

# **MULTISTACK**<sup>®</sup>

Originators. Innovators. Never the Imitators.<sup>sm</sup>



## **Dedicated Heat Recovery Chiller™ (DHRC)**

**Product Data Catalog for R410A and R134a Refrigerants**

<b>MS010XC-410A</b>	<b>MS010AN-134a</b>
<b>MS015XC-410A</b>	<b>MS015AN-134a</b>
<b>MS020XC-410A</b>	<b>MS020AN-134a</b>
<b>MS030XC-410A</b>	<b>MS030AN-134a</b>
<b>MS050XC-410A</b>	<b>MS050AN-134a</b>
<b>MS070XC-410A</b>	<b>MS070AN-134a</b>



Made in the USA



# Dedicated Heat Recovery Chiller™ (DHRC)

## PRODUCT INTRODUCTION

**M**ultistack® is the recognized world leader in the design and implementation of modular chillers. Through 20-plus years of product development we have learned how to best capture and control the heat that is typically rejected by the chiller. With that in mind we set out to build the industry's best, most efficient, Dedicated Heat Recovery Chiller™ (DHRC).

During the process of cooling, heat is generated, and, more often than not, discarded to the atmosphere. This process has been around for as long as there have been heating and cooling systems. There are many negative effects with the disposal of heat as waste. Buildings can use two times more energy to do the cooling and dispose of the heat, as if they just took possession of the heat and using that heat where it is needed. Even in the middle of summer, most buildings require a certain amount of heat to be made for proper humidity control, potable hot water, and many other hot water applications. Heat recovery addresses this waste and turns it into a way to lower energy bills, reduce the carbon footprint of a building and will provide tremendous improvement for overall building efficiency. Currently, the requirement for LEED is to improve upon ASHRAE 90.1 by up to 30%. A DHRC can help you get there.

Heat recovery is not a new concept, it has been around since the early 1970s, however it was not easy to implement based on the size of chillers then — and the very limited hot water temperatures achievable. The Multistack DHRC, by the very nature of a modular chiller, changes the application from difficult to simple because it gives you control of hot and cold water simultaneously, and most buildings have a constant heating and cooling requirement. By identifying the maximum and minimum loads of both, it becomes fairly easy to size a DHRC from 10 – 900-tons per array. This allows the DHRC to be a part of the buildings chiller and boiler system — especially since it can produce water up to 180°F.

When a DHRC is applied as a supplement to a building system, it can contribute to the cooling process during the spring, summer and fall, while supplying the hot water for the building for free. During the winter, by directing the DHRC to focus on the constant cooling demands of the building core, a data center or phone room, it will continue to supply hot water—still for basically free and eliminating the use of natural gas for creating the heat.

Anytime a building has a concurrent demand identified, it makes sense to look to the DHRC for a first stage economizer, rather than bringing in cold outside air and exhausting building heat. This application makes even more sense when you have an array of Multistack chillers that are the primary source of cooling for the building, allowing all the heat generated during that first stage to be used—for free!

To associate some dollars saved to this concept, the 45-ton DHRC installed upstream of the condensing boilers at Evansville State Hospital in Evansville, Indiana. Designed to satisfy all the VAV reheating and the domestic hot water—while supplementing the cooling load— the DHRC is having a significant impact on the utility costs at the hospital by saving \$36,000 - \$54,000 per year, depending on the costs of natural gas. See this case study, and others, at [www.multistack.com](http://www.multistack.com)

These are just some of the reasons a DHRC can be a great addition to almost any building.



### Applications for a Multistack DHRC

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

### Typical Buildings for DHRC Applications

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

### Benefits

- Reduced CO<sub>2</sub> emissions
- Easy retrofit for any mechanical room
- Double Wall Vented Heat Exchanger allows for potable water (optional)
- Payback in less than three years typically
- More efficient than a gas boiler
  - COP can exceed 7.0
- Low load efficiency
- Apply for Leed points
- ASHRAE 15 / B-52 compliant without monitoring or ventilation equipment.

### Features

- Independent refrigerant circuits
- No reversing valves
- Auto mode controls
- Control the mode dynamically without input from the BAS

### Highly Dependable

- Multiple independent 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

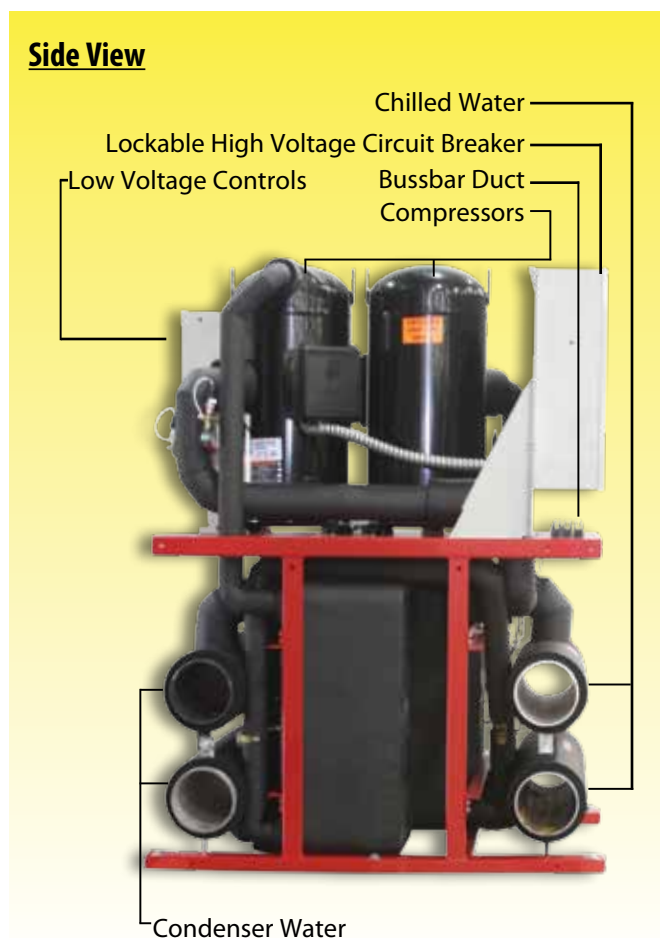
- Manual switch allows redundancy control as each module has a processor allowing it to run even if master controller fails
- Optional Fail-To-Run software
- Display at each module
- Remote display option
- Automatic controls for both chilled and hot water
- Optional BAS Interface

### 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

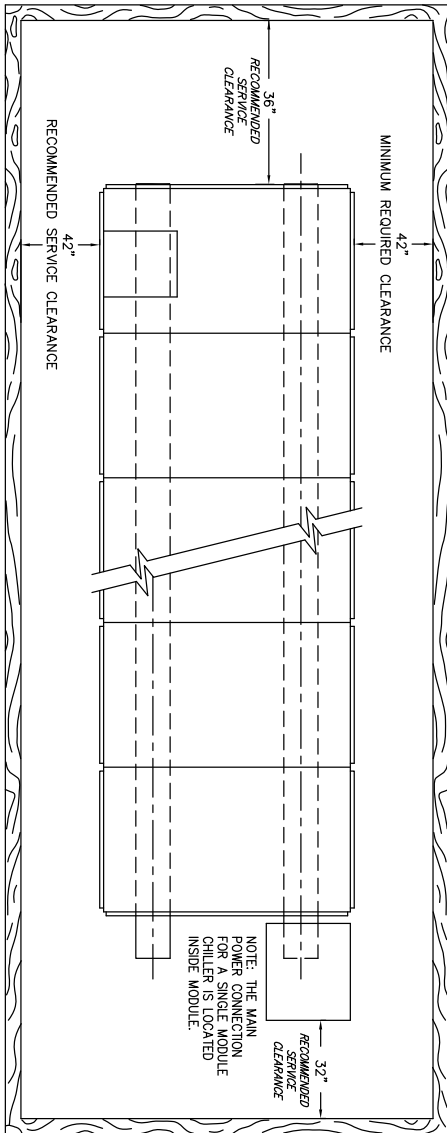


# Dedicated Heat Recovery Chiller™ (DHRC)

## CHILLER OPTIONS

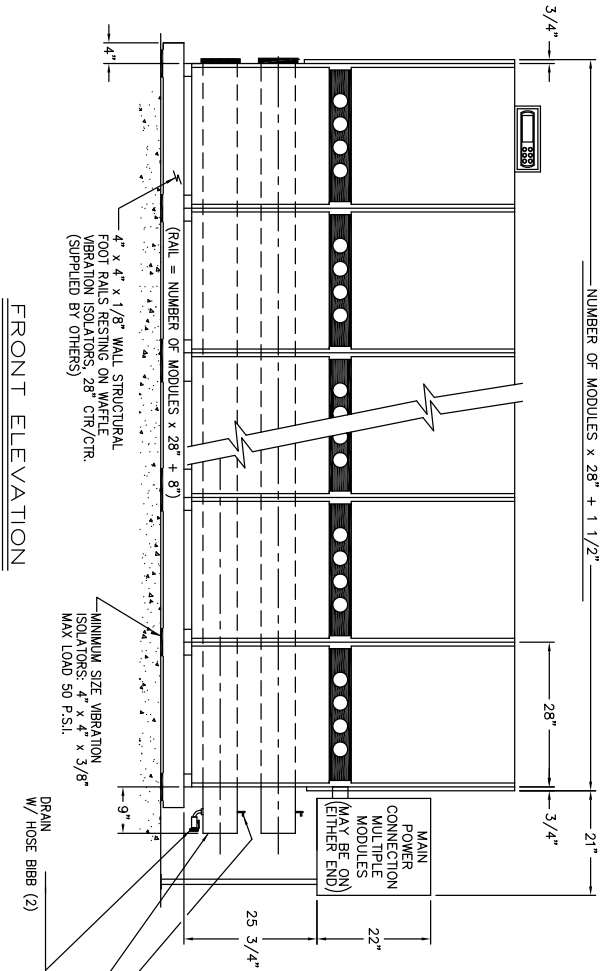
### Standard Modules (Constant Flow Design)

\*Standardized drawing of sample customer installation

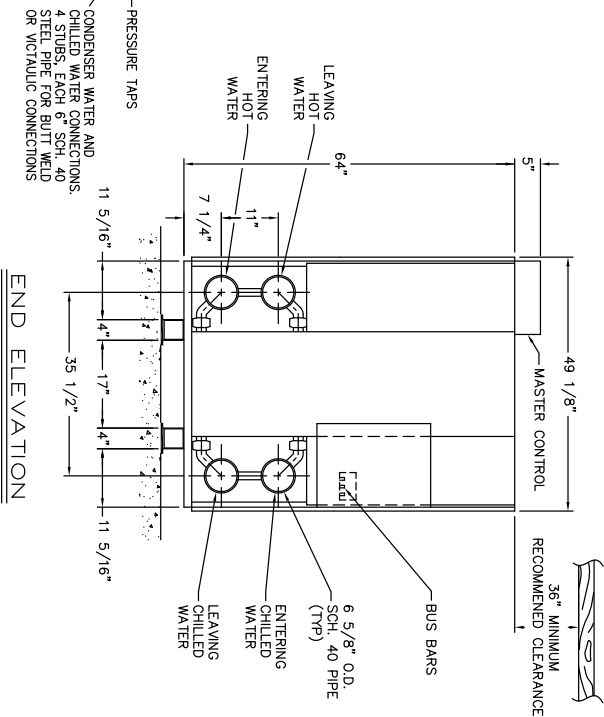


PLAN VIEW

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"



FRONT ELEVATION



END ELEVATION

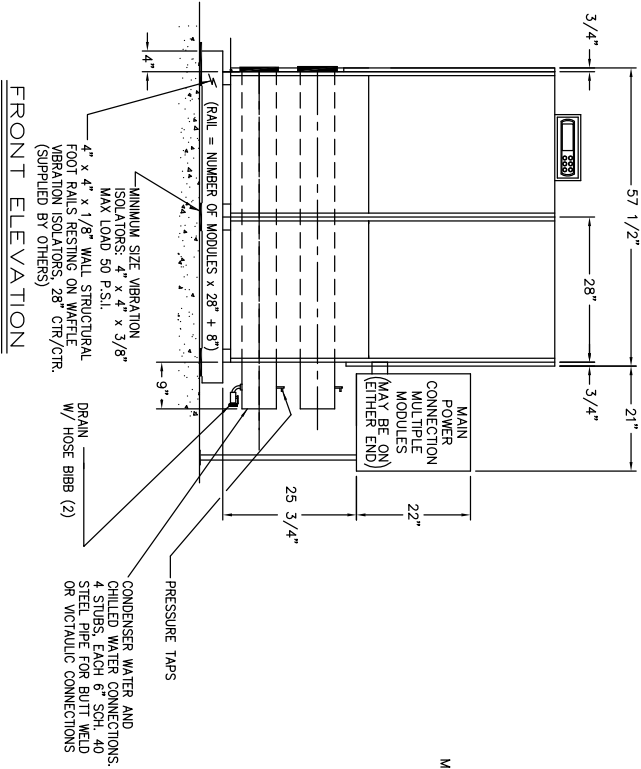
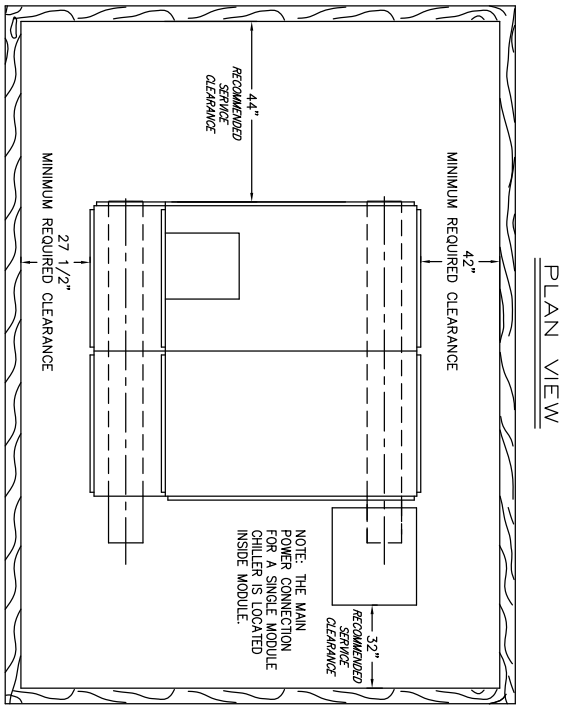


# Dedicated Heat Recovery Chiller™ (DHRC)

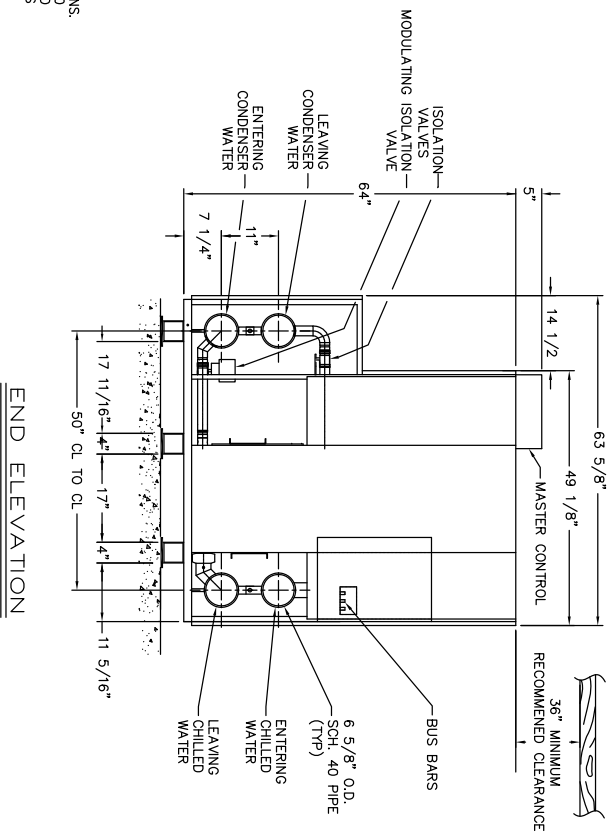
## CHILLER OPTIONS, Cont'd

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

\*Standardized drawing of sample customer installation

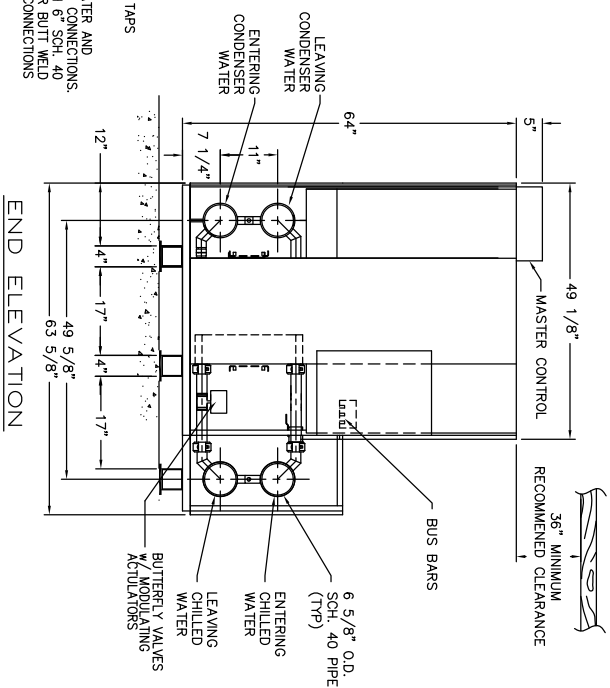
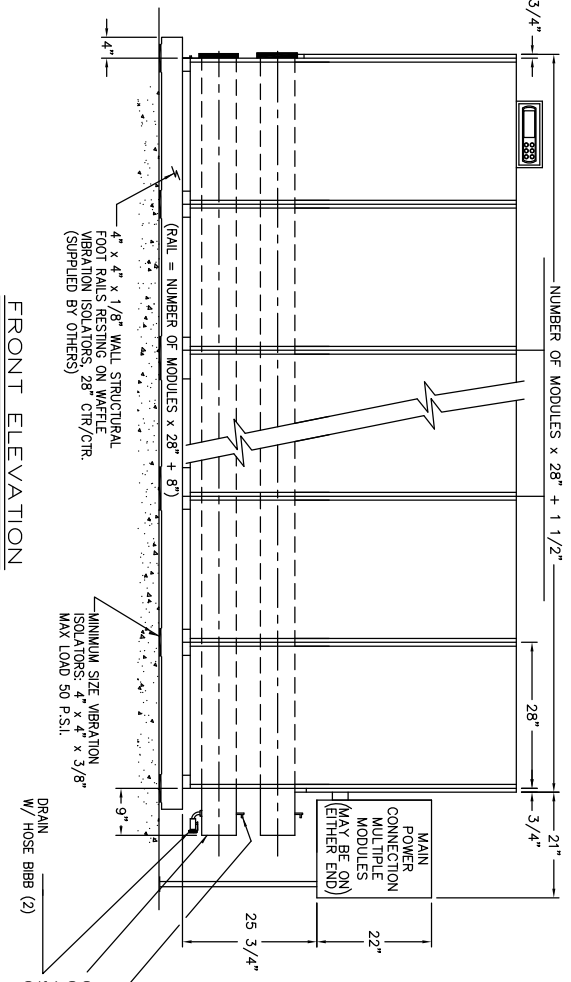
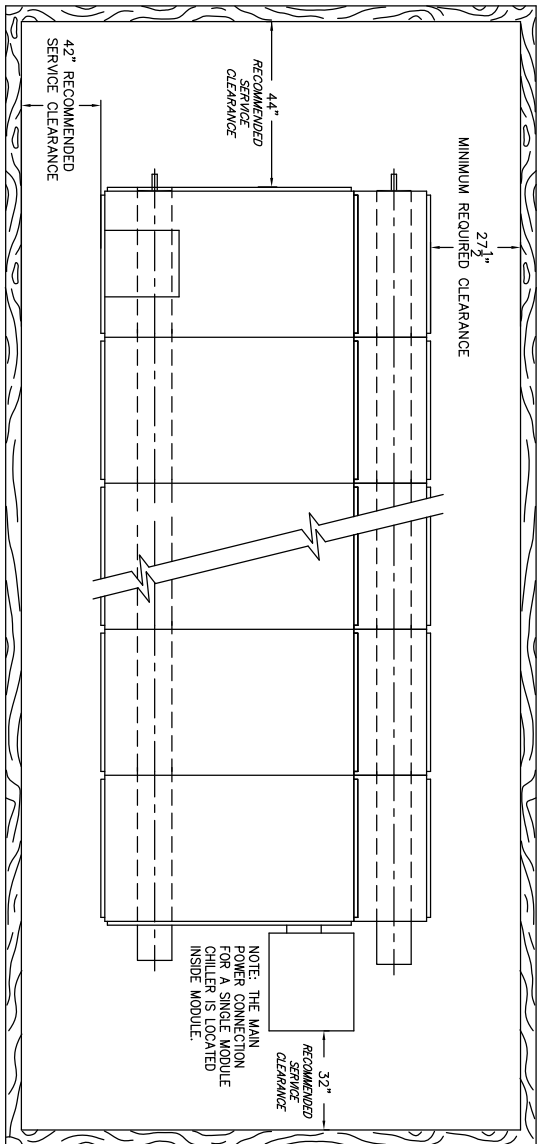


Dimensions (No Panels)			
	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010-050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/4"	64"
Extended Headers (2)	28"	76 3/8"	64"



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

\*Standardized drawing of sample customer installation



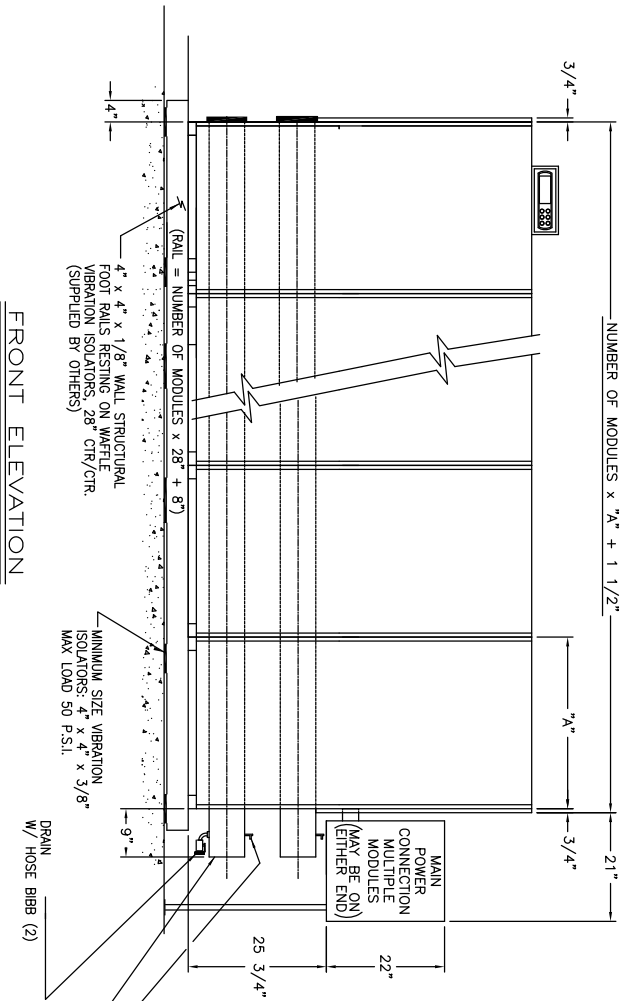
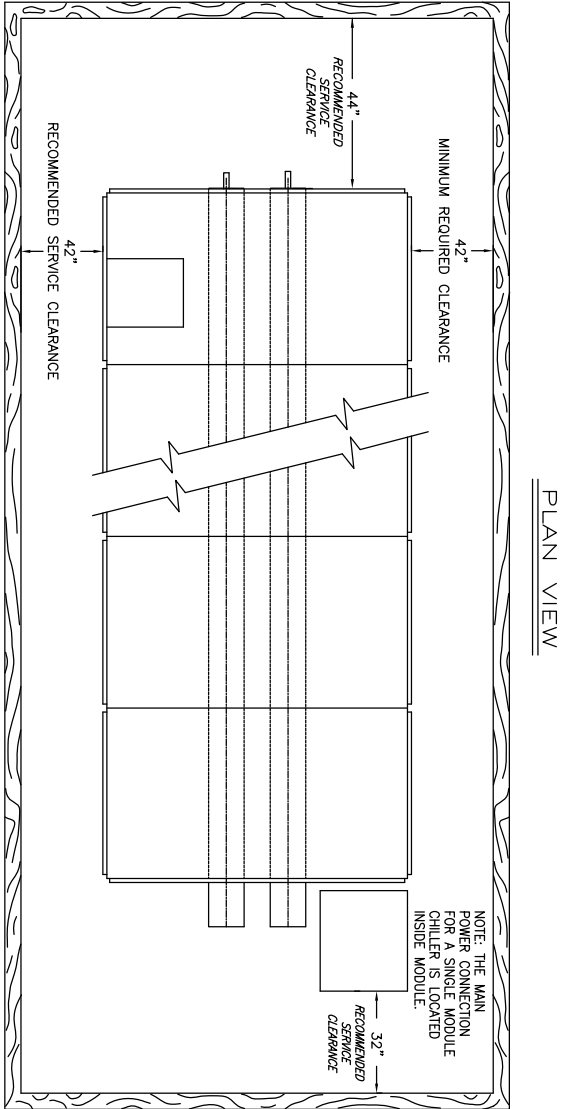
Dimensions (No Panels)			
	Width (A)	Depth (B)	Height (C)
Standard	28"	47 5/8"	64"
Total Access (MS010--050)	32"	56"	67"
Total Access (MS070)	34"	56"	67"
Extended Headers (1)	28"	62 1/8"	64"
Extended Headers (2)	28"	76 5/8"	64"

# Dedicated Heat Recovery Chiller™ (DHRC)

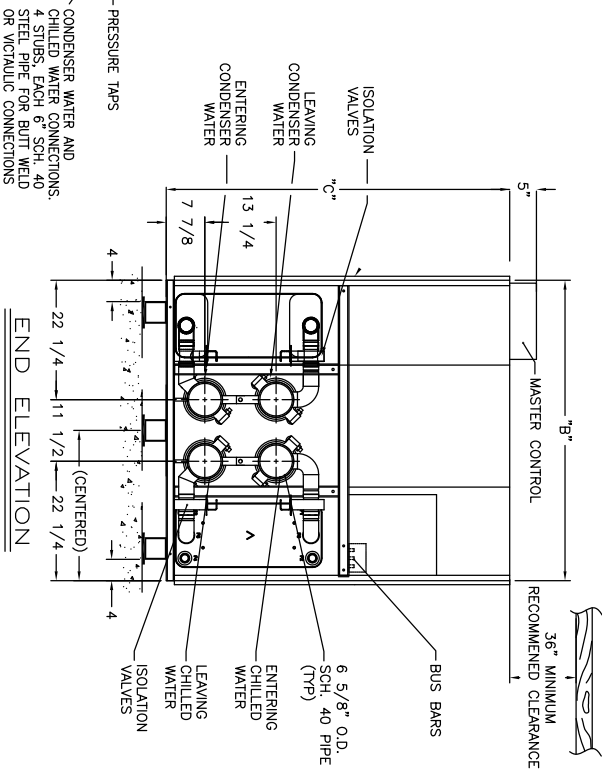
## CHILLER OPTIONS, Cont'd

### Total Access Design with or without Variable Flow

\*Standardized drawing of sample customer installation



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"



# Dedicated Heat Recovery Chiller™ (DHRC)

## GENERAL DATA

General Data Table						
	MS010XC-410A/ MS010AN-134a	MS015XC-410A/ MS015AN-134a	MS020XC-410A/ MS020AN-134a	MS030XC-410A/ MS030AN-134a	MS050XC-410A/ MS050AN-134a	MS070XC-410A/ MS070AN-134a
<b>Compressor Type</b>	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Dry Weight (lbs. each)	89	135	135	146	353	390
Normal Capacity (tons each)	5	8.5	10	15	25	32
Quantity	2	2	2	2	2	2
Oil Charge (pints)	3.5	6.9	6.9	6.9	14.4	13.3
<b>Evaporator (Brazed Plate)</b>	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs. each)	80	80	80	105	180	243
Water Storage (gallons each)	1.9	1.9	1.9	2.9	4.8	7.3
Circuit Configuration	Dual	Dual	Dual	Dual	Dual	Dual
Quantity	1	1	1	1	1	1
Header System (gallons)	7	7	7	7	7	7
<b>Condenser</b>	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lbs. each)	90	90	90	135	220	313
Water Storage (gal. each)	2.4	2.4	2.4	4.1	6.6	10.1
Circuit Configuration	Dual	Dual	Dual	Dual	Dual	Dual
Quantity	1	1	1	1	1	1
Header System (gallons)	7	7	7	7	7	7
<b>Refrigerant Type</b>	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a	R410A/R134a
Charge (lbs./circuit)	6.5	6.5	8	12	18	24
Number of Circuits	2	2	2	2	2	2
<b>Operating Weight (lbs.)</b>	1110	1200	1200	1625	2000	2200
<b>Shipping Weight (lbs.)</b>	950	1040	1040	1450	1730	1900

### 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

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS010XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	9.5	11.2	167.3	14.2	5.2	9.3
48°F	9.6	10.8	162.3	13.6	5.0	9.0
46°F	9.6	10.4	157.3	13.0	4.8	8.6
45°F	9.6	10.2	154.9	12.7	4.7	8.4
44°F	9.6	10.0	152.5	12.4	4.6	8.3
42°F	9.7	9.6	147.8	11.9	4.5	8.0
40°F	9.7	9.2	143.3	11.3	4.3	7.7
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	10.6	10.5	161.9	11.9	4.5	7.9
48°F	10.7	10.1	157.1	11.3	4.3	7.7
46°F	10.7	9.7	152.3	10.8	4.2	7.3
45°F	10.7	9.5	150.0	10.6	4.1	7.2
44°F	10.8	9.3	147.7	10.3	4.0	7.1
42°F	10.8	8.9	143.3	9.9	3.9	6.8
40°F	10.8	8.5	138.9	9.4	3.8	6.5
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	11.9	9.6	156.2	9.8	3.9	6.7
48°F	11.9	9.2	151.6	9.3	3.7	6.5
46°F	12.0	8.9	147.0	8.9	3.6	6.2
45°F	12.0	8.7	144.8	8.7	3.5	6.1
44°F	12.0	8.5	142.6	8.5	3.5	6.0
42°F	12.1	8.1	138.3	8.0	3.4	5.7
40°F	12.1	7.7	134.2	7.7	3.2	5.5
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	12.6	9.2	153.2	8.8	3.6	6.2
48°F	12.6	8.8	148.7	8.4	3.5	5.9
46°F	12.7	8.4	144.3	8.0	3.3	5.7
45°F	12.7	8.2	142.1	7.8	3.3	5.6
44°F	12.7	8.0	140.0	7.6	3.2	5.5
42°F	12.8	7.7	135.8	7.2	3.1	5.2
40°F	12.8	7.3	131.7	6.9	3.0	5.0
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	13.3	8.7	150.2	7.9	3.3	5.6
48°F	13.4	8.4	145.8	7.5	3.2	5.4
46°F	13.4	8.0	141.5	7.1	3.1	5.2
45°F	13.5	7.8	139.4	6.9	3.0	5.1
44°F	13.5	7.6	137.3	6.8	3.0	5.0
42°F	13.5	7.3	133.2	6.4	2.9	4.8
40°F	13.6	6.9	129.2	6.1	2.8	4.6
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	14.1	8.3	147.2	7.0	3.1	5.1
48°F	14.2	7.9	142.9	6.7	3.0	4.9
46°F	14.2	7.5	138.7	6.3	2.9	4.7
45°F	14.3	7.3	136.6	6.2	2.8	4.6
44°F	14.3	7.2	134.6	6.0	2.8	4.5
42°F	14.4	6.8	130.6	5.7	2.7	4.3
40°F	14.4	6.5	126.7	5.4	2.6	4.2

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS015XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	15.4	18.9	278.9	14.7	5.3	9.6
48°F	15.3	18.2	270.4	14.2	5.2	9.3
46°F	15.3	17.5	262.2	13.7	5.0	9.0
45°F	15.3	17.2	258.1	13.4	4.9	8.9
44°F	15.3	16.8	254.1	13.2	4.9	8.7
42°F	15.3	16.2	246.4	12.7	4.7	8.4
40°F	15.3	15.6	238.8	12.2	4.6	8.2
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	17.3	17.7	271.3	12.3	4.6	8.2
48°F	17.2	17.0	263.2	11.9	4.5	8.0
46°F	17.2	16.4	255.4	11.4	4.3	7.7
45°F	17.2	16.1	251.6	11.2	4.3	7.6
44°F	17.2	15.8	247.9	11.0	4.2	7.4
42°F	17.3	15.1	240.6	10.5	4.1	7.2
40°F	17.3	14.6	233.4	10.1	4.0	6.9
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	19.5	14.4	239.0	8.8	3.6	6.2
48°F	19.5	15.8	256.2	9.8	3.9	6.7
46°F	19.5	15.2	249.9	9.4	3.7	6.5
45°F	19.5	14.9	245.3	9.2	3.7	6.4
44°F	19.5	14.6	241.8	9.0	3.6	6.3
42°F	19.5	14.0	234.8	8.6	3.5	6.1
40°F	19.5	13.5	228.1	8.3	3.4	5.9
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	20.7	15.8	260.0	9.2	3.7	6.4
48°F	20.7	15.2	252.7	8.8	3.6	6.2
46°F	20.7	14.6	245.6	8.4	3.5	6.0
45°F	20.7	14.3	242.1	8.3	3.4	5.9
44°F	20.7	14.0	238.7	8.1	3.4	5.8
42°F	20.8	13.4	232.0	7.8	3.3	5.6
40°F	20.8	12.9	225.5	7.4	3.2	5.4
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	22.0	15.1	256.2	8.2	3.4	5.8
48°F	22.0	14.5	249.2	7.9	3.3	5.6
46°F	22.1	13.9	242.3	7.6	3.2	5.4
45°F	22.1	13.6	238.9	7.4	3.2	5.4
44°F	22.1	13.4	235.6	7.3	3.1	5.3
42°F	22.1	12.8	229.2	6.9	3.0	5.1
40°F	22.2	12.3	222.8	6.6	2.9	4.9
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	23.4	14.4	252.5	7.4	3.2	5.3
48°F	23.5	13.8	245.6	7.1	3.1	5.1
46°F	23.5	13.2	239.0	6.8	3.0	5.0
45°F	23.5	13.0	235.8	6.6	2.9	4.9
44°F	23.5	12.7	232.6	6.5	2.9	4.8
42°F	23.6	12.2	226.3	6.2	2.8	4.6
40°F	23.6	11.6	220.2	5.9	2.7	4.5

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS020XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	17.7	22.5	329.7	15.2	5.5	9.9
48°F	17.7	21.6	319.7	14.7	5.3	9.6
46°F	17.6	20.8	310.0	14.2	5.2	9.3
45°F	17.6	20.4	305.2	13.9	5.1	9.2
44°F	17.6	20.0	300.4	13.6	5.0	9.0
42°F	17.6	19.3	291.1	13.1	4.9	8.7
40°F	17.6	18.5	281.9	12.6	4.7	8.4
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	19.9	21.0	319.3	12.7	4.7	8.4
48°F	19.9	20.2	309.6	12.2	4.6	8.1
46°F	19.9	19.4	300.1	11.7	4.4	7.9
45°F	19.9	19.0	295.5	11.5	4.4	7.7
44°F	19.9	18.6	290.9	11.2	4.3	7.6
42°F	19.9	17.8	281.9	10.8	4.2	7.3
40°F	19.9	17.1	273.1	10.3	4.0	7.1
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	22.5	19.3	308.3	10.3	4.0	7.0
48°F	22.5	18.5	299.1	9.9	3.9	6.8
46°F	22.5	17.8	290.1	9.5	3.8	6.6
45°F	22.5	17.4	285.7	9.3	3.7	6.4
44°F	22.5	17.0	281.3	9.1	3.7	6.3
42°F	22.5	16.3	272.8	8.7	3.5	6.1
40°F	22.6	15.6	264.6	8.3	3.4	5.9
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	23.9	18.4	302.8	9.2	3.7	6.4
48°F	24.0	17.7	293.8	8.9	3.6	6.2
46°F	24.0	16.9	285.1	8.5	3.5	6.0
45°F	24.0	16.6	280.9	8.3	3.4	5.9
44°F	24.0	16.2	276.7	8.1	3.4	5.8
42°F	24.1	15.5	268.5	7.8	3.3	5.5
40°F	24.1	14.9	260.5	7.4	3.2	5.3
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	25.5	17.5	297.2	8.2	3.4	5.8
48°F	25.5	16.8	288.6	7.9	3.3	5.6
46°F	25.6	16.1	280.2	7.5	3.2	5.4
45°F	25.6	15.7	276.1	7.4	3.2	5.3
44°F	25.6	15.4	272.1	7.2	3.1	5.2
42°F	25.7	14.7	264.3	6.9	3.0	5.0
40°F	25.7	14.1	256.7	6.6	2.9	4.8
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	27.2	16.6	291.7	7.3	3.1	5.3
48°F	27.2	15.9	283.5	7.0	3.1	5.1
46°F	27.3	15.2	275.5	6.7	3.0	4.9
45°F	27.3	14.9	271.6	6.5	2.9	4.8
44°F	27.3	14.5	267.8	6.4	2.9	4.7
42°F	27.4	13.9	260.3	6.1	2.8	4.6
40°F	27.5	13.3	253.1	5.8	2.7	4.4

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS030XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	26.8	33.6	494.7	15.1	5.4	9.8
48°F	26.6	32.4	479.7	14.6	5.3	9.6
46°F	26.5	31.2	465.1	14.1	5.1	9.3
45°F	26.5	30.6	457.9	13.9	5.1	9.2
44°F	26.4	30.1	450.8	13.7	5.0	9.0
42°F	26.3	28.9	436.9	13.2	4.9	8.7
40°F	26.2	27.8	423.4	12.7	4.7	8.5
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	29.6	31.5	478.9	12.8	4.8	8.5
48°F	29.5	30.4	464.7	12.4	4.6	8.2
46°F	29.4	29.2	450.8	11.9	4.5	8.0
45°F	29.3	28.7	444.0	11.7	4.4	7.9
44°F	29.3	28.1	437.3	11.5	4.4	7.8
42°F	29.2	27.0	424.1	11.1	4.3	7.5
40°F	29.1	26.0	411.3	10.7	4.1	7.3
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	32.9	29.2	462.6	10.7	4.1	7.3
48°F	32.8	28.1	449.1	10.3	4.0	7.0
46°F	32.7	27.1	436.1	9.9	3.9	6.8
45°F	32.6	26.5	429.7	9.8	3.9	6.7
44°F	32.6	26.0	423.3	9.6	3.8	6.6
42°F	32.5	25.0	411.0	9.2	3.7	6.4
40°F	32.5	24.0	398.9	8.9	3.6	6.2
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	34.7	28.0	454.2	9.7	3.8	6.7
48°F	34.6	26.9	441.2	9.3	3.7	6.5
46°F	34.5	25.9	428.6	9.0	3.6	6.3
45°F	34.5	25.4	422.4	8.8	3.6	6.2
44°F	34.5	24.9	416.3	8.7	3.5	6.1
42°F	34.4	23.9	404.4	8.3	3.4	5.9
40°F	34.3	23	392.7	8.0	3.4	5.7
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	36.6	26.7	445.8	8.8	3.6	6.1
48°F	36.6	25.7	433.3	8.4	3.5	5.9
46°F	36.5	24.7	421.1	8.1	3.4	5.8
45°F	36.5	24.2	415.1	8.0	3.3	5.7
44°F	36.4	23.8	409.2	7.8	3.3	5.6
42°F	36.4	22.8	397.7	7.5	3.2	5.4
40°F	36.3	21.9	386.5	7.2	3.1	5.2
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	38.7	25.4	437.4	7.9	3.3	5.6
48°F	38.7	24.5	425.3	7.6	3.2	5.5
46°F	38.6	23.5	413.6	7.3	3.1	5.3
45°F	38.6	23.0	407.8	7.2	3.1	5.2
44°F	38.6	22.6	402.2	7.0	3.1	5.1
42°F	38.5	21.7	391.1	6.7	3.0	5.0
40°F	38.5	20.8	380.4	6.5	2.9	4.8

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS050XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	43.0	54.4	799.0	15.2	5.5	9.9
48°F	42.9	52.3	774.1	14.7	5.3	9.6
46°F	42.7	50.4	750.0	14.1	5.1	9.3
45°F	42.7	49.4	738.2	13.9	5.1	9.2
44°F	42.6	48.4	726.6	13.6	5.0	9.0
42°F	42.5	46.6	703.9	13.2	4.9	8.7
40°F	42.4	44.8	681.8	12.7	4.7	8.4
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	47.7	50.8	772.7	12.8	4.8	8.5
48°F	47.6	48.9	749.3	12.3	4.6	8.2
46°F	47.5	47.1	726.6	11.9	4.5	8.0
45°F	47.4	46.1	715.4	11.7	4.4	7.9
44°F	47.4	45.3	704.5	11.5	4.4	7.7
42°F	47.2	43.5	683.1	11.0	4.2	7.5
40°F	47.1	41.8	662.3	10.6	4.1	7.2
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	53.1	47.1	746.8	10.7	4.1	7.2
48°F	53.0	45.3	724.9	10.3	4.0	7.0
46°F	52.9	43.6	703.5	9.9	3.9	6.8
45°F	52.9	42.7	693.1	9.7	3.8	6.7
44°F	52.8	41.9	682.9	9.5	3.8	6.6
42°F	52.7	40.3	662.8	9.2	3.7	6.4
40°F	52.6	38.7	643.3	8.8	3.6	6.2
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	56.1	45.2	734.1	9.7	3.8	6.7
48°F	56.0	43.5	712.9	9.3	3.7	6.5
46°F	55.9	41.8	692.3	9.0	3.6	6.3
45°F	55.8	41.0	682.2	8.8	3.6	6.2
44°F	55.8	40.2	672.3	8.6	3.5	6.1
42°F	55.7	38.6	652.9	8.3	3.4	5.9
40°F	55.6	37.1	634.1	8.0	3.3	5.7
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	59.3	43.3	721.5	8.8	3.6	6.1
48°F	59.2	41.6	701.1	8.4	3.5	5.9
46°F	59.1	40.0	681.2	8.1	3.4	5.8
45°F	59.0	39.2	671.5	8.0	3.3	5.7
44°F	59.0	38.4	661.9	7.8	3.3	5.6
42°F	58.8	36.9	643.2	7.5	3.2	5.4
40°F	58.7	35.4	625.1	7.2	3.1	5.2
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	62.7	41.3	709.2	7.9	3.3	5.6
48°F	62.6	39.7	689.5	7.6	3.2	5.5
46°F	62.4	38.1	670.3	7.3	3.1	5.3
45°F	62.4	37.4	661.0	7.2	3.1	5.2
44°F	62.3	36.6	651.8	7.0	3.1	5.1
42°F	62.2	35.1	633.8	6.8	3.0	5.0
40°F	62.1	33.7	616.3	6.5	2.9	4.8

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R410A REFRIGERANT

### MS070XC-410A LEAVING HOT WATER TEMPERATURE

105°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	56.0	71.1	1043.6	15.2	5.5	9.9
48°F	55.7	68.5	1011.7	14.7	5.3	9.7
46°F	55.5	66.0	980.6	14.3	5.2	9.4
45°F	55.4	64.7	965.4	14.0	5.1	9.2
44°F	55.3	63.5	950.3	13.8	5.0	9.1
42°F	55.0	61.1	920.8	13.3	4.9	8.8
40°F	54.8	58.8	892.1	12.9	4.8	8.5
115°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	62.1	66.5	1010.0	12.9	4.8	8.5
48°F	61.9	64.1	980.0	12.4	4.6	8.3
46°F	61.6	61.7	950.7	12.0	4.5	8.0
45°F	61.5	60.5	936.3	11.8	4.5	7.9
44°F	61.4	59.4	922.1	11.6	4.4	7.8
42°F	61.2	57.1	894.3	11.2	4.3	7.6
40°F	61.1	54.9	867.2	10.8	4.2	7.3
125°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	69.1	61.7	976.6	10.7	4.1	7.3
48°F	68.9	59.5	948.4	10.4	4.0	7.1
46°F	68.7	57.2	921.0	10.0	3.9	6.9
45°F	68.6	56.1	907.5	9.8	3.9	6.8
44°F	68.5	55.0	894.2	9.6	3.8	6.7
42°F	68.4	52.9	868.1	9.3	3.7	6.5
40°F	68.2	50.8	842.6	8.9	3.6	6.2
130°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	73.0	59.3	960.0	9.7	3.9	6.7
48°F	72.8	57.0	932.8	9.4	3.8	6.5
46°F	72.6	54.9	906.2	9.1	3.7	6.3
45°F	72.5	53.8	893.2	8.9	3.6	6.2
44°F	72.4	52.8	880.3	8.7	3.6	6.1
42°F	72.3	50.7	855.0	8.4	3.5	5.9
40°F	72.1	48.7	830.3	8.1	3.4	5.8
135°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	77.2	56.7	943.4	8.8	3.6	6.2
48°F	76.9	54.6	917.1	8.5	3.5	6.0
46°F	76.8	52.5	891.5	8.2	3.4	5.8
45°F	76.7	51.5	878.9	8.1	3.4	5.7
44°F	76.6	50.4	866.4	7.9	3.3	5.6
42°F	76.4	48.5	842.0	7.6	3.2	5.5
40°F	76.3	46.5	818.1	7.3	3.1	5.3
140°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	81.5	54.1	926.9	8.0	3.3	5.7
48°F	81.3	52.0	901.5	7.7	3.3	5.5
46°F	81.2	50.0	876.7	7.4	3.2	5.3
45°F	81.1	49.0	864.6	7.3	3.1	5.3
44°F	81.0	48.0	852.6	7.1	3.1	5.2
42°F	80.8	46.1	829.0	6.8	3.0	5.0
40°F	80.7	44.2	805.9	6.6	2.9	4.9

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R134a REFRIGERANT

### MS010AN-134a LEAVING HOT WATER TEMPERATURE

150°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	10.0	5.5	99.6	6.5	2.9	4.8
48°F	10.0	5.2	96.6	6.3	2.8	4.7
46°F	10.0	5.0	93.6	6.0	2.8	4.5
45°F	10.0	4.9	92.2	5.9	2.7	4.4
44°F	9.9	4.7	88.2	1.2	2.7	4.4
42°F	9.9	4.5	88.1	5.5	2.6	4.2
40°F	9.9	4.3	85.6	5.2	2.5	4.1
160°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	11.2	5.0	97.8	5.3	2.6	4.1
48°F	11.2	4.7	95.0	5.0	2.5	4.0
46°F	11.2	4.5	92.4	4.8	2.4	3.8
45°F	11.2	4.4	91.1	4.7	2.4	3.8
44°F	11.2	4.3	89.8	4.6	2.3	3.7
42°F	11.3	4.1	87.4	4.4	2.3	3.6
40°F	11.3	3.9	85.1	4.1	2.2	3.4
170°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	12.7	4.4	96.3	4.2	2.2	3.5
48°F	12.7	4.2	93.8	4.0	2.2	3.3
46°F	12.7	4.0	91.4	3.8	2.1	3.2
45°F	12.7	3.9	90.3	3.7	2.1	3.2
44°F	12.7	3.8	89.1	3.6	2.1	3.1
42°F	12.8	3.6	87.0	3.4	2.0	3.0
40°F						
180°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	14.3	3.9	95.0	3.2	2.0	2.9
48°F	14.3	3.7	92.8	3.1	1.9	2.8
46°F	14.4	3.5	90.7	2.9	1.8	2.7
45°F	14.4	3.4	89.7	2.8	1.8	2.6
44°F	14.5	3.3	88.8	2.7	1.8	2.6
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R134a REFRIGERANT

### MS015AN-134a LEAVING HOT WATER TEMPERATURE

150°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	19.2	8.1	162.5	5.0	2.5	4.0
48°F	19.2	7.7	157.8	4.8	2.4	3.8
46°F	19.1	7.3	153.3	4.6	2.3	3.7
45°F	19.1	7.2	151.1	4.5	2.3	3.6
44°F	19.1	7.0	148.9	4.4	2.3	3.6
42°F	19.0	6.6	144.6	4.2	2.2	3.5
40°F	19.0	6.3	140.5	4.0	2.2	3.3
160°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	21.3	7.1	157.9	4.0	2.2	3.4
48°F	21.2	6.8	153.7	3.8	2.1	3.2
46°F	21.2	6.4	149.5	3.7	2.1	3.1
45°F	21.1	6.3	147.5	3.6	2.0	3.1
44°F	21.1	6.1	145.5	3.5	2.0	3.0
42°F	21.0	5.8	141.6	3.3	2.0	2.9
40°F	21.0	5.5	137.8	3.2	1.9	2.9
170°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	23.5	6.1	153.7	3.1	1.9	2.8
48°F	23.4	5.8	149.9	3.0	1.9	2.8
46°F	23.4	5.5	146.1	2.8	1.8	2.7
45°F	23.3	5.5	144.3	2.8	1.8	2.6
44°F	23.3	5.3	142.5	2.7	1.8	2.6
42°F	23.2	5.0	139.0	2.6	1.8	2.5
40°F						
180°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	25.9	5.2	150.0	2.4	1.7	2.4
48°F	25.8	4.9	146.6	2.3	1.7	2.3
46°F	25.7	4.6	143.2	2.2	1.6	2.3
45°F	25.7	4.5	141.6	2.1	1.6	2.2
44°F	25.6	4.4	140.0	2.1	1.6	2.2
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R134a REFRIGERANT

### MS020AN-134a LEAVING HOT WATER TEMPERATURE

150°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	20.3	9.4	181.8	5.6	2.6	4.3
48°F	20.2	9.0	176.6	5.3	2.6	4.1
46°F	20.2	8.6	171.5	5.1	2.5	4.0
45°F	20.2	8.4	169.0	5.0	2.5	3.9
44°F	20.1	8.2	166.5	4.9	2.4	3.9
42°F	20.1	7.8	161.7	4.6	2.4	3.7
40°F	20.0	7.4	157.0	4.4	2.3	3.6
160°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	22.5	8.4	177.3	4.5	2.3	3.6
48°F	22.4	8.0	172.5	4.3	2.3	3.5
46°F	22.4	7.6	167.7	4.1	2.2	3.4
45°F	22.3	7.4	165.4	4.0	2.2	3.3
44°F	22.3	7.3	163.1	3.9	2.1	3.3
42°F	22.2	6.9	158.6	3.7	2.1	3.2
40°F	22.2	6.6	154.2	3.6	2.0	3.1
170°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	24.8	7.4	173.1	3.6	2.0	3.1
48°F	24.8	7.0	168.6	3.4	2.0	3.0
46°F	24.7	6.7	164.2	3.2	2.0	2.9
45°F	24.7	6.5	162.1	3.2	1.9	2.9
44°F	24.6	6.3	159.9	3.1	1.9	2.8
42°F	24.5	6.0	155.8	2.9	1.9	2.7
40°F						
180°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	27.4	6.3	169.0	2.8	1.8	2.6
48°F	27.3	6.0	164.9	2.6	1.8	2.5
46°F	27.2	5.7	160.9	2.5	1.7	2.5
45°F	27.2	5.5	159.0	2.4	1.7	2.4
44°F	27.1	5.4	157.0	2.4	1.7	2.4
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

**Dedicated Heat Recovery Chiller™ (DHRC)**  
**PERFORMANCE DATA-R134a REFRIGERANT**

<b>MS030AN-134a LEAVING HOT WATER TEMPERATURE</b>						
<b>150°F</b>						
<b>Leaving Chilled Water °F</b>	<b>Power (kW)</b>	<b>Cooling (Tons)</b>	<b>Heat (MBH)</b>	<b>Cooling EER</b>	<b>Heat COP</b>	<b>H &amp; C COP</b>
50°F	25.6	13.6	250.6	6.4	2.9	4.7
48°F	25.6	13.0	243.1	6.1	2.8	4.6
46°F	25.6	12.4	235.6	5.8	2.7	4.4
45°F	25.6	12.1	231.9	5.7	2.7	4.3
44°F	25.6	11.8	228.3	5.5	2.6	4.2
42°F	25.6	11.2	221.0	5.2	2.5	4.1
40°F	25.5	10.6	213.9	5.0	2.5	3.9
<b>160°F</b>						
<b>Leaving Chilled Water °F</b>	<b>Power (kW)</b>	<b>Cooling (Tons)</b>	<b>Heat (MBH)</b>	<b>Cooling EER</b>	<b>Heat COP</b>	<b>H &amp; C COP</b>
50°F	28.8	12.1	243.3	5.0	2.5	4.0
48°F	28.7	11.5	235.9	4.8	2.4	3.8
46°F	28.7	10.9	228.5	4.5	2.3	3.7
45°F	28.7	10.6	224.9	4.4	2.3	3.6
44°F	28.7	10.3	221.3	4.3	2.3	3.5
42°F	28.7	9.7	214.1	4.1	2.2	3.4
40°F	28.7	9.1	207.1	3.8	2.1	3.2
<b>170°F</b>						
<b>Leaving Chilled Water °F</b>	<b>Power (kW)</b>	<b>Cooling (Tons)</b>	<b>Heat (MBH)</b>	<b>Cooling EER</b>	<b>Heat COP</b>	<b>H &amp; C COP</b>
50°F	32.3	10.5	235.6	3.9	2.1	3.3
48°F	32.3	9.9	228.2	3.7	2.1	3.1
46°F	32.2	9.3	221.0	3.4	2.0	3.0
45°F	32.2	9.0	217.4	3.3	2.0	3.0
44°F	32.2	8.7	213.8	3.2	1.9	2.9
42°F	32.2	8.1	206.7	3.0	1.9	2.8
40°F						
<b>180°F</b>						
<b>Leaving Chilled Water °F</b>	<b>Power (kW)</b>	<b>Cooling (Tons)</b>	<b>Heat (MBH)</b>	<b>Cooling EER</b>	<b>Heat COP</b>	<b>H &amp; C COP</b>
50°F	36.2	8.7	227.4	2.9	1.8	2.7
48°F	36.2	8.1	220.1	2.7	1.8	2.6
46°F						
45°F						
44°F						
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R134a REFRIGERANT

### MS050AN-134a LEAVING HOT WATER TEMPERATURE

150°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	46.1	26.3	473.1	6.9	3.0	5.0
48°F	46.0	25.2	459.1	6.6	2.9	4.9
46°F	45.9	24.1	445.7	6.3	2.8	4.7
45°F	45.9	23.6	439.1	6.2	2.8	4.6
44°F	45.8	23.0	432.7	6.0	2.8	4.5
42°F	45.8	22.0	420.3	5.8	2.7	4.4
40°F	45.7	21.0	408.4	5.5	2.6	4.2
160°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	52.0	24.4	469.6	5.6	2.6	4.3
48°F	52.0	23.3	456.7	5.4	2.6	4.1
46°F	52.1	22.3	444.5	5.1	2.5	4.0
45°F	25.1	21.7	438.5	5.0	2.5	3.9
44°F	52.1	21.3	432.7	4.9	2.4	3.9
42°F	52.2	20.3	421.4	4.7	2.4	3.7
40°F	52.3	19.4	410.7	4.4	2.3	3.6
170°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	59.3	22.3	470.0	4.5	2.3	3.6
48°F	59.5	21.3	458.4	4.3	2.3	3.5
46°F	59.7	20.3	447.4	4.1	2.2	3.4
45°F	59.8	19.9	442.1	4.0	2.2	3.3
44°F	59.9	19.4	437.0	3.9	2.1	3.3
42°F	60.1	18.5	427.0	3.7	2.1	3.2
40°F						
180°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	68.3	20.2	475.1	3.5	2.0	3.1
48°F	68.7	19.2	465.0	3.4	2.0	3.0
46°F						
45°F						
44°F						
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## PERFORMANCE DATA-R134a REFRIGERANT

### MS070AN-134a LEAVING HOT WATER TEMPERATURE

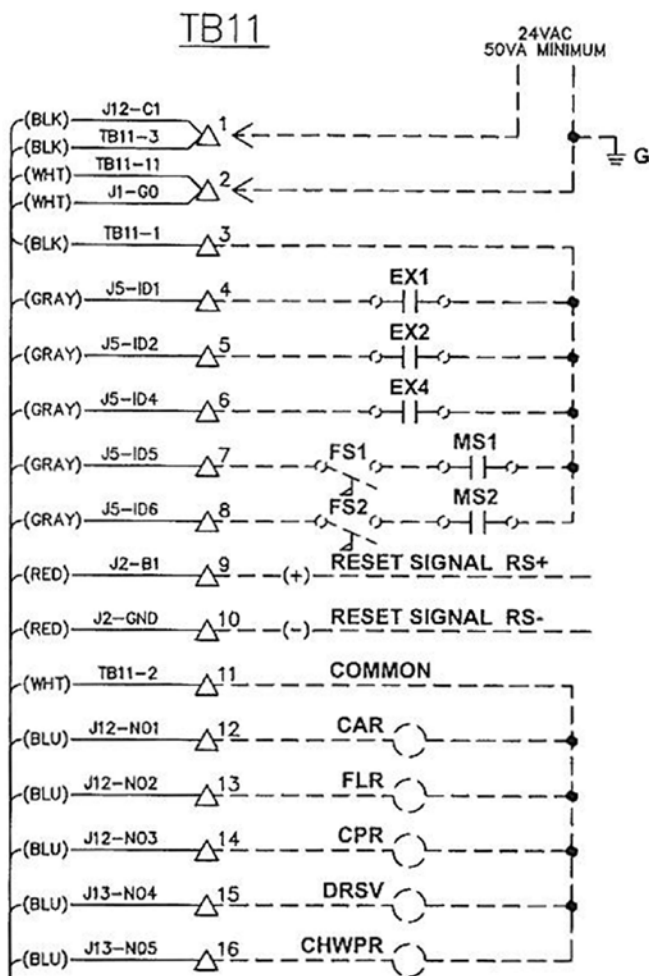
150°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	58.7	34.3	612.0	7.0	3.1	5.1
48°F	58.6	32.8	593.8	6.7	3.0	4.9
46°F	58.5	31.4	576.3	6.4	2.9	4.8
45°F	58.5	30.7	567.8	6.3	2.8	4.7
44°F	58.4	30.0	559.5	6.2	2.8	4.6
42°F	58.4	28.7	543.3	5.9	2.7	4.5
40°F	58.3	27.4	527.8	5.6	2.7	4.3
160°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	66.3	31.7	607.0	5.7	2.7	4.4
48°F	66.3	30.3	590.3	5.5	2.6	4.2
46°F	66.4	29.0	574.2	5.2	2.5	4.1
45°F	66.4	28.3	566.5	5.1	2.5	4.0
44°F	66.4	27.7	558.9	5.0	2.5	3.9
42°F	66.5	26.4	544.2	4.8	2.4	3.8
40°F	66.7	25.2	530.2	4.5	2.3	3.7
170°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	75.7	29.1	606.9	4.6	2.4	3.7
48°F	75.9	27.8	591.8	4.4	2.3	3.6
46°F	76.1	26.5	577.5	4.2	2.2	3.5
45°F	76.3	25.9	570.6	4.1	2.2	3.4
44°F	76.4	25.3	563.8	4.0	2.2	3.3
42°F	76.7	24.1	550.8	3.8	2.1	3.2
40°F						
180°F						
Leaving Chilled Water °F	Power (kW)	Cooling (Tons)	Heat (MBH)	Cooling EER	Heat COP	H & C COP
50°F	87.2	26.3	612.9	3.6	2.1	3.1
48°F	87.7	25.1	599.6	3.4	2.0	3.0
46°F						
45°F						
44°F						
42°F						
40°F						

For non-published performance ranges, please contact Multistack.

# Dedicated Heat Recovery Chiller™ (DHRC)

## 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.	<b>EXTERNAL INPUTS: (CLOSED TO OPERATE)</b>
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.	<b>EXTERNAL OUTPUTS:</b>
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.)
DRSV	- DEBRIS REMOVAL SOLENOID VALVE (24VAC, 6W, 16VA) MAX. OF (2) DRSV IN THIS CIRCUIT

#### NOTES:

- \*RLA1 = RLA of the largest compressor in the system. RLA2 & RLA3 = RLA of the other compressors in the system.
- The total system Minimum Circuit Ampacity (aMCA) shall not exceed 500A.
- 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.

### System Wire & Fuse Sizing Specifications

(Applicable codes may require different wire sizing)

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

R410A	VOLTAGE	208	230	460	575
MS010XC		22.8/123	20.6/123	10.3/62	8.4/50
MS015XC		36.5/225	33/225	16.5/114	13/80
MS020XC		44/239	40/239	20/125	16/80
MS030XC		68/340	61/340	31/173	25/132
MS050XC		101/605	91/605	46/272	37/215
MS070XC		133/599	120/599	60/310	48/239

R134a	VOLTAGE	208	230	460	575
MS010AN		23.5/128	21/128	10.2/63	8.2/49
MS015AN		38.7/225	35/225	17.5/114	14/80
MS020AN		44/239	40/239	20/125	16/80
MS030AN		61/300	55/300	27/150	22/109
MS050AN		100/500	90/500	46/250	37/198
MS070AN		127/599	114/599	58/310	47/239

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

- Wiring Sizing: Minimum Circuit Ampacity (MCA)

$$MCA = (1.25 \times RLA1^*) + RLA2 + RLA3$$

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

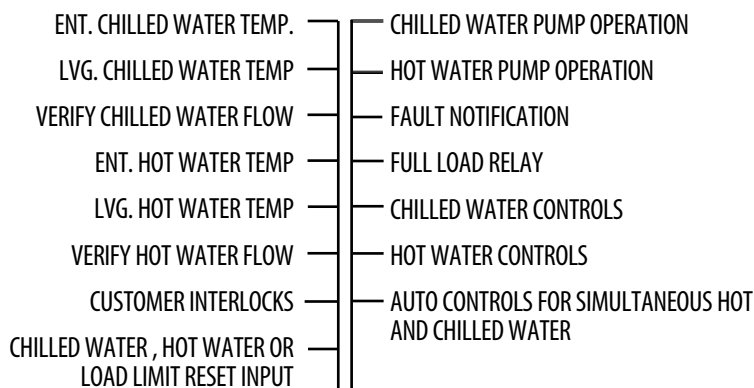
- Fuse Sizing: Maximum Fuse (MF), Type RK5 Fuse

$$MF = (2.25 \times RLA1^*) + RLA2 + RLA3$$

Where the MF does not equal a standard size fuse, the next larger size should be used.

# Dedicated Heat Recovery Chiller™ (DHRC) CONTROLLER SCHEMATICS

## Chiller Data



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



**REMOTE DISPLAY**  
(optional)

## Module Data

### MODULE CONTROL PANEL

#### 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)

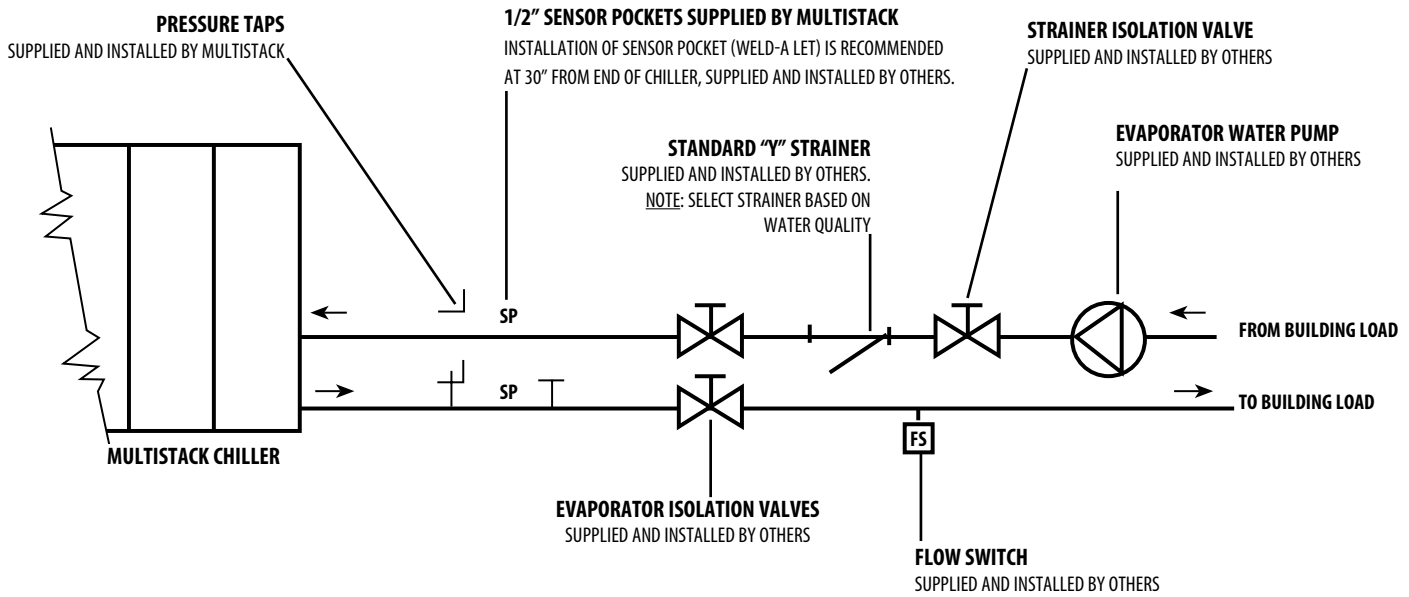
#### SNMP PROTOCOL

#### LONMARK™

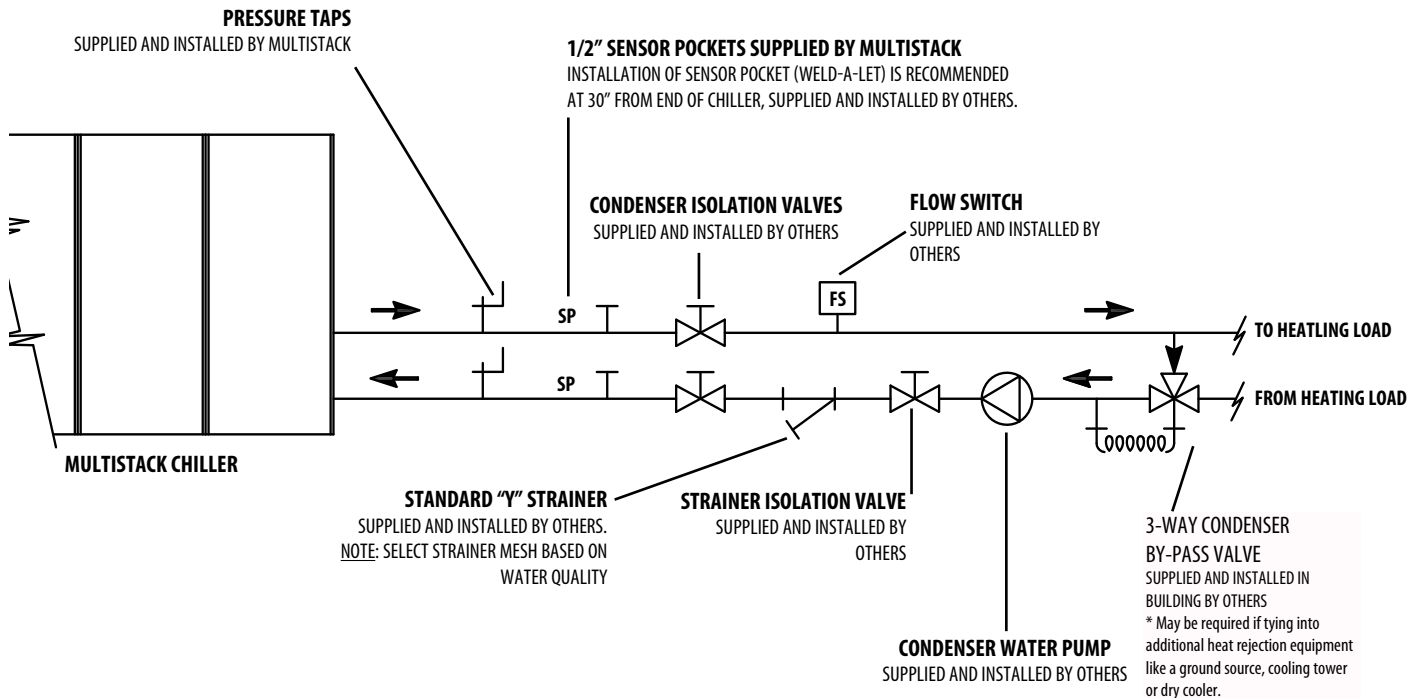
# Dedicated Heat Recovery Chiller™ (DHRC)

## SCHEMATICS

### Required Chilled Water Piping (Evaporator)

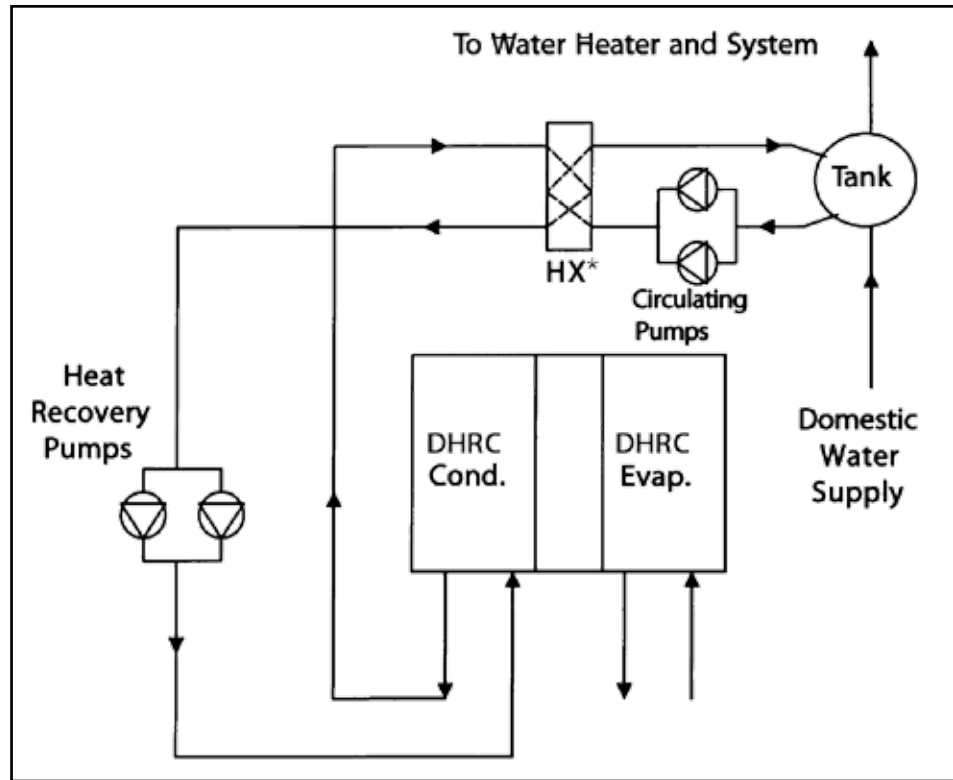


### Required Hot Water Piping (Condenser)



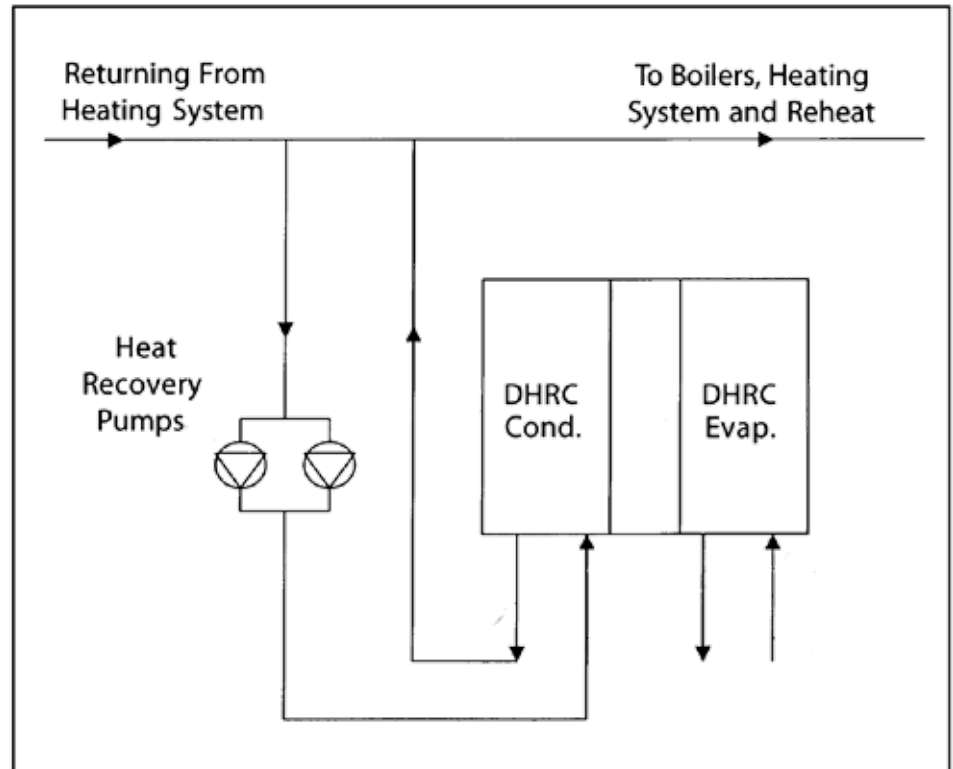
**SAMPLE PIPING SCHEMATICS**

Figure 1: Domestic Water Heating



If using double wall heat exchangers, intermediate heat exchanger is not required.  
 \*HX=Intermediate heat exchanger.

Figure 2: Space Hot Water Heating



# Dedicated Heat Recovery Chiller™ (DHRC)

## SAMPLE PIPING SCHEMATICS, Cont'd

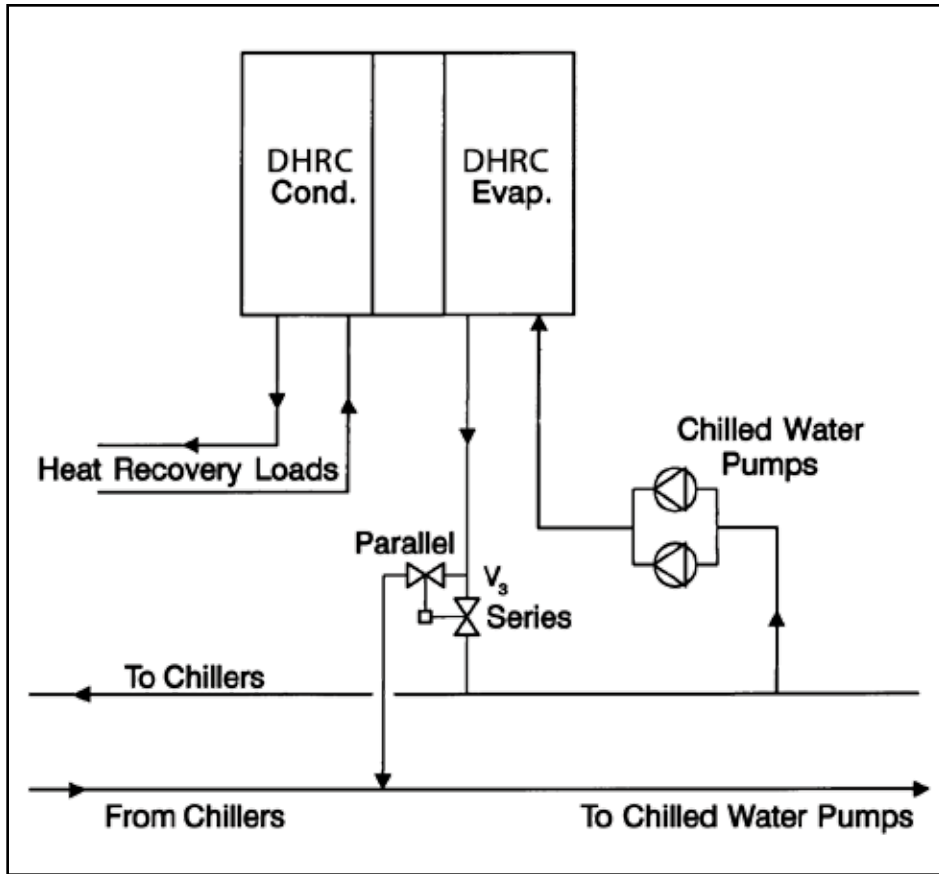


Figure 3: Chiller Cooling Load

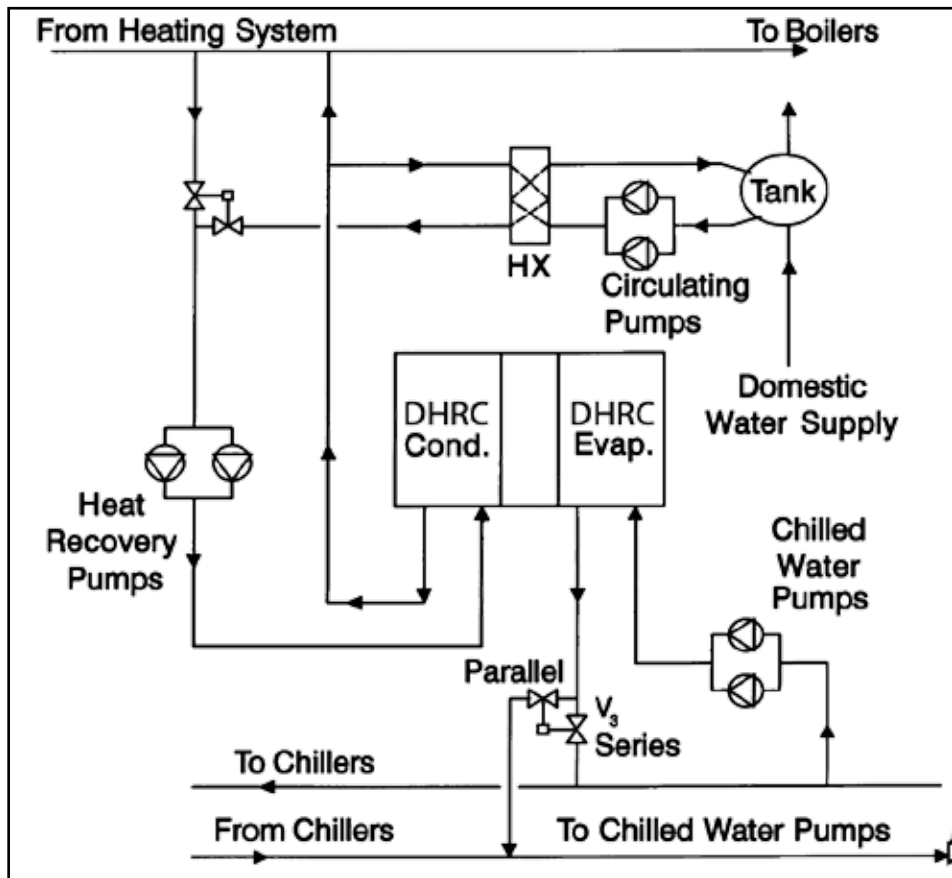


Figure 4: Combination System

### 1.01 OPERATING CONDITIONS

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

### 1.02 DEDICATED HEAT RECOVERY CHILLER

- A. Approved manufacturer is MULTISTACK.
- B. System Description: Chiller shall incorporate Scroll-type compressors and consist of multiple \_\_\_\_\_-ton refrigerant circuits. Each refrigerant circuit shall consist of an individual compressor, condenser, evaporator, thermal expansion 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 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 \_\_\_\_\_ lb. of R-410A or R-134a refrigerant.
- C. General
  1. Chiller Modules shall be ETL listed in accordance with UL Standard 995, CSA certified per Standard C22.236.
  2. Dedicated Heat Recovery Chiller modules shall be based on AHRI certified platforms.
  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 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. Grooved end connections are provided for interconnection to six inch standard (6.625" outside diameter) piping with Victaulic type couplings. All headers to be factory insulated. When modules are joined together mains shall create a single point of connection for hot and cold water.
- E. Evaporators and condensers: Each evaporator and condenser shall be brazed plate heat exchangers constructed of 316 stainless steel, designed and tested 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. Both shall be insulated.
- 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. 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 Status
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 semi-graphical 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 chilled water temperatures from each refrigeration system shall be programmed to protect against freeze-up.
6. The control system shall monitor entering and leaving hot and 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 fine tune the chiller to different existing building conditions.
7. Optionally, 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.
- H. 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 Hot/Chilled/Load Limit Reset Signal
  4. EHW to Mechanical Cooling Module
  5. LHW 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
- I. Each inlet water header shall incorporate a built in 30-mesh 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.
- J. 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.

# Dedicated Heat Recovery Chiller™ (DHRC)

## MECHANICAL SPECIFICATIONS, cont'd

### 1.03 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 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 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. Dedicated Heat Recovery Controls (DHRC)
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. 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 fine tune the Dedicated Heat Recovery Chiller to different existing building 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
- F. Optional—Variable Flow Operation—Chilled and/or Hot Water
1. 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.

- G. Optional—Total Access Design

1. 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.

- H. Optional—Double Wall Vented Condenser for Potable Water in DHRC (MS020 and MS030 only)

### 1.04 INSTALLATIONS

#### 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 organic materials. 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 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. The Y-strainer should remain in place for permanent operation.

### 1.05 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<sub>3</sub> 30 to 500 ppm
  4. Alkalinity as Ca CO<sub>3</sub> 30 to 500 ppm
  5. Chlorides Less than 200 ppm
  6. Sulfates Less than 200 ppm

### **AHRI Certified**

All Multistack certifiable production chillers are AHRI Certified providing performance assurance when comparisons are done in that category.

### **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.

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### **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**<sup>®</sup>

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