MULTISTACK®

Water-to-Water Heat Pump

Product Data Catalog

R-134a Modules

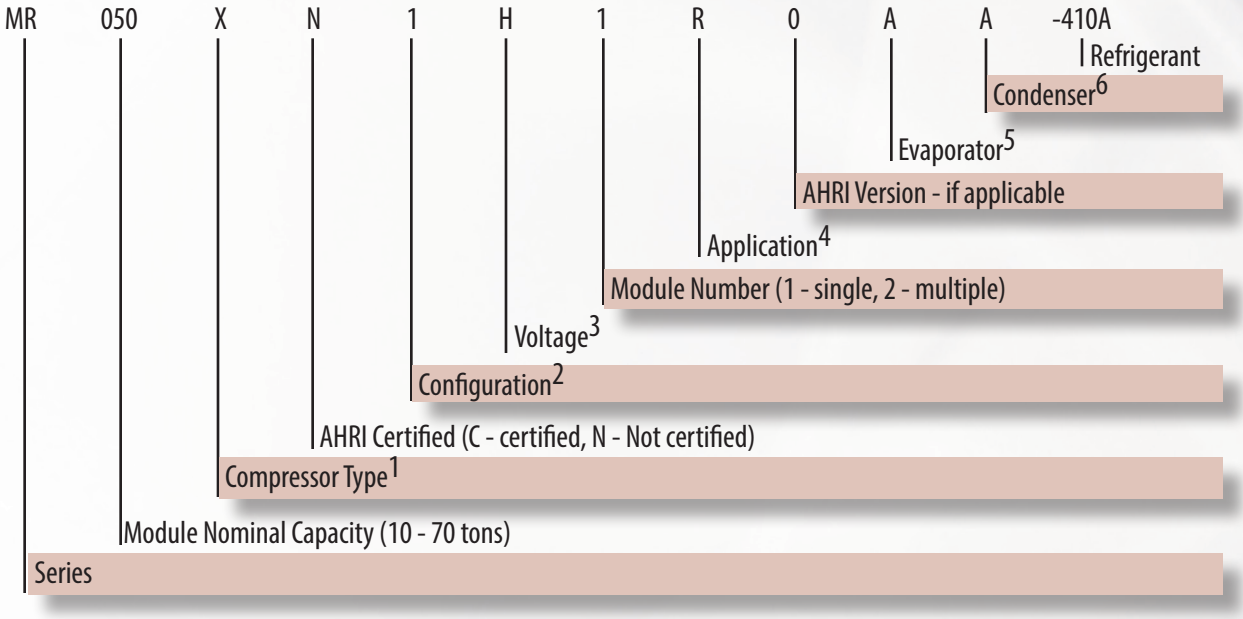
MR010AN, MR015AN, MR020AN, MR030AN, MR040AN, MR050AN, MR070AN, MR085AN

R-410A Modules

MR010XN, MR015XN, MR020XN, MR030XN, MR040XN, MR050XN, MR070XN

Table of Contents

Model Number Nomenclature



1 C: Trane Cornerstone, Z: Copeland scroll (old elec), X: Copeland Scroll (ZP), A: Copeland Scroll (ZR)
2 1- Standard, 2- Total Access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, V - others
3 A - 208/3/60, L - 230/3/60, H - 460/3/60, C - 575/3/60, D - 200/3/50, E - 400/3/50, F - 380/3/60, S - 220/230/1/60, V - other
4 R - Heat pump
5 A - Brazed SS, B - Brazed SMO, V - Other
6 A - Brazed SS, B - Brazed SMO, E - Double-wall brazed, V - Other

Applications for a Multistack Heat Pump

- Laundry Water Heating
- Swimming Pool Heating
- Process Heating and Cooling
- Domestic Hot Water
- Building Heat
- Reheat Coils
- VAV Reheat

Typical Buildings for Heat Pump Applications

- Hotels and Motels
- Resorts
- Recreational Facilities
- Schools
- Hospitals
- Nursing Homes
- Process Cooling and Heating
- Data Centers
- Call Centers
- Campus Cooling and Heating Plants

Features & Benefits

- Reduced CO_2 emissions
- Easy retrofit for any mechanical room
- Payback in less than three years typically
- More efficient than a gas boiler
  - Heating COP with R-410A can exceed 5.0
  - Heating COP with R-134a can exceed 3.0
  - Cooling EER with R-410A can exceed 15.0
  - Cooling EER with R-134a can exceed 7.0
- Low load efficiency
- Apply for USGBC LEED points
- ASHRAE 15 / B-52 compliant without monitoring or ventilation equipment.

Highly Dependable

- Multiple independent refrigeration systems for redundancy
- Comprehensive computer monitoring of operations (optional)
- Automatic diagnostic recording of fault conditions
- Rotates lead compressor every 24 hours

Simple To Operate

- Large LCD screen displays information in plain English
- Simple keypad provides control of unit operations

Easy To Install

- Compact modules fit through standard doorways and into elevators
- Modules interconnect easily and quickly
- All refrigeration systems are factory charged and run tested
- Single point power up to 500 MCA

Programmable Logic Controller (PLC) System

- Manual switch allows redundancy control as each module has a processor allowing it to run even if master controller fails
- Display at each module
- Remote display option
- Optional BAS Interface

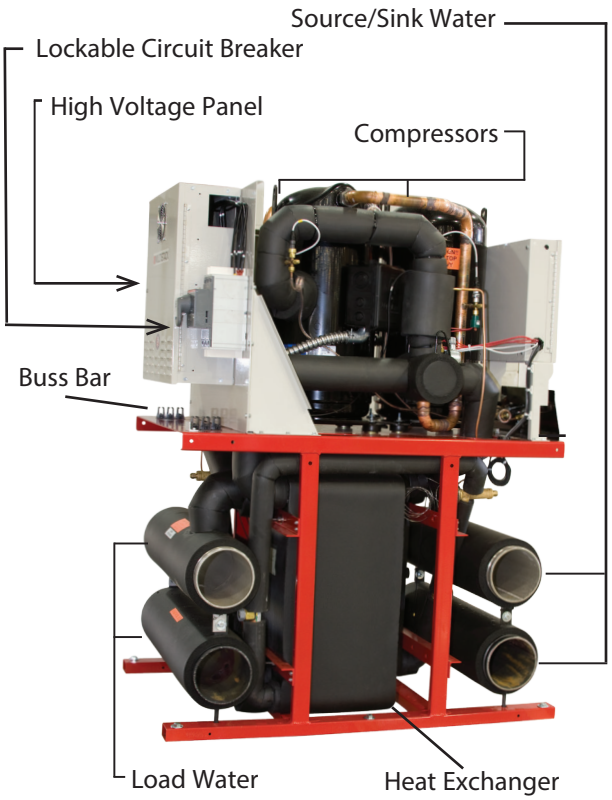
Design Flexibility

- Wide array of module combinations
- Install only the capacity required at the time
- Variable or constant flow options

Simple To Service

- Service can often be performed on a convenient, non-emergency basis
- Most components are standard, off the shelf design
- Able to service one module while system is in operation

Side View



General Data Table							
	MR010*	**MR015***	**MR020***	**MR030***	**MR040***	**MR050***	**MR070***
Compressor Type	**Scroll**	**Scroll**	**Scroll**	**Scroll**	**Scroll**	**Scroll**	**Scroll**
Dry Weight (lbs. each)	89	135	135	146	280	353	390
Normal Capacity (tons each)	5	8.5	10	15	20	25	32
Quantity	2	2	2	2	2	2	2
Oil Charge (pints)	3.5	6.9	6.9	6.9	9.5	14.4	13.3
Evaporator (Brazed Plate)	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs. each)	70	70	90	180	180	220	300
Water Storage (gal. each)	1.6	1.6	2.2	5.5	5.5	7.3	10.1
Circuit Configuration	Dual	Dual	Dual	Dual	Dual	Dual	Dual
Quantity	1	1	1	1	1	1	1
Header System (gal.)	6	6	6	6	6	6	6
Condenser	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs. each)	70	70	90	180	180	220	300
Water Storage (gal. each)	1.6	1.6	2.2	5.5	5.5	7.3	10.1
Circuit Configuration	Dual	Dual	Dual	Dual	Dual	Dual	Dual
Quantity	1	1	1	1	1	1	1
Header System (gal. entering water)	6	6	6	6	6	6	6
Refrigerant Type	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a
Charge (lbs./circuit)	8	8	8	12	18	18	24
Number of Circuits	2	2	2	2	2	2	2
Operating Weight (lbs.)	1,530	1,550	1,550	1,650	1,950	1,950	2,100
Shipping Weight (lbs.)	1,380	1,400	1,400	1,500	1,790	1,790	1,940

***Data applies to R-410A and R-134a refrigerants.**

Multistack Glycol Solution Information

Low Temperature Operation with Glycol

In chilled water systems where water temperatures of less than 40°F and ambient temperatures of 32° F are likely to occur, it is necessary to add a glycol-based heat transfer fluid to the system. Both Ethylene and Propylene are available and they offer the same basic freeze and corrosion protection although there are performance differences in the solutions.

Notes: 1. Ethylene and propylene glycol ratings are outside the scope of AHRI Standard 550/590 Certifications.

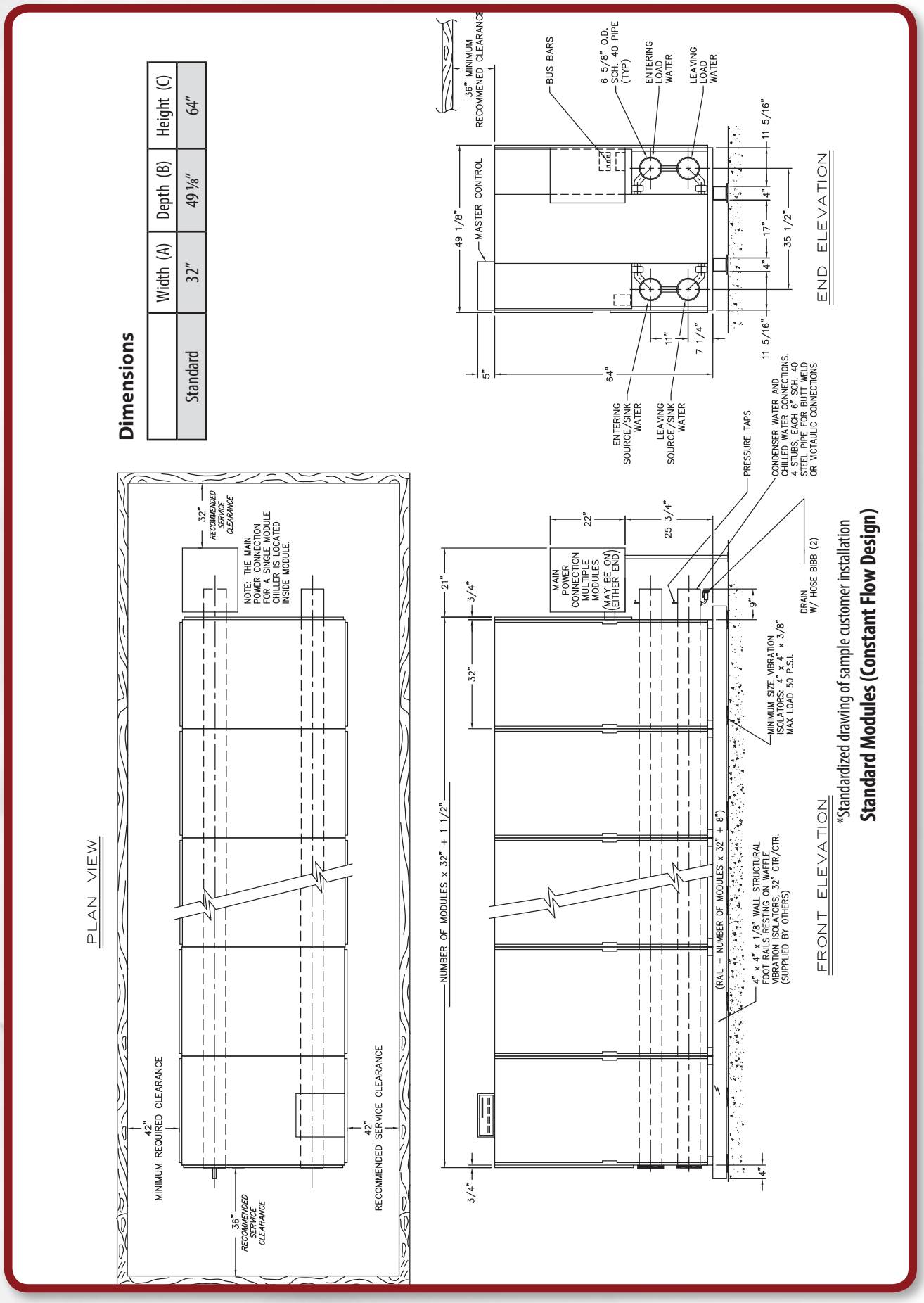
2.The effect of glycol in the condenser is negligible as it tends to mirror the properties of water as its temperature increases. No emphasis on derate on condenser capacity with glycol is necessary in the selection process.

Ethylene Glycol						
Ethylene %	**Freeze Point**		**Capacity**	**Power**	**Flow**	**Pressure Drop**
	°F	**°C**				
10	26	-3.3	0.996	0.999	1.035	1.096
20	18	-7.8	0.986	0.998	1.06	1.219
30	7	-13.9	0.978	0.996	1.092	1.352
40	-7	-21.7	0.966	0.993	1.131	1.53
50	-28	-33.3	0.955	0.991	1.182	1.751

Propylene Glycol						
Propylene %	**Freeze Point**		**Capacity**	**Power**	**Flow**	**Pressure Drop**
	°F	**°C**				
10	26	-3	0.987	0.992	1.01	1.068
20	19	-7	0.975	0.985	1.028	1.147
30	9	-13	0.962	0.978	1.05	1.248
40	-5	-21	0.946	0.971	1.078	1.366
50	-27	-33	0.929	0.965	1.116	1.481

Dimensions

	Width (A)	Depth (B)	Height (C)
Standard	32"	49 1/8"	64"



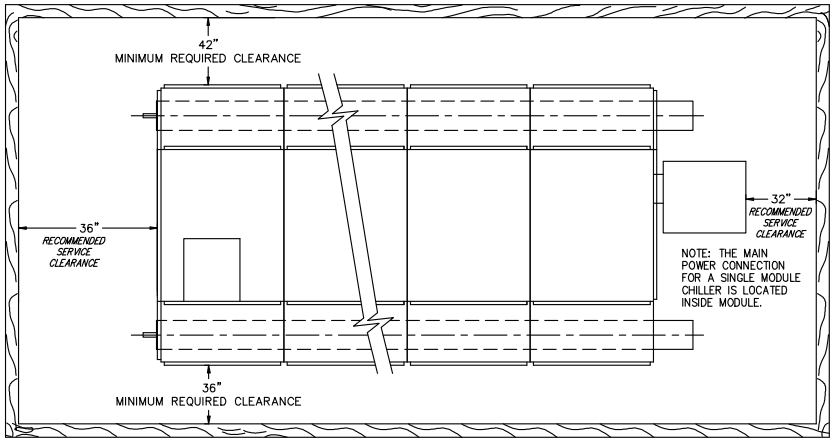
*Standardized drawing of sample customer installation

Standard Modules (Constant Flow Design)

Variable Flow Design for Load and Source/Sink– Extended Headers on Load Side and Source/Sink Side

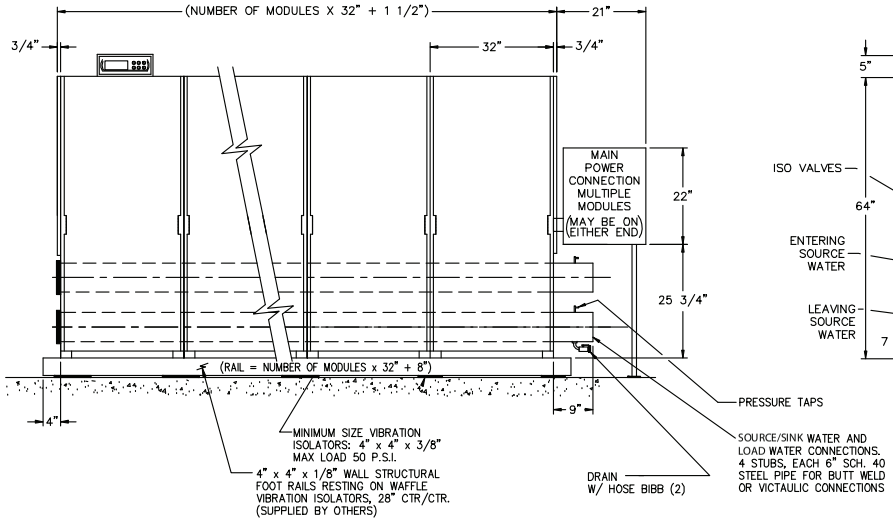
*Standardized drawing of sample customer installation

PLAN VIEW

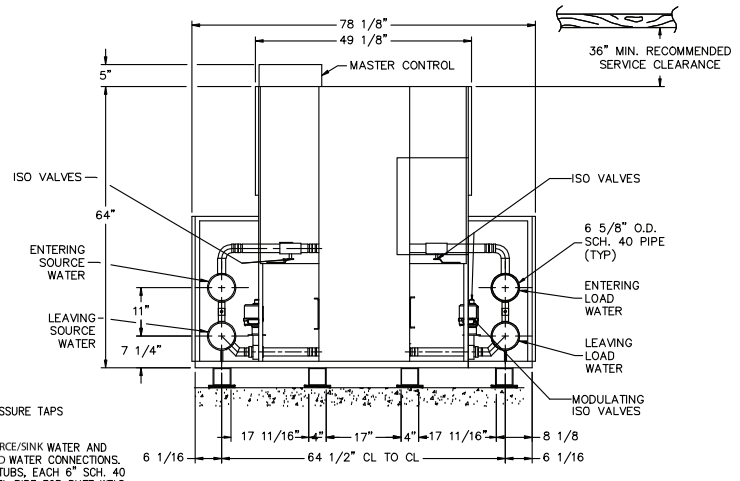


Dimensions

	Width (A)	Depth (B)	Height (C)
Extended Headers	32"	78 1/8"	64"



FRONT ELEVATION

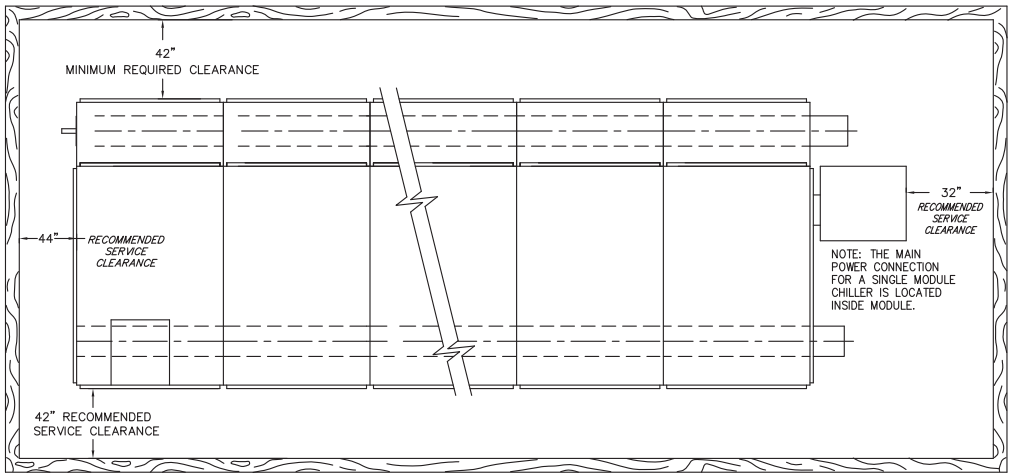


END ELEVATION

Variable Flow Design for Load Water
Constant Flow for Source/Sink
Extended Headers on Load Side

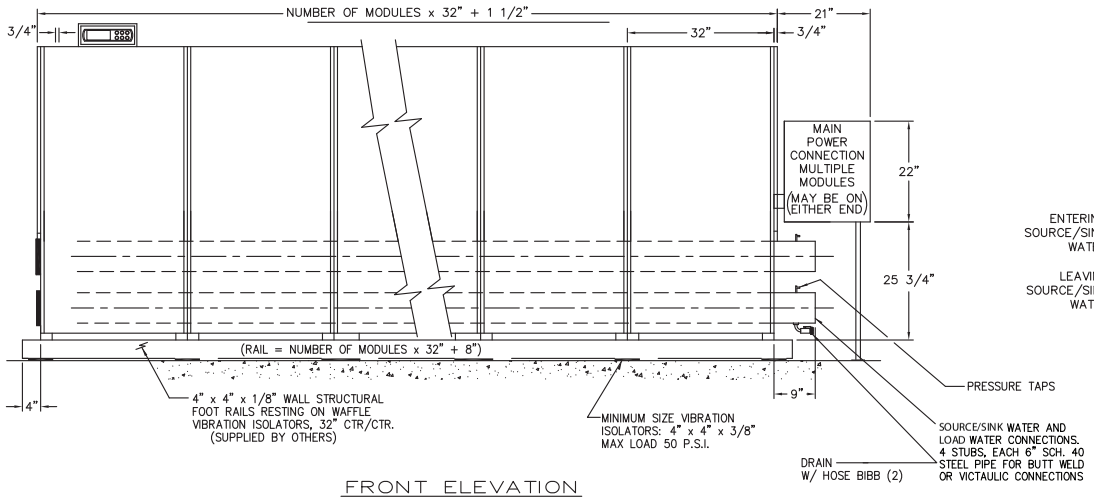
*Standardized drawing of sample customer installation

PLAN VIEW



Dimensions

	Width (A)	Depth (B)	Height (C)
Extended Headers (Load)	32"	63 5/8"	64"



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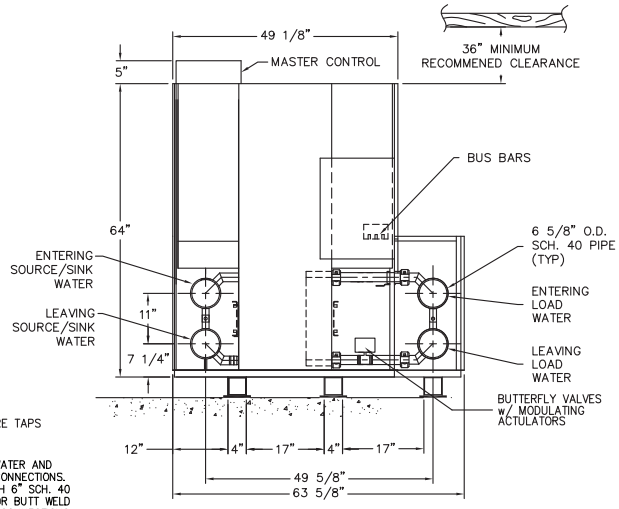
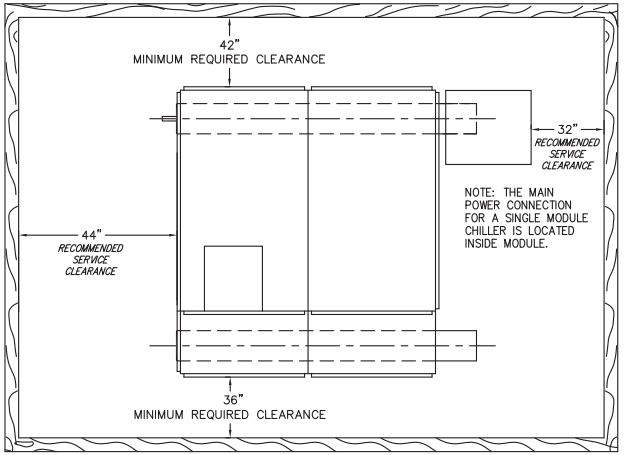


END ELEVATION

Variable Flow Design for Source/Sink Water
Constant Flow for Load Water
Extended Headers on Source/Sink Side

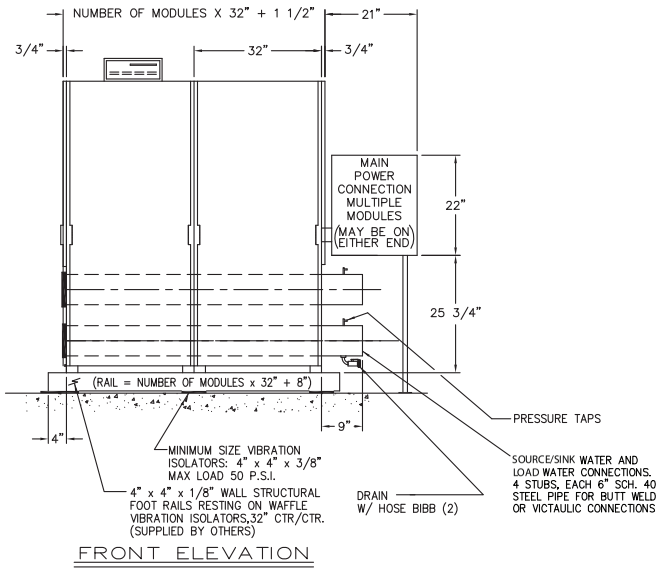
*Standardized drawing of sample customer installation

PLAN VIEW



Dimensions

	Width (A)	Depth (B)	Height (C)
Extended Headers (Source/Sink)	32″	63 ⅝″	64″



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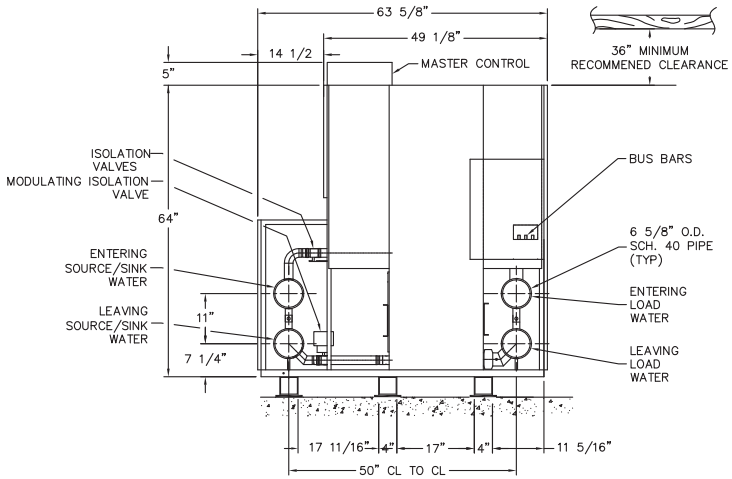


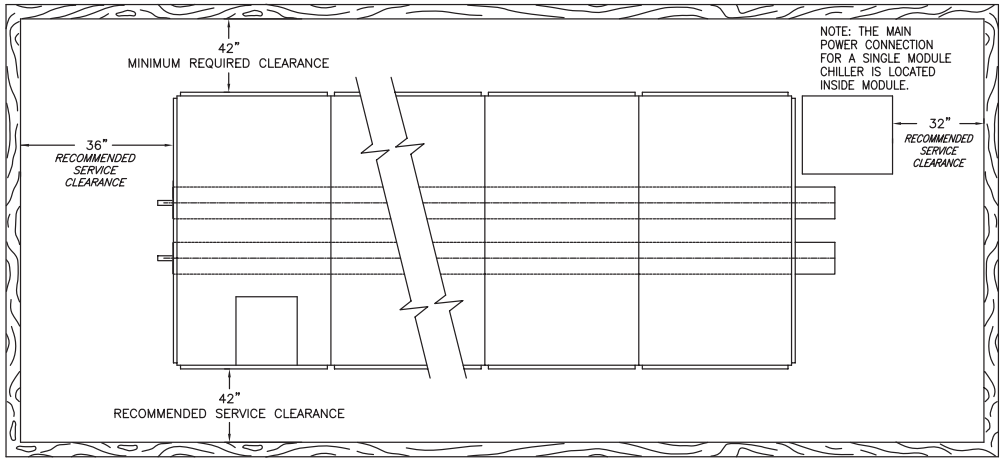
END ELEVATION

Variable Flow* or Constant Flow for Source/Sink and/or Load Water Total Access Design

Standardized drawing of sample customer installation

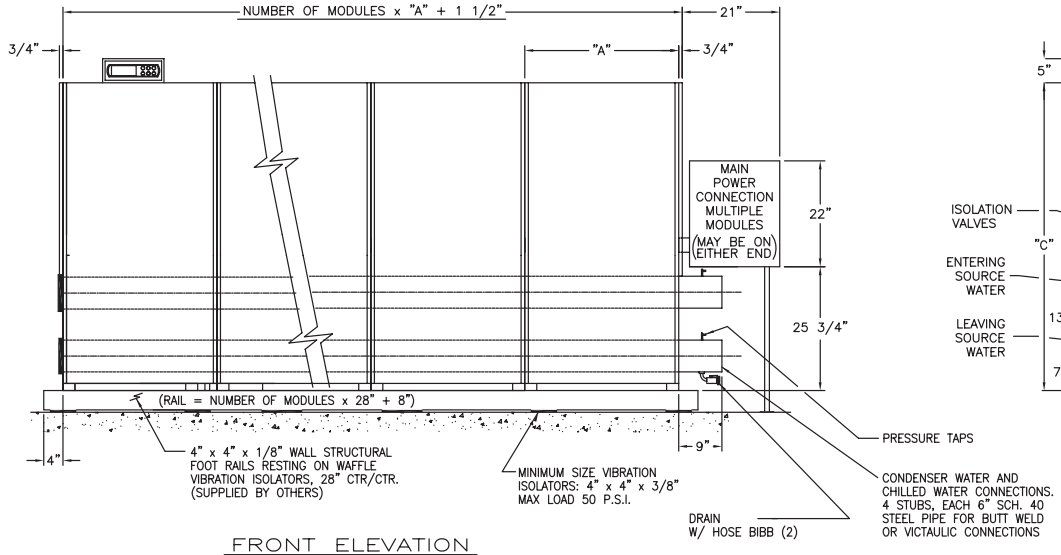
*Required optional actuators.

PLAN VIEW



Dimensions

	Width (A)	Depth (B)	Height (C)
MR010X, MR015X, MR020X, MR030X	32″	56″	67″
MR050X	34″	56″	67″
MR070X	34″	56″	67″



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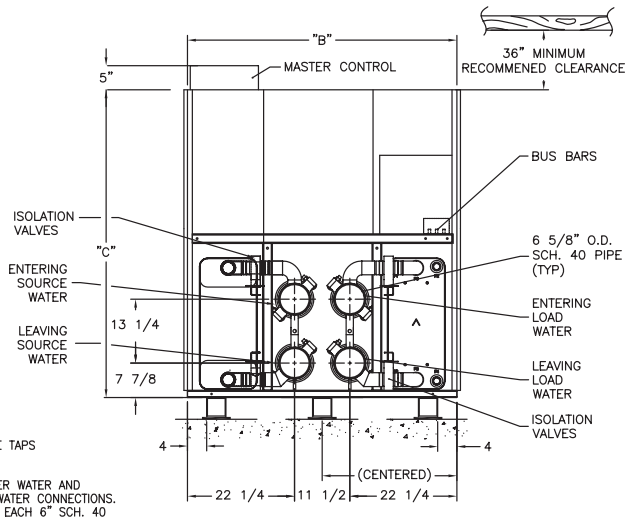
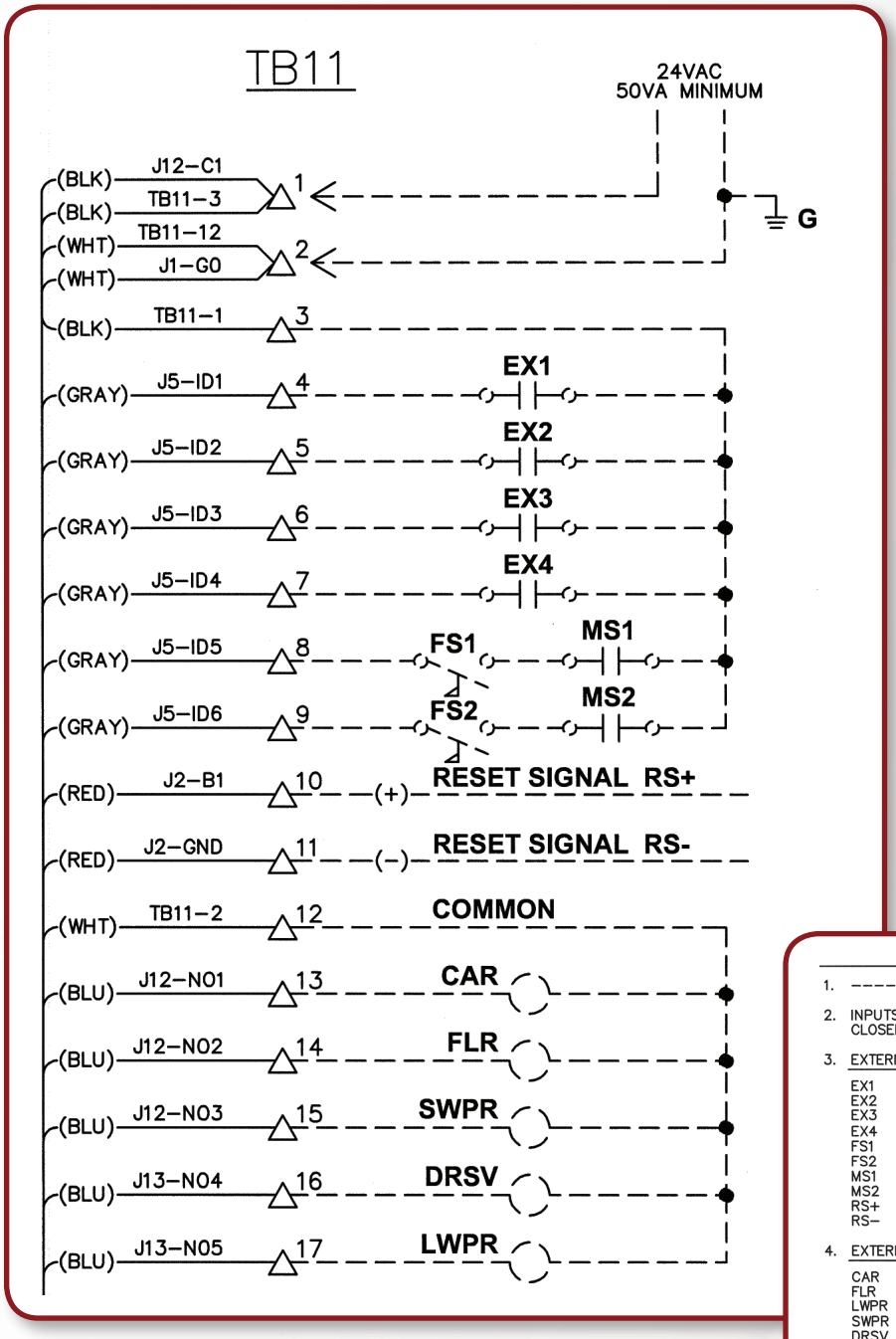


END ELEVATION

External Input/Output Connections



LEGEND

1. ---- COMPONENTS & WIRING BY OTHERS. (18 AWG MIN. WIRE)
2. INPUTS TO TERMINALS 4 THRU 8 OF TB11 MUST BE WIRED CLOSED IF NOT USED.
3. EXTERNAL INPUTS: (CLOSED TO OPERATE)

EX1	–	REQUIRES MANUAL RESET TO RESUME OPERATION
EX2	–	AUTO RESET (REMOTE START/STOP)
EX3	–	CONTROL INPUT: CLOSED=HEATING; OPEN=COOLING
EX4	–	AUTO RESET (POWER PHASE MONITOR INPUT)
FS1	–	FLOW SWITCH (LOAD WATER)
FS2	–	FLOW SWITCH (SOURCE/SINK WATER)
MS1	–	AUX. INTERLOCK (LOAD WATER PUMP STARTER)
MS2	–	AUX. INTERLOCK (SOURCE/SINK WATER PUMP STARTER)
RS+	–	RESET SIGNAL (SOFTWARE SELECTABLE 0–10VDC, 4–20mA)
RS–	–	RESET SIGNAL (SOFTWARE SELECTABLE 0–10VDC, 4–20mA)

4. EXTERNAL OUTPUTS:

CAR	–	CUSTOMER ALARM RELAY (24VAC, 5VA MAX.)
FLR	–	FULL LOAD RELAY (24VAC, 5VA MAX.)
LWPR	–	LOAD WATER PUMP RELAY (24VAC, 5VA MAX)
SWPR	–	SOURCE/SINK PUMP RELAY (24VAC, 5VA MAX.)
DRSV	–	DEBRIS REMOVAL SOLENOID VALVE (24VAC, 6W, 16VA) MAX. OF (2) DRSV IN THIS CIRCUIT

5. SENSOR INPUTS:

ESW	–	ENTERING SOURCE/SINK
LSW	–	LEAVING SOURCE/SINK
ELW	–	ENTERING LOAD WATER
LLW	–	LEAVING LOAD WATER

System Wire & Fuse Sizing Specifications

(Applicable codes may require different wire sizing)

1. Compressor Rated Load Amps (RLA) and Locked Rotor Amps (LRA) Data: RLA/LRA

R-410A

VOLTAGE	208	230	460	575
MR010XN	22.8/123	20.6/123	10.3/62	8.4/50
MR015XN	36.5/225	33/225	16.5/114	13/80
MR020XN	44/239	40/239	20/125	16/80
MR030XN	68/340	61/340	31/173	25/132
MR040XN	87/538	78.5/538	37.5/229	30/180
MR050XN	101/605	91/605	46/272	37/215
MR070XN	133/599	120/599	60/310	48/239

Note: *RLA and LRA is per compressor. Two compressors per module.*

R-134a

VOLTAGE	208	230	460	575
MR010AN	23.5/128	21/128	10.2/63	8.2/49
MR015AN	38.7/225	35/225	17.5/114	14/80
MR020AN	44/239	40/239	20/125	16/80
MR030AN	61/300	55/300	27/150	22/109
MR040AN	88.5/505	80/505	40/225	32/180
MR050AN	100/500	90/500	46/250	37/198
MR070AN	127/599	114/599	58/310	47/239

Note: *RLA and LRA is per compressor. Two compressors per module.*

2. Wiring Sizing: Minimum Circuit Ampacity (MCA)
MCA = (1.25 x RLA1*) + RLA2 + RLA3

MCA	3 CONDUCTORS 1 CONDUIT	6 CONDUCTORS 2 CONDUIT
50	8	—
65	6	—
85	4	—
100	3	—
115	2	—
130	1	—
150	1/0	—
175	2/0	—
200	3/0	—
230	4/0	—
255	250 MCM	—
285	300 MCM	1/0
300	—	2/0
350	—	3/0
400	—	4/0
460	—	4/0
500	—	250 MCM

3. Fuse Sizing: Maximum Fuse (MF), Type RK5 Fuse
MF= (2.25 x RLA1*) + RLA2 + RLA3
Where the MF does not equal a standard size fuse, the next larger size should be used.

4. Standard modules short circuit current rating: SCCR=5kA

NOTES:

A.*RLA1 = RLA of the largest compressor in the system. RLA2 & RLA3 = RLA of the other compressors in the system.

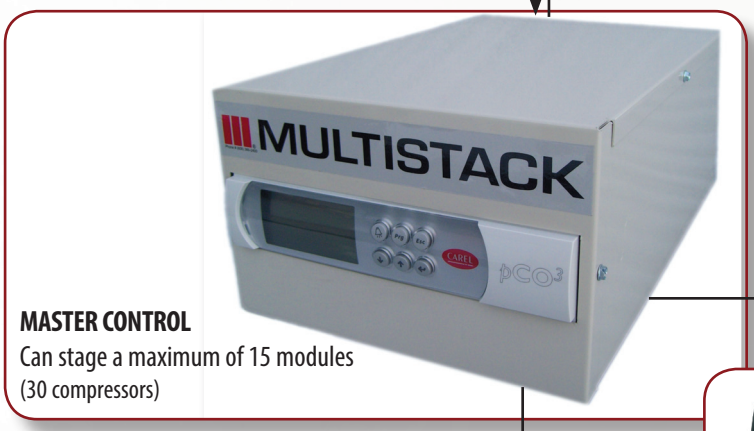
B. The total system Minimum Circuit Ampacity (MCA) shall not exceed 500A.

C. Wire sizing is based on National Electric Code (NEC) rating for 75°C copper wire, with three wires per conduit.

D. Wiring Distance from branch circuit shall not exceed 100 feet.

Chiller Data

- ENTERING LOAD WATER TEMP.
- LEAVING LOAD WATER TEMP
- VERIFY LOAD WATER FLOW
- ENTERING SOURCE/SINK WATER TEMP
- LEAVING SOURCE/SINK WATER TEMP
- VERIFY SOURCE/SINK WATER FLOW
- CUSTOMER INTERLOCKS
- LOAD WATER , OR LOAD LIMIT RESET INPUT
- LOAD WATER PUMP OPERATION
- SOURCE/SINK WATER PUMP OPERATION
- FAULT NOTIFICATION
- FULL LOAD RELAY
- CHILLED WATER CONTROLS
- HOT WATER CONTROLS



MASTER CONTROL
Can stage a maximum of 15 modules
(30 compressors)

REMOTE DISPLAY
(optional)

Module Data

MODULE CONTROL PANEL

DATA FROM REFRIGERATION SYSTEM "A"

- HIGH PRESSURE TRANSDUCER
- HIGH PRESSURE SWITCH
- LOW PRESSURE TRANSDUCER
- COMPRESSOR MOTOR PROTECTION
- SUCTION TEMPERATURE
- LEAVING LOAD WATER TEMP
- CIRCUIT FAULT CONDITION
- LEAVING SOURCE/SINK WATER TEMP

DATA FROM REFRIGERATION SYSTEM "B"

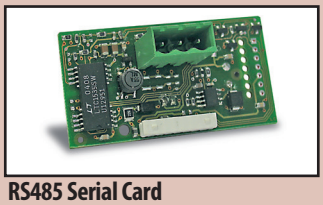
- HIGH PRESSURE TRANSDUCER
- HIGH PRESSURE SWITCH
- LOW PRESSURE TRANSDUCER
- COMPRESSOR MOTOR PROTECTION
- SUCTION TEMPERATURE
- LEAVING LOAD WATER TEMP
- CIRCUIT FAULT CONDITION
- LEAVING SOURCE/SINK WATER TEMP

HIGH VOLTAGE CONTROL PANEL

- CIRCUIT "A" COMPRESSOR CONTACTOR
- CIRCUIT "B" COMPRESSOR CONTACTOR

Building Automation Solutions

Interoperability Portals



RS485 Serial Card

PCO Net RS485 Interface Board

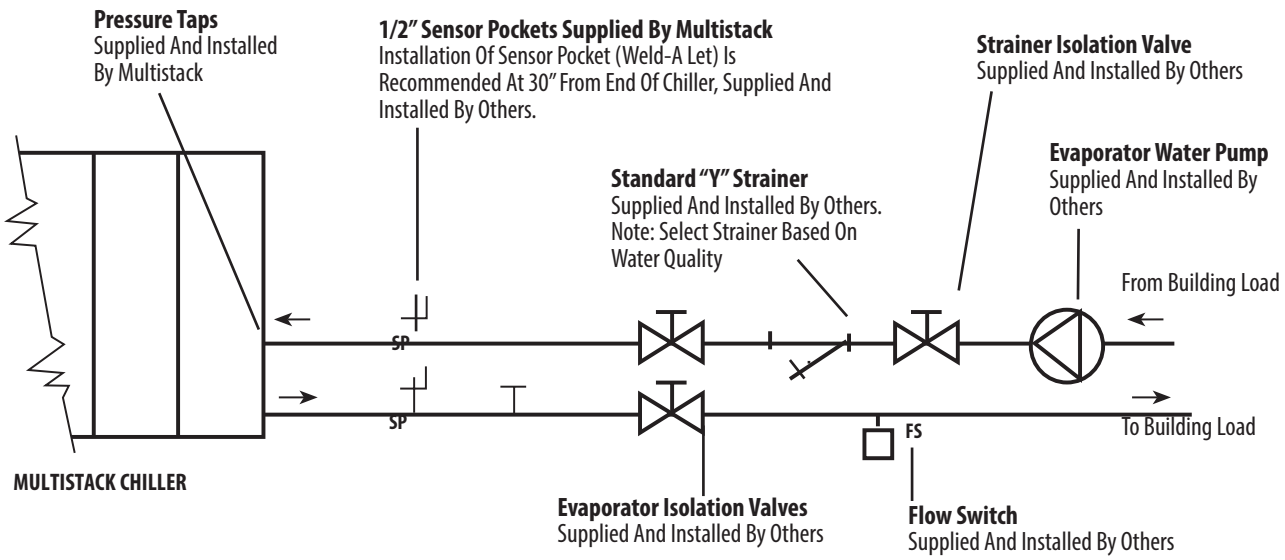
PCO Web Ethernet Interface Board

BACNET™
- MSTP
- ETHERNET
- TCP/IP

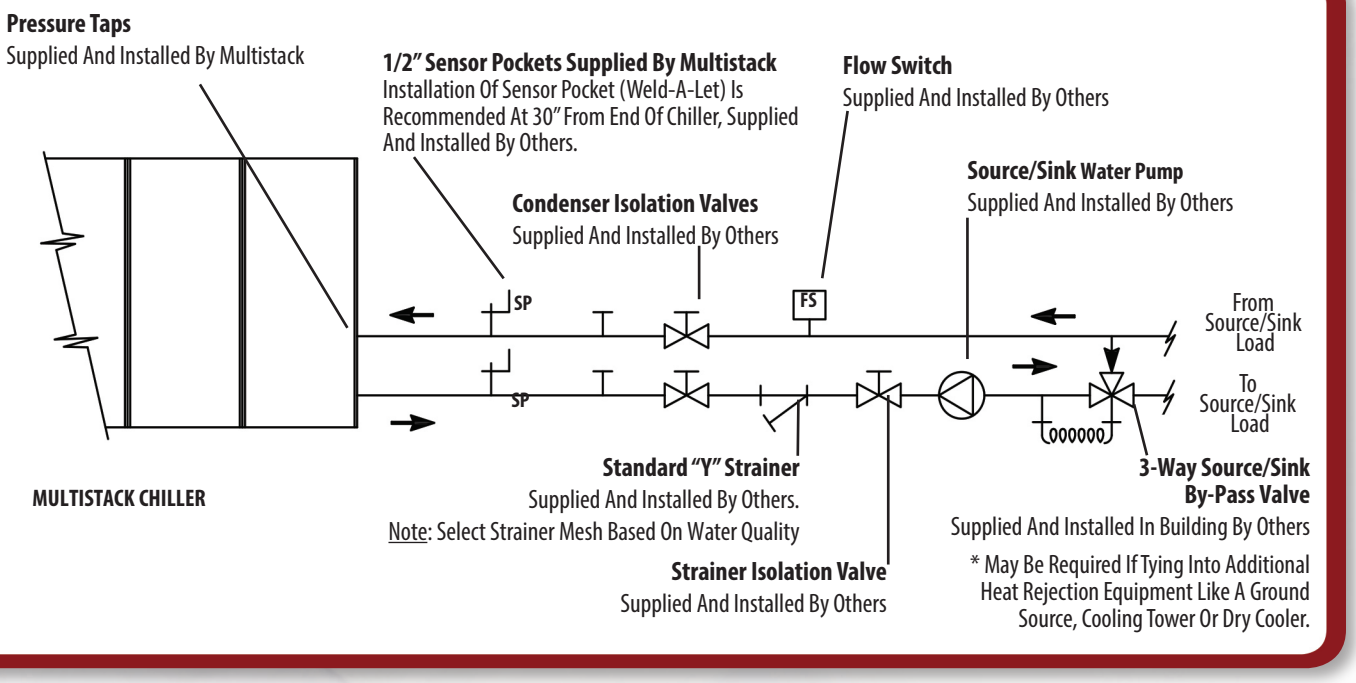
MODBUS™ (RTU)

LONMARK™

Required Load Water Piping



Required Source/Sink Water Piping



PART 2 PRODUCTS

2.01 Operating Conditions

A. Provide water-to-water heat pump with the capacity as scheduled on drawings at job site elevation listed in Section 15050.
B. Heat Pump shall be designed to operate using R-410A or R-134a Refrigerant.
C. Heat Pump shall be designed for parallel evaporator water flow.
D. The liquid to be heated and cooled will be water containing corrosion inhibitors.
E. Heat Pump shall be designed to operate using _____ volt, 3 phase, 60 Hz electrical power supply.

2.02 Water-to-Water Packaged Heat Pump

A. Approved manufacturer is MULTISTACK.
B. System Description: Heat Pump shall incorporate Scroll-type compressors and consist of multiple refrigerant circuits. Each refrigerant circuit shall consist of an individual compressor, condenser, evaporator circuit, thermal expansion valve, reversing valve, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The multi-circuit heat pump must be able to produce chilled water even in the event of a failure of one or more refrigerant circuits. Circuits shall not contain more than 20 lb. of R-410A refrigerant.
C. General
    1. Heat Pump Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236, and bear the ASME UM stamp on all heat exchangers (not applicable for modules with R-410A refrigerant).
    2. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment.
    3. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.
D. Water Mains: Each module shall include supply and return mains for both load and source-sink water. Grooved end connections are provided for interconnection to six inch standard (6.625" outside diameter) piping with grooved type couplings.
E. Heat Exchangers: Each load and source-sink heat exchanger shall be brazed plate heat exchangers constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL code 1995 for 650 psig working pressure on load and source-sink heat exchangers. Heat exchangers shall be mounted below the compressor, to eliminate the effect of migration of refrigerant to the cold evaporator with consequent liquid slugging on start-up.
F. Compressor: Each module shall contain two hermetic scroll compressors independently circuited and with internal spring isolation mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure manual reset safety cut-outs.
G. Central Control System.
    1. Scheduling of the various compressors shall be performed by a microprocessor based control system (Master Controller). A new lead compressor is selected every 24 hours to assure even distribution of compressor run time.
    2. The Master Controller shall monitor and report the following on each refrigeration system:
        a. Discharge Pressure Fault
        b. Suction Pressure Fault
        c. Compressor Winding Temperature
        d. Suction Temperature
        e. Load Leaving Water Temp.
        f. Source-Sink Leaving Water Temp.
    3. The Master Controller shall monitor and report the following system parameters:
        a. Load Water Entering and Leaving Temperature
        b. Source-Sink Water Entering and Leaving Temperature
        c. Load Water and Source-Sink Water Flow
    4. An out of tolerance indication from these controls or sensors shall cause a "fault" indication at the Master Controller and shutdown of that compressor with the transfer of load requirements to the next available compressor. In the case of a System Fault the entire heat pump will be shut down. When a fault occurs, the Master Controller shall record conditions at the time of the fault and store the data for recall. This information shall be capable of being recalled through the keypad of the Master Controller and displayed on the Master Controller's semigraphical display. A history of faults shall be maintained including date and time of day of each fault (up to the last 20 occurrences).
    5. Individual monitoring of leaving water temperatures from each refrigeration system shall be programmed to protect against heat exchanger freeze-up.
    6. The control system shall monitor entering and leaving water temperatures to determine system load and select the number of compressor circuits required to operate. Response times and set points shall be adjustable. The system shall provide for variable time between compressor sequencing and temperature sensing, so as to fine tune the heat pump to different existing building conditions.
    7. Optionally, the Heat pump shall be capable of interfacing with the Building Automation System via an Interoperability Web Portal.
    8. The heat pump mode (heating or cooling) shall be selected by an external dry contact interlock to the Master Controller. If no interlock is present, or in the event of a reversing valve solenoid failure, the system shall revert to heating mode.
H. Heat pump shall have a single point power connection and external inputs and outputs to be compatible with the building management system. Inputs/Outputs include:
    1. Remote Start/Stop
    2. Cooling Alarm
I. Each inlet water header shall incorporate a built in 30-mesh in-line strainer system to prevent heat exchanger fouling.

2.03 SAFETIES, CONTROLS AND OPERATION

A. Heat pump safety controls system shall be provided with the unit (minimum) as follows:
   1. Low refrigerant pressure
   2. Loss of flow through the source/sink heat exchanger
   3. Loss of flow through the load heat exchanger
   4. High refrigerant pressure
   5. High compressor motor temperature
   6. Low suction gas temperature
   7. Low leaving water temperature

B. Failure of heat pump to start or heat pump shutdown due to any of the above safety cutouts shall be enunciated by display of the appropriate diagnostic description at the unit control panel. This annunciation will be in plain English. Alphanumeric codes shall be unacceptable.

C. The heat pump shall be furnished with a Master Controller as an integral portion of the heat pump control circuitry to provide the following functions:
   1. Provide automatic heat pump shutdown during periods when the load level decreases below the normal operating requirements of the heat pump. Upon an increase in load, the heat pump shall automatically restart.
   2. Provisions for connection to automatically enable the heat pump from a remote energy management system.
   3. The control panel shall provide alphanumeric display showing all system parameters in the English language with numeric data in English units.

D. Normal Heat Pump Operation
   1. When heat pump is enabled, the factory supplied Master Controller modulates the heat pump capacity from minimum to maximum as required by building load.
   2. The heat pump control system shall respond to Entering Water Temperature and will have an integral reset based on entering water temperature to provide for efficient operation at part-load conditions.
   3. The operating mode (heating or cooling) shall be determined by a customer provided dry contact interlock.

E. Power Phase Monitor
   1. Provide a Power Phase Monitor on the incoming power supply to the heat pump. This device shall prevent the heat pump from operating during periods when the incoming power is unsuitable for proper operation.
   2. The Power Phase Monitor shall provide protection against the following conditions:
      a. Low Voltage (Brown-Out)
      b. Phase Rotation
      c. Loss of Phase
      d. Phase Imbalance

PART 3 INSTALLATION

3.01 PIPING SYSTEM FLUSHING PROCEDURE

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

B. During the flushing 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove collected residue. The flushing process shall take no less than 6 hours or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturers instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.

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

3.02 Water Treatment Requirements

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

1. pH Greater than 7 and less than 9
2. Total Dissolved Solids (TDS) Less than 1000 ppm
3. Hardness as $CaCO_3$ 30 to 500 ppm
4. Alkalinity as $CaCO_3$ 30 to 500 ppm
5. Chlorides Less than 200 ppm
6. Sulfates Less than 200 ppm

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