Product Catalog

Water-Cooled Modular Chillers

Manhattan™ Gen II — 15 to 80 Nominal Tons
SuperMod™ — 20 to 40 Nominal Tons

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Introduction

Design and manufacturing excellence make Trane a leader in the water-cooled chiller marketplace. This tradition of using excellence to meet market demands is illustrated with the Trane Manhattan Gen II and SuperMod line of water-cooled chillers. These modular chillers offer scalable application flexibility, efficiency, and cost savings all bundled into one.

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Features and Benefits

Manhattan Gen II

- Dual R-410A refrigeration circuits on each chiller module.
- Hermetic scroll compressor on each refrigeration circuit with Rotalock service valves, solid-state overload protection, and in-line circuit breaker.
- Dual circuit, brazed plate evaporator in each chiller module.
- Available in Heat Pump configurations.

SuperMod

- Single R-410A refrigerant circuit in each module.
- Hermetically sealed variable speed and fixed speed scroll tandem compressor set, each with oil level sight glass, in-line circuit breaker and solid-state overload protection.
- Variable speed package containing a brushless permanent-magnet compressor motor and variable speed AC motor drive.
- Variable speed drive (VSD) scroll compressor shall provide smooth and efficient operation from 40 Hz to 120 Hz for close temperature control.
- Electronic expansion valve.
- Single circuit, brazed plate evaporator in each chiller module.

Both

- Fine mesh strainer.
- Thermal dispersion flow switch.
- Electronic and manual isolation valves on each evaporator branch line to permit service isolation of the flow switch, strainer, and evaporator.
- Individual strainer serviceability while balance of chiller system remains operational.
- Single point power supply to a load distribution panel containing a circuit breaker for each module for electrical service isolation and branch circuit overload protection.
- Phase monitor on the power supply wired to the primary microprocessor to protect against low voltage, phase unbalance, phase loss, and phase reversal conditions.
- Roll grooved header pipe and internal pipe connections.
- 3/4 inch insulation on each evaporator, fluid piping, and components.
- 3/4–inch insulation on each condenser, fluid piping, and components (heat recovery modules only).
- Formed sheet metal frames, powder-coated with an oven-baked finish.
- Primary microprocessor controller provides current alarm status, alarm logging of the previous 200 alarms, fluid temperatures for each module, refrigeration pressure on each refrigeration circuit, compressor run hours, current status display, remote on/off, and general alarm contacts.
- Distributed microprocessor controller on each secondary module to allow continued operation 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.
- Heat Recovery configurations available.

Application Consideration

Proper application considerations must be taken into account when sizing, selecting, and installing Trane modular chillers. Improper application can impact system performance and unit and system reliability. Deviations from these recommendations should be reviewed with your local sales representative.

Definitions of Terms

These terms will be capitalized to signify they are defined terms and can be referenced by the reader.

Automatic Isolation Valve: Two-position valve that automatically opens when a Module is enabled to run by the Chiller Bank Controller. Trane modular chillers have the option for factory installed flow isolation valves on each individual module's heat exchanger. That includes the evaporator, condenser and geothermal (on PolyTherm™ Heat Recovery models) heat exchangers.

Chiller Bank: All the factory components that make up a Modular Chiller. It includes at a minimum all the refrigeration Modules, and as installed may include accessory modules for pumps, expansion tanks, buffer tanks, glycol feeders, free cooling, etc. This may sometimes be used synonymously with Modular Chiller or the more generic term chiller.

Chiller Bank Controller: The module unit controller that coordinates the operation of all individual Modules to achieve the desired system operation. Each Module in the Chiller Bank has its own unit controller that manages that module's operation and communicates with the Chiller Bank Controller. The module unit controller for the first Module in the Chiller Bank typically functions as the Chiller Bank Controller. In networking terms the Chiller Bank Controller is the primary controller and the other module unit controllers are secondary controllers.

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

Lead/Lag Sequence: The staging order of either the Modules within a Chiller Bank or the staging order of the compressors within a specific Module. On a regular basis this sequence affects the order of equipment operation to equalize runtime and account for failed components. The Chiller Bank Controller manages the Lead/Lag Sequence order of the Modules, and the individual Modules' unit controller manages the Lead/Lag Sequence order of its compressors.

Module: The individual segments of refrigeration or accessories that make up a Modular Chiller. A Module is a self-contained cooling/heating unit that typically includes refrigeration compressors, heat exchangers (i.e. evaporator, condenser, etc.), unit controls and power electricals, as well as other components that may be required to enable the module operation. There are optional types of accessory Modules that enable the operation of the Chiller Bank in specific systems; examples of this special type of Module include: pumps, expansion tanks, buffer tanks, glycol feeders, free cooling, etc.

Modular Chiller: A cooling and/or heating unit typically consisting of two or more refrigeration Modules and accessory Modules assembled together to create a Chiller Bank. Modular Chillers are normally characterized by their field assembled nature whereby individual Modules are shipped separately to the job site and assembled together with integral interconnecting valves, piping, and controls with a single power connection to create the complete chiller.

Modular Chiller System: The complete chilled water and/or hot water system that has its cooling/heating loads met by a Modular Chiller. It would include the Modular Chiller, piping, pumps, tanks, valves, cooling tower(s) or dry cooler(s), system controls and other such components required for the specific system configuration.

Packaged Chiller: A cooling and/or heating unit consisting of one refrigeration unit typically characterized by a larger unit design capacity than an individual Module in a Modular Chiller. Multiple Packaged Chillers are normally installed in a system using field provided interconnecting valves, piping, and controls.

Packaged Chiller System: The complete chilled water and/or hot water system that has its cooling/heating loads met by one or more Packaged Chillers. It would include the Packaged Chiller(s), piping, pumps, tanks, valves, cooling tower(s) or dry cooler(s), system controls and other such components required for the specific system configuration.

Chiller Bank and Module Sizing

There are two separate sizing calculations that come into play when designing and selecting a Modular Chiller System. They are:

- Chiller Bank sizing
- Module sizing

Chiller Bank Sizing: The Design Operating Capacity of the Chiller Bank should be based on the HVAC system peak block load, either cooling or heating, not the sum of the peaks of all the individual system loads. Do not include redundancy requirements in the Design Operating Capacity. An oversized chiller is more expensive to purchase, install, and operate. A provision for redundancy is discussed below.

Module Sizing: The proper number and size of Modules that makes up the Chiller Bank is dependent on several factors:

- Required Steps of Unloading: The designer must decide the number of chiller steps of unloading appropriate for the application. The number and size of the steps can severely impact system and chiller operating characteristics:
  - Rate of compressor cycling at part and minimum load
  - Stability of chilled water temperature control
  - Accuracy of chilled water temperature control
  - System minimum chilled water volume required

  For typical medium to large comfort cooling applications, it is a best practice for the chiller to have at least four steps of unloading. This implies a 25% minimum step of unloading. More steps of unloading provide operating benefits but may excessively increase unit first cost.

  All Trane Manhattan and SuperMod chiller Modules have two compressors for two steps of unloading on each Module. SuperMod chiller Modules have a variable speed drive on the lead compressor for further unloading. Therefore a 25% minimum step of unloading implies it is a good practice to apply two or more Modules in typical commercial systems.
- Low Load Operation: Both the system peak block and the minimum expected operating loads should be evaluated when deciding on the number and size of the unloading steps. If extended periods of very low load, less than the minimum step of default module unloading, are expected, it is better to select a Chiller Bank with more smaller Modules to provide for superior capacity turndown. A chiller with fewer larger Modules may be forced to excessively cycle compressors.
- Redundancy: One advantage of Modular Chillers is N+1 redundancy can be achieved by simply adding one extra Module to the Chiller Bank. This is the preferred method for adding redundancy as it does not impact control accuracy or other system design requirements. Adding an incremental Module is typically less costly and complex then adding another chiller in a Packaged Chiller System. The Chiller Bank Controller automatically enables the redundant Module in the event of a failure in another Module. The redundant Module is also rotated into the Lead/Lag Sequence to ensure it is operational when needed.
- System Fluid Volume: The capacity of the module refrigeration circuit drives the system minimum fluid volume. Larger capacity Modules drive the need for greater system volume. See the Hydronic System Fluid Volume section below for volume requirement details.

Water Treatment

The use of untreated or improperly treated water may result in scaling, corrosion, and algae or slime buildup in the chiller 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 chiller 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
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 chillers. Trane recommends using a qualified water treatment specialist to assist in establishing a proper water treatment program.

.Foreign matter in the chilled water system can also foul the chiller system piping, brazed plate heat exchangers, and strainers thereby increasing pressure drop and reducing fluid flow. A 40-mesh screen strainer must be installed in each water/liquid system piping inlet for proper filtration and protection of the heat exchangers. It is important to thoroughly flush all piping in the hydronic system before making the final piping connections to the chiller system. See the Trane Modular Chiller Installation, Operation, and Maintenance manual for proper system flushing procedures.

Hydronic System Fluid Volume

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

The chiller's system temperature control sensors are located in field install, Trane provided, spool pieces on the supply (outlet) fluid pipe and return (entering) fluid pipe. The system temperature sensors dictate when compressors energize and de-energize in relation to the temperature setpoint. This location allows the building piping to act as a buffer to slow the rate of change of the system water temperature. If there is not sufficient fluid volume in the system to provide an adequate buffer, temperature control will be erratic, and the compressor will cycle excessively.

For Trane modular chillers in typical comfort cooling applications, the minimum hydronic system volume should be 25 times the smallest refrigeration circuitcapacity in the Chiller Bank– or 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, one or more of the following considerations are necessary to reduce the rate of change of the return water temperature and/or allow for greater refrigeration circuit unloading.

- A volume buffer tank located in the return water piping.
- Larger system supply and return header piping (which also reduces system pressure drop and pump energy use).
- A variable speed drive to one or more compressors in the chiller system for closer temperature control and unloading.
- A digital scroll compressor to one or more refrigeration circuits in the chiller system for closer temperature control and unloading (for chiller modules 30 tons and smaller).

Variable Flow

Trane Modular Chillers 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.

Variable flow systems, those with 2-way control valves controlling AHU coils are popular, and/or required by codes because of their energy efficient operating characteristics. VPF systems in particular are favored for having a single set of pumps thus reducing first cost. VP/VS system configurations are growing in popularity for their stability of operation and potential pumping energy savings depending on the chiller characteristics.

Distribution pump speed is typically controlled to maintain a target differential pressure (DP) at a specific point in the system (at the most remote equipment user). The distribution system flow is a function of coil 2-way control valve operation and pump speed. The range of flow allowed by the chiller is a function of the module's fluid heat exchanger selection and the number of active Modules. Independent of the distribution system flow the chiller's flow must be maintained within a safe operating range. In VPF systems this is typically accomplished through control of a minimum flow bypass valve. In VP/VS systems chiller flow is controlled through primary (chiller) pump speed control.

Trane Modular Chillers have several available options that enable or enhance variable fluid flow operation.

The optional Automatic Isolation Valves per module heat exchanger stops flow through a Module when its compressors are cycled off reducing the total flow required by the chiller. When increased capacity is required dictating the operation of another Module the valve to the additional Module is opened to allow for compressor operation. The Chiller Bank Controller signals the BAS /pumping control system the number of active Modules to enable the proper control of chiller flow.

Pump Modules with various hydronic specialties are optionally available. The pumping Modules include sequences compatible with various system configurations including VPF.

Contact your Trane sales representative for the Trane Modular Chiller Variable Primary Flow System Design and Control Engineering Bulletin for more detail on variable flow applications.

Heat Pump

A typical HVAC system has a cooling requirement in the summer and shoulder seasons and a heating requirement in the winter and shoulder seasons. A modular water-source heat pump system is well suited to this cyclic cooling and heating demand. The heat pump system can be sized for the greater of the cooling demand or heating demand. When the smaller of the demands is operating, not all modules function thereby saving energy costs and improving efficiency. This also allows for the non-operating modules to be on reserve should any of the modules require servicing.

When the HVAC system demand switches between heating and cooling the heat pump mode is switched and the reversing valve in each functioning Module reverses the refrigerant cycle to produce the required heating or cooling supply. The water-source heat pump unit does not simultaneously heat and cool. It only produces either heating or cooling at any moment in time depending on the commanded mode of operation. The heat source/heat sink for the unit is typically a geo-source of some type, often a geothermal well field.

Heat Recovery

Unlike a heat pump, a heat recovery unit does not have reversible refrigeration circuits. Heat recovery applications primarily control to a supply heating temperature and typically recover/ source energy from the HVAC system chilled water loop for heating use. There must be a cooling load to satisfy a heating load and vice versa. The unit recovers the lesser of the two load demands. Another application is for heating only with an “infinite” energy source for heat, typically a geothermal source.

Glycol

Glycols are used in HVAC systems to prevent damage from corrosion and freezing. Glycol suppliers provide concentration data for freeze protection and burst protection. Which one should I use?

As the temperature drops below the inhibited glycol solution's freeze point, ice crystals will begin to form. Because the water freezes first, the remaining glycol solution is further concentrated and remains fluid. The combination of ice crystals and fluid makes up a flowable slush. The fluid volume increases as this slush forms and flows into available expansion volume.

Freeze protection indicates the concentration of glycol required to prevent ice crystals from forming at the given temperature. Burst protection indicates the concentration required to prevent damage to equipment (e.g. coil tubes bursting). Burst protection requires a lower concentration of glycol, which results in less degradation of heat transfer capacity.

Burst protection is usually sufficient in systems that are inactive during winter and there is adequate space to accommodate the expansion of an ice/slush mixture. Given a sufficient concentration of glycol for burst protection, no damage to the system will occur. Burst protection is also appropriate for closed-loop systems which must be protected despite power or pump failure. An example is an air-cooled chilled-water system that does not need to run during subfreezing weather.

Freeze protection is mandatory in those cases where no ice crystals can be permitted to form or where there is inadequate expansion volume available. An example is a coil runaround loop. Also, HVAC systems that must start-up during cold weather following prolonged winter shutdowns may require freeze protection. However, specify freeze protection only when the fluid must remain 100% liquid at all times.

For either freeze or burst protection, the required concentration of glycol depends on the operating conditions of the system and the lowest expected ambient temperature. Often, the 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. Be sure equipment selections are made at the required glycol concentration to ensure proper sizing.

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	Burst	Freeze	Burst
20	16.80%	11.50%	18%	12%
10	26.2%	17.8%	29%	20%
0	34.6%	23.1%	36%	24%
-10	40.9%	27.3%	42%	28%
-20	46.1%	31.4%	46%	30%
-30	50.3%	31.4%	50%	33%
-40	54.5%	31.4%	54%	35%
-50	58.7%	31.4%	57%	35%
-60	62.9%	31.4%	60%	35%

Freeze Avoidance

Important: *If a chiller is located in a climate which rarely sees freezing ambient temperatures, the chiller can still experience freezing conditions due to refrigerant migration.*

Model Number Descriptions

Digit 1— Brand

T = Trane

Digit 2 — Model Series

P = Process and Modular 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 — Voltage

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 Manhattan Gen II modules (460/3/60 voltage)

Capacity (Tons)	15	20	25	30	40	50	60	80
General Unit								
Refrigerant Type	R410-A	R410-A	R410-A	R410-A	R410-A	R410-A	R410-A	R410-A
Number of Independent Refrigeration Circuits	2	2	2	2	2	2	2	2
Refrigerant Charge (lbs/circuit)	6	8	10	12	16	20	24	32
Chilled Fluid Volume(gal/module)	4.7[a]	5.1[a]	8.9	9.2	13.4	14.6	17.5	20.7 (27.1)[b]
Condenser Fluid Volume (gal/module)	5.0[a]	5.7[a]	9.1	9.4	14.1	15.1	18.3	24.3 (30.7)[b]
Compressor								
Type	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL	SCROLL
Quantity	2	2	2	2	2	2	2	2
Evaporator								
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	1	1	1	1	1	1	1	1
Fluid Volume (gal)	1.38	1.77	2.31	2.54	4.00	5.15	7.70	9.73
Fouling Factor (hr ft^2-F/Btu)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Material (plates/brazing)	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU
Condenser								
Type	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE	BRAZED PLATE
Quantity	1	1	1	1	1	1	1	1
Fluid Volume (gal)	1.75	2.30	2.50	2.70	4.60	5.50	8.50	13.31
Fouling Factor (hr ft^2-F/Btu)	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025	0.00025
Material (plates/brazing)	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU	316 SST/CU
Dimensions / Weights								
Width (in)	24	24	24	24	34	34	34	34
Depth (in)	66	66	66	66	66	66	66	78
Height (in)	77	77	77	77	77	77	77	80
Weight (lbs) (empty)	1400	1400	1500	1600	1800	1800	1900	2600

(a) 4-inch pipe headers
(b) 8-inch pipe headers

Table 3. Water-cooled SuperMod modules (460/3/60 voltage)

Capacity (Tons)	**20**	**25**	**30**	**40**
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)	16	20	24	32
Fluid Volume (gal/module)	8.5[a]	12	12.5	17
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)	1.8	2.4	2.6	4
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)	1.7	2.3	2.5	4
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)	24 in x 66 in x 77 in	24 in x 66 in x 77 in	24 in x 66 in x 77 in	24 in x 66 in x 77 in
Weight (lbs)	1350	1400	1450	1550

(a) 4-inch pipe headers

![TRANE logo]

Controls

Carel c.pCO OEM Controller

Water-cooled modular chiller models 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 modules that make up the chiller system. For multiple model systems, secondary microprocessor controllers are included in all non-primary modules.

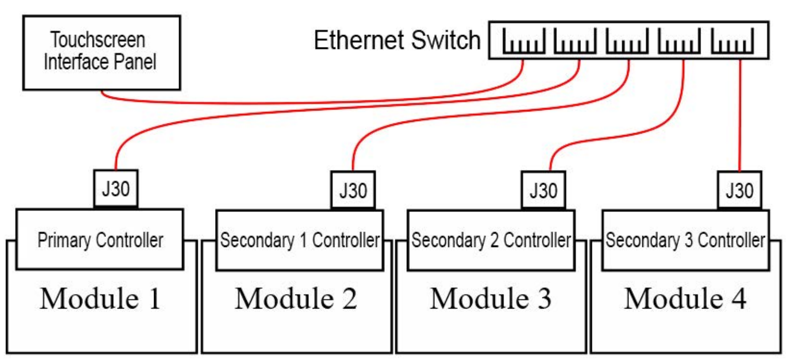
Primary/Secondary Operation

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

Stand-Alone Operation

Secondary modules can also operate in stand-alone mode if the system-controlled 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 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 chiller 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 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
- Chiller 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 chiller is energized. This touchscreen interface panel can be located within proximity of the primary microprocessor controller. When connected to the Ethernet switch, the touchscreen interface panel displays current, real-time, information about the chiller, 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: chiller enable/disable; compressor run status; pump controls (if included with chiller system); 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. Trane can undertake full responsibility for optimized automation and energy management for the entire chiller system.

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 4. Manhattan Gen II electrical data

Unit Size	Rated Voltage[a]	Compressor Data					Chiller Data		
		Compr Qty	RLA		LRA		FLA	MCA	MOP
			Circuit 1	Circuit 2	Circuit 1	Circuit 2			
15	208/60/3	2	23.0	23.0	195	195	45.9	52.0	70.0
	230/60/3	2	20.8	20.8	195	195	41.5	47.0	70.0
	460/60/3	2	10.4	10.4	95	95	20.7	24.0	35.0
	575/60/3	2	8.3	8.3	80	80	16.6	19.0	25.0
20	208/60/3	2	23.1	23.1	239	300	55.9	63.0	90.0
	230/60/3	2	20.9	20.9	239	300	50.7	57.0	80.0
	460/60/3	2	10.4	10.4	125	150	25.3	29.0	40.0
	575/60/3	2	8.4	8.4	80	109	20.2	23.0	35.0
25	208/60/3	2	37.2	37.2	300	300	74.4	84.0	110.0
	230/60/3	2	33.7	33.7	300	300	67.3	76.0	110.0
	460/60/3	2	16.9	16.9	150	150	33.7	38.0	50.0
	575/60/3	2	13.5	13.5	109	109	26.9	31.0	50.0
30	208/60/3	2	46.9	46.9	340	340	93.7	106.0	150.0
	230/60/3	2	42.4	42.4	340	340	84.8	96.0	150.0
	460/60/3	2	21.2	21.2	173	173	42.4	48.0	70.0
	575/60/3	2	17.0	17.0	132	132	33.9	39.0	60.0
40	208/60/3	2	52.5	52.5	538	538	104.9	118.0	175.0
	230/60/3	2	47.5	47.5	538	538	94.9	107.0	150.0
	460/60/3	2	23.8	23.8	229	229	47.5	54.0	80.0
	575/60/3	2	19.0	19.0	180	180	38.0	43.0	60.0
50	208/60/3	2	58.6	58.6	605	605	117.1	132.0	200.0
	230/60/3	2	53.0	53.0	605	605	105.9	119.0	175.0
	460/60/3	2	30.0	30.0	320	320	60.0	68.0	100.0
	575/60/3	2	21.2	21.2	250	250	42.3	48.0	70.0
60	208/60/3	2	83.5	83.5	599	599	166.9	188.0	250.0
	230/60/3	2	75.5	75.5	599	599	150.9	170.0	250.0
	460/60/3	2	37.8	37.8	310	310	75.5	85.0	125.0
	575/60/3	2	30.2	30.2	239	239	60.4	68.0	100.0
80	208/60/3	2	108.3	108.3	943	943	216.5	244.0	350.0
	230/60/3	2	97.9	97.9	943	943	195.8	220.0	300.0
	460/60/3	2	49.0	49.0	408	408	97.9	110.0	150.0
	575/60/3	2	39.2	39.2	357	357	78.3	88.0	125.0

(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)

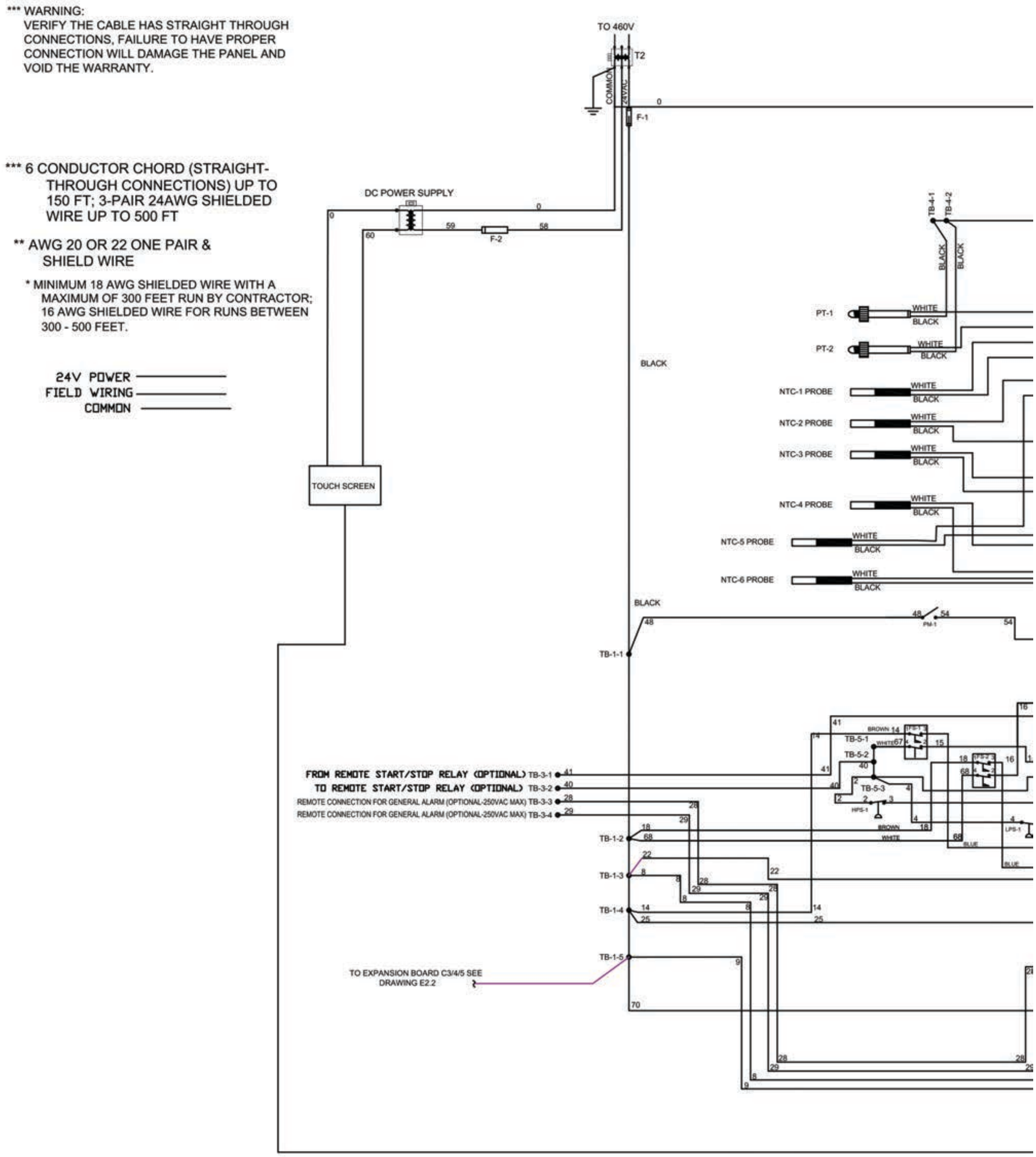
Table 5. SuperMod electrical data

Unit Size	Rated Voltage (a)	Compressor Data			Chiller Data		
		Compr Qty	RLA	LRA	FLA	MCA	MOP
			Tandem Compr Set	Tandem Compr Set			
20	208/60/3	2	55.7	20 + 195	55.7	63.0	90.0
	230/60/3	2	50.3	20 + 195	50.3	57.0	80.0
	460/60/3	2	25.2	10 + 95	25.2	29.0	50.0
	575/60/3	2	20.1	10 + 80	20.1	23.0	25.0
25	208/60/3	2	66.5	30 + 300	66.5	77.0	110.0
	230/60/3	2	60.2	30 + 300	60.2	69.0	100.0
	460/60/3	2	30.1	15 + 150	30.1	35.0	50.0
	575/60/3	2	24.1	15 + 109	24.1	28.0	50.0
30	208/60/3	2	75.7	30 + 340	75.7	86.0	125.0
	230/60/3	2	68.4	30 + 340	68.4	78.0	110.0
	460/60/3	2	34.2	15 + 173	34.2	39.0	60.0
	575/60/3	2	27.4	15 + 132	27.4	32.0	50.0
40	208/60/3	2	–	–	–	–	–
	230/60/3	2	–	–	–	–	–
	460/60/3	2	49	15 + 320	49.0	57.0	90.0
	575/60/3	2	–	–	–	–	–

(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. Manhattan Gen II PLC



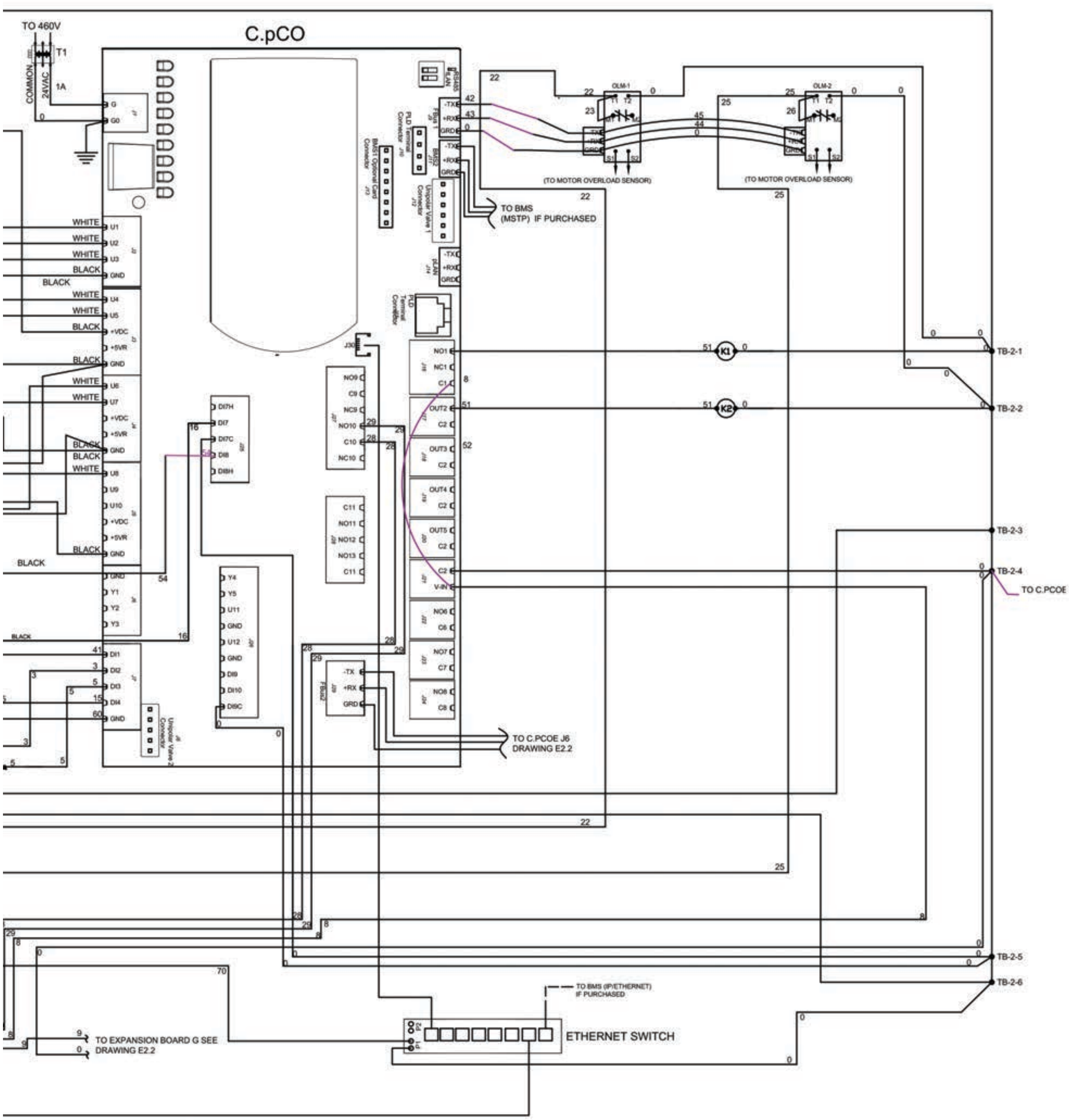

TO 460V
T1
COMMON
24VAC
1A
C.pCO
WHITE
BLACK
OLM-1
OLM-2
(TO MOTOR OVERLOAD SENSOR)
TO BMS
(MSTP) IF PURCHASED
TB-2-1
TB-2-2
TB-2-3
TB-2-4
TO C.PCOE
TO C.PCOE J6
DRAWING E2.2
TB-2-5
TB-2-6
TO BMS (IP/ETHERNET)
IF PURCHASED
ETHERNET SWITCH
TO EXPANSION BOARD G SEE
DRAWING E2.2

Figure 2. Manhattan Gen II high voltage

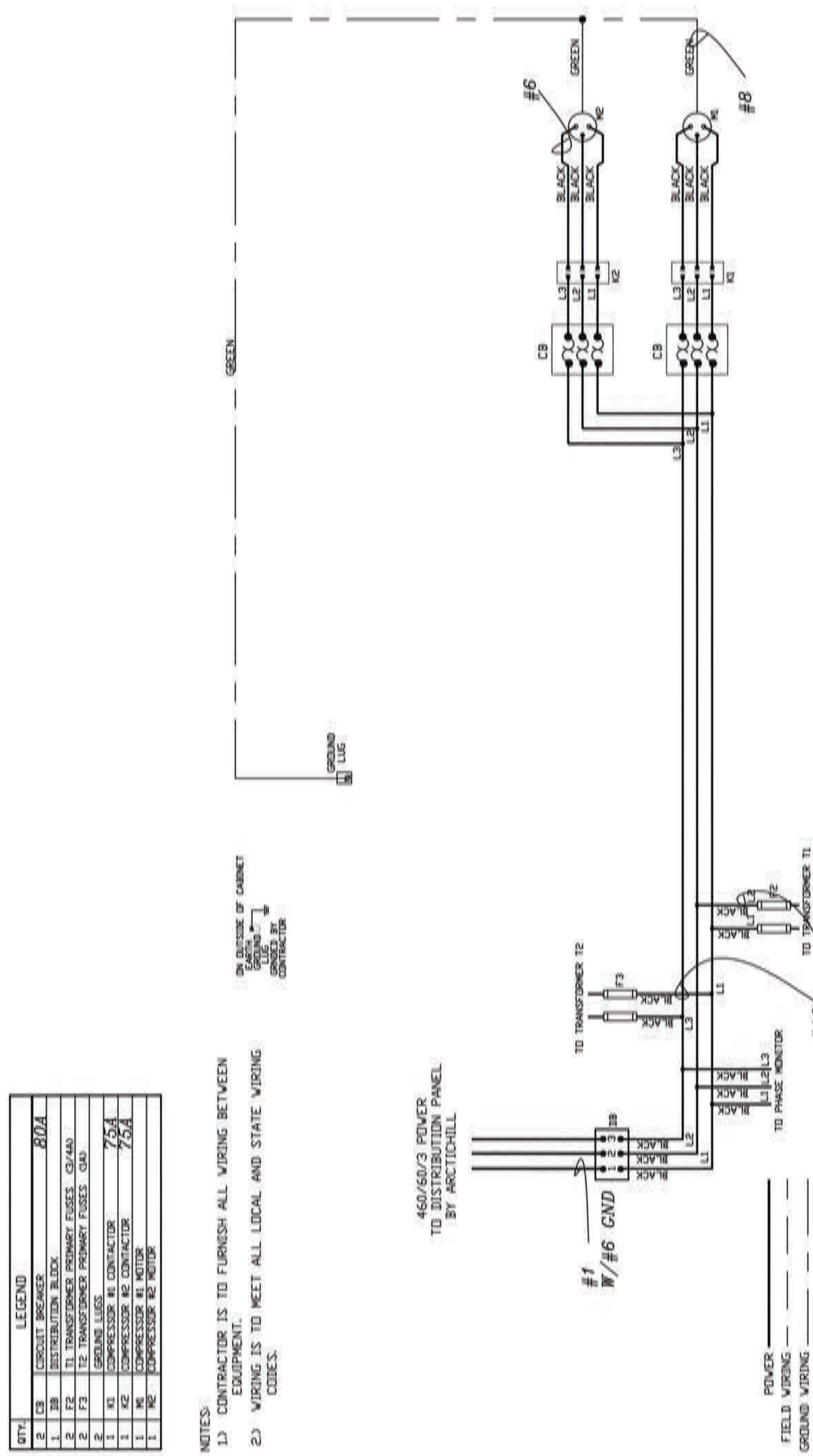


Figure 3. Manhattan Gen II expansion board

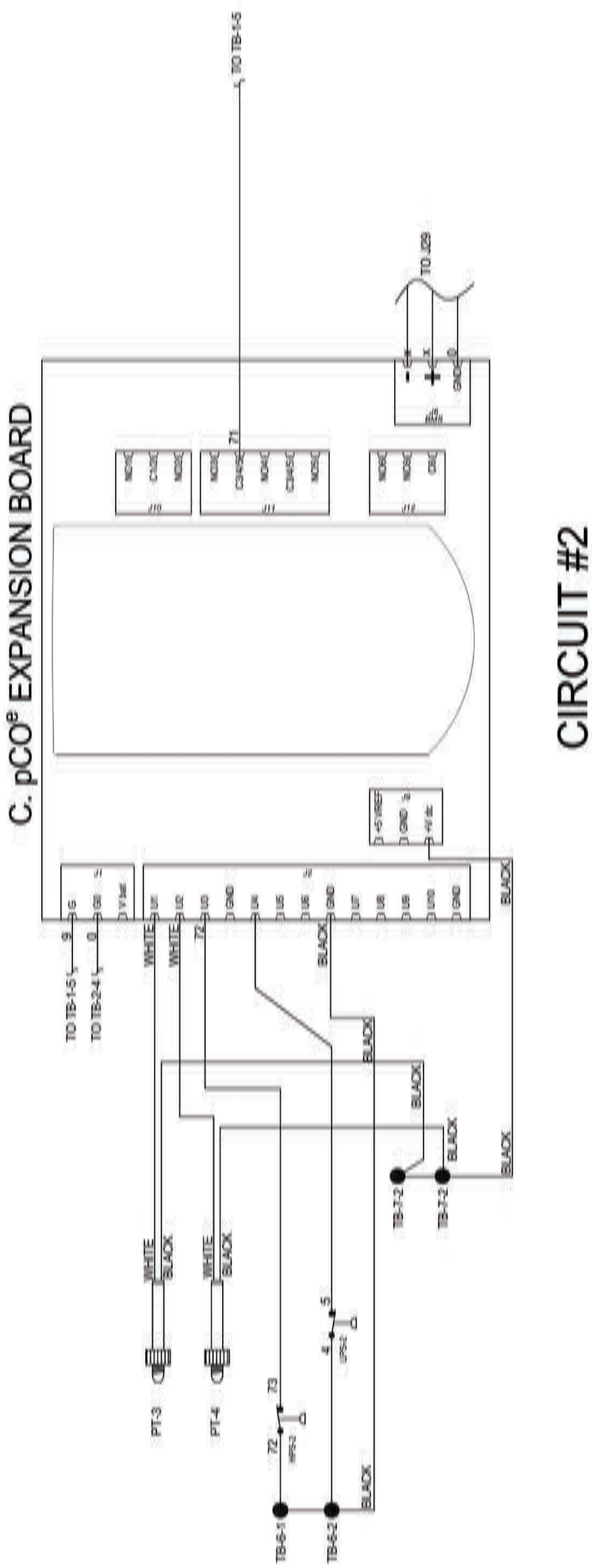


Figure 4. Manhattan Gen II primary electrical schematic

QTY.	LEGEND	
1	F-1	FUSE (5A)
1	FS-1	EVAPORATOR WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	FS-2	CONDENSER WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	K1	COMPRESSOR #1 CONTACTOR
1	K2	COMPRESSOR #2 CONTACTOR
1	HPS-1	HIGH PRESSURE SAFETY SWITCH CIRCUIT #1 - OPENS ON HIGH PRESSURE
1	HPS-2	HIGH PRESSURE SAFETY SWITCH CIRCUIT #2 - OPENS ON HIGH PRESSURE
1	LPS-1	LOW PRESSURE SAFETY SWITCH CIRCUIT #1 - OPENS ON LOW PRESSURE
1	LPS-2	LOW PRESSURE SAFETY SWITCH CIRCUIT #2 - 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 ENTERING EVAPORATOR WATER TEMPERATURE
1	NTC-4	TEMPERATURE SENSOR - SYSTEM LEAVING EVAPORATOR WATER TEMPERATURE
1	NTC-5	TEMPERATURE SENSOR - CHILLER ENTERING CONDENSER WATER TEMPERATURE
1	NTC-6	TEMPERATURE SENSOR - CHILLER LEAVING CONDENSER WATER TEMPERATURE
1	OLM-1	COMPRESSOR #1 OVERLOAD
1	OLM-2	COMPRESSOR #2 OVERLOAD
1	PLC	CPCO PROGRAMMABLE LOGIC CONTROLLER
1	PM	PHASE MONITOR
1	PT-1	4-20 mA OUTPUT PRESSURE TRANSMITTER - LOW PRESSURE CIRCUIT #1
1	PT-2	4-20 mA OUTPUT PRESSURE TRANSMITTER - HIGH PRESSURE CIRCUIT #1
1	PT-3	4-20 mA OUTPUT PRESSURE TRANSMITTER - LOW PRESSURE CIRCUIT #2
1	PT-4	4-20 mA OUTPUT PRESSURE TRANSMITTER - HIGH PRESSURE CIRCUIT #2
1	T1	460 V PRIMARY, 24 V SECONDARY - 50 VA TRANSFORMER
1	T2	460 V PRIMARY, 24 V SECONDARY - 75 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	GROUND TERMINAL BLOCK C.PCO
1	TB-6	GROUND TERMINAL BLOCK C.PCOE
1	TB-7	24V DC TERMINAL BLOCK C.PCOE

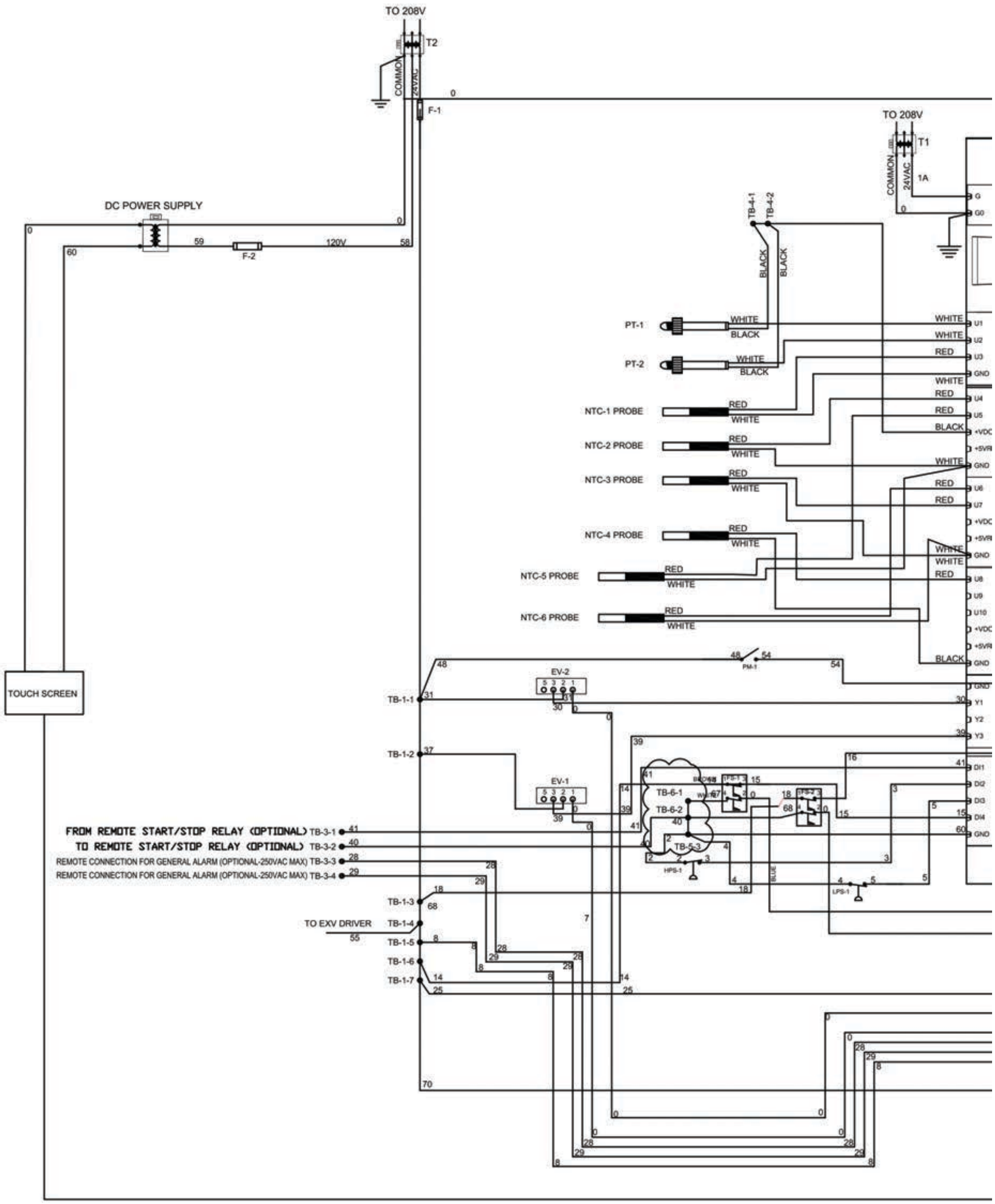
NOTES:

1. CONTRACTOR IS TO FURNISH ALL WIRING BETWEEN EQUIPMENT.
2. WIRING IS TO MEET ALL LOCAL AND STATE WIRING CODES.

* MINIMUM 18 AWG SHIELDED WIRE WITH A MAXIMUM OF 300 FEET RUN BY CONTRACTOR; 16 AWG SHIELDED WIRE FOR RUNS BETWEEN 300 - 500 FEET.

24V POWER ————
FIELD WIRING — — — — (6 WIRE PHONE CORD)
COMMON ————

Figure 5. SuperMod PLC



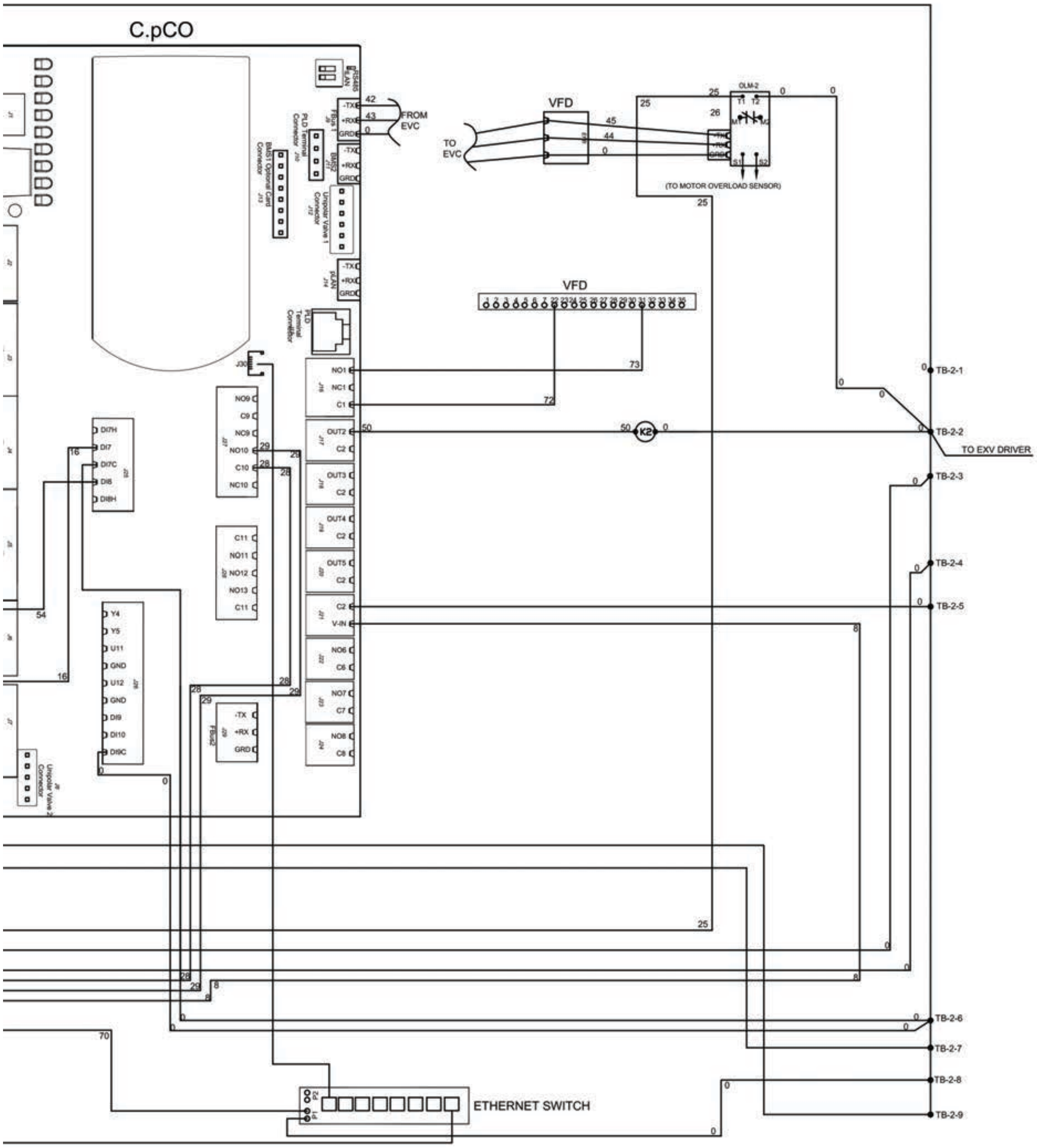

C.pCO
FROM EVC
TO EVC
VFD
VFD
OLM-2
(TO MOTOR OVERLOAD SENSOR)
K2
TB-2-1
TB-2-2
TO EXV DRIVER
TB-2-3
TB-2-4
TB-2-5
TB-2-6
TB-2-7
TB-2-8
TB-2-9
ETHERNET SWITCH

Figure 6. SuperMod high voltage

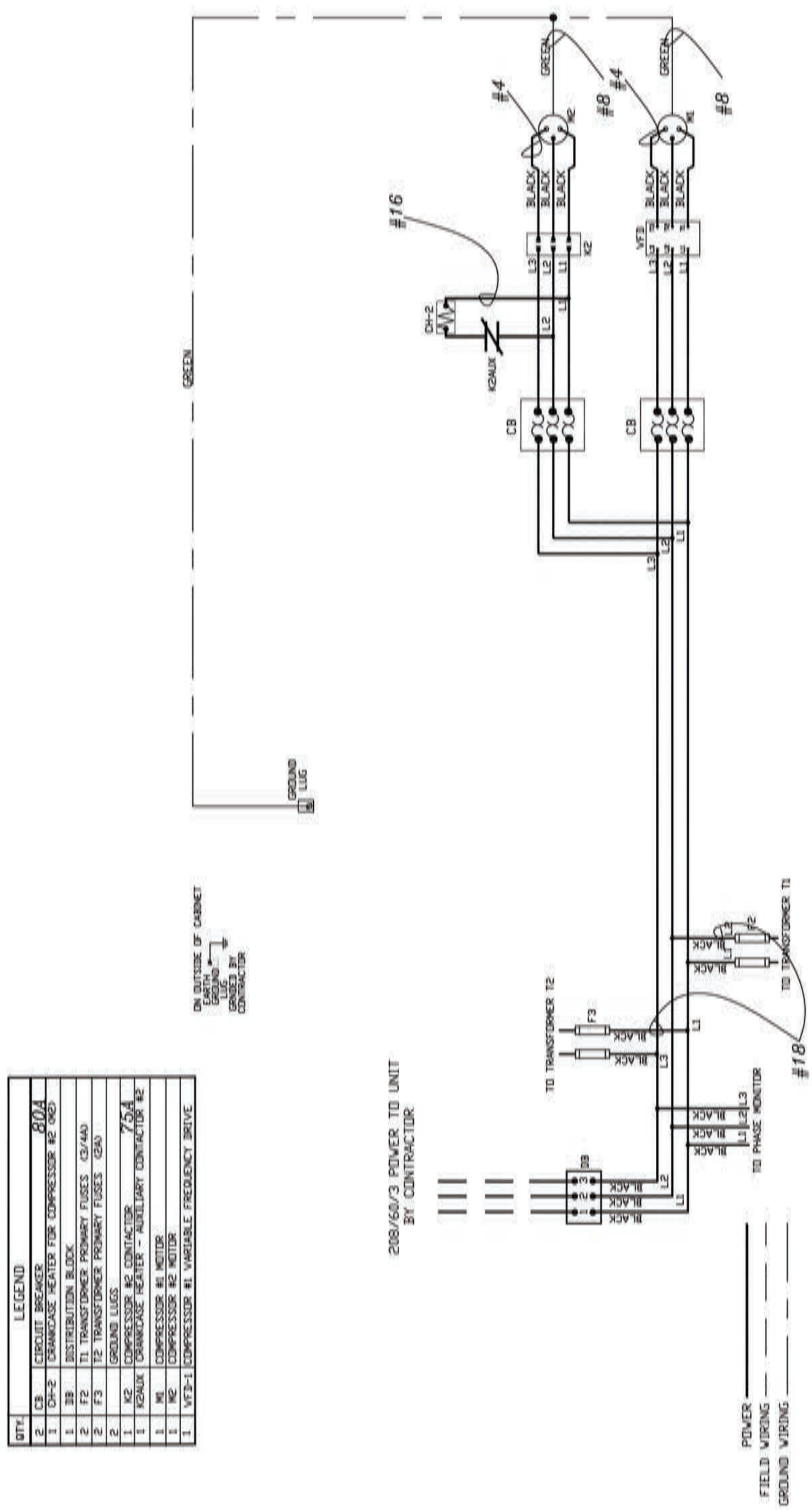


Figure 7. SuperMod expansion valve

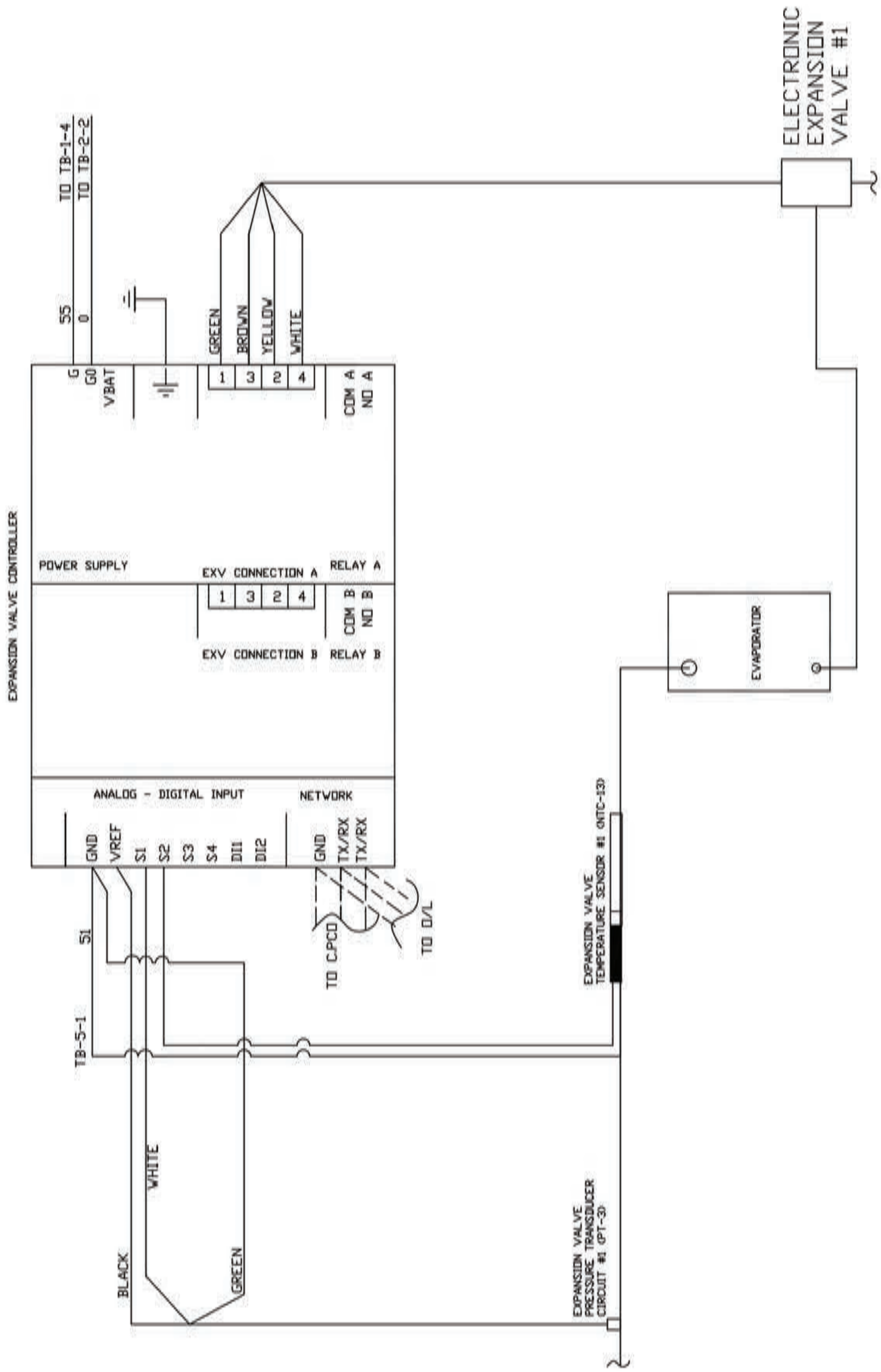


Figure 8. SuperMod primary electrical schematic

QTY.	LEGEND	
1	ES	ETHERNET SWITCH
1	EV-1	ELECTRONIC TWO-WAY ISOLATION VALVE (EVAPORATOR)
1	EV-2	ELECTRONIC TWO-WAY VALVE (CONDENSER)
1	FS-1	EVAPORATOR WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	FS-2	CONDENSER WATER FLOW SWITCH - CLOSES ON FLOW INCREASE
1	F-1	FUSE (10A)
1	F-2	FUSE (2A)
1	HPS-1	HIGH PRESSURE SAFETY SWITCH CIRCUIT #1 - OPENS ON HIGH PRESSURE
1	K2	COMPRESSOR #2 CONTACTOR
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 EVAPORATOR ENTERING WATER TEMPERATURE
1	NTC-4	TEMPERATURE SENSOR - SYSTEM EVAPORATOR 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-13	ELECTRONIC EXPANSION VALVE TEMP SENSOR #1
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 - EXPANSION VALVE
1	T1	208 V PRIMARY, 24 V SECONDARY - 50 VA TRANSFORMER
1	T2	208 V PRIMARY, 24 V SECONDARY -150 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	TERMINAL BLOCK - GROUND
1	VFD	VARIABLE FREQUENCY DRIVE

Units Dimensions and Weights

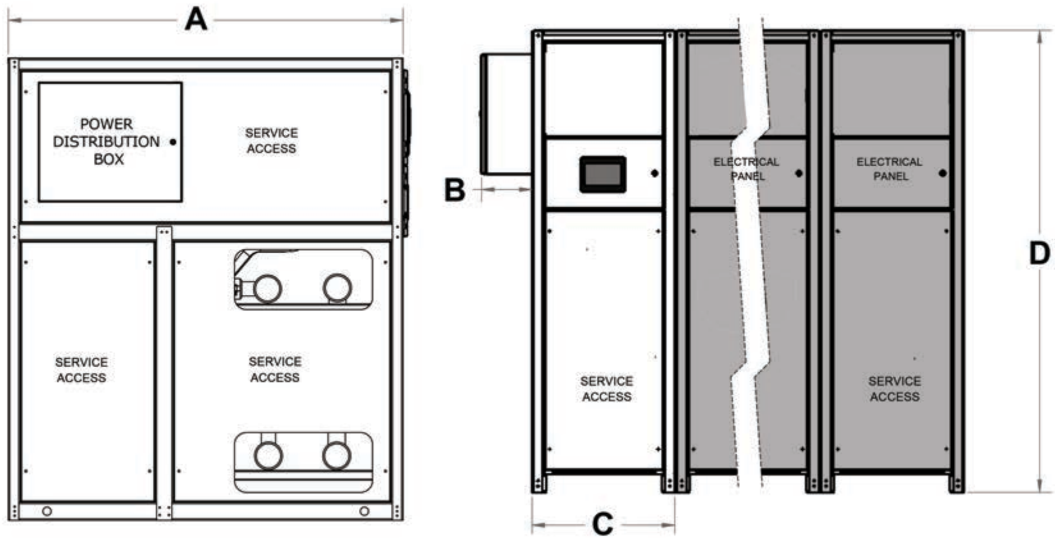


Table 6. Manhatten Gen II WC sizes and weights per module

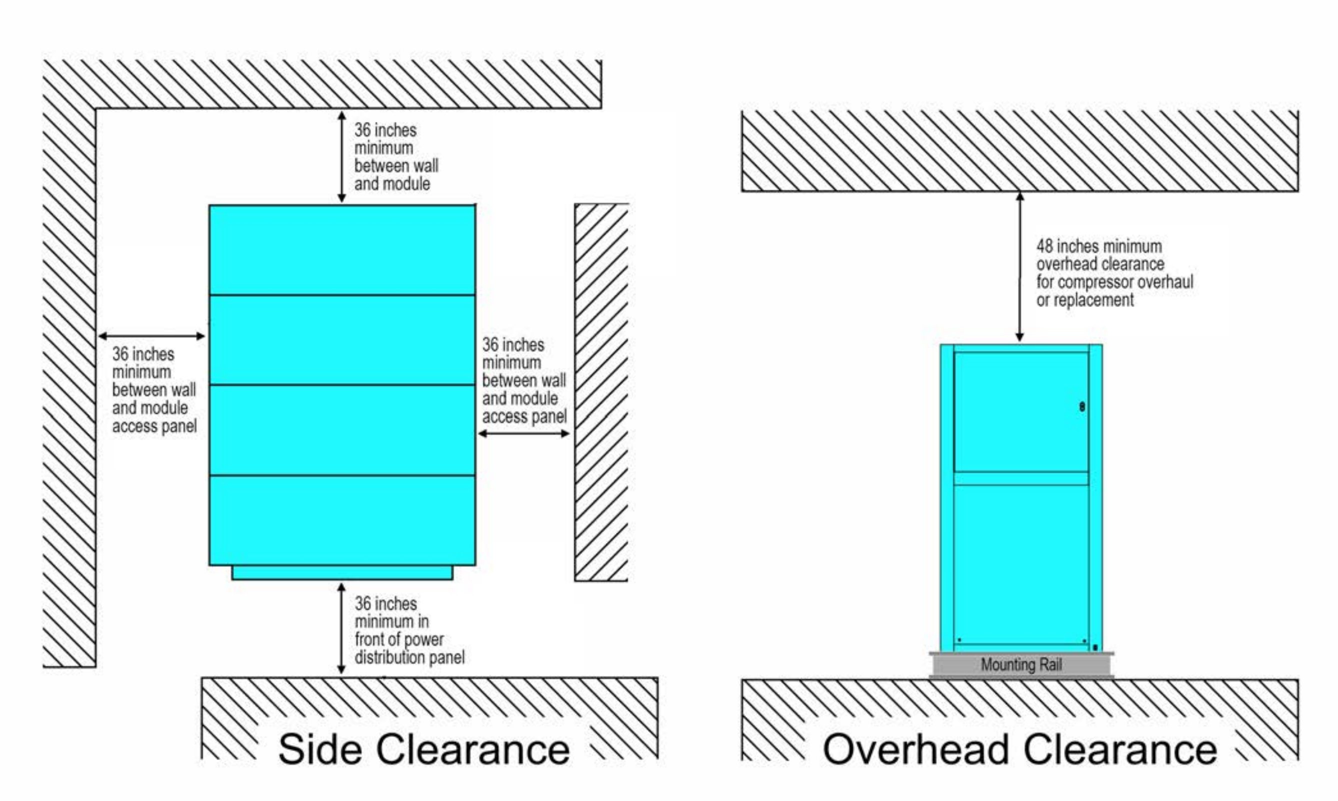
Dim	Units	15 Tons	20 Tons	25 Tons	30 Tons	40 Tons	50 Tons	60 Tons	80 Tons
A	inch	66	66	66	66	66	66	66	78
B		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
C		24	24	24	24	34	34	34	34
D		77	77	77	77	77	77	77	80
Wt	lbs	1400	1400	1500	1600	1800	1800	1900	2600

Table 7. SuperMod WC sizes and weights per module

Dim	Units	20 Tons	25 Tons	30 Tons	40 Tons
A	inch	66	66	66	66
B		8.5	8.5	8.5	8.5
C		24	24	24	24
D		77	77	77	77
Wt	lbs	1350	1400	1450	1550

Service Clearance

Figure 9. Service clearance



Mechanical Specifications

General

The water-cooled modular chiller system shall consist of individual chiller modules . Each chiller module shall be completely factory wired and tested prior to shipment. Each module shall include a compressor, evaporator, water cooled condenser, and controls. Controls shall be designed on a distributed microprocessor 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 primary microprocessor.

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).

Refrigeration Circuits

The **Manhattan Gen II** Chiller uses dual independent refrigeration circuits in each module using hermetically sealed scroll compressors each with Rotalock connections, oil level sight glass, suction gas-cooled motor with solid-state sensors in the windings for overload protection, and circuit breaker protection. There shall be two independent compressors and refrigerant circuits per module. Compressors shall be mounted to the formed sheet metal frame with rubber-in-shear vibration isolators.

The **SuperMod** Chiller uses a hermetically sealed tandem scroll compressor set with a true variable speed lead compressor motor and a fixed speed lag compressor. The tandem set shall include an 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 formed sheet metal frame with rubber-in-shear vibration isolators.

Evaporator

The **Manhattan Gen II** chiller uses a dual circuit, brazed plate evaporator on each module constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each evaporator shall include an electronic and a manual isolation valve to allow servicing of each module individually while the remaining modules continue to operate, and to allow for variable flow. The fluid connections to each evaporator shall use roll grooved couplings for service convenience and ease of installation. Each evaporator shall be insulated with ¾ inch closed cell insulation. The maximum working pressure shall be 650 psi. Evaporator piping fluid velocity shall not exceed 10 fps at any point in the system.

The **SuperMod** chiller uses a brazed plate, single circuit evaporator in each module constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each of the evaporator shall include an electronic and a manual isolation valve to allow servicing of each module individually while the remaining modules continue to operate, and to allow for variable flow. The fluid connections to each evaporator shall use roll grooved couplings for service convenience and ease of installation. Evaporators shall be insulated with ¾ inch closed cell insulation.

Condenser

The **Manhattan Gen II** chiller uses a dual circuit, brazed plate heat exchanger, constructed of stainless steel 316. The supply fluid piping is fitted with a cleanable strainer to protect the condenser. The supply and return fluid piping connections to each evaporator shall include an electronic and a manual isolation valve to allow servicing of each module individually, while the remaining modules continue to operate, and to allow for variable flow.

The **SuperMod** chiller uses a single circuit, brazed plate condenser constructed of 316 stainless steel plates and copper brazing. The supply and return fluid piping connections to each condenser shall include manual and electronic modulating valves to allow servicing of each module individually, while the remaining modules continue to operate and to allow variable low and head pressure control. The fluid connections to each condenser shall use roll grooved couplings for service convenience and ease of installation.

Compressor

The **Manhattan Gen II** chiller uses a hermetically sealed, scroll compressor on each refrigeration circuit. The Copeland 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 **SuperMod** chiller uses a tandem set of fixed speed and variable speed compressors by Copeland. The variable speed compressor is the latest development by Copeland using brushless permanent magnet motors.

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.

Variable Speed Drive (SuperMod)

The lead compressor of the tandem compressor set in a **SuperMod** chiller module include the Emerson Copeland Scroll EVC1150B/1185B Variable Frequency Drive (VFD) which delivers maximum machine performance with sensorless permanent magnet motor control, for dynamic and efficient machine operation. The drive is designed to control a compressor in one of two modes. The analog / digital control mode and the Modbus control mode.

Unit Controls

The primary chiller 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 chiller 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 chillers 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 chiller 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

Heat Recovery Operation

The modular heat recovery chiller system is equipped with a brazed plate condenser in each module each with a thermal dispersion flow switch compressor, fine mesh strainer, plus valves and controls for heat recovery operation.

Heat Pump Operation (Manhattan Gen II Only)

The modular chiller/heat pump system is equipped with a brazed plate heat exchanger for use as an evaporator and condenser in each module. Each fluid branch line includes a thermal dispersion flow switch and fine mesh strainer as well as an electronic and thermal expansion valve. Each refrigeration circuit includes a reversing valve and controls for heat pump operation.

Digital Scroll Compressor (Manhattan Gen II Only)

A digital scroll compressor can be included on the lead compressor or both compressors or the lead compressor of the lead module only for efficient part load operation and close load matching.

Shell and Tube Condenser / Evaporator (Manhattan Gen II Only)

A compact shell and tube evaporator or condenser can be included in each module in lieu of the standard brazed plate evaporator and condenser. Their low susceptibility to fouling and the ability for the condenser tubes to be cleaned make the shell and tube heat exchangers ideal for applications where the fluid quality Is poor. The shell and tube condenser and evaporator are dual circuited and have a carbon steel shell material and copper tubes. Fluid flows through the shell on the evaporator and the tubes on the condenser and refrigerant flows through the shell on the condenser and the tubes in the evaporator.

Variable Speed Drive (Manhattan Gen II Only)

The lead chiller module or all chiller modules can have a variable speed drive (VSD) on the lead scroll compressor and standard scroll compressor on the lag circuit. The VSD scroll compressor shall provide smooth and efficient operation from 45 Hz to 60 Hz for close temperature control. This part load operation shall lower the compressor condensing temperatures thereby lowering power consumption during low cooling load demands.

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 chiller 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: Chiller 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.

Backup Primary Controller

Redundant primary allows backup controller to provide all control functions upon failure of the primary.

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.

Other Options

Stainless Steel Cabinet Enclosure (Manhatten Gen II Only)

Stainless steel sheet metal panels are available for corrosion resistance and shall be easily removable for servicing via stainless steel fasteners and retaining clips.

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Supersedes (New)