Product Catalog

PolyTherm™ Water-Cooled, Multi-Pipe Unit

30 to 60 Nominal Tons

November 2022

ARTC-PRC003B-EN

Introduction

Design and manufacturing excellence make Trane a leader in the water-cooled multi-pipe marketplace. This tradition of using excellence to meet market demands is illustrated with the Trane PolyTherm™ water-cooled, multi-pipe units . These modular units offer the ultimate in versatility and thermal effiency.

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Revision History

- Removed Variable Speed Drive option from Application Considerations and Options chapter.
- Removed Water Flow Limits from Application Considerations chapter.
- Updated PolyTherm PLC in Electrical Connections chapter.

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Features and Benefits

- Single R-410A refrigerant circuit on each module.
- Hermetic scroll tandem compressor set with two fixed speed compressors, each tandem set with oil level sight glass, in-line circuit breaker, and solid-state overload protection.
- Six pipe system design provides hot and cold building load fluid using the chilled fluid supply and return piping, hot fluid supply and return piping and source/sink geothermal/cooling tower loop supply and return piping.
- Single circuit, brazed plate evaporator and condenser in each module.
- Fine mesh strainer on each evaporator and condenser branch line piping.
- Thermal dispersion flow switch on each evaporator branch line piping.
- Electronic and manual isolation valves on each evaporator and condenser branch line piping for service isolation and variable flow.
- Thermal dispersion flow switch on each condenser branch line piping.
- Single circuit, brazed plate heat exchanger in each module for source/sink fluid (geothermal or cooling tower) for rejecting (condenser operation) or extracting (evaporator operation) heat to the fluid when there is no longer a hot or cold fluid requirement, respectively.
- Electronic and manual valves on each source/sink loop heat exchanger to allow for head pressure control as well as individual isolation.
- Electronic expansion valve.
- Phase monitor on the power supply to protect against low voltage, phase imbalance, phase loss, and phase reversal conditions.
- Individual strainer serviceability while balance of system is operational.
- Single point power supply to a load distribution panel with a circuit breaker for each module to provide electrical service isolation and branch circuit overload protection.
- 6-inch schedule 10 carbon steel load fluid evaporator, condenser, and source/sink fluid heat exchanger headers with roll grooved connections.
- 3/4-inch Insulation on each evaporator, condenser, fluid piping, and components.
- Formed sheet metal frames and panels powder-coated with an oven-baked finish.
- Primary microprocessor controller provides current alarm status, alarm logging of the previous 200 alarms, water temperatures for each module, refrigeration pressure, compressor run hours, current status display, remote on/off, and general alarm contacts.
- Distributed primary microprocessor controller on each secondary module to allow the secondary modules to continue to operate should there be a failure of the primary microprocessor controller (Only applicable when one or more secondary modules are required).
- 7-inch touchscreen graphical interface display installed on the primary module of the system.

Application Considerations

Proper application considerations are required when sizing, selecting, and installing Trane PolyTherm™ water-cooled multi-pipe units. Improper application can impact the system and module performance and reliability. Deviations from these recommendations should be reviewed with your local Trane sales representative.

Definitions of Terms

Design Capacity: The full load cooling or heating capacity required to meet the building load.

Electronic Isolation Valve: Two-position valve that automatically opens when a module is enabled by the primary microprocessor controller. Trane PolyTherm™ water-cooled multi-pipe units have a factory installed electronic valve on each individual module's three heat exchangers: the evaporator, condenser, and source/sink heat exchanger.

Primary Microprocessor Controller: The controller on the primary module that coordinates the operation of all individual modules to achieve the desired system operation. Each module in the PolyTherm™ multi-pipe bank has its own microprocessor controller to operate. The first module in the system is typically the primary module with the primary microprocessor controller and the remaining secondary modules each have a secondary controller. The secondary modules' microprocessors all communicate with the primary microprocessor.

Lead/Lag Sequence: The staging order of either the PolyTherm™ multi-pipe units within a bank or the staging order of the compressors within a specific module. The lead module is rotated every 168 hours to equalize runtime with the remaining modules when a module is shut down for servicing or for component failure. The primary controller determines the lead/lag sequence order of the modules.

Module: The individual PolyTherm™ water-cooled multi-pipe unit that make up a modular system. A PolyTherm™ multi-pipe unit includes two compressors on a single refrigeration circuit, brazed plate load side evaporator, brazed plate load side condenser, brazed plate source/sink heat exchanger, controller, electrical panel, as well as other components required to enable the modular operation.

PolyTherm™ Water-Cooled Multi-Pipe Units: The PolyTherm™ modular simultaneous heating and cooling system is designed to have individual modules to independently operate in a heating mode, cooling mode or simultaneous heating and cooling based on the system demand. The modular system contains independent fluid loops that are never mixed for hot and cold load fluids and the source/sink fluid. The cold load fluid has a dedicated evaporator, the hot load fluid has a dedicated condenser, and the source/sink fluid has a dedicated heat exchanger that operates as an evaporator or condenser depending on the operating mode. The single refrigeration circuit includes a set of check valves and solenoid valves that direct fluid flows to relevant evaporator, condenser and/or source/sink heat exchanger depending upon the operating mode.

PolyTherm™ Multi-Pipe System: A PolyTherm™ multi-pipe system shall contain a minimum of three modules for optimum performance. Individual modules are typically field assembled whereby individual modules are shipped separately to the job site and assembled together with integral pipe headers, controls, and power connections to create the complete multi-pipe system.

Design Fluid Temperature Limits

PolyTherm™ water-cooled multi-pipe unit have three heat exchangers with distinct water temperature design limits. The following are the individual heat exchanger's acceptable selection ranges. Note that a unit may not be selectable at the combined extreme temperatures of each individual heat exchanger. It should also be noted that the maximum hot water temperature is limited by the compressor operating envelope and achievable only at higher evaporator or source liquid temperatures.

- The maximum fluid temperature that can be circulated through any unit heat exchanger when the unit is not operating is 120°F (48.9°C).
- The evaporator / chilled fluid leaving temperature range with water is 42 to 65°F (5.6 to 18.3°C). With the appropriate glycol concentration, the evaporator leaving temperature may be as low as 30° F (-1.1°C). The condenser / heating fluid leaving temperature range is 100 to 135°F (37.8 to 57.2° C).

- The source/sink heat exchanger leaving fluid temperature range in the COOLING DOMINATE MODE (rejecting heat) is 60 to 100°F (15.6 to 37.8°C).
- The source/sink heat exchanger leaving fluid temperature range in the HEATING DOMINATE MODE (absorbing heat) with water is 42 to 70°F (5.6 to 21.1°C). With the appropriate glycol concentration, the leaving fluid temperature may be as low as 30°F (-1.1°C).

Operating Temperature Limits

The actual operating cooling and heating temperatures available from a PolyTherm™ water-cooled multi-pipe unit are dependent upon the combination of cooling and heating loop conditions. Actual system operating temperatures often differ from selected design temperatures and may be more extreme. Validating the equipment's ability to operate at the expected operating extremes is important for sustained reliable operation. When deciding upon system design conditions be sure to select the most extreme operating conditions to ensure the equipment can meet the system requirements. Some operating conditions to consider include:

- Heating Mode Operational Checks:
  – Minimum source/sink temperature that allows for heating mode operation.
  – Minimum source/sink conditions at which unit can produce design leaving heating fluid temperature.
  – Heating capacity at design leaving heating fluid temperature and minimum allowed source/sink temperature.
  – Maximum leaving heating fluid temperature at the minimum expected source/sink temperature.
  – Heating capacity at the minimum expected source/sink temperature and corresponding maximum leaving heating fluid temperature.
- Cooling Mode Operational Checks:
  – Maximum source/sink temperature that allows for cooling mode operation.
  – Source/sink conditions at which unit can produce design leaving chilled water fluid temperature.
  – Cooling capacity at design leaving chilled fluid temperature and maximum allowed source/sink temperature. Minimum leaving chilled fluid temperature at the maximum expected source/sink temperature.
  – Cooling capacity at the maximum expected source/sink temperature and corresponding minimum leaving chilled fluid temperature.
- Simultaneous Cooling and Heating:
  – Minimum leaving chilled fluid temperature at design heating leaving fluid temperature.

Multi-Pipe Bank and Module Sizing

There are two sizing calculations to consider when designing and selecting a modular PolyTherm™ multi-pipe system. They are:

- Multi-Pipe Bank sizing
- Module sizing

Multi-Pipe Bank Sizing

The design operating capacity of the multi-pipe bank should be based on the greater of the HVAC system peak heating load or the system peak cooling load. A provision for redundancy is discussed below.

Module Sizing

The proper number and size of modules that makes up the PolyTherm™ multi-pipe bank is dependent on several factors:

- Required Steps of Unloading: The number of steps of unloading impact system and module operating characteristics including:
  – Rate of compressor cycling

- Stability of chilled/hot fluid temperature control
- Accuracy of chilled/hot fluid temperature control
- System minimum chilled/hot fluid volume required

The PolyTherm™ multi-pipe system shall have at least three modules or six steps of unloading.

Each Trane PolyTherm™water-cooled multi-pipe unit has a tandem compressor set for two steps of unloading on each module.

- Low Load Operation: Both the system peak and the minimum design cooling and heating loads should be evaluated when deciding on the number and size of the unloading steps. If extended periods of very low loading (less than the minimum step of unloading) are expected, a PolyTherm™ system with smaller modules for better capacity turndown should be selected. A multi-pipe system with larger modules have less turndown and poorer load matching and can result in wide temperature swings, head pressure or low temperature trips and excessive compressor cycling.
- Redundancy: N+1 module redundancy can be achieved by PolyTherm™ water-cooled multi-pipe systems by adding one extra module to the system. This is the preferred method for adding redundancy as it does not impact control accuracy or other system design requirements and is less costly and complex than adding another full capacity heat recovery system. The primary microprocessor controller automatically enables the redundant module in the event of a failure of an operating module. The redundant module is also rotated into the lead/lag sequence to ensure it is operational when needed.
- System Fluid Volume: The size of the PolyTherm™ multi-pipe unit determines the system minimum fluid volume. Larger capacity modules drive the need for greater system volume.

Minimum PolyTherm™ System Volume

Adequate fluid volume is an important system design consideration as it provides for stable fluid temperature control and limits unacceptable short cycling of compressors.

For PolyTherm multi-pipe units, the minimum hydronic system volume in each cooling, heating and source/sink fluid loop should be 25 times the smallest refrigeration circuit capacity in the modular system (i.e.: the smallest unloading step) For example, if the smallest refrigerant circuit is 15 tons without a compressor VFD, the minimum hydronic volume would be 25 x 15 = 375 gallons. For systems with a rapidly changing load profile, the volume should be increased.

If the installed system volume does not meet the above recommendations, avolume buffer tank located in the return fluid piping. is required to reduce the rate of change of the return water temperature and/or allow for greater refrigeration circuit unloading.

Typical Water Piping

All fluid piping loops must be flushed prior to making final connections to the multi-pipe units. To reduce heat loss and prevent condensation, insulation should be applied. Expansion tanks are also usually required so that each circuit’s fluid volume changes can be accommodated.

Variable Flow

Trane water-cooled multi-pipe units are designed to work in many common system configurations including primary/secondary (P/S or decoupled), variable primary / variable secondary (VP/VS), and variable primary flow (VPF) systems.

VP/VS system configurations are used for their operational stability and potential pumping energy savings. The operating objective for pump control of a Polytherm modular system is to provide the design flow for each active module (steps of flow control) and variable flow out to the loads at each AHU coil. Pumps in the hot fluid, cold fluid and source/sink fluid should be on standby and available when signaled to start in any operating mode.

The range of flow allowed by the Polytherm multi-pipe system is a function of the operating mode and the number of active modules. The PolyTherm™ modules must have a minimum flow rate through the module evaporator(s) and the source/sink heat exchanger(s) when operating as evaporator(s). In VPF systems, a minimum flow bypass valve at the most remote fan coil is typically used to ensure this minimum flow. In VP/VS systems, PolyTherm™ modules’ flow rate is controlled through primary pump speed control. Installation of a flow meter in each primary fluid loop is highly recommended to ensure the required flow rate.

Electronic valves are installed on each heat exchanger to isolate or allow fluid to flow through a module when its compressors are cycled. When the cooling or heating load increases - thereby requiring the operation of another module - the valve to that module is opened to allow for compressors to start. The PolyTherm™ primary module controller signals to the BAS /pumping control system that the number of active modules has increased and to properly control the speed of the corresponding pumps on the fluid loops that are operating.

Glycol

Glycols are used in HVAC systems to prevent damage from corrosion and freezing. Freeze protection is the concentration of glycol required to prevent ice crystals from forming at the given leaving fluid temperature of the PolyTherm™ module evaporator(s) and the source/sink heat exchanger (s) when operating as an evaporator.

The glycol concentration is selected based on a temperature that is at least 5° F lower than the lowest anticipated design operating temperature. Table below is an excerpt from product information bulletins published by The Dow Chemical Company.

Table 1. Typical concentrations (by % volume) required to provide freeze and burst protection at various temperatures

Temperature (°F)	DOWNTHERM SR-1 (Ethylene glycol)	DOWNFROST HD (Propylene glycol)
	Freeze Protection	Freeze Protection
20	16.80%	18%
10	26.20%	29%
0	34.60%	36%
-10	40.90%	42%
-20	46.10%	46%
-30	50.30%	50%
-40	54.50%	54%
-50	58.70%	57%
-60	62.90%	60%

Water Treatment

The use of untreated or improperly treated water may result in scaling, corrosion, and algae or slime buildup in the PolyTherm™ brazed plate evaporators and condensers and associated piping and components. This will adversely affect heat transfer between the water and brazed plate heat exchangers and may lead to premature unit piping and/or component failure. Below are the fluid quality guidelines for heat exchanger scaling and corrosion management. Algae and slime buildup is managed with microbiological control agents.

Element/Compound/Property	Value/Unit
pH	7.5 – 9.0
Conductivity	< 500 µS/cm
Total Hardness	4.5 – 8.5 dH˚
Free Chlorine	< 1.0 ppm
Ammonia (NH_3)	< 0.5 ppm
Sulphate (SO_4^{2-})	< 100 ppm

Element/Compound/Property	Value/Unit
Hydrogen Carbonate (HCO_3^-)	60 – 200 ppm
(HCO_3^-)/(SO_4^{2-})	> 1.5
(Ca+Mg)/(HCO_3^-)	> 0.5
Chloride (Cl-)	< 200 ppm

Salt and brackish water is not recommended for use in water-cooled units . Trane recommends using a qualified water treatment specialist to assist in establishing a proper water treatment program.

Foreign matter in the cooling, heating or source/sink fluid loops can also foul the multi-pipe system piping, brazed plate heat exchangers, and strainers thereby increasing pressure drop and reducing fluid flow. A 40- mesh screen strainer is installed in each branch line to the brazed plate heat exchanger to reduce fouling. It is important to thoroughly flush all piping in the hydronic system before making the final piping connections to the PolyTherm™ modules. See ARTC-SVX005*-EN, PolyTherm™ Simultaneous Chiller/Heater Installation, Operation, and Maintenance manual for proper system flushing procedures.

Servicing

Service clearance for all internal components in each PolyTherm™ module as well as in front of each electrical panel must be provided. These clearances are indicated in the dimensional data section. Local codes may take precedence.

Model Number Descriptions

Digit 1— Brand

T = Trane

Digit 2 — Model Series

P = Process and Modular Series
M = Medical and Critical Duty Series

Digit 3, 4, 5 — Condenser Type

ACH = Air-Cooled, Horizontal Air Flow
ACV = Air-Cooled, Vertical Air Flow
ACR = Air-Cooled Remote Condenser
WCC = Water-Cooled Condenser

Digit 6 — Chilled Water System

P = Recirculating System, Tank and Pump
M = Single Pass Chiller Unit, no Tank and Pump

Digit 7 — Cabinet Type

H = Horizontal Low Profile
V = Vertical Upright

Digit 8, 9, 10, 11— Chiller Capacity

0030 = 3 Ton Capacity
0300 = 30 Ton Capacity

Digit 12 — Refrigeration Circuits

D = Dual Independent Refrigeration Circuits
S = Single Refrigeration Circuit
R = Redundant Refrigeration
T = Tandem Compressors Set in Single Circuit

Digit 13 — Voltage

1 = 208/230/60/1
2 = 460/60/1
3 = 208/230/60/3
4 = 460/60/3
5 = 575/60/3
7 = 380/50/3

Digit 14, 15 — Chiller Application

MM = Modular

Digit 16, 17 — Additional Features

VS = Variable Speed
VS1 = Variable Speed (1 Compressor)
VS2 = Variable Speed (2 Compressors)
DS = Digital Scroll
DS1 = Digital Scroll (1 Compressor)
DS2 =Digital Scroll (2 Compressors)
HP = Heat Pump
HR = Heat Recovery
HR-3HX = PolyTherm (Water-Cooled)
HR-3HX = EcoTherm (Air-Cooled)
FC = Integral Free Cooling

General Data

Table 2. Water-cooled PolyTherm multi-pipe units (460/3/60 Voltage)

Capacity (Tons)	30	40	50	60
General Unit				
Refrigerant Type	R410-A	R410-A	R410-A	R410-A
Number of Independent Refrigeration Circuits	1	1	1	1
Refrigerant Charge (lbs/circuit)	30	40	50	60
Fluid Volume (gal/module)	14.2	15.9	25.4	29.6
Compressor				
Type	TANDEM SCROLL	TANDEM SCROLL	TANDEM SCROLL	TANDEM SCROLL
Quantity	1 SET	1 SET	1 SET	1 SET
Evaporator				
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	1	1	1	1
Fluid Volume (gal)	5.0	5.5	7.8	9.3
Fouling Factor (hr ft^2-F/Btu)	0.0001	0.0001	0.0001	0.0001
Material	316 SST	316 SST	316 SST	316 SST
Condenser				
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	1	1	1	1
Fluid Volume (gal)	4.5	5.2	8.3	9.6
Fouling Factor (hr ft^2-F/Btu)	0.00025	0.00025	0.00025	0.00025
Material	316 SST	316 SST	316 SST	316 SST
Source/Sink Heat Exchanger				
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	1	1	1	1
Fluid Volume (gal)	4.7	5.2	9.3	10.7
Fouling Factor (hr ft^2-F/Btu)	0.00025	0.00025	0.00025	0.00025
Material	316 SST	316 SST	316 SST	316 SST
Dimensions / Weights				
Dimensions (W x D x H)	34" x 66" x 77"	34" x 66" x 77"	42" x 79" x 80"	42" x 79" x 80"
Weight (lbs)	1800	2000	2900	3100

Controls

Carel c.pCO OEM Controller

PolyTherm water-cooled multi-pipe units use Carel c.pCO series microprocessor controllers to monitor and report critical operating parameters. A primary controller is used to control and coordinate the functioning of all the remaining secondary modules that make up the multi-pipe system. Secondary microprocessor controllers are included in all secondary modules.

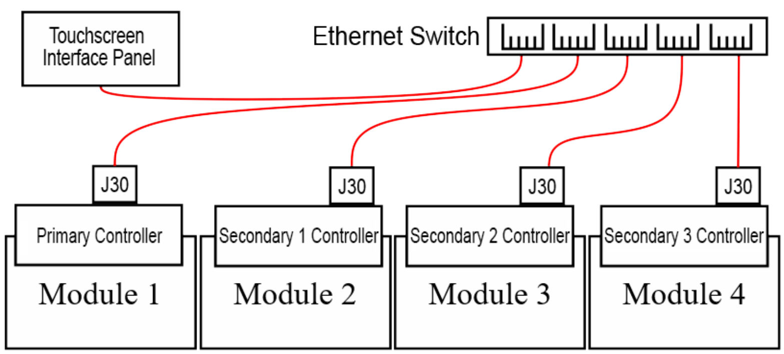
Primary/Secondary Module Operation

The distributed microprocessor control system enables all secondary modules to operate independently in the event that the primary microprocessor controller fails. All safeties including temperature set point, refrigerant pressures, and freeze protection are preserved. Each secondary controller monitors key performance parameters of the module and sends real-time information to the touch screen HMI on the primary controller via ethernet communication. The primary controller monitors the performance of the unit, activating and deactivating modules as needed to maintain the leaving fluid temperature for the PolyTherm™ multi-pipe system.

Stand-Alone Operation

Secondary modules can operate in stand-alone mode if the system's cooling and/or heating temperature sensor has failed or if the primary/secondary communication has been lost. When in "stand-alone mode", each module runs independently and controls cooling and/or heating temperature based on its local temperature sensors. Modules will operate temporarily in this "stand-alone mode" until normal primary/secondary operation is recovered. Lead module weekly rotation and communication to the BMS is lost while in this "stand-alone" mode.

Typical Controller Network



Controller Functions

All essential control information and operator actions are read and responded to using the touch-screen interface panel. The touch-screen interface panel is connected to the primary microprocessor controller and is the only way to access many primary controller functions. The microprocessor shall provide the following minimum functions and alarms:

- Adjustable fluid temperature set point
- Multiple stage compressor control, including compressor rotation to provide even compressor usage and wear
- High and low fluid temperature alarm set points
- Fluid inlet and outlet temperature
- Suction and discharge refrigeration pressures
- Compressor run status
- Current alarm status

- Alarm logging
- Demand load
- Compressor run hours
- Remote start stop input
- Dry contact for general alarm

Controller Key Features

Temperature Reset Logic

Temperature Reset logic allows the system to adapt to load variation by automatically adjusting the temperature setpoint based on the load demand.

Adaptive Temperature Control

Adaptive temperature control is based on the temperature change rate - an enhanced temperature control algorithm. In addition to the main temperature control algorithm, the adaptive temperature control can force or hold compressor staging by tracking controlled temperature change rate and predict demand trends. Also, variable speed compressor applications allow for uninterrupted compressor operation at low loads, therefore, excessive compressor on/off cycling is avoided to ensure smooth temperature control.

EXOR eSmart07 Touch-Screen HMI

The standard EXOR eSmart touch-screen interface panel provided with the Carel c.pCO controller features a 7–inch touch-screen, allowing access to all operational inputs and outputs. The interface screen is the primary means for the building operator that allows to monitor and modify a host of functions involving temperatures, pressures, set points, alarms, operating schedules, and elapsed operating hours.

HMI Key Features

- 7–inch TFT color display, dimmable LED backlight
- 800 x 480 pixel (WVGA) resolution, 64K colors
- Resistive touch-screen
- Alarm logging of the previous 2000 alarms with time and date of each occurrence
- Unit bank setpoints can be saved and restored in one click
- Ethernet port
- USB port

HMI Operator Control

The touchscreen interface panel is ready to use when it is connected to the Ethernet switch and unit is energized. This touchscreen interface panel is located on the primary module or can be mounted remotely for control and monitoring away from the PolyTherm™ modules. When connected to the Ethernet switch, the touchscreen interface panel displays current, real-time, information about the multi-pipe system, as well as the status of critical parameters within each module.

Optional Remote Monitoring

This option allows a user to perform remote management and monitor and adjust on-site operation data such as pressures, temperatures, time delays, alarm and fault information, trending, troubleshooting, preventive maintenance, and data analysis.

Optional Building Management System (BMS)

The c.pCO primary microprocessor controller can communicate with the building management systems. These building management systems can control the operation of all functions of the control system including: unit enable/disable; compressor run status; pump controls (if included with system); system cold and hot fluid temperatures; adjustment of all system set points; review and resetting of all non-active faults; and display of all sensor faults.

There are 5 BMS communication options:

1. BACnet® MS/TP. Connection through built-in BMS2 port
2. BACnet IP. BACnet router is used
3. Modbus™ RTU. Connection through built-in BMS2 port
4. Modbus IP. Modbus router is used
5. LonWorks®. LonWorks router is used

Electrical Data

Table 3. Electrical data

Unit Size	Rated Voltage(a)	Compressor Data			System Data		
		Compr Qty	RLA Tandem Compr Set	LRA Tandem Compr Set	FLA	MCA	MOP
30	208/60/3	2	112.0	340+56	112.0	119.0	150.0
	230/60/3	2	101.3	340+51	101.3	108.0	150.0
	460/60/3	2	50.7	173+26	50.7	57.0	90.0
	575/60/3	2	40.5	132+20	40.5	47.0	75.0
40	208/60/3	2	130.1	538+65	130.1	138.0	175.0
	230/60/3	2	117.6	538+59	117.6	125.0	175.0
	460/60/3	2	58.8	229+29	58.8	67.0	100.0
	575/60/3	2	47.1	180+24	47.1	55.0	90.0
50	208/60/3	2	165.2	605+83	165.2	175.0	225.0
	230/60/3	2	149.4	605+75	149.4	159.0	200.0
	460/60/3	2	74.7	320+38	74.7	85.0	125.0
	575/60/3	2	59.8	250+30	59.8	70.0	110.0
60	208/60/3	2	210.1	599+105	210.1	222.0	300.0
	230/60/3	2	190.0	599+95	190.0	202.0	250.0
	460/60/3	2	95.0	310+43	95.0	107.0	175.0
	575/60/3	2	76.0	239+38	76.0	88.0	150.0

Note: All electrical data is at AHRI conditions, check the selection software at for electrical data at other conditions.

(a) Voltage Utilization Range: +/- 10% of Rated voltage (use range): 208/60/3 (180-220), 230/60/3 (208-254), 460/60/3 (414-506), 575/60/3 (516-633).

Electrical Connections

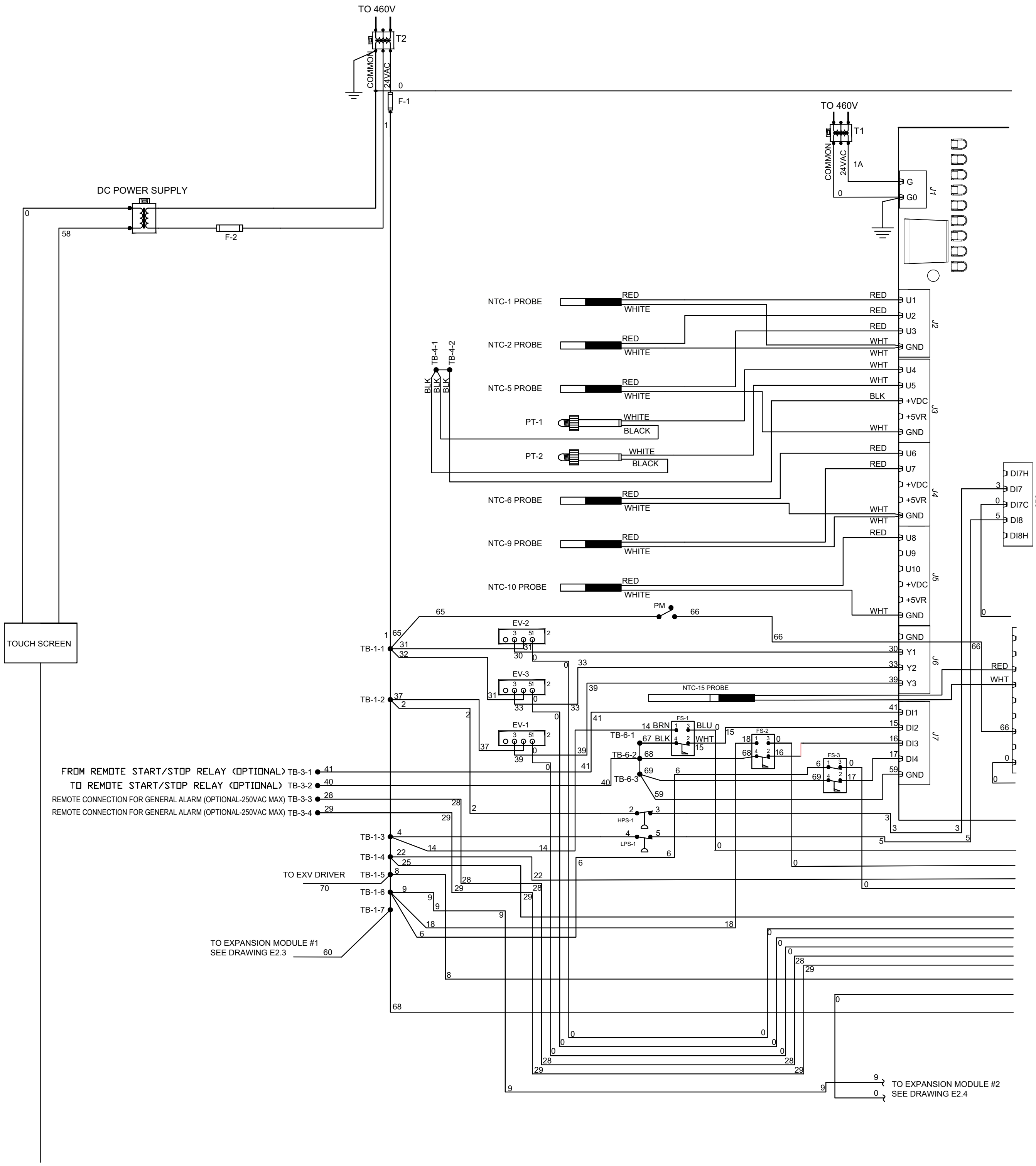
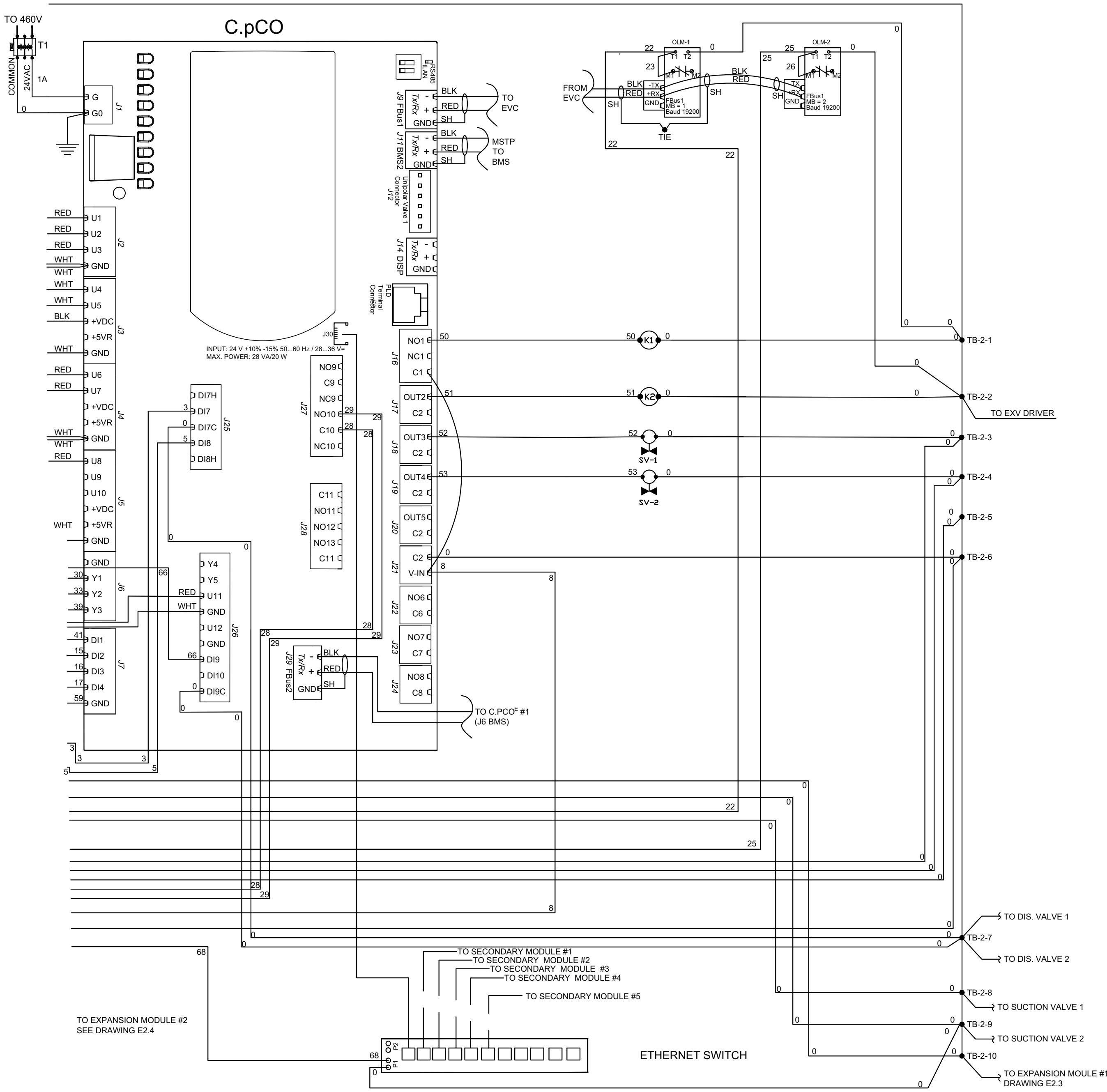


Figure 1. PolyTherm PLC



TO 460V
T1
COMMON
24VAC
1A
C.pCO
G
G0
J1
U1
U2
U3
GND
J2
U4
U5
+VDC
+5VR
J3
U6
U7
J4
U8
U9
U10
J5
Y1
Y2
Y3
J6
DI1
DI2
DI3
DI4
J7
RED
WHT
BLK
INPUT: 24 V +10% -15% 50...60 Hz / 28...36 V=
MAX. POWER: 28 VA/20 W
DI7H
DI7
DI7C
DI8
DI8H
J25
Y4
Y5
U11
U12
DI9
DI10
DI9C
J26
NO9
C9
NC9
NO10
C10
NC10
J27
C11
NO11
NO12
NO13
J28
Tx/Rx
J29 FBus2
RS485
tLAN
J9 FBus1
J11 BMS2
Unipolar Valve 1 Connector J12
J14 DISP
PLD Terminal Connector
J30
NO1
NC1
C1
J16
OUT2
C2
J17
OUT3
J18
OUT4
J19
OUT5
J20
V-IN
J21
NO6
C6
J22
NO7
C7
J23
NO8
C8
J24
TO EVC
MSTP TO BMS
TO C.PCO #1 (J6 BMS)
FROM EVC
OLM-1
OLM-2
T1
T2
M1
M2
-TX
+RX
FBus1
MB = 1
MB = 2
Baud 19200
SH
TIE
K1
K2
SV-1
SV-2
TB-2-1
TB-2-2
TO EXV DRIVER
TB-2-3
TB-2-4
TB-2-5
TB-2-6
TB-2-7
TO DIS. VALVE 1
TO DIS. VALVE 2
TB-2-8
TO SUCTION VALVE 1
TB-2-9
TO SUCTION VALVE 2
TB-2-10
TO EXPANSION MOULE #1
DRAWING E2.3
TO SECONDARY MODULE #1
TO SECONDARY MODULE #2
TO SECONDARY MODULE #3
TO SECONDARY MODULE #4
TO SECONDARY MODULE #5
TO EXPANSION MODULE #2
SEE DRAWING E2.4
ETHERNET SWITCH

Figure 2. PolyTherm high voltage

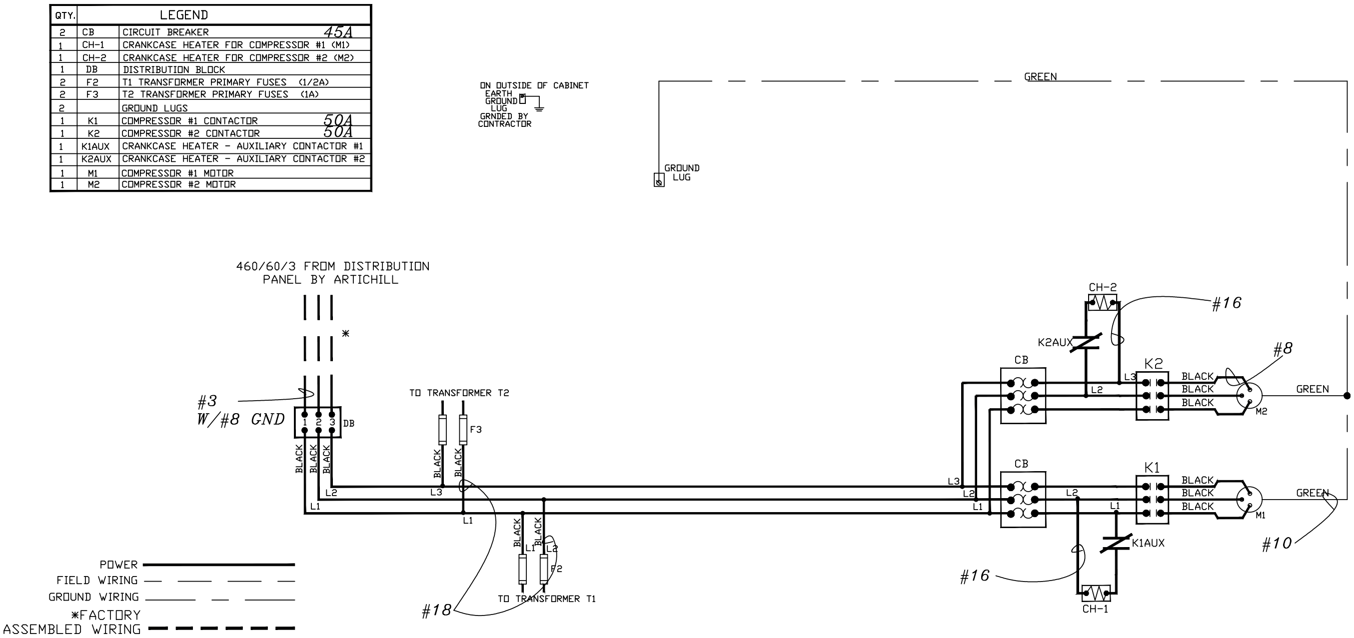


Figure 3. PolyTherm expansion valve

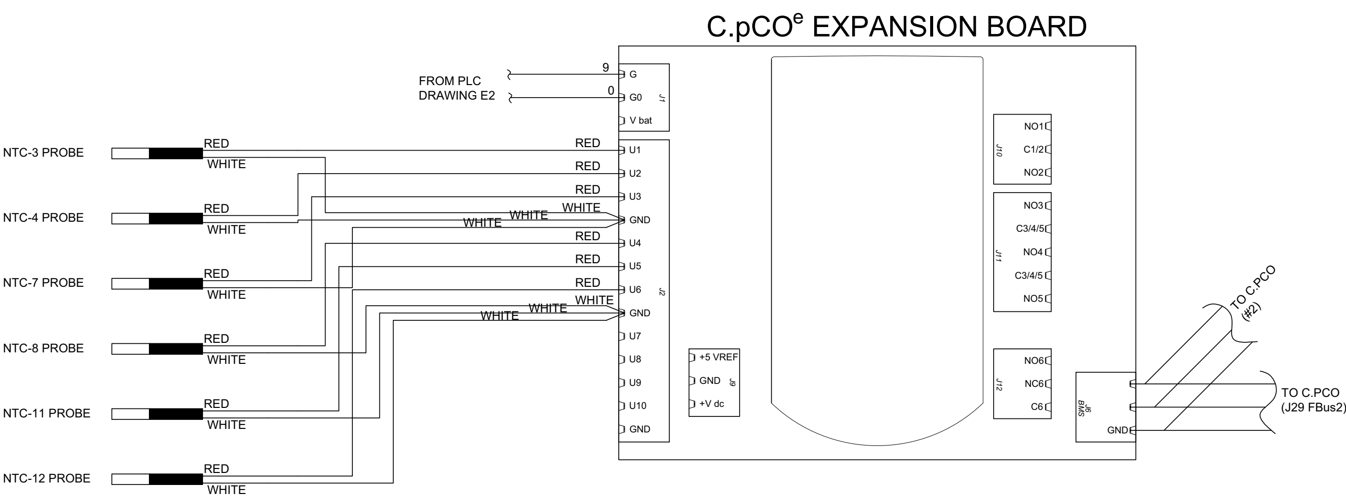


Figure 4. PolyTherm expansion valve 2

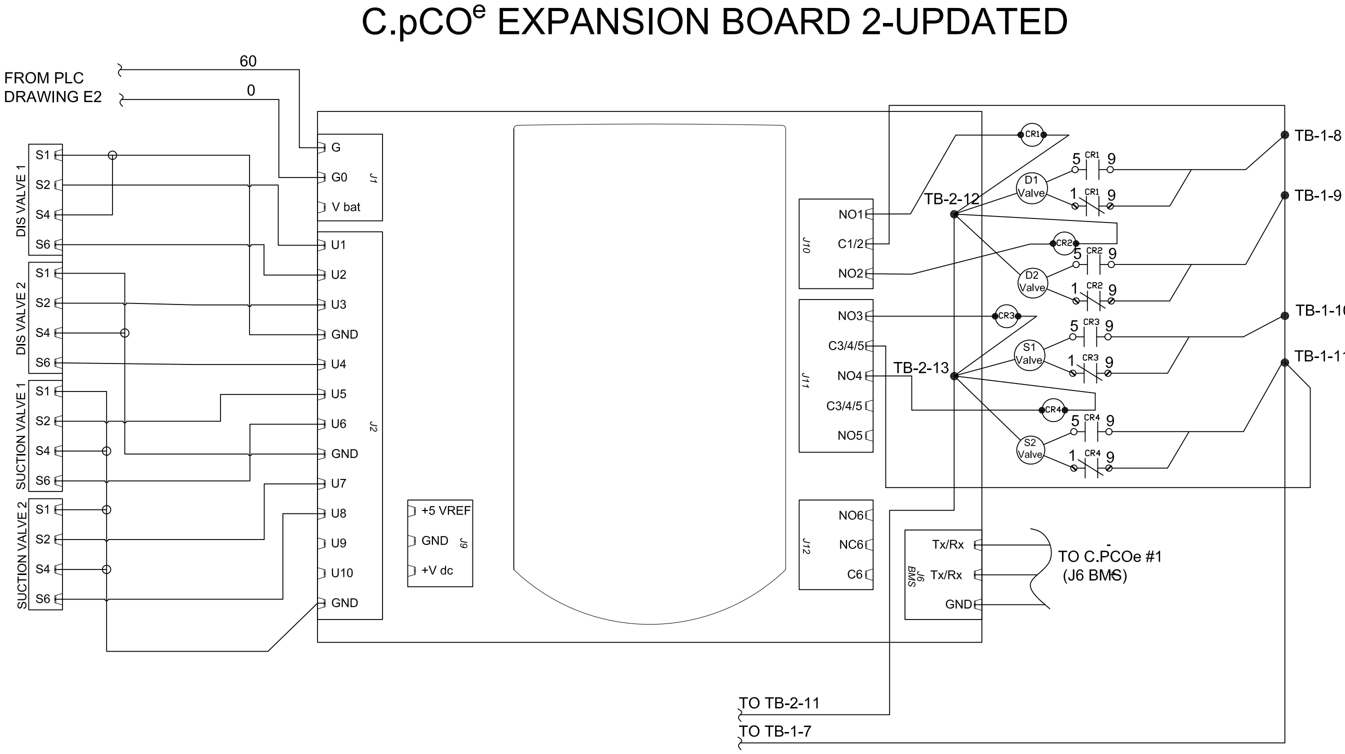


Figure 5. PolyTherm primary electrical schematic

QTY.	LEGEND	
1	EV-1	ELECTRONIC MODULATING VALVE (EVAPORATOR)
1	EV-2	ELECTRONIC MODULATING VALVE (CONDENSER)
1	EV-3	ELECTRONIC MODULATING VALVE (SOURCE)
1	FS-1	EVAPORATOR WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	FS-2	CONDENSER WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	FS-3	SOURCE WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	F-1	FUSE (15A)
1	HPS-1	HIGH PRESSURE SAFETY SWITCH CIRCUIT #1 - OPENS ON HIGH PRESSURE
1	LPS-1	LOW PRESSURE SAFETY SWITCH CIRCUIT #1 - OPENS ON LOW PRESSURE
1	NTC-1	TEMPERATURE SENSOR - CHILLER ENTERING EVAPORATOR WATER TEMPERATURE
1	NTC-2	TEMPERATURE SENSOR - CHILLER LEAVING EVAPORATOR WATER TEMPERATURE
1	NTC-3	TEMPERATURE SENSOR - SYSTEM CHILLED WATER TEMPERATURE
1	NTC-4	TEMPERATURE SENSOR - SYSTEM CHILLED LEAVING WATER TEMPERATURE
1	NTC-5	TEMPERATURE SENSOR - CHILLER CONDENSER ENTERING WATER TEMPERATURE
1	NTC-6	TEMPERATURE SENSOR - CHILLER CONDENSER LEAVING WATER TEMPERATURE
1	NTC-7	TEMPERATURE SENSOR - SYSTEM HOT WATER IN
1	NTC-8	TEMPERATURE SENSOR - SYSTEM HOT WATER OUT
1	NTC-9	TEMPERATURE SENSOR - SOURCE WATER IN
1	NTC-10	TEMPERATURE SENSOR - SOURCE WATER OUT
1	NTC-11	TEMPERATURE SENSOR - SYSTEM SOURCE WATER IN
1	NTC-12	TEMPERATURE SENSOR - SYSTEM SOURCE WATER OUT
1	NTC-13	EXV1 SUCTION TEMPERATURE SENSOR
1	NTC-14	EXV2 SUCTION TEMPERATURE SENSOR
1	NTC-15	LIQUID LINE SENSOR
1	OLM-1	COMPRESSOR #1 OVERLOAD
1	OLM-2	COMPRESSOR #2 OVERLOAD
1	PLC	C.PCO OEM PROGRAMMABLE LOGIC CONTROLLER
1	PM-1	PHASE MONITOR
1	PT-1	4-20 mA OUTPUT PRESSURE TRANSMITTER - LOW PRESSURE
1	PT-2	4-20 mA OUTPUT PRESSURE TRANSMITTER - HIGH PRESSURE
1	PT-3	4-20 mA OUTPUT PRESSURE TRANSMITTER - EXV1 SUCTION PRESSURE SENSOR
1	PT-4	4-20 mA OUTPUT PRESSURE TRANSMITTER - EXV2 SUCTION PRESSURE SENSOR
1	SV-1	SOLENOID VALVE - EVAPORATOR
1	SV-2	SOLENOID VALVE - SOURCE
1	T1	208 V PRIMARY, 24 V SECONDARY - 50 VA TRANSFORMER
1	T2	208 V PRIMARY, 24 V SECONDARY - 250 VA TRANSFORMER
1	TB-1	CHILLER - 24V AC TERMINAL BLOCK
1	TB-2	CHILLER - COMMON TERMINAL BLOCK
1	TB-3	CUSTOMER CONNECTION TERMINAL BLOCK
1	TB-4	24V DC TERMINAL BLOCK
1	TB-5	ELECTRONIC EXPANSION VALVE TERMINAL BLOCK
1	TB-6	FLOW SWITCH TERMINAL BLOCK

Dimensions and Weights

Figure 6. 30 and 40 ton modules

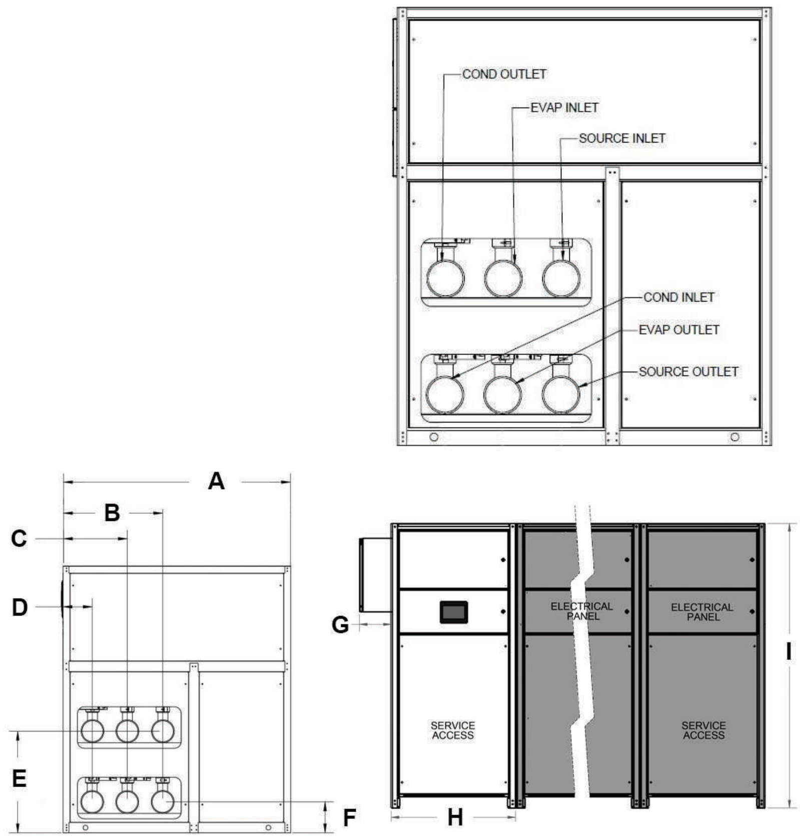


Table 4. Dimensions and weights for 30 and 40 ton modules

DIM	PolyTherm Dimensions and Weights Per Module	
	30 Tons	40 Tons
A	66.00	66.00
B	28.75	28.75
C	18.50	18.50
D	8.50	8.50
E	29.25	29.25
F	9.00	9.00
G	8.50	8.50
H	34.00	34.00
I	77.00	77.00
Wt	1800 lbs	2000 lbs

Figure 7. 50 and 60 ton modules

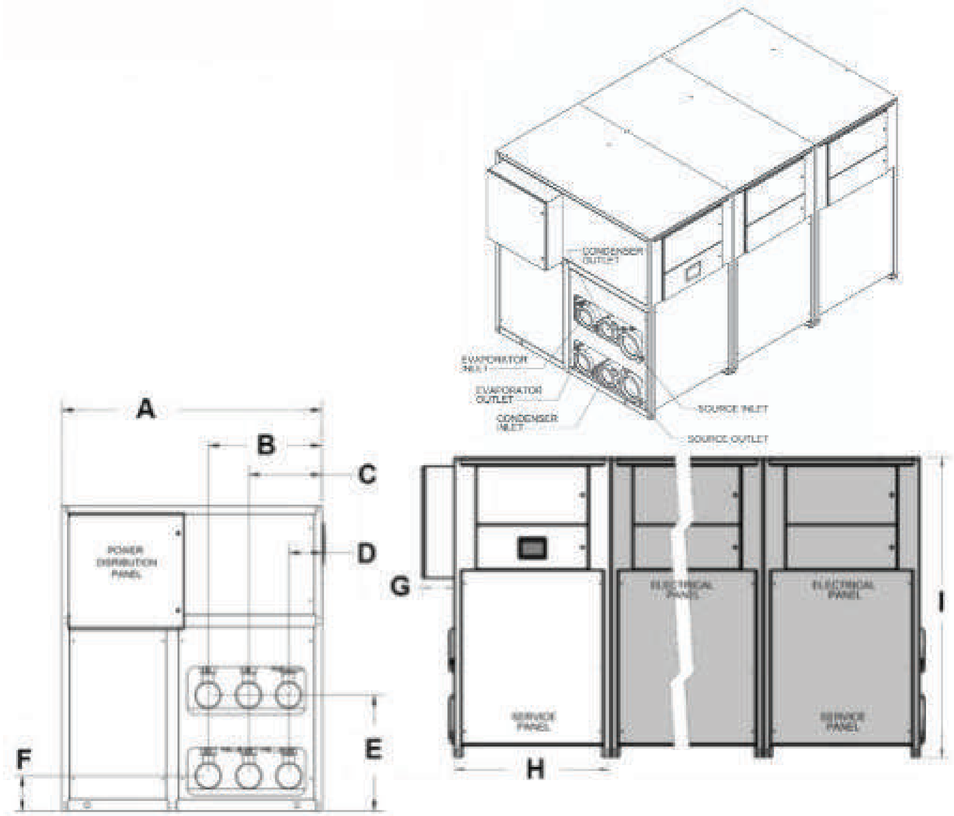


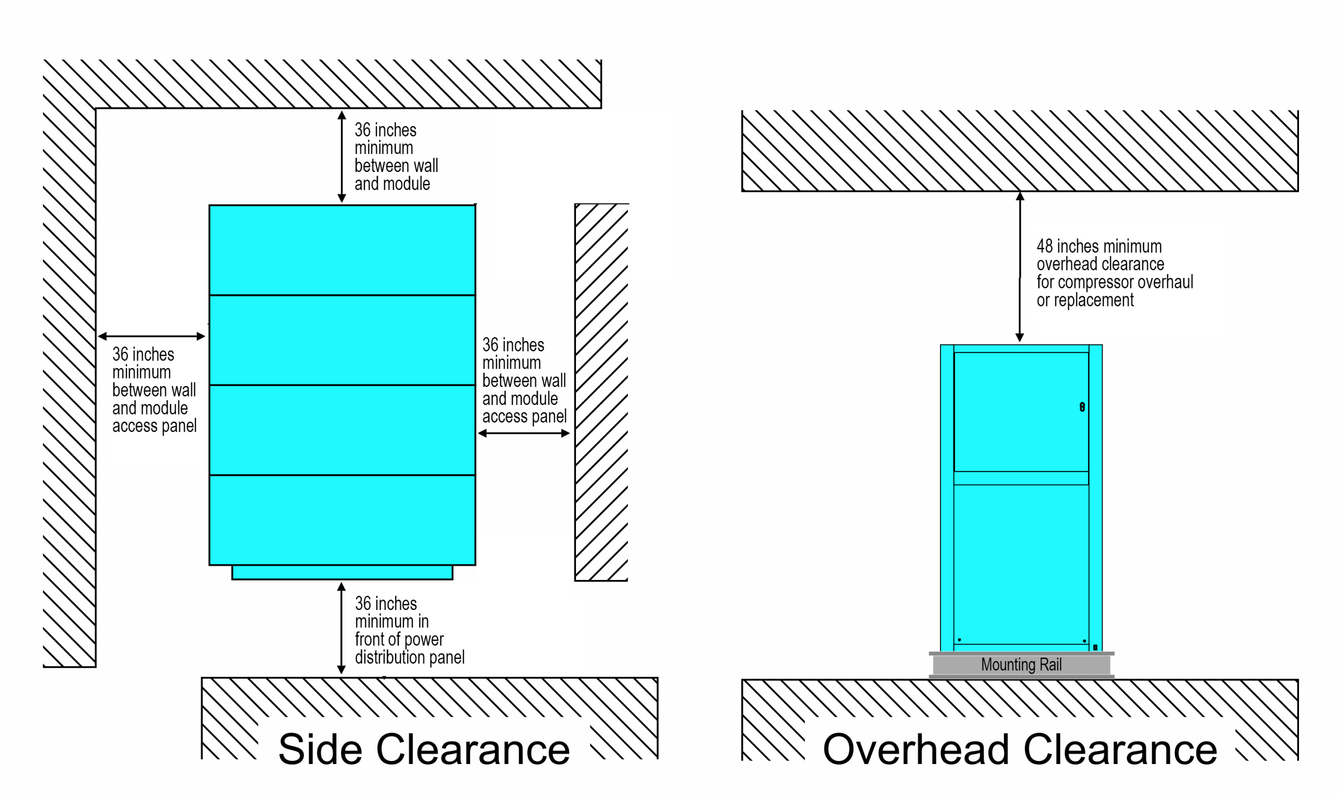
Table 5. Dimensions and weights for 50 and 60 ton modules

Dim	PolyTherm Dimensions and Weights Per Module	
	50 Tons	**60 Tons**
A	79.00	79.00
B	34.00	34.00
C	21.75	21.75
D	9.50	9.50
E	29.25 / 28.50[a]	29.25 / 28.50[a]
F	8.75 / 10.00[a]	8.75 / 10.00[a]
G	8.50	8.50
H	42.00	42.00
I	80.00	80.00
Wt	2900 lbs	3100 lbs

(a) Source header dimensions only. The 50- and 60-Ton modules have 8-inch headers.

Service Clearance

Figure 8. Service clearance



Mechanical Specifications

General

The PolyTherm™ water-cooled multi-pipe system shall consist of individual modules. Each module shall be completely factory wired and tested prior to shipment. Each module shall include a compressor, brazed plate evaporator, brazed plate condenser, geothermal fluid brazed plate heat exchanger, and controls. Controls shall be designed on a distributed primary control system that allows the primary microprocessor to operate remaining secondary modules in the event of a malfunction of any secondary controller. The controls shall also be designed to allow each individual secondary microprocessor to operate on its own temperature sensor if there is a failure of the secondary microprocessor.

Refrigeration Circuits

The PolyTherm™ multi-pipe module uses a hermetically sealed scroll tandem compressor set on a single refrigeration circuit, oil level sight glass, suction gas-cooled motor with solid-state sensors in the windings for overload protection, and in-line circuit breaker protection. There shall be two compressors per tandem set and one refrigerant circuit per module. Compressors shall be mounted to the steel frame with rubber-in-shear vibration isolators.

Evaporators, Condensers and Source/Sink Heat Exchangers

Each single circuit brazed plate evaporator, condenser and source/sink heat exchanger is constructed of 316 stainless steel plates and copper brazing and shall be insulated with ¾” closed cell insulation. The fluid piping to each module shall have an electronic two-way valve for selecting geothermal fluid or load hot or cold fluid depending on the building heating or cooling demands. The supply and return fluid piping from each evaporator, condenser, and source/sink heat exchanger shall include a manual and an electronic valve for servicing each module individually while the remaining modules continue to operate, to allow for variable flow and, on each source/sink heat exchanger operating as a condenser, to control refrigeration head pressure. The fluid connections to each heat exchanger shall use roll-grooved couplings for service convenience and ease of installation.

Tandem Compressors

For multi-pipe units larger than 10 tons, the tandem scroll compressor is a state-of-the-art compressor with relay and overload monitoring capabilities designed to accommodate liquids (both oil and refrigerant) without causing compressor damage. The Copeland compressor uses CoreSense technology as a sensor to unlock advanced capabilities such as protection, diagnostics, communication, and verification. Technicians can make faster, more accurate decisions resulting in improved compressor performance and reliability.

Unit Controls

The primary module shall incorporate the primary microprocessor controller. The primary microprocessor shall communicate with the remaining secondary microprocessors in each module via a local network communications protocol. The primary microprocessor shall include a phase monitor to protect against low voltage, phase unbalance, phase loss, and phase reversal conditions. The primary controller shall read all analog and fault port values from all secondary module controllers and shall pass these values to the Building Automation System via BACnet®, Modbus™ or LonWorks® protocols.

Each unit control system shall include operational switches for each compressor; high and low pressure transmitters to provide indication of refrigeration pressures in each circuit; high and low refrigeration pressure alarms including shutting shut down the faulty compressor(s); anti-short cycling compressor timers; minimum compressor run timers; connection to Building Automation System (if required).

Carel c.pCO Controller

The units employ a Carel c.pCO all-digital data control system which is assigned to all primary and secondary modules to control and report key system settings and indicators. Key features include:

Processes all communications, IOs, and executes programs in tens of milliseconds; Online debugging for prompt programming code troubleshooting; Includes 3 serial ports, 2 ethernet ports and 1 USB port.

EXOR eSmart07 HMI

An operator 7–inch touch screen interface panel with graphical display shall be installed on the primary module to allow operation monitoring, adjustment of user set points, and alarm monitoring. Key features include:

- Resistive touchscreen
- Remote monitoring and control with primary-secondary functionality
- Wide selection of communication drivers available with multiple-driver communication capability
- Data display in numerical, text, bar graph, analog gauges, and graphic image formats

Options

Application Options

Electronic Isolation Valve

Each evaporator branch line includes a manual inlet and an electronic discharge butterfly valve that only allows system flow to each active module to match the cooling requirements of the system. By isolating individual modules that are not operating, the hydronic system can have variable primary flow. The valves shall be the slow opening type to minimize the sudden change in flow to the previously active modules. The valves shall have a minimum opening cycle time of 90 seconds between the fully closed and open position and shall have roll grooved connections. The valves shall have a minimum close off pressure of not less than 75 psi and shall be rated for a maximum working pressure of 250 psi. The actuators shall be rated for 24 Vac.

Tank and Pump Module

A tank and pump module shall contain:

- Dual lead/lag redundant 3600 RPM cast iron bronze fitted centrifugal pumps each sized to provide the design flow rate at the design pressure head.
- Discharge check valves and suction and discharge isolation valves.
- Discharge pressure gauge.
- Microprocessor controller with automatic lead/lag switching of pumps on time and failure.
- Roll grooved pipe connections.
- 30-gallon diaphragm expansion tank.
- Glycol make up tank with charging pump (for glycol fluid hydronic systems).
- Power distribution panel with single point power supply. Panel is mounted on the tank and pump module and contains a circuit breaker for each module for branch circuit overload protection. A phase monitor is installed in the electrical panel of the primary module for protection against low voltage, phase imbalance, phase loss, and phase reversal.

Optional:

- Variable frequency drive and TEFC premium efficient pump motor for varying each pump speed and flow rate for variable primary flow systems.
- Suction diffuser/strainer on each pump inlet.
- Sealed stainless steel reservoir that includes a liquid level sight glass with isolation valves, manual tank fill, and a low-level cut-out to prevent pump operation in low level conditions, relief valve and vacuum vent and enclosed with 3/4 inch closed cell insulation.

Pump Module

- Dual lead/lag redundant cast iron bronze fitted centrifugal pumps each sized to provide the design flow rate at the design pressure head.
- Discharge check valves and suction and discharge isolation valves.
- Discharge pressure gauge.
- Microprocessor controller with automatic lead/lag switching of pumps on time and failure Roll grooved pipe connections.
- Power distribution panel with single point power supply. Panel is mounted on the tank and pump module and contains a circuit breaker for each module for branch circuit overload protection. A phase monitor is installed in the electrical panel of the primary module for protection against low voltage, phase imbalance, phase loss, and phase reversal.

Optional:

- Variable frequency drive and TEFC premium efficient pump motor for varying each pump speed and flow rate for variable primary flow systems.
- Suction diffuser/strainer on each pump inlet.

Electrical Options

Fused or Non-Fused Disconnect Switch

Systems are optionally equipped with a panel-mounted fused or non-fused disconnect switch installed on the power distribution panel. Alternatively, the disconnect can be installed on each module's high power electrical panel if the unit has power supplied directly to each individual module. Fused disconnect switches provide 65,000 amps SCCR protection.

Power Distribution Panel

A single electrical power supply feeds a power distribution panel. The panel is mounted on the primary module or lead-free cooling module or tank and pump module (if equipped) and contains a circuit breaker for each module for branch circuit overload protection.

Control Options

BMS Integration

The primary microprocessor controller shall provide communications to the building management system. The system shall interface with the BMS via BACnet® MS/TP or BACnet IP/Ethernet, Modbus™ or LonWorks®. All functions of the control system shall be accessible from the BMS including: Unit enable/disable; Compressor run status; Pump controls; System evaporator and condenser temperatures; Adjustment of all system set points; Review and resetting of all non-active faults; Interrogation and display of all sensor faults.

Remote Monitoring

This option allows a user to perform remote management and monitor and adjust on-site operation data such as pressures, temperatures, time delays, alarm and fault information, trending, troubleshooting, preventive maintenance, and data analysis.

Sound Options

Compressor Wraps

Absorbs compressor sound, dampens vibration and shock, and is weather resistant.

Acoustical Panels

1–inch multi-layered polyether urethane open cell foam installed inside the unit‘s formed sheet metal panels and frame to reduce reverberation and to lower reflected sound.

Trane - by Trane Technologies (NYSE: TT), a global innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane. com or tranetechnologies.com.

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