the local interface with the additional ability to download fault history. This feature allows one to review history graphically. The controller stores 1,008 packets of information that can be graphically presented on the remote computer. Data can be taken from the controller for graphical display based on the set time interval. The time interval is factory set at 15 seconds, but is adjustable. Up to 99 fault conditions are stored in the controller and 120 seconds of history is saved any time a fault occurs that results in a compressor lockout.

Color Touchscreen Displays

While the keypad with a 128 X 64 dot pixel display screen can be used to control, program, and review alarm and fault conditions, a laptop or PC is invaluable for viewing dynamic on-line display screens and for better graphing capability. If a better human interface without the need of a laptop or PC is preferred, the optional 10.1inch or 15.4-inches color touchscreen is the solution. These color touchscreens are capable of displaying all unit control set points, fault and alarm conditions with history, operating conditions, schedules, run history, chiller IOMs, and unit wiring diagrams.

Reliability

Standard on each chiller module are current sensors that verify the operation of compressors. The same current sensors detect and initiate the disabling of the compressor if a high amperage condition is detected. The CICD modular chillers are designed to keep power and control items above all the fluid piping. Should a small leak develop in a fitting, water will not drip upon any electrical components.

Serviceability

The CICD compact chiller has a unique level of serviceability for a modular chiller. Each modular chiller comes with a sight glass on each refrigerant circuit. All refrigerant components such as filter driers, expansion valves, sight glasses and solenoid valves can be accessed from the front of the chiller module. Low voltage circuit switches on every chiller can act as an emergency stop to cut power to the chiller from low voltage side of the control panel. Switches are also provided to disable each refrigerant circuit. This very useful when trying to charge a circuit with refrigerant or when needing to provide maintenance on a compressor. All terminal blocks and the wires feeding into the terminal block are labeled to aid service and trouble shooting.

Insulation

All cold surfaces are insulated with 0.5 inch (12.7mm) thick closed-cell flexible insulation with a K value of 0.26 BTU/ (hr-ft.-°F).

Sound Attenuation Options

Chillers installed near noise sensitive areas have two options to address the issue. The first factory installed option provides insulated sound covers on each compressor. These blankets dampen compressor generated sound. The blankets can be used alone or in combination with a sound cabinet, the other sound attenuation option. The sound enclosure is also a factory installed option. The panels completely encase the chiller module. The panels, lined with sound absorbing insulation, can be removed for access in case of service.

Vibration Isolation

In applications that are sensitive to noise and vibration, optional neoprene isolator pads can be provided for load bearing points on a CICD Modular chiller.

Chilled Water Wye Strainer

Chilled water wye-strainer with removable 20 mesh screen and blow down provision is required for all individual chiller and chiller array installations. Strainer is shipped loose and field installed by others.

Wye Strainer Kits

All brazed plate heat exchanges should have a strainer with a minimum 20-mesh screen. The strainers are field installed prior to connection of the chiller array to the condenser or chilled water inlet piping. A wye strainer kit provides adapters that aid in the connection of the threaded end of the strainer to the grooved fittings on the chiller. In addition, the kit provides ports for differential pressure measurement which assists in the adjustment of the valves when balancing water flows. There is also a blowdown port to clear contaminants trapped by the mesh screen.

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