

MULTISTACK[®]

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Dedicated Heat Recovery Chiller™ (DHRC)

Product Data Catalog for R410A and R134a Refrigerants

Includes:

MS010XC1-410A	MS085XC1-410A	MS010AN1-134a	MS050AN1-134a
MS015XC1-410A	MS105XC1-410A	MS015AN1-134a	MS070AN1-134a
MS020XC1-410A	MS135XC1-410A	MS020AN1-134a	MS105AN1-134a
MS030XC1-410A	MS145XC1-410A	MS030AN1-134a	MS135AN1-134a
MS050XC1-410A	MS165XC1-410A		
MS070XC1-410A			



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Product Information

Multistack® is the world leader in design and implementation of modular chillers. With more than 20 years of product development experience we have learned how best to capture and control building heat that is typically rejected by a chiller. With that experience, Multistack builds the industry's best, most efficient Dedicated Heat Recovery Chiller.

During the air conditioning and cooling process, heat is generated that is usually discarded to the atmosphere. This practice has existed for as long as there have been heating and cooling systems. There are many negatives associated with disposing of heat as waste. Buildings can use as much as twice the energy to provide cooling and dispose of heat as waste when compared to recovering and using the otherwise wasted heat. Even in mid-summer, most buildings require some heat for proper humidity control, potable hot water and other hot water applications. Heat recovery addresses this waste, improving building efficiency, reducing carbon footprint and significantly reducing energy use and cost.

Currently, USGBC (U.S. Green Building Council) LEED™ (Leadership in Energy Efficient Design) direction is to continuously improve upon established/accepted ASHRAE efficiency guidelines. A Multistack DHRC chiller can help you achieve your efficiency goals.

The heat recovery concept has existed since the early 1970s, but it was not easy to implement early on due to the size of chillers and the very limited hot water temperatures achievable. The very nature of the modular Multistack DHRC chiller transforms the application from difficult to simple because it provides simultaneous control of hot and cold water. Most buildings have a constant heating and cooling requirement. By identifying the maximum and minimum heating and cooling loads it becomes easy to size a DHRC from 10 to 900 tons capacity per array. This allows the DHRC to become an integral part of a building's chiller and boiler systems—especially since the DHRC can produce water at up to 180° F.

When applied to a building system as a supplement, the DHRC can contribute to the cooling process during spring, summer and fall months while supplying building hot water for free. During the winter, by directing the DHRC to focus on the constant cooling load of the building core such as a data center or phone room, the DHRC continues to supply hot water—essentially for free while eliminating the need to consume natural gas or other energy sources.

Any time that a building has a concurrent heating and cooling load, it makes sense to consider the DHRC as a first-stage economizer rather than bringing in cold outside air and exhausting building heat. This application makes even more sense with an array of Multistack chillers that are the primary source of building cooling, allowing all the heat generated during that first stage to be used—for free!

To quantify the dollar savings possible with the DHRC concept, consider the 45-ton DHRC unit installed upstream of the condensing boilers at Evansville State Hospital in Indiana. Designed to satisfy all the VAV reheating and domestic hot water needs—while supplementing the cooling load—the DHRC has had a significant impact on the hospital utility costs by saving as much as \$54,000 per year, depending on natural gas costs. See this and other Multistack case studies at: www.multistack.com.



Product Introduction

Model Number Nomenclature

MS	050	X	C or N	1	H	1	W	0	A	A	C	-410A
												Refrigerant (410A, 134a, 407c)
												Controller Option ⁷
												Condenser ⁶
												Evaporator ⁵
												AHRI Version - if applicable
												Application ⁴
												Module Number (1 - single, 2 - multiple)
												Voltage (see voltage codes)
												Configuration ³
												AHRI Certified (C - certified, N - Not certified)
												Compressor Type ²
												Module Nominal Capacity (10 - 165 tons)
												Series ¹

¹ MS - Multistack (non - reversing valve), MR - Multistack Heat pump (w/ reversing valve)

² A - Copeland Scroll (ZR), B - Bristol, C: Trane Cornerstone, D-Copeland Digital Scroll, H - Hanbell screw, N - none, R - Bitzer Screw, S - Trane Scroll, T - Danfoss Turbocor, Z - Copeland scroll (old elec), X - Copeland Scroll (ZP)

³ 1- Standard, 2- Total access, 3 - Evap extended headers, 4 - Cond extended headers, 5 - Both extended headers, 6-Outdoor, V - others

⁴ A - Air Cooled split, C - Single module temp controller, D - Cond unit, F - Fluid cooler (high temp), H - Heat recovery, R - Heat pump, W - Water cooled

⁵ A - Brazed SS, B - Brazed SMO, C- S&T copper, D - S&T cu-Ni, O - remote by others, R - remote by MS, V - Other

⁶ A - Brazed SS, B - Brazed SMO, C- S&T copper, D - S&T cu-Ni, E - Double wall brazed, O - remote by others, R - remote by MS, V - Other

⁷ F - FlexSys base, G - FlexSys with options, C - Carel, V - Other

Amperage Codes/MOP

A	70
B	80
C	90
D	100
E	110
F	125
G	150
H	175

I	200
J	225
K	250
L	300
M	350
N	400
O	450
P	500

Q	600
R	700
S	800
T	350/500
U	400/500
V	450/500
W	450/600
X	500/600

Voltage Codes

C	575/3/60
E	380 - 415/3/50
F	380/3/60
H	460/3/60
V	OTHER

More reasons why a Multistack DHRC system can be a great addition to almost any building with simultaneous heating and cooling loads:

Typical DHRC Building Applications

- Hotels, motels, resorts
- Recreational facilities
- Schools, university campuses, natatoriums
- Hospitals, nursing facilities
- Process cooling and heating
- Data centers, call centers

Multistack DHRC Applications

- Domestic hot water
- Building heat
- VAV reheat, reheat coils
- Laundry water heating
- Swimming pool heating
- Ice hockey rinks

Multistack DHRC Benefits

- Easy installation for virtually any mechanical room
- COP can exceed 7.0 by leveraging combined chilled and hot water efficiency — more efficient than a gas-fired boiler at 0.95 COP !
- Typical payback less than three years
- High efficiency at low load
- Reduced CO2 emissions
- Qualifies for USGBC LEED points
- ASHRAE 15/B52 compliant without monitoring or ventilation equipment
- Double-wall vented heat exchanger allows for potable water (optional)

DHRC Features

- Independent refrigerant circuits
- No reversing valves
- Auto mode controls
- Dynamic mode control without BAS input

Dependability

- Multiple independent systems for redundancy
- Comprehensive computer operations monitoring
- Automatic diagnostics and fault condition recording
- Rotates lead compressor every 24 hours

Easy to Operate

- Large LCD screen with plain English display
- Simple keypad unit operation and control

Easy to Install

- Compact modules up to 085X size fit standard doors and elevators; larger units fit double doors and freight elevators
- Modules connect easily and quickly
- All refrigerant systems factory charged and run tested

Programmable Logic Controller (PLC)

- Automatic controls for both chilled and hot water
- Manual switch for redundant operation—each module has its own processor allowing operation even if master controller fails
- Display at each module (Remote display optional)
- Optional fail-to-run software
- Optional BAS interface

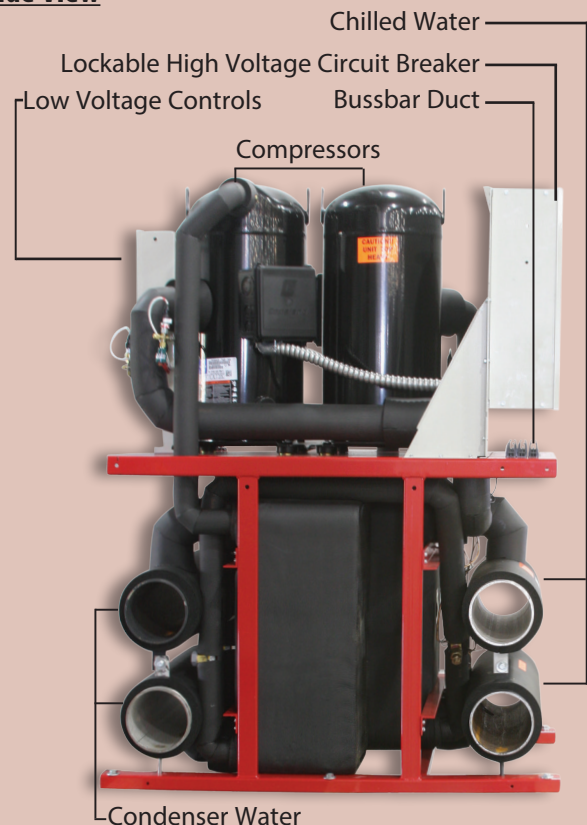
Design Flexibility

- Wide array of module combinations available
- Install only capacity needed when needed
- Variable or constant flow options

Easy Service and Maintenance

- Service can be performed on a convenient, non-emergency basis
- Most parts standard and available off the shelf
- Can service individual modules while system is operating

Side View



General Data

General Data Table MS010X-MS030X				
	MS010XC1-410A/ MS010AN1-134a	MS015XC1-410A/ MS015AN1-134a	MS020XC1-410A/ MS020AN1-134a	MS030XC1-410A/ MS030AN1-134a
Compressor Type	Scroll	Scroll	Scroll	Scroll
Dry Weight (lbs.)	89	135	135	146
Normal Capacity (tons)	5	8.5	10	15
Quantity	2	2	2	2
Oil Charge (pints per compressor)	3.5	6.9	6.9	6.9
Evaporator	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	45.8	63.7	63.7	81.6
Water Storage (gallons)	0.9	1.57	1.57	2.24
Circuit Configuration	Dual	Dual	Dual	Dual
Quantity	1	1	1	1
Header System (gallons)	7	7	7	7
Condenser	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	48.2	77.5	77.5	97.9
Water Storage (gallons)	1.05	2.17	2.17	2.92
Circuit Configuration	Dual	Dual	Dual	Dual
Quantity	1	1	1	1
Header System (gallons)	7	7	7	7
Refrigerant Type	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a
Charge (lbs./circuit)	6.5	6.5	8	12
Number of Circuits	2	2	2	2
Operating Weight (lbs.)	1110	1200	1200	1625
Shipping Weight (lbs.)	950	1040	1040	1450

General Data Table MS050X-MS085X			
	MS050XC1-410A/ MS050AN1-134a	MS070XC1-410A/ MS070AN1-134a	MS085XC1-410A
Compressor Type	Scroll	Scroll	Scroll
Dry Weight (lbs.)	353	390	441
Normal Capacity (tons)	25	32	40
Quantity	2	2	2
Oil Charge (pints per compressor)	14.4	13.3	13.3
Evaporator	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	180	243	292
Water Storage (gallons)	4.8	7.3	10.0
Circuit Configuration	Dual	Dual	Dual
Quantity	1	1	1
Header System (gallons)	7	7	14
Condenser	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	220	313	340
Water Storage (gallons)	6.6	10.1	12.3
Circuit Configuration	Dual	Dual	Dual
Quantity	1	1	1
Header System (gallons)	7	7	14
Refrigerant Type	R410A/R134a	R410A/R134a	R410A
Charge (lbs./circuit)	18	24	28
Number of Circuits	2	2	2
Operating Weight (lbs.)	2000	2200	2550
Shipping Weight (lbs.)	1730	1900	2100

General Data, Cont'd

General Data Table MS105X-MS165X, Quad Scroll Modules				
	MS105XC1-410A/ MS105AN1-134a	MS135XC1-410A/ MS135AN1-134a	MS145XC1-410A	MS165XC1-410A
Compressor Type	Scroll	Scroll	Scroll	Scroll
Dry Weight (lbs.)	353	390	441	441
Normal Capacity (tons)	105	135	40	40
Quantity	4	4	4	4
Oil Charge (pints per compressor)	14.4	13.3	13.3	13.3
Evaporator	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	332	403	534	534
Water Storage (gallons)	11.0	13.7	18.6	18.6
Circuit Configuration	Dual	Dual	Dual	Dual
Quantity	1	1	1	1
Header System (gallons)	50	50	50	50
Condenser	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs.)	403	435	534	534
Water Storage (gallons)	13.7	16.8	18.6	18.6
Circuit Configuration	Dual	Dual	Dual	Dual
Quantity	1	1	1	1
Header System (gallons)	50	50	50	50
Refrigerant Type	R410A/R134a	R410A/R134a	R410A	R410A
Charge (lbs./circuit)	40	45	50	51
Number of Circuits	2	2	2	2
Operating Weight (lbs.)	6000	6300	6600	6800
Shipping Weight (lbs.)	5200	5500	5800	6000

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.

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

*Note: 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.

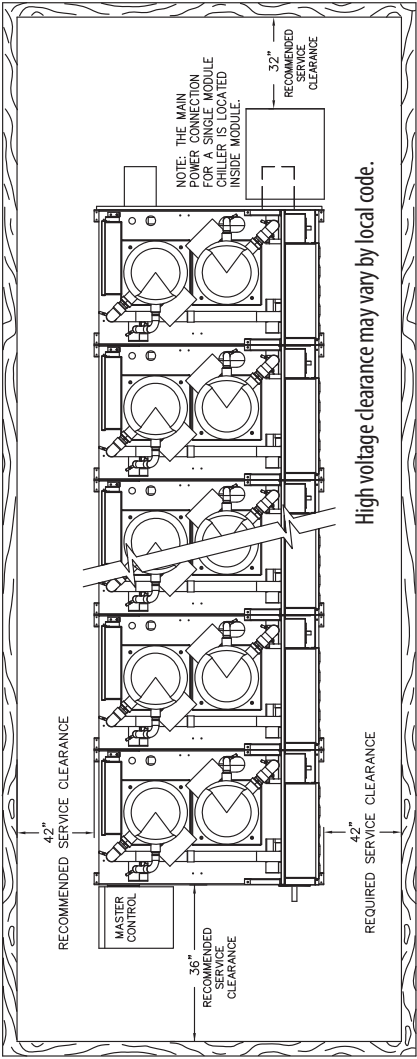
Ethylene Glycol						
Ethylene %	Freeze Point		Capacity	Power	Flow	Pressure Drop
	°F	°C				
10	26	-3.3	0.996	0.999	1.035	1.096
20	18	-7.8	0.986	0.998	1.06	1.219
30	7	-13.9	0.978	0.996	1.092	1.352
40	-7	-21.7	0.966	0.993	1.131	1.53
50	-28	-33.3	0.955	0.991	1.182	1.751

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

Standard Modules (Constant Flow Design)

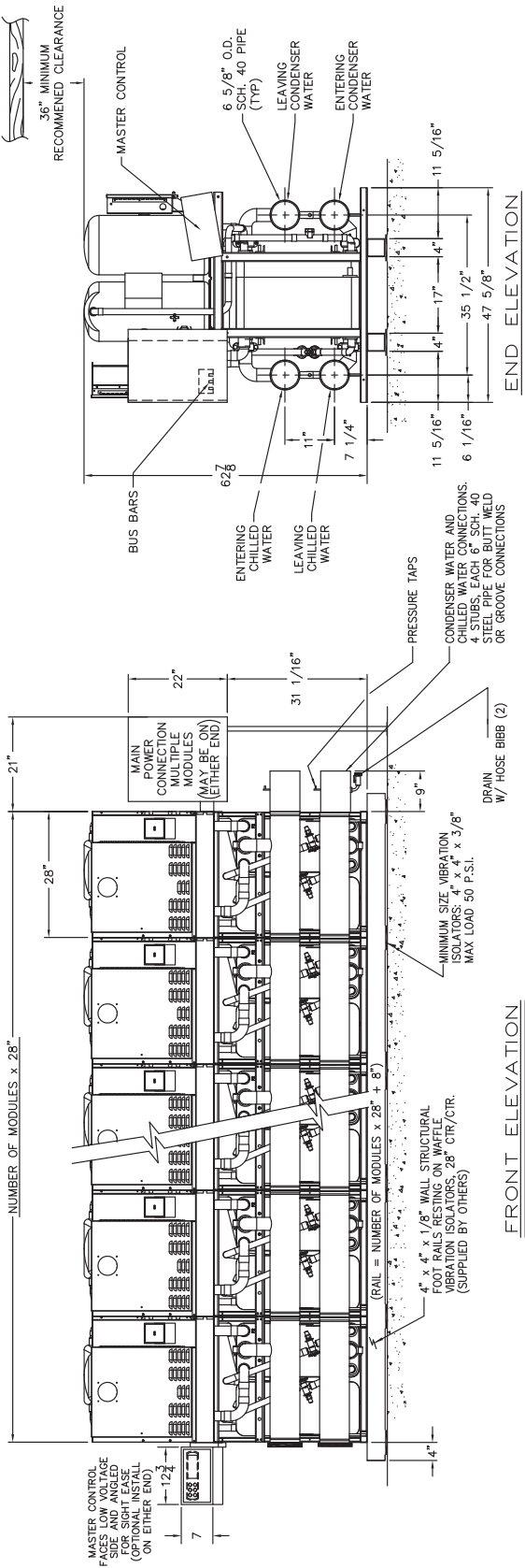
*Standardized drawing of sample customer installation
**Panels are optional

PLAN VIEW



Dimensions (No Panels)

	Width (A)	Depth (B)	Height (C)
Standard	28"	47 3/8"	64"
Total Access (MS010--050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/8"	64"
Extended Headers (2)	28"	76 5/8"	64"

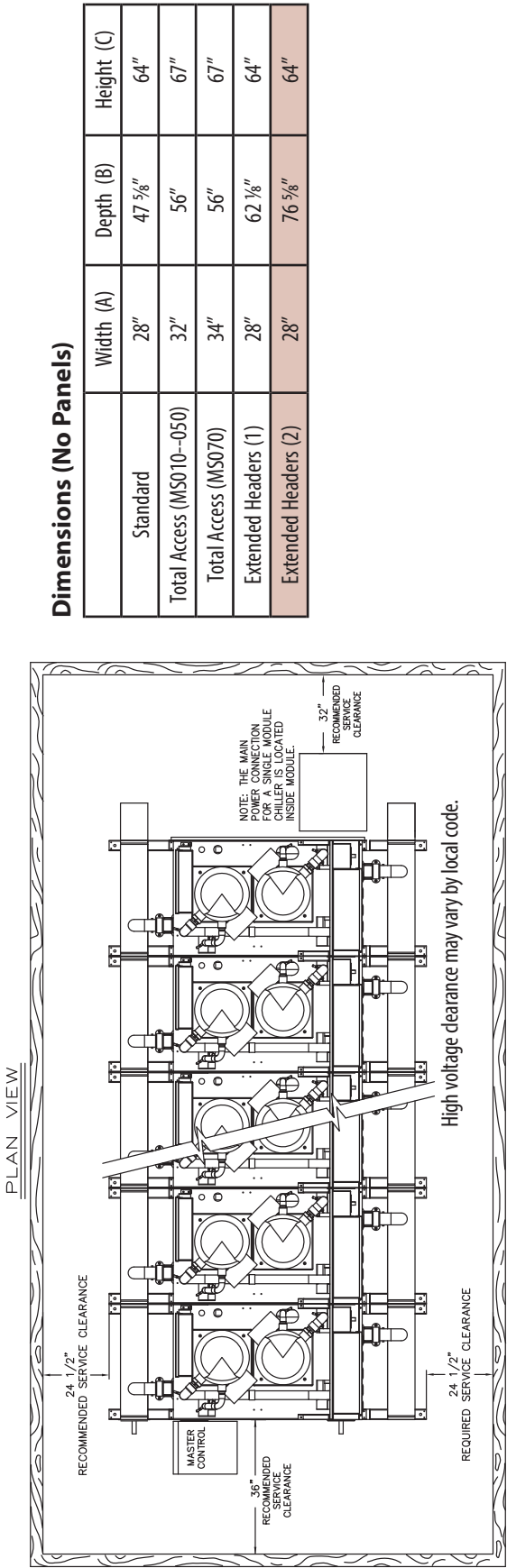


FRONT ELEVATION

END ELEVATION

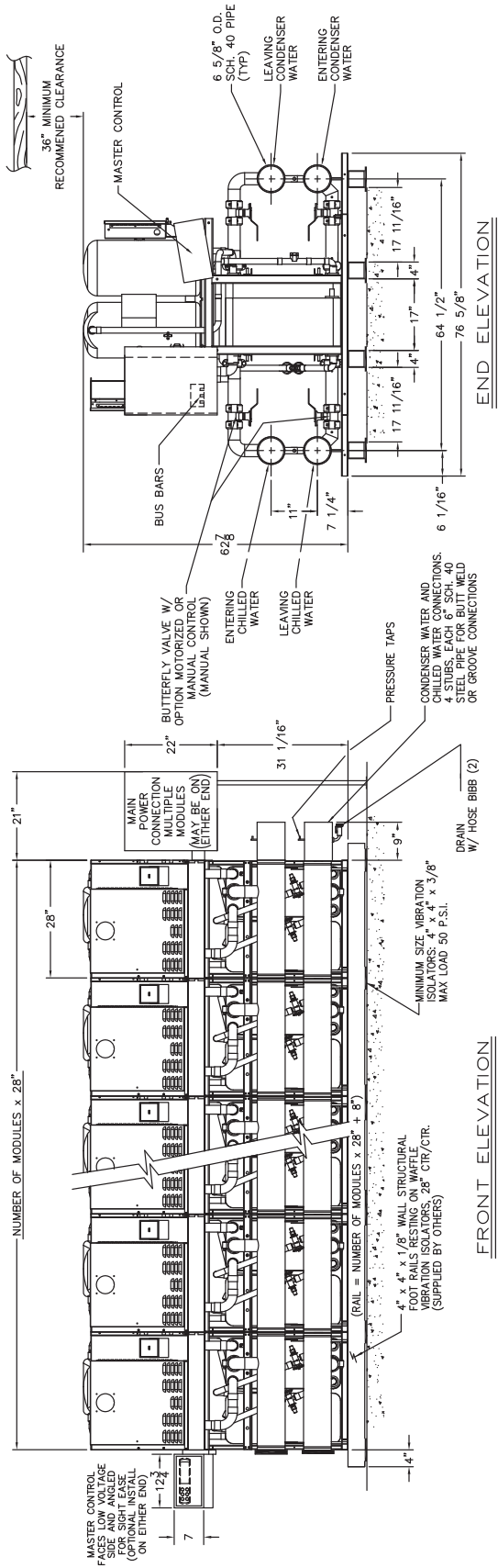
Variable Flow Design for Chilled and Hot Water-
Extended Headers on Evaporators and Condensers

*Standardized drawing of sample customer installation
**Panels are optional



Dimensions (No Panels)

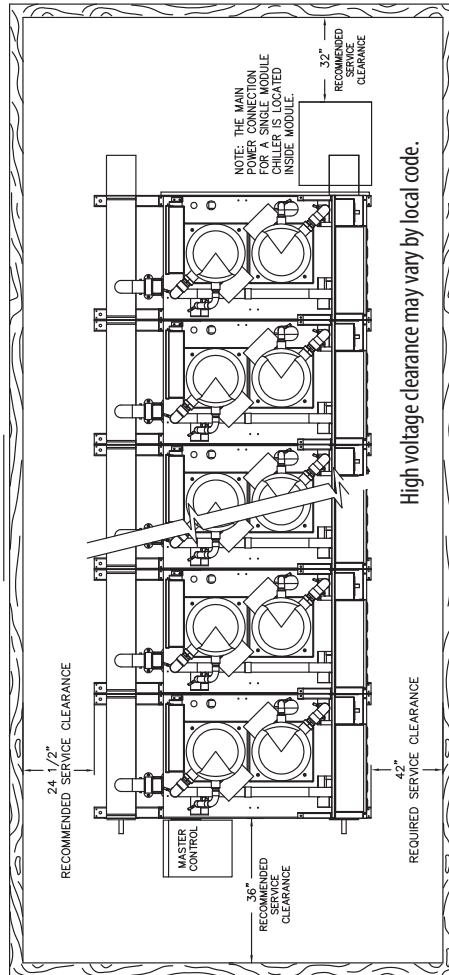
	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010--050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/8"	64"
Extended Headers (2)	28"	76 5/8"	64"



Variable Flow Design for Hot Water, Constant Flow for Chilled Water Extended Headers on Condensers

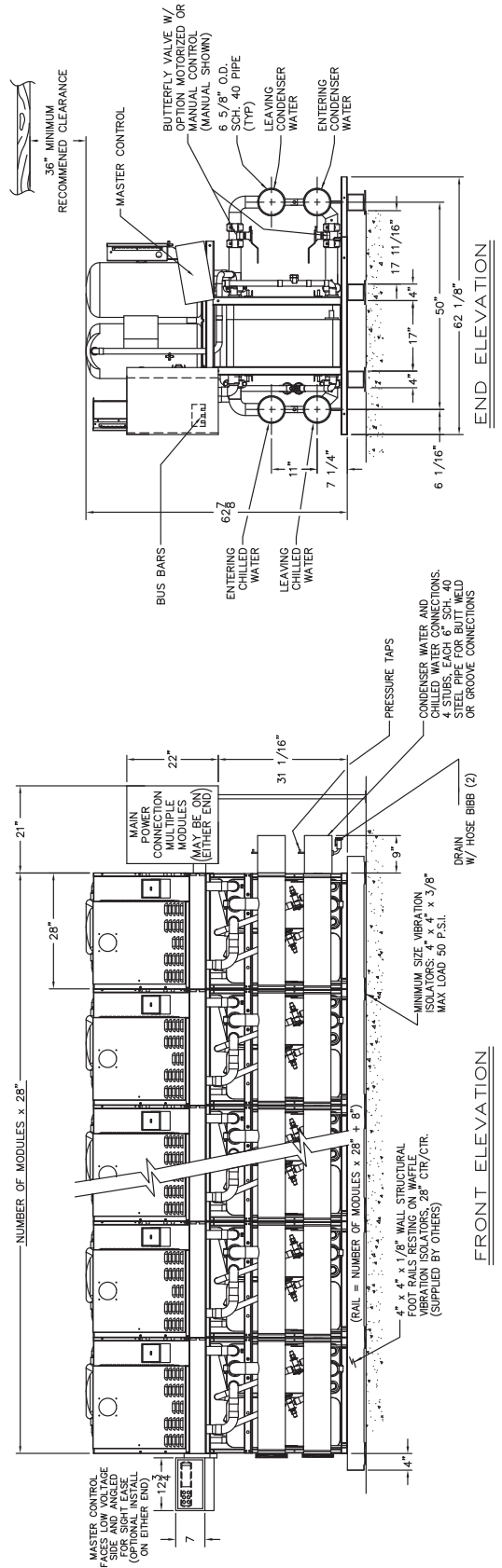
*Standardized drawing of sample customer installation
**Panels are optional

PLAN VIEW



Dimensions (No Panels)

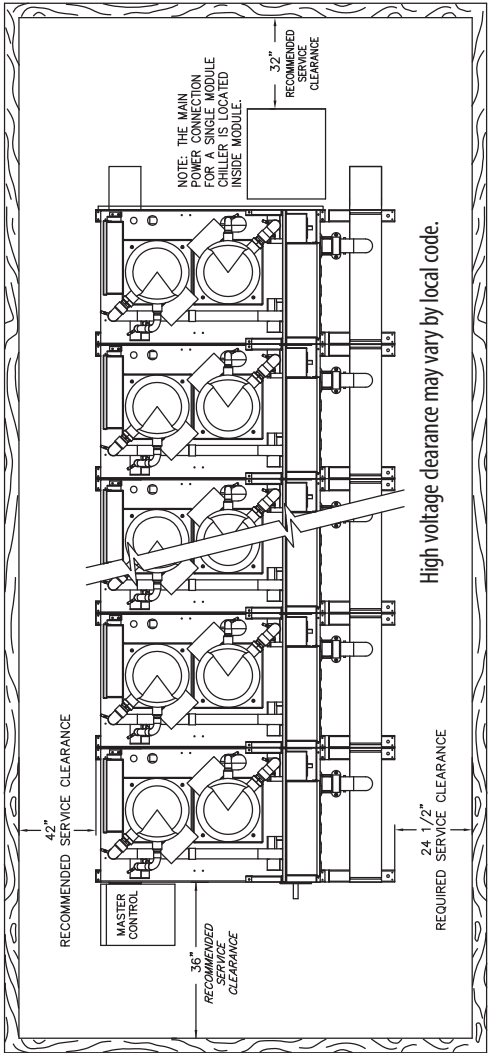
	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010--050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/2"	64"
Extended Headers (2)	28"	76 5/8"	64"



Variable Flow Design for Chilled Water, Constant Flow for Condenser Water
Extended Headers on Evaporators

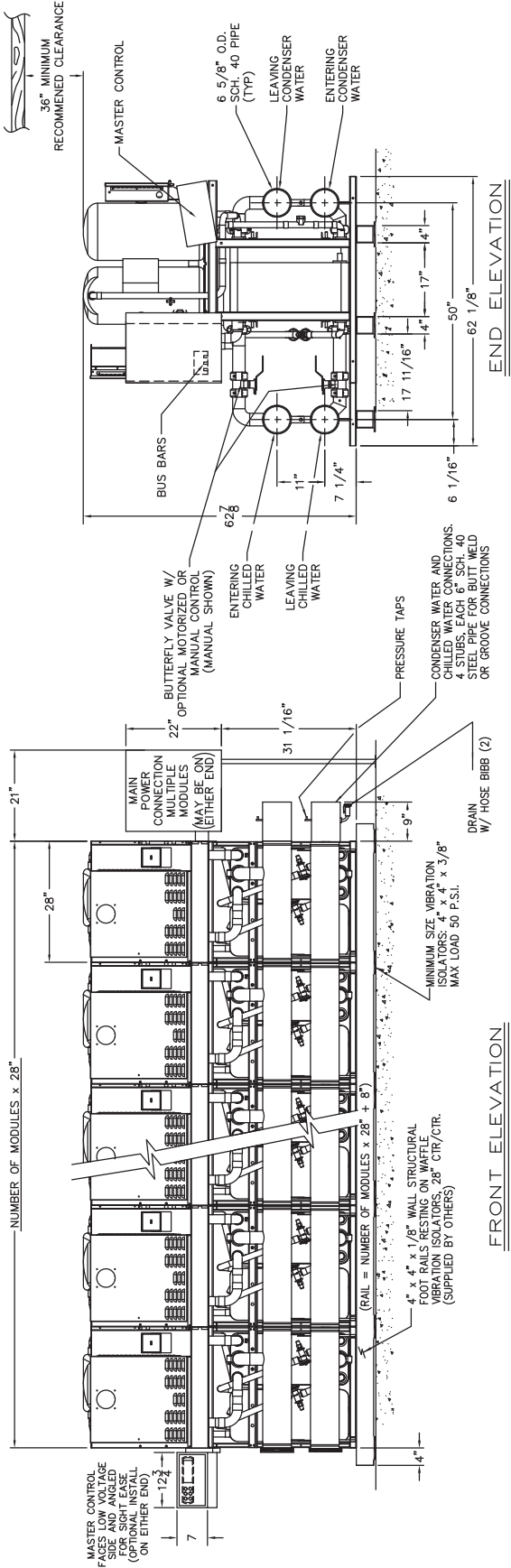
*Standardized drawing of sample customer installation
**Panels are optional

PLAN VIEW



Dimensions (No Panels)

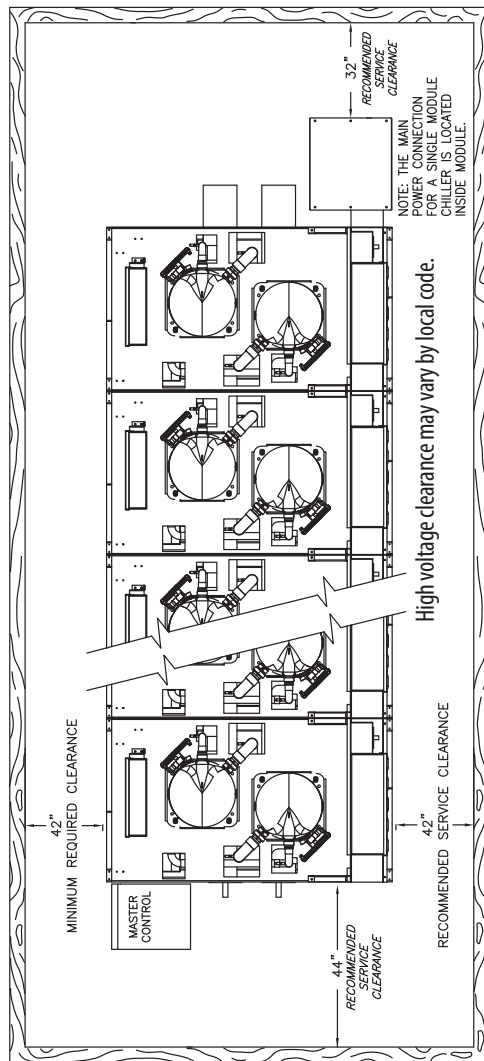
	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010--050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/8"	64"
Extended Headers (2)	28"	76 5/8"	64"



Total Access Design with or without Variable Flow

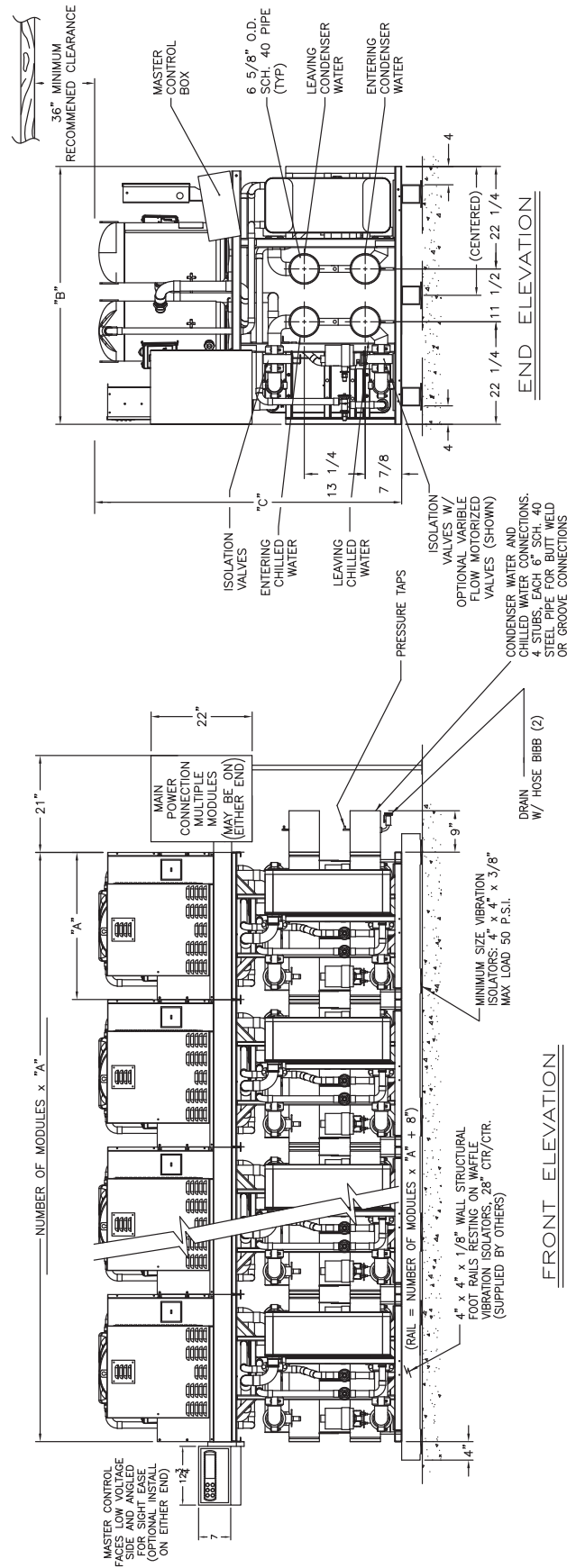
*Standardized drawing of sample customer installation
 **Panels are optional

PLAN VIEW



Dimensions (No Panels)

	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010-050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/8"	64"
Extended Headers (2)	28"	76 5/8"	64"



*Standardized drawing of sample customer installation

****Panels are optional**



*Standardized drawing of sample customer installation

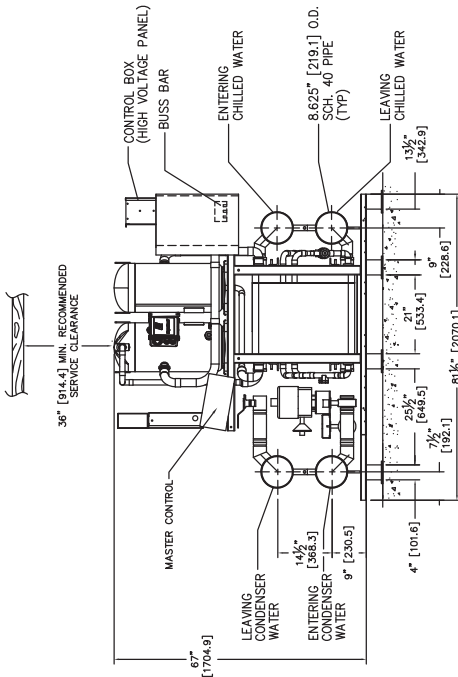
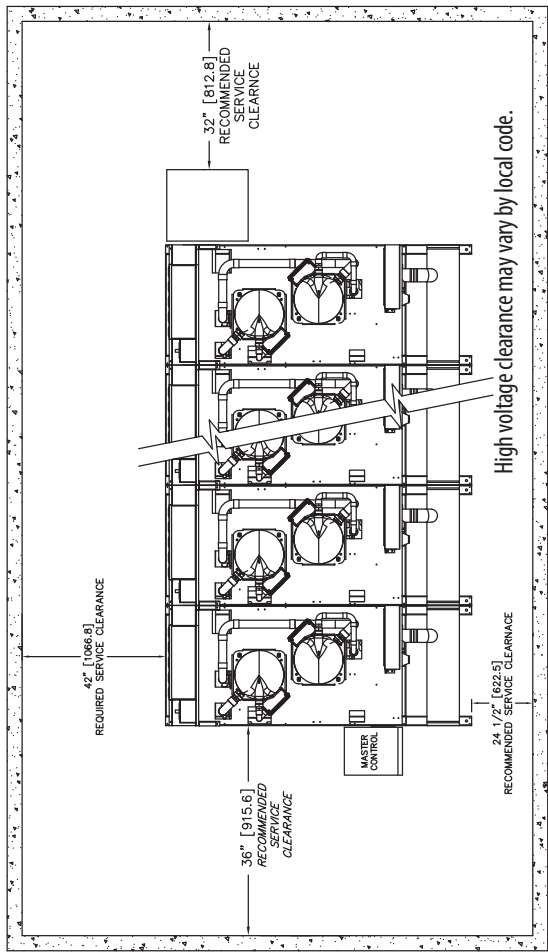
PLAN VIEW



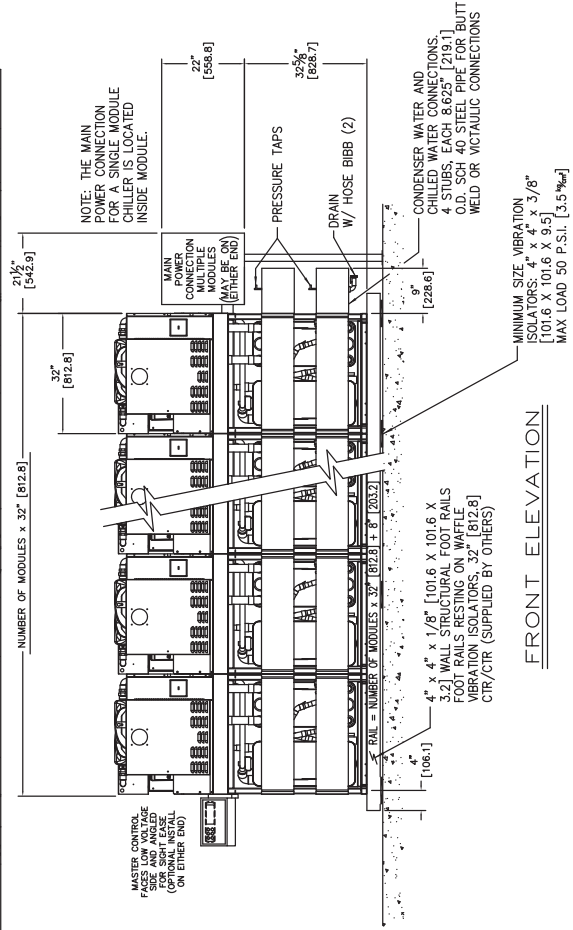
Variable Flow Design for Hot Water, Constant Flow for Chilled Water
Extended Headers on Condensers

*Standardized drawing of sample customer installation
**Panels are optional

PLAN VIEW



END ELEVATION

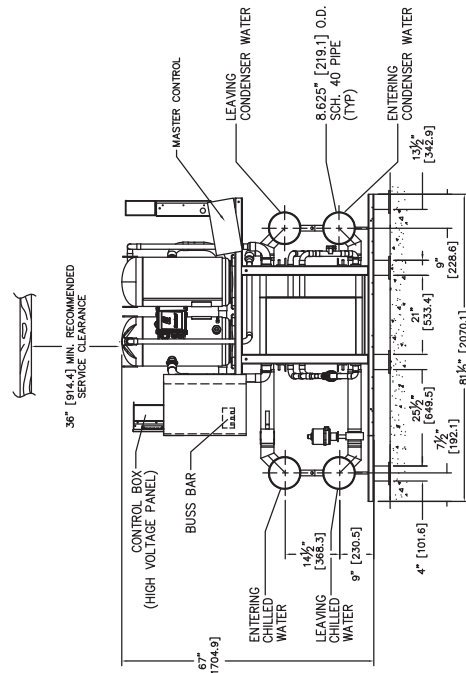
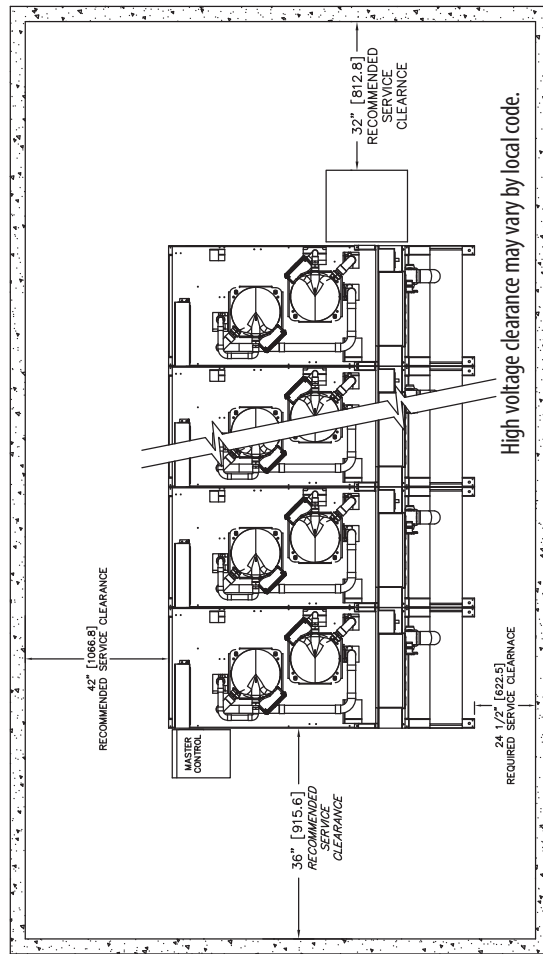


FRONT ELEVATION

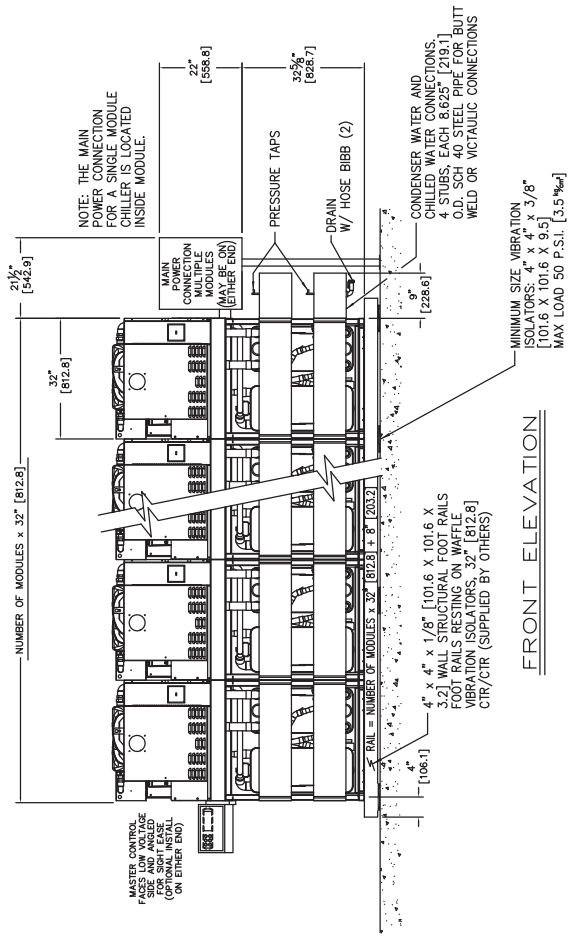
Variable Flow Design for Chilled Water, Constant Flow for Condenser Water Extended Headers on Evaporators

*Standardized drawing of sample customer installation
**Panels are optional

PLAN VIEW

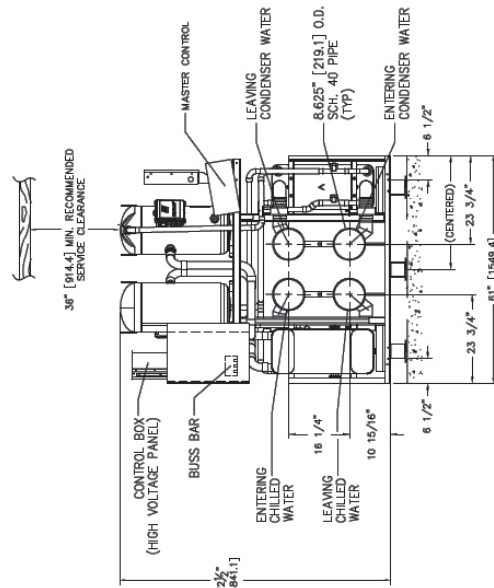


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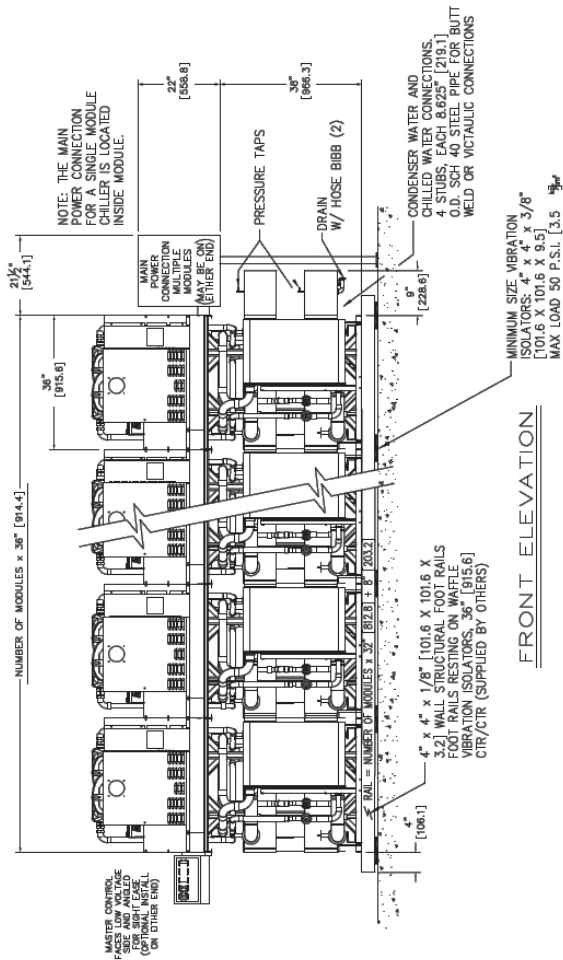
FRONT ELEVATION

*Standardized drawing of sample customer installation
**Panels are optional



END ELEVATION

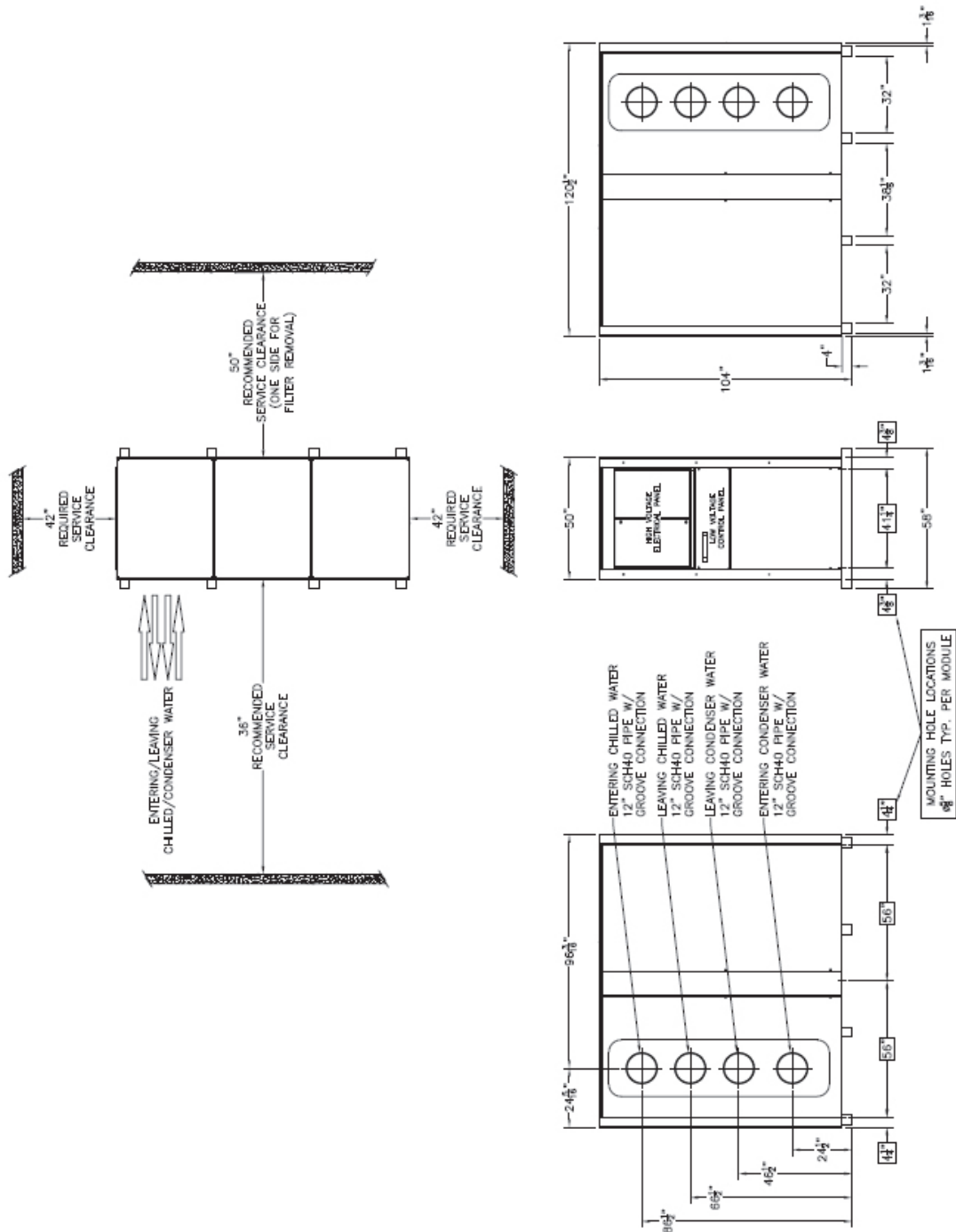
High voltage clearance may vary by local code.



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Quad Scroll Design with or without Variable Flow - Single Module

*Standardized drawing of sample customer installation
**Panels are optional

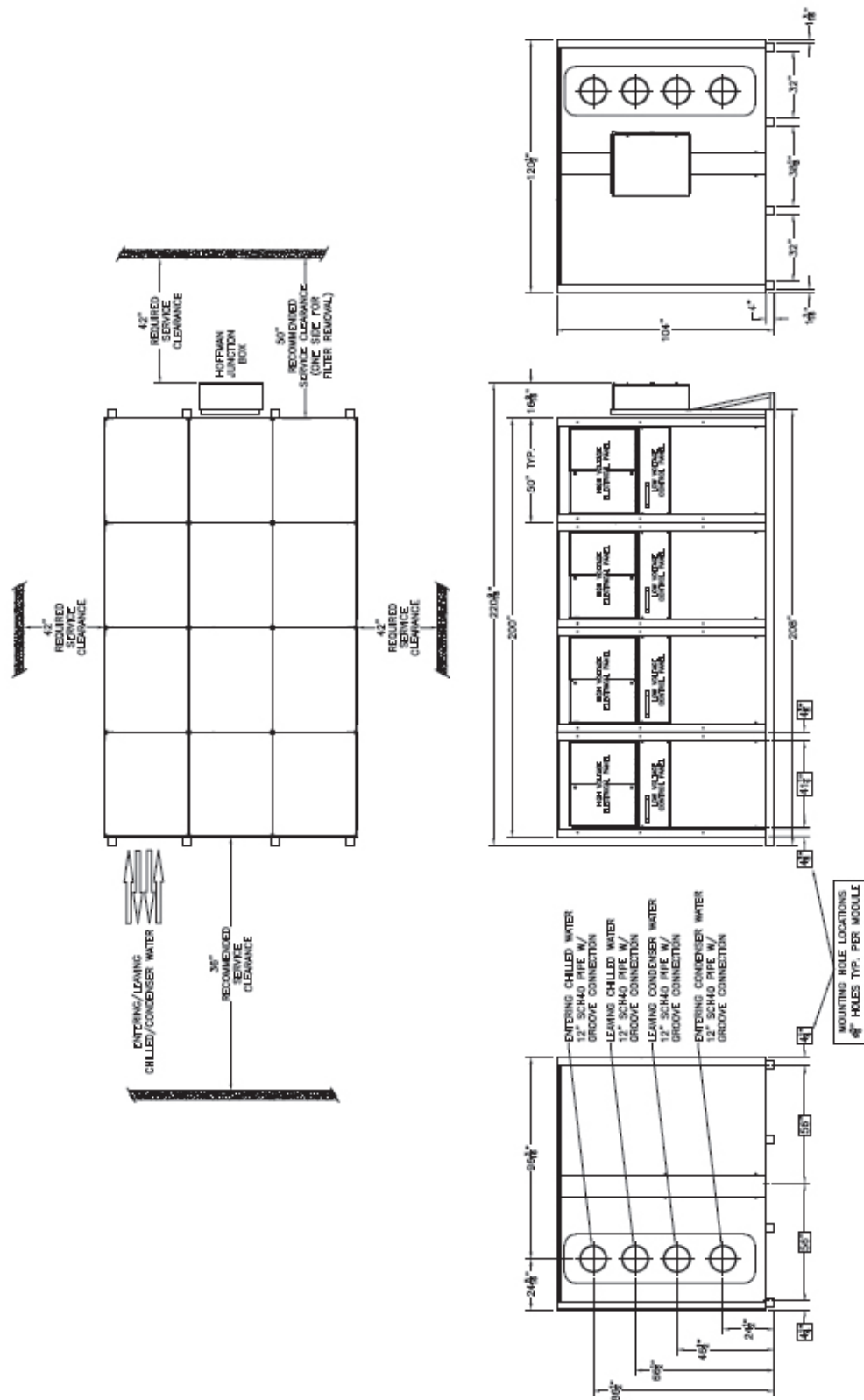


High voltage clearance may vary by local code.

Quad Scroll Design with or without Variable Flow - Multiple Modules

*Standardized drawing of sample customer installation

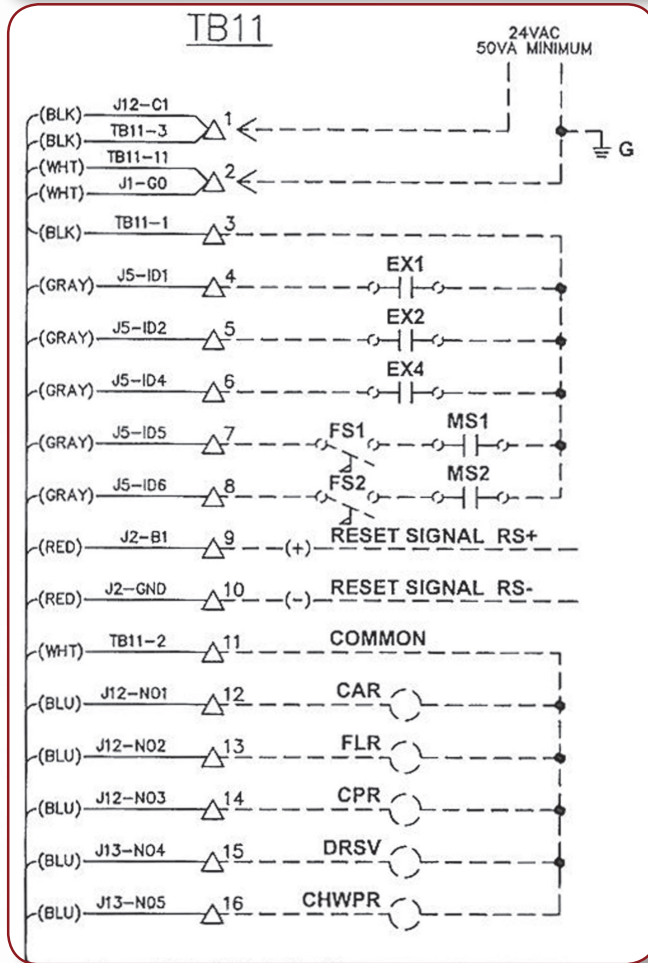
****Panels are optional**



High voltage clearance may vary by local code.

Electrical Data

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)
 - EX4 - AUTO RESET (POWER PHASE MONITOR INPUT)
 - FS1 - FLOW SWITCH (CHILLED WATER)
 - FS2 - FLOW SWITCH (CONDENSER WATER)
 - MS1 - AUX. INTERLOCK (CHILLED WATER PUMP STARTER)
 - MS2 - AUX. INTERLOCK (CONDENSER 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.)
 - CHWPR - CHILLED WATER PUMP RELAY (24VAC, 5VA MAX.)
 - CPR - CONDENSER PUMP RELAY (24VAC, 5VA MAX.)

System Wire & Maximum Overcurrent Protection (MOP) Sizing Specifications

(Applicable codes may require different wire sizing)

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

R-410A		Voltage			
Model	# Comp.	208	230	460	575
MS010XC	2	22.8/123	20.6/123	10.3/62	8.4/50
MS015XC	2	36.5/225	33/225	16.5/114	13/80
MS020XC	2	44/239	40/239	20/125	16/80
MS030XC	2	68/340	61/340	31/173	25/132
MS050XC	2	101/605	91/605	46/272	37/215
MS070XC	2	133/599	120/599	60/310	48/239
MS085XC	2	—	—	75/368	61.3/375
MS105XC	4	101/605	91/605	46/272	37/215
MS135XC	4	133/599	120/599	60/310	48/239
MS145XC	4	—	—	60/310	48/239
MS145XC	4	—	—	75/368	61.3/375
MS165XC	4	—	—	75/368	61.3/375

R-134a		Voltage			
Model	# Comp.	208	230	460	575
MS010AN1	2	23.5/128	21/128	10.2/63	8.2/49
MS015AN1	2	38.7/225	35/225	17.5/114	14/80
MS020AN1	2	44/239	40/239	20/125	16/80
MS030AN1	2	61/300	55/300	27/150	22/109
MS050AN1	2	100/500	90/500	46/250	37/198
MS070AN1	2	127/599	114/599	58/310	47/239
MS105AN1	4	100/500	90/500	46/250	37/198
MS135AN1	4	127/599	114/599	58/310	47/239

NOTES:

- RLA1 = RLA of the largest compressor in the system.
- RLA2 & RLA3 = RLA of the other compressors in the system.
- Wire sizing is based on the Nat. Electr. Code (NEC) rating for 75°C copper wire, with 3 wires per conduit.
- Wiring Distance from branch circuit shall not exceed 100ft.

Electrical Data, Cont'd**2. Wiring Sizing: Minimum Circuit Ampacity (MCA) = (1.25 x RLA1*) + RLA2 + RLA3**Bussbar Applications

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	—

MCA	3 CONDUCTORS 1 CONDUIT	6 CONDUCTORS 2 CONDUIT
285	300 MCM	1/0
300	—	1/0
350	—	2/0
400	—	3/0
460	—	4/0
500	—	250 MCM

Junction Box Applications

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	—

MCA	3 CONDUCTORS 1 CONDUIT	6 CONDUCTORS 2 CONDUIT
285	300 MCM	1/0
310	—	2/0
335	—	3/0
380	—	4/0
460	—	4/0
510	—	250 MCM
570	—	300 MCM
620	—	350 MCM
670	—	400 MCM
760	—	500 MCM
800	—	600 MCM

3. Fuse Sizing: Maximum Overcurrent Protection (MOP), Type RK5 Fuse

$$\text{MOP} = (2.25 \times \text{RLA1}^*) + \text{RLA2} + \text{RLA3}$$

Where the MOP does not equal a standard breaker size, the next larger size should be used. Use Type RK5 Fuse or HACR rated time delayed circuit breaker.

Controller Schematic

Chiller Data

ENT. CHILLED WATER TEMP.	CHILLED WATER PUMP OPERATION
LVG. CHILLED WATER TEMP	HOT WATER PUMP OPERATION
VERIFY CHILLED WATER FLOW	FAULT NOTIFICATION
ENT. HOT WATER TEMP	FULL LOAD RELAY
LVG. HOT WATER TEMP	CHILLED WATER CONTROLS
VERIFY HOT WATER FLOW	HOT WATER CONTROLS
CUSTOMER INTERLOCKS	AUTO CONTROLS FOR SIMULTANEOUS HOT AND CHILLED WATER
CHILLED WATER, HOT WATER OR LOAD LIMIT RESET INPUT	



MASTER CONTROL

Can stage a maximum of:
15 modules, 30 compressors;
or 8 modules, 32 compressors (Quad Modules)



REMOTE DISPLAY
(optional)

Module Data

DATA FROM REFRIGERATION SYSTEM "A"

HP TRANSDUCER
HIGH PRESSURE SWITCH
LP TRANSDUCER
COMP. MOTOR PROTECTION
SUCTION TEMPERATURE
LVG. CHILLED WATER TEMP
CIRCUIT FAULT CONDITION

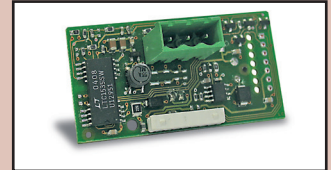
DATA FROM REFRIGERATION SYSTEM "B"

HP TRANSDUCER
HIGH PRESSURE SWITCH
LP TRANSDUCER
COMP. MOTOR PROTECTION
SUCTION TEMPERATURE
LVG. CHILLED WATER TEMP
CIRCUIT FAULT CONDITION

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

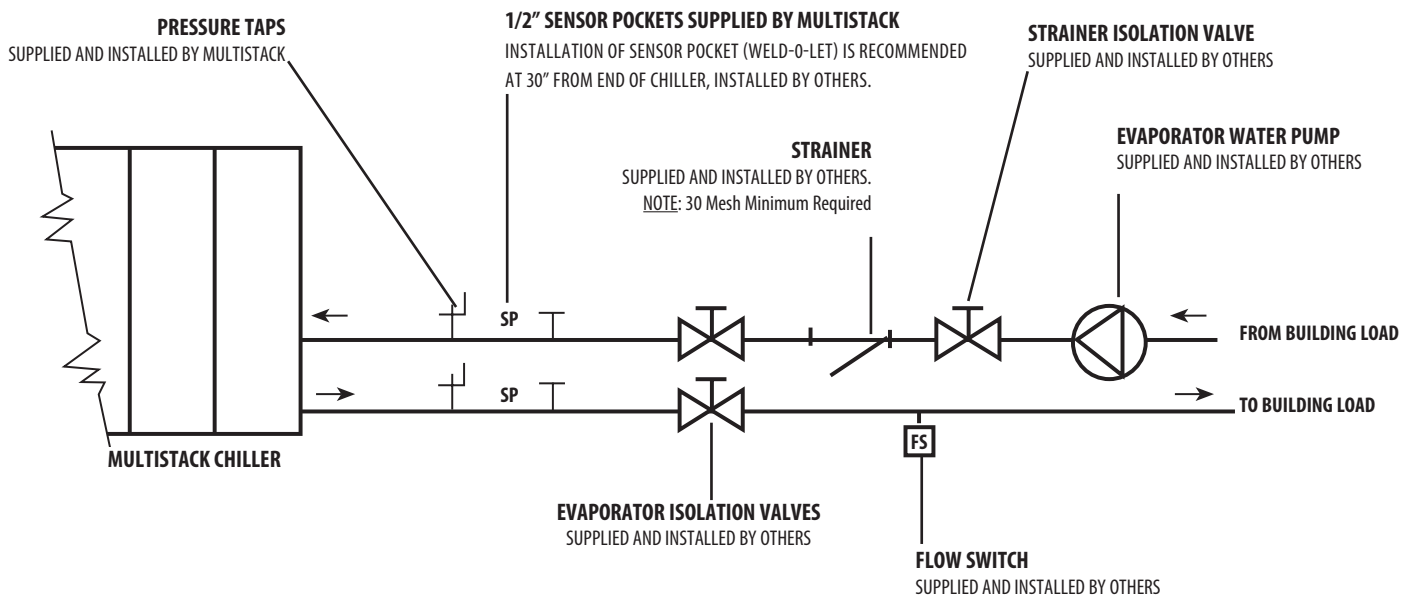
MODBUS™ (RTU)

LONMARK™

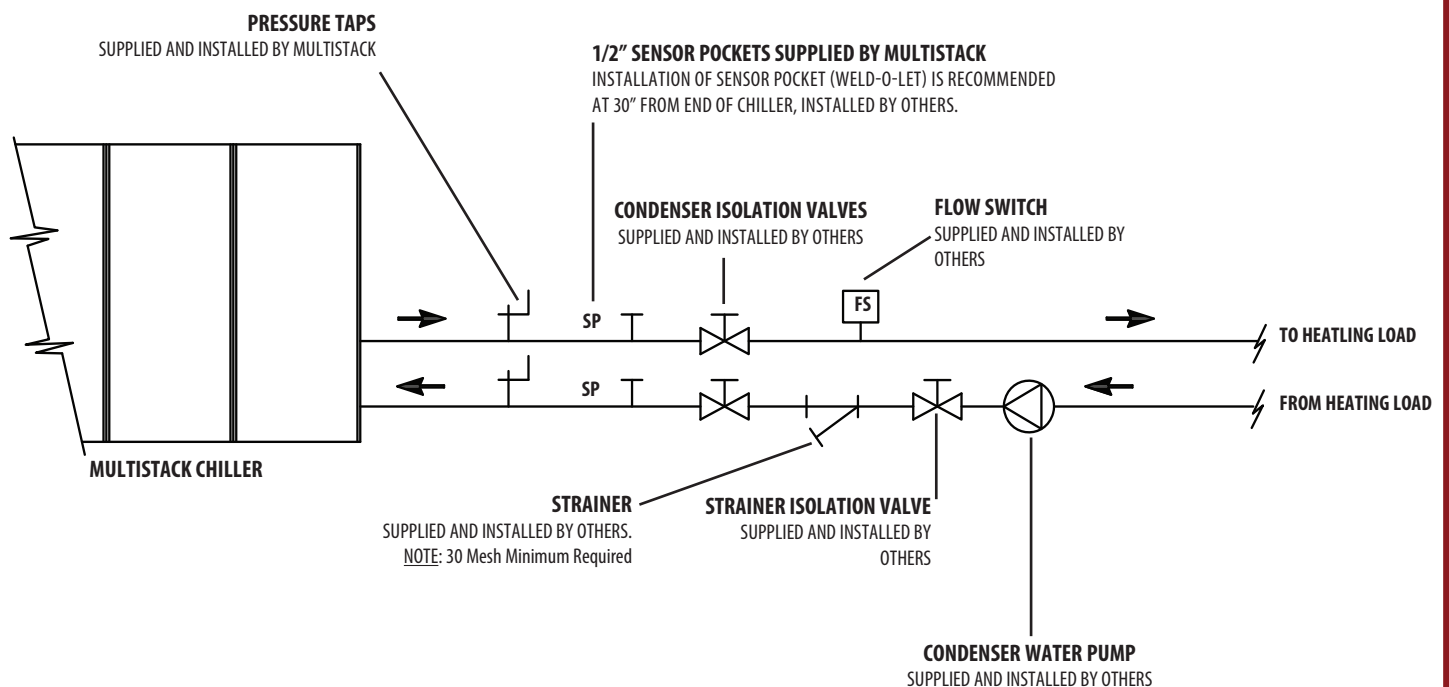
**The controller in this picture does not apply to Quad Scroll Modules.*

Required Piping Configurations

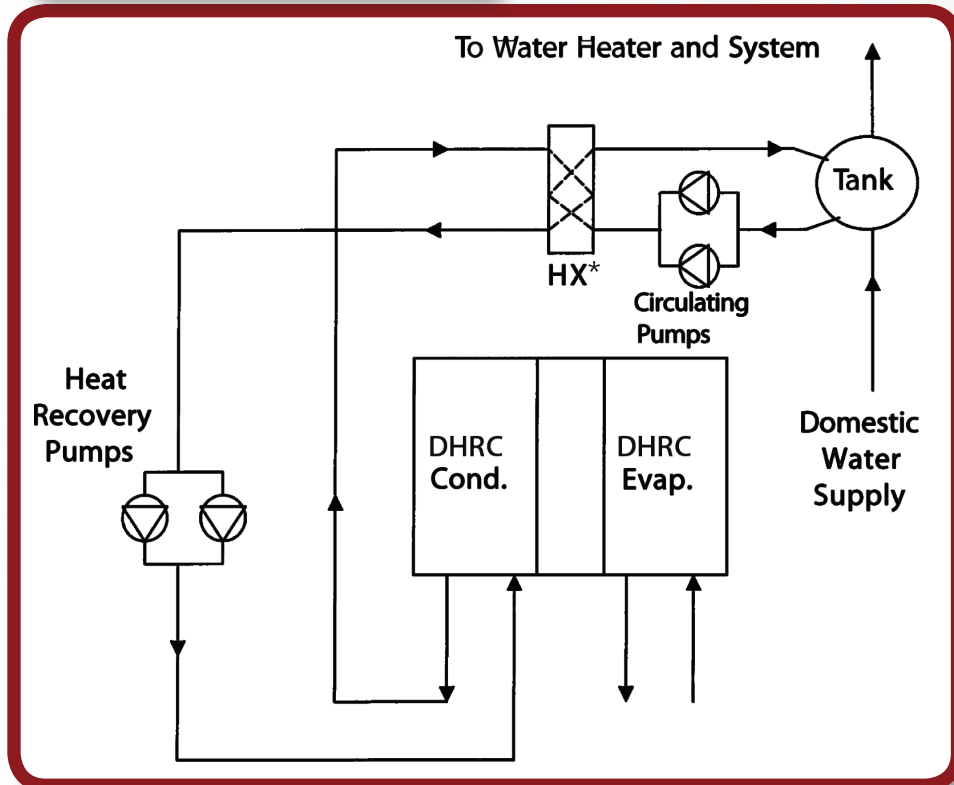
Required Chilled Water Piping (Evaporator)



Required Hot Water Piping (Condenser)



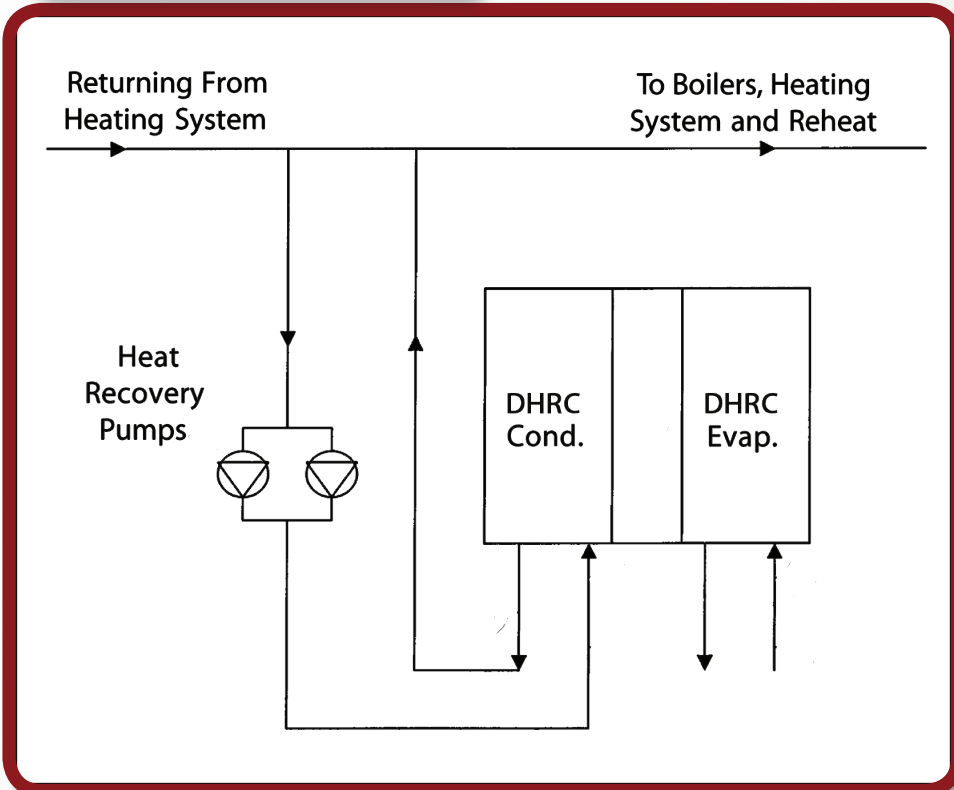
Domestic Water Heating



If using double wall heat exchangers, intermediate heat exchanger is not required.

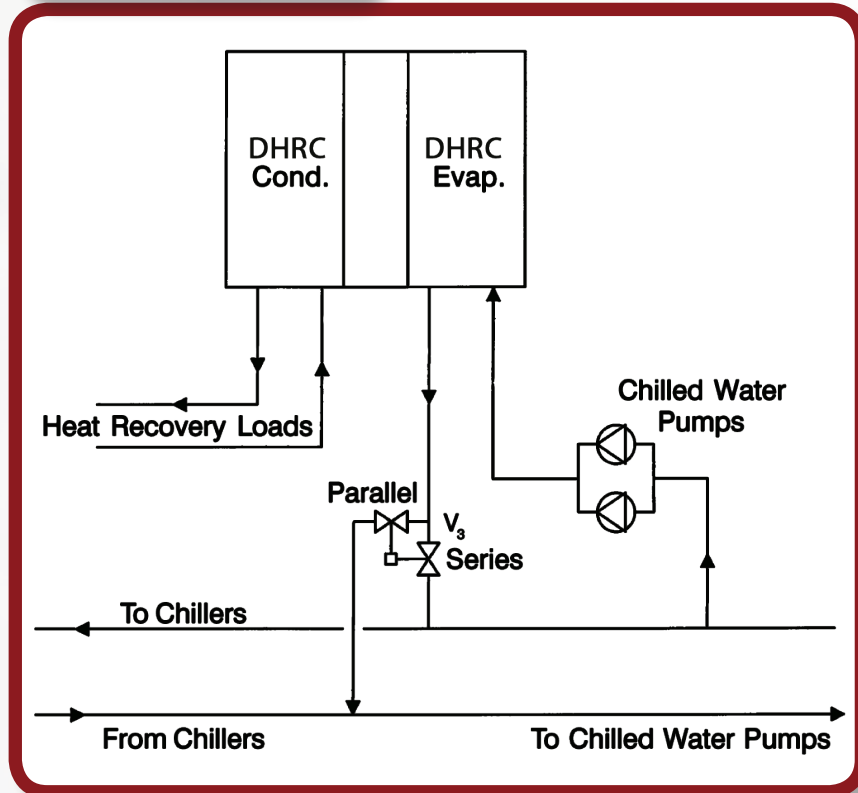
*HX=Intermediate heat exchanger.

Space Hot Water Heating

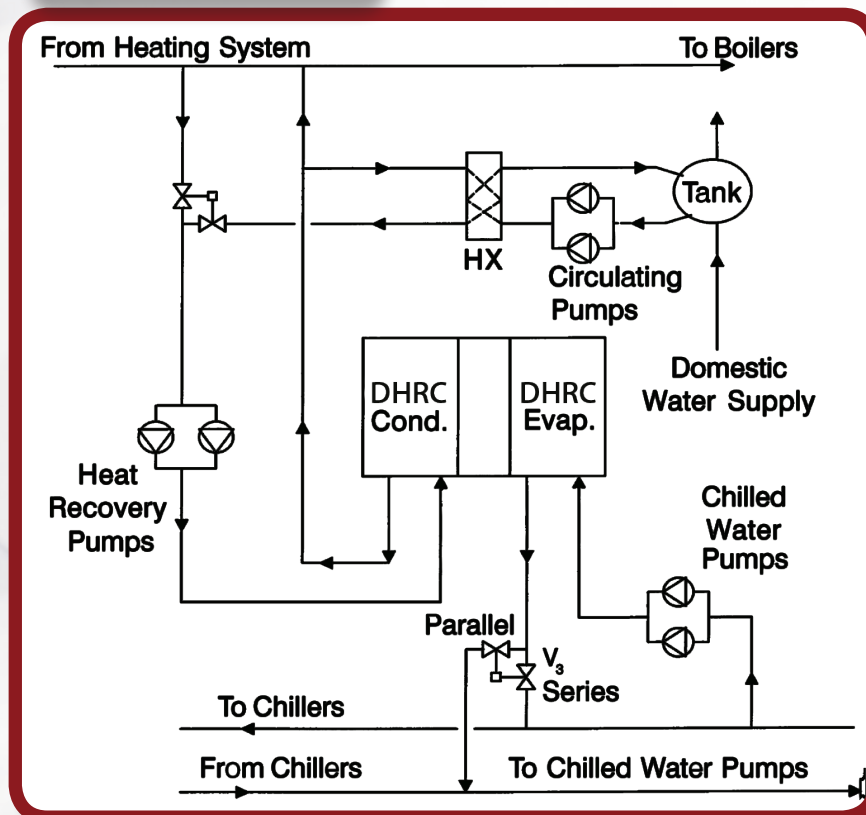


Suggested Piping Configurations

Chiller Cooling Load



Combination System



Virtual Movable End Cap™ II

Multistack DHRC units now offer another amazing feature and benefit: the all-new Virtual Moveable End Cap™ II. With this technology a design engineer can specify a system that will provide variable simultaneous heating and cooling as a central station while eliminating the need for separate cooling and heating systems or a distributed water source heat pump system. This can save significant installation costs, dramatically reduce a building's carbon footprint by reducing or even eliminating natural gas use, and lowering energy bills. The VME II operating algorithm automatically matches the heating and cooling load requirements of the building by closing and/or opening the appropriate VME valves and optimizing operation for maximum efficiency.

Multistack DHRC units with VME provide system expandability and redundancy at little added cost. DHRC units offer outstanding energy efficiency, minimal refrigerant charges and easy installation. With multiple small compressors, units can be cycled to match heating and cooling loads at any level. With two compressors per module, a Multistack DHRC array achieves N+1 redundancy by adding just one module, as opposed to requiring another separate system. The compact size of DHRC units allows units up to Size 085X into a building through a standard-width door and can be moved into a mechanical room via passenger elevator. Units Size 085X and larger will fit through standard double-width doors and into freight elevators, depending upon elevator lifting capacity. No cranes, no demolition, no big expenses.

An array of Multistack DHRC chillers provide huge benefit in both space and installation costs through use of single-point water and electrical connections—simplifying mechanical room design and allowing easy future expansion while reducing maintenance costs.

Features & Benefits

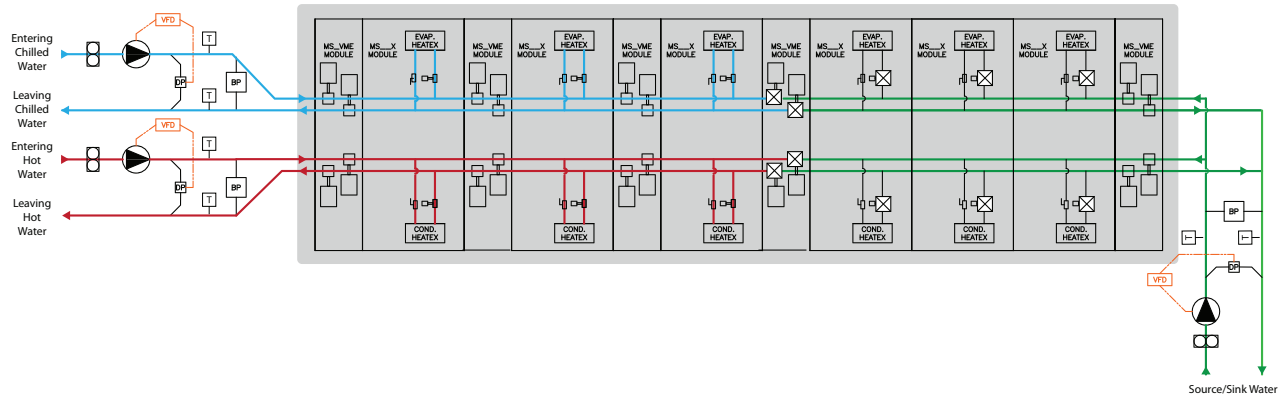
- No reversing valves for maximum reliability, efficiency
- Integrates simultaneous heating and cooling without need for geothermal water as an energy transfer buffer
- Forty percent efficiency gain for simultaneous loads
- Five to nine percent efficiency gain for normal loads
- Typically allows a module per machine to be eliminated versus VME I, reducing footprint and electrical load
- Offers compressor run time equalization
- Offers pump energy savings



Sample Schematics

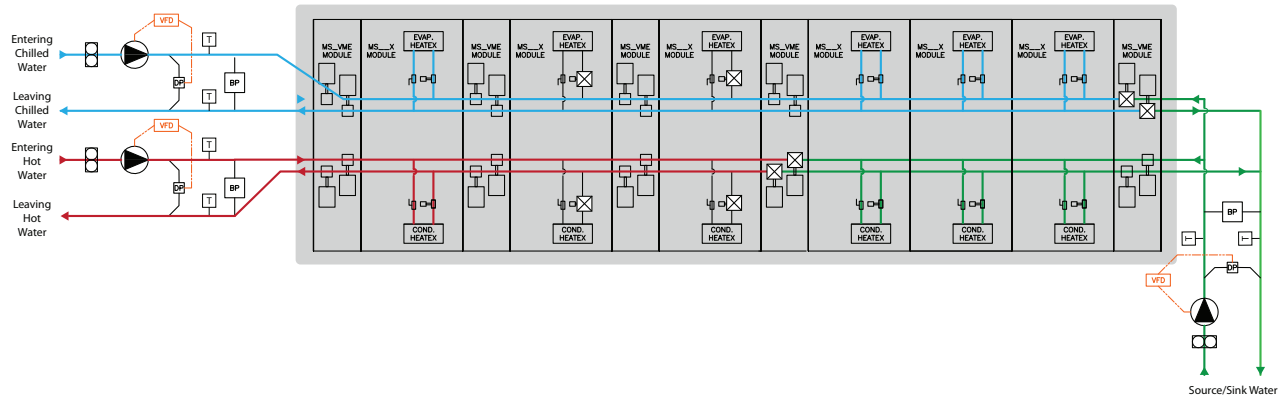
Simultaneous Mode

3 Cooling, 3 Heating



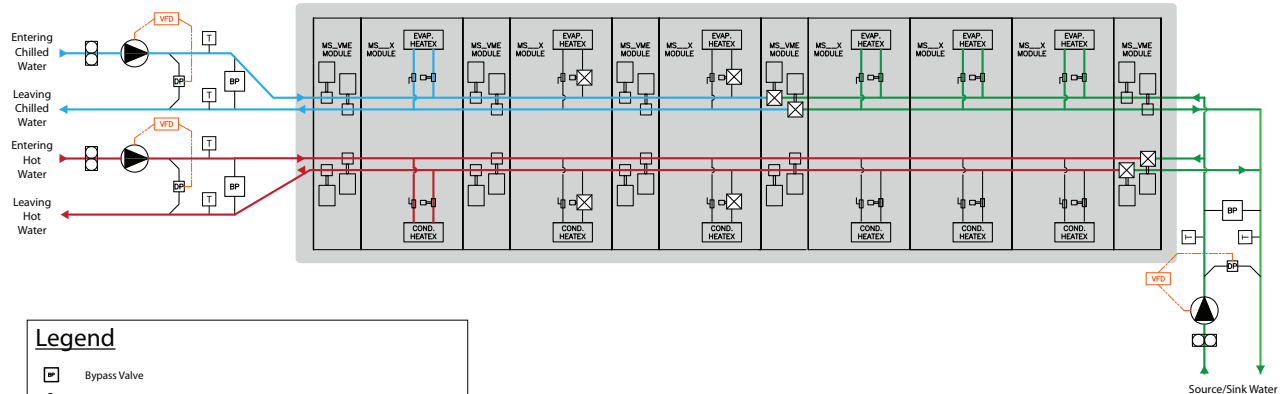
Cooling Dominant Mode

4 Cooling, 1 Heating



Heating Dominant Mode

1 Cooling, 4 Heating



Legend

- Bypass Valve
- Capped End
- Differential Pressure
- Direction of Flow
- Motorized Butterfly Valve
- Manual Butterfly Valve
- Motorized Butterfly Valve - VME
- Pump
- Strainer
- Variable Frequency Drive
- Temperature Sensor

Note:

Area highlighted in grey is supplied by Multistack. All other components can be optionally provided or field provided, except for temperature sensors, which are supplied by Multistack and field installed.

PRODUCTS

2.01 Operating Conditions

- A. Provide Dedicated Heat Recovery Chiller with the capacity as scheduled on drawings at job site elevation listed in Section 15050.
- B. The Dedicated Heat Recovery Chiller shall be designed to operate using (R-410a OR R-134a) Refrigerant.
- C. The Dedicated Heat Recovery Chiller shall be designed for parallel evaporator water flow.
- D. The liquid to be heated/chilled will be water containing corrosion inhibitors.
- E. The Dedicated Heat Recovery Chiller shall be designed to operate using _____ volt, 3 phase, 60 (50) Hz electrical power supply.

2.02 Dedicated Heat Recovery Chiller

- A. Approved manufacturer is MULTISTACK.
- B. System Description: The Dedicated Heat Recovery Chiller shall incorporate Scroll-type compressors and can consist of multiple (10, 15, 20, 30, 50, 70, 85) -ton modules. Each refrigerant circuit shall consist of an individual compressor, common dual circuit condenser, dual circuit evaporator, thermal expansion valves, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The multi-circuit Dedicated Heat Recovery Chiller must be able to produce hot water even in the event of a failure of one or more refrigerant circuits. Circuits shall not contain more than (6.5, 6.5, 6.5, 10, 20, 23, 28) lb. of (R-410a OR R-134a) refrigerant.
- C. General
 - 1. The Dedicated Heat Recovery Chiller Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236.
 - 2. Chiller modules shall be AHRI certified. (R-410a Only)
 - 3. Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment on an AHRI certified or 3rd party verified test stand.
 - 4. Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge, powder coated steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.
- D. OPTIONAL: Sound Reduction Panel Package Each module shall be supplied with a light weight aluminum frame with sound reduction panels. Panels are powder coated 20 gauge steel with 1" of fiberglass insulation to reduce sound levels. Optional sound package will reduce sound pressure levels measured at 1 meter at a minimum of 12 dBA.
- E. Chilled and Hot Water Mains: Each module shall include supply and return mains for both chilled and hot water. Cut grooved end connections are provided for interconnection to six inch standard (6.625" outside diameter) piping with grooved type couplings. Rolled grooved shall be unacceptable. Water Mains shall be installed such that they are beneath any power or control wiring so as to insure for safe operation in the event of condensation or minor piping leaks.
- F. Evaporators and condensers: Each evaporator and condenser shall be brazed plate heat exchangers constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig working pressure on the evaporator and 650 psig working pressure on the condenser. Both the condenser and evaporator heat exchanger 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.
- G. OPTIONAL: Variable Flow Operation - Chilled and/or Condenser Water
Butterfly type isolation valves shall incorporate appropriate accessories and controls to allow the chiller to operate efficiently in a variable primary flow system. Valves shall modulate via a motorized actuator for leaving water temperature control, chiller minimum flow bypass, chiller no load bypass, or head pressure control. Compressor staging based off of return water temperature is not acceptable for temperature control.
- H. OPTIONAL: Total Access Design
Isolation valves shall be installed between the heat exchangers and water supply mains for heat exchanger isolation and removal without the requirement to shut down the entire chiller allowing for total access to all serviceable components.
- I. OPTIONAL: Double Wall Vented Hot Water Heat Exchanger for Potable Water (MS020X and MS030X only)
Hot water heat exchanger shall be double wall vented for use with domestic water.
- J. 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.
- K. Central Control System.
 - 1. The Dedicated Heat Recovery Chiller (DHRC) shall be equipped with a microprocessor based return water controller. The Dedicated Heat Recovery Chiller shall have the capability to operate in response to either heating water or cooling water set points. The selection of these two modes of operation shall be made automatically by the Dedicated Heat Recovery Chiller's Master Controller or alternatively, this mode may be set manually or through a binary input to the controller.
 - 2. 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.

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3. 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. Evaporator Leaving Chilled Water Temp.
4. The Master Controller shall be powered by the chillers single point power connection and shall monitor and report the following system parameters:
 - a. Chilled Water Entering and Leaving Temperature
 - b. Hot Water Entering and Leaving Temperature
 - c. Chilled Water and Hot Water Flow
5. 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 Dedicated Heat Recovery Chiller 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 2 line by 40 character back-lit LCD. A history of faults shall be maintained including date and time of day of each fault (up to the last 20 occurrences).
6. Individual monitoring of leaving chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.
7. The control system shall monitor entering and leaving hot and/or chilled 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 optimize the Dedicated Heat Recovery Chiller performance to different existing building loads.
8. **OPTIONAL: INTEROPERABILITY**
The Chiller shall be capable of interfacing to a building automation system. Interface shall be accomplished using an Interoperability Web Portal and shall be capable of communication over BACNet, Modbus or LON.
9. **OPTIONAL: Fail to Run Mode (FRM)**
Chiller shall be capable of operation in the event that the Master Controller has lost communication. FRM provides the ability to switch the chiller into manual mode automatically keeping the chiller online until a replacement Master Controller can be provided. FRM requires a power phase monitor per module.
- L. Dedicated Heat Recovery Chiller 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. Heating/Cooling Alarm Relay
 3. Customer Chilled/Load Limit Reset Signal
 4. ECW to Mechanical Cooling Module
 5. LCW from Mechanical Cooling Module
 6. ECHW to Mechanical Cooling Module
 7. LCHW from Mechanical Cooling Module
 8. Power Phase Monitor
 9. Chilled Water Flow Switch Input
 10. Condenser Water Flow Switch Input
 11. Full Load Indicator Relay
 12. Condenser Pump Relay
 13. Chilled Water Pump Relay
- M. Each inlet water header shall incorporate a built in 30-mesh (maximum) in-line strainer system to prevent heat exchanger fouling and accommodate 100% flow filtration with a minimum surface area of 475 sq inches per module.

N. Single Point Power: Chiller shall be equipped with a pre-engineered genuine buss bar electrical system for single point power. Where the equipment size exceeds the amp rating of the buss bar, multiple power connections may be applied. Pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be taken off-line for repair while the rest of the modules continue to operate. Individual power feeds to each module shall be unacceptable.

O. OPTIONAL: IFM flow switch per module. Integral to each module and powered by the module for individual module proof of flow and flow safety. Modules without independent IFM switches per module are not acceptable alternates.

2.03 SAFETIES, CONTROLS AND OPERATION

A. Dedicated Heat Recovery Chiller safety controls system shall be provided with the unit (minimum) as follows:

1. Low evaporator refrigerant pressure
2. Loss of flow through the evaporator
3. Loss of flow through the condenser
4. High condenser refrigerant pressure
5. High compressor motor temperature
6. Low suction gas temperature
7. Low leaving evaporator water temperature

B. Failure of Dedicated Heat Recovery Chiller to start or Dedicated Heat Recovery Chiller shutdown due to any of the above safety cutouts shall be annunciated 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 Dedicated Heat Recovery Chiller shall be furnished with a Master Controller as an integral portion of the Dedicated Heat Recovery Chiller control circuitry to provide the following functions:

1. Provide automatic Dedicated Heat Recovery Chiller shutdown during periods when the load level decreases below the normal operating requirements of the Dedicated Heat Recovery Chiller. Upon an increase in load, the Dedicated Heat Recovery Chiller shall automatically restart.
2. Provisions for connection to automatically enable the Dedicated Heat Recovery Chiller 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.
4. Each module shall contain a slave controller that will allow any module to run in the event of a master controller failure or loss of communication with the master controller via an on/off/manual toggle switch.

D. Normal Dedicated Heat Recovery Chiller Operation

1. When Dedicated Heat Recovery Chiller is enabled, the factory supplied Master Controller stages the Dedicated Heat Recovery Chiller capacity from minimum to maximum as required by building load.
2. The Dedicated Heat Recovery Chiller 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.

E. Power Phase Monitor

1. Provide a Power Phase Monitor on the incoming power supply to the Dedicated Heat Recovery Chiller. This device shall prevent the Dedicated Heat Recovery Chiller 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. Prior to connecting the Dedicated Heat Recovery Chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organics. In old piping systems with heavy encrustation of inorganic materials consult a water treatment specialist for proper passivation and/or removal of these contaminants.

B. During the flushing, a 30 mesh (max.) Y-strainers (or acceptable equivalent) shall be in place in the system piping and examined periodically as necessary to remove

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

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

3.02 Water Treatment Requirements

- A. Supply water for both the chilled water and hot 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 Dedicated Heat Recovery Chiller's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular Dedicated Heat Recovery Chillers 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 Ca CO ₃	30 to 500 ppm
5. Chlorides	Less than 200 ppm
6. Sulfates	Less than 200 ppm

3.03 Warranty and Start-Up

- A. Manufacturer's Warranty: Manufacturer shall provide full parts-only warranty coverage for entire chiller for a period of one year. All parts shall be warranted against defects in material and workmanship. Similar parts-only coverage shall be provided for the chillers compressors for a period of five years. The warranty period shall commence either on the equipment start-up date or six months after shipment, whichever is earlier.
- B. Manufacturer shall provide the services of a Factory Authorized Service Engineer to provide complete start-up supervision. Factory Authorized Service Engineer shall also be responsible for assembly of the chillers cabinetry package and electrical bus bar system. After start-up a Manufacturer's Representative shall provide a minimum of 8-hours of operator training to the owner's designated representative(s).

PART 2 PRODUCTS: 105- to 165-Tons**2.01 Operating Conditions**

Provide water-cooled liquid chiller with the capacity as scheduled on drawings at job site elevation listed in Section 15050.

- A. Chiller shall be designed to operate using R-410a Refrigerant.
- B. Chiller shall be designed for parallel evaporator water flow.
- C. The liquid to be chilled will be water containing corrosion inhibitors.
- D. Chiller shall be designed to operate using _____ volt, 3 phase, 60 (50) Hz electrical power supply.

2.02 Water-Cooled Packaged Chiller

- A. Approved manufacturer is MULTISTACK.
- B. System Description: Chiller shall incorporate Scroll-type compressors and consist of multiple (105, 135, 145, 165)-ton modules. Each module shall consist of (2) tandem compressor sets, and common dual circuit condenser, dual circuit evaporator, thermal expansion valves, and control system. Each circuit shall be constructed to be independent of other circuits from a refrigeration and electrical stand-point. The multi-circuit chiller 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 (40, 45, 50, 51) lb. of R-410a refrigerant.
- C. General
- Chiller Modules shall be ETL listed in accordance with UL Standard 1995, CSA certified per Standard C22.2#236.
 - Chiller modules shall be AHRI certified.
 - Modules shall ship wired and charged with refrigerant. All modules shall be factory run tested prior to shipment on an AHRI certified or 3rd party verified test stand.
 - Compressors, heat exchangers, piping and controls shall be mounted on a heavy gauge, powder coated steel frame. Electrical controls, contactors, and relays for each module shall be mounted within that module.

- D. Chilled and Condenser Water Mains: Each module shall include supply and return mains for both chilled and condenser water. Cut grooved end connections are provided for interconnection to ten inch standard (10.625" outside diameter) piping with grooved type couplings. Rolled grooved shall be unacceptable. Water Mains shall be installed such that they are beneath any power or control wiring so as to insure for safe operation in the event of condensation or minor piping leaks.
- E. Evaporators and condensers: Each evaporator and condenser shall be brazed plate heat exchangers constructed of 316 stainless steel; designed, tested, and stamped in accordance with UL 1995 code for 650 psig refrigerant working pressure and 350 psig working water pressure on the evaporator and 650 psig working refrigerant pressure and 350 psig working water pressure on the condenser. Both the condenser and evaporator heat exchanger 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. OPTIONAL: Variable Flow Operation - Chilled and/or Condenser Water Butterfly type isolation valves shall incorporate appropriate accessories and controls to allow the chiller to operate efficiently in a variable primary flow system. Valve shall modulate via a motorized actuator for leaving water temperature control, chiller minimum flow bypass, chiller no load bypass, or head pressure control. Compressor staging based off of return water temperature is not acceptable for temperature control.
- G. Compressor: Each module shall contain two compressor sets, each set containing two compressors, with the two compressors in the set manifolded together and mounted to the module with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction pressure safety cut-outs.
- H. 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. Evaporator Leaving Chilled Water Temp.
 - 3. The Master Controller shall be powered by the chillers single point power connection and shall monitor and report the following system parameters:
 - a. Chilled Water Entering and Leaving Temperature
 - b. Condenser Water Entering and Leaving Temperature
 - c. Chilled Water and Condenser 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 chiller 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 2 line by 40 character back-lit LCD. 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 chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.
 - 6. The control system shall monitor entering and leaving chilled 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 optimize the chiller performance to different existing building loads.
 - 7. OPTIONAL: INTEROPERABILITY- The Chiller shall be capable of interfacing to a building automation system. Interface shall be accomplished using an Interoperability Web Portal and shall be capable of communication over BACNet, Modbus or LON.
 - 8. OPTIONAL: Fail to Run Mode (FRM)- Chiller shall be capable of operation in the event that the Master Controller has lost communication. FRM provides the ability to switch the chiller into manual mode automatically keeping the chiller online until a replacement Master Controller can be provided. FRM requires a power phase monitor per module.
 - a. OPTIONAL: IFM flow switch per module. Integral to each module and powered by the module for individual module proof of flow and flow safety. Modules without independent IFM switches per module are not acceptable alternates.
- I. Chiller 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. Customer Alarm Relay
 - 3. Customer Chilled/Load Limit Reset Signal
 - 4. ECW to Mechanical Cooling Module

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5. LCW from Mechanical Cooling Module
 6. ECHW to Mechanical Cooling Module
 7. LCHW from Mechanical Cooling Module
 8. Power Phase Monitor
 9. Chilled Water Flow Switch Input
 10. Condenser Water Flow Switch Input
 11. Full Load Indicator Relay
 12. Condenser Pump Relay
 13. DDRS Condenser Multiflush Relay
 14. Chilled Water Pump Relay
- J. Each inlet water header shall incorporate a built in 30-mesh (maximum) in-line strainer system to prevent heat exchanger fouling and accommodate 100% flow filtration with a minimum surface area of 475 sq inches per module. Condenser-side strainer system shall incorporate an automatic debris blow-down system for self-cleaning of the strainer system that is controlled and powered by the chiller.
- K. Single Point Power: Chiller shall be equipped with a pre-engineered junction box system for single point power. Where the equipment size exceeds the amp rating of a single box, multiple power connections may be applied. Pre-engineered system shall also incorporate individual module isolation circuit breakers for full redundancy and ability of a module to be taken off-line for repair while the rest of the modules continue to operate.
- L. OPTIONAL: IFM flow switch per module. Integral to each module and powered by the module for individual module proof of flow and flow safety. Modules without independent IFM switches per module are not acceptable alternates.

2.03 SAFETIES, CONTROLS AND OPERATION

- A. Chiller safety controls system shall be provided with the unit (minimum) as follows:
1. Low evaporator refrigerant pressure
 2. Loss of flow through the evaporator
 3. Loss of flow through the condenser
 4. High condenser refrigerant pressure
 5. High compressor motor temperature
 6. Low suction gas temperature
 7. Low leaving evaporator water temperature
- B. Failure of chiller to start or chiller shutdown due to any of the above safety cutouts shall be annunciated 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 chiller shall be furnished with a Master Controller as an integral portion of the chiller control circuitry to provide the following functions:
1. Provide automatic chiller shutdown during periods when the load level decreases below the normal operating requirements of the chiller. Upon an increase in load, the chiller shall automatically restart.
 2. Provisions for connection to automatically enable the chiller 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.
 4. Each module shall contain a slave controller that will allow any module to run in the event of a master controller failure or loss of communication with the master controller via an on/off/manual toggle switch.
- D. Normal Chiller Operation
1. When chiller is enabled, the factory supplied Master Controller stages the chiller capacity from minimum to maximum as required by building load.
 2. The Chiller 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.
- E. Power Phase Monitor
1. Provide a Power Phase Monitor on the incoming power supply to the chiller. This device shall prevent the chiller 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. Prior to connecting the chiller to the condenser and chilled water loop, the piping loops shall be flushed with a detergent and hot water (110-130° F) mixture to remove previously accumulated dirt and other organics. In old piping systems with heavy encrustation of inorganic materials consult a water treatment specialist for proper passivation and/or removal of these contaminants.
- 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 use of on board chiller strainers shall not be acceptable. The flushing process shall take no less than 6 hours or until the strainers when examined after each flushing are clean. Old systems with heavy encrustation shall be flushed for a minimum of 24 hours and may take as long as 48 hours before the filters run clean. Detergent and acid concentrations shall be used in strict accordance with the respective chemical manufacturer's instructions. After flushing with the detergent and/or dilute acid concentrations the system loop shall be purged with clean water for at least one hour to ensure that all residual cleaning chemicals have been flushed out.
- C. Prior to supplying water to the chiller the Water Treatment Specification shall be consulted for requirements regarding the water quality during chiller operation. The appropriate chiller manufacturer's service literature shall be available to the operator and/or service contractor and consulted for guidelines concerning preventative maintenance and off-season shutdown procedures.

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 chiller's heat exchangers, headers and associated piping. Cycles of concentration shall be controlled such that recirculated water quality for modular chillers 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 Ca CO ₃	30 to 500 ppm
5. Chlorides	Less than 200 ppm
6. Sulfates	Less than 200 ppm

3.03 Warranty and Start-Up

- A. Manufacturer's Warranty: Manufacturer shall provide full parts-only warranty coverage for entire chiller for a period of one year. All parts shall be warranted against defects in material and workmanship. Similar parts-only coverage shall be provided for the chillers compressors for a period of five years. The warranty period shall commence either on the equipment start-up date or six months after shipment, whichever is earlier.
- B. Manufacturer shall provide the services of a Factory Authorized Service Engineer to provide complete start-up supervision. Factory Authorized Service Engineer shall also be responsible for assembly of the chillers cabinetry package and electrical bus bar system. After start-up a Manufacturer's Representative shall provide a minimum of 8-hours of operator training to the owner's designated representative(s).

Environmentally Friendly Refrigerants

R-410A and R-134a

Refrigerant R-410A and R-134a are widely available, safe, and environmentally friendly refrigerants. R-410A is available in virtually all Multistack systems making hot water up to 140°F and R-134a is available in machines making hot water up to 180°F. Good environmental choices!

Environmental Focus

In addition to providing products to deliver reliable comfort and low operating cost, Multistack's products can also reduce your environmental footprint. We are committed to developing and manufacturing cooling and heating products that can eliminate fossil fuel consumption and operate on the refrigerants designed to protect the environment. Dedicated heat pump boilers, air-to-water heat pumps and efficiency improvements across our product line are the result of this focus.

Originators...

Multistack invented the modular water chiller. It started with a radically simple idea: chiller modules that could be brought into the equipment room one at a time, through standard doorways and down elevators, to form a fully integrated chiller system. The idea launched a revolution and transformed Multistack into a leader in the commercial water-chiller industry.

Innovators...

Multistack perfected the modular chiller and leads the industry in innovative and environmentally friendly modular solutions. Since founding in the late 1980s, Multistack has engineered, manufactured, and distributed an impressive array of modular air conditioning firsts: the first on-board strainer, the first modular automatic blow-down device, the first modular chiller for variable flow, the first modular chiller-heater (heat pump), the first modular heat-recovery chiller, the first modular air-to-water heat pump, the first modular chiller to utilize MagLev™ compressor technology, and the first modular chiller to utilize R-410A.

Never the Imitators...

Multistack sets the standard in the industry for superior customer service, fast and on time shipment, superior product quality, and new product development. Our pioneering leadership in environmental issues is well documented. If you want the best, be sure to specify the original – Multistack®.



MULTISTACK®
Originators. Innovators. Never the Imitators.

1065 Maple Avenue P.O. Box 510 Sparta, WI 54656

Phone 608-366-2400 • info@multistack.com

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