MULTISTACK®

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Water Cooled Condensing Unit

Product Data Catalog

For Modules:
MS020C1, MS030C1, MS030C2, MS050B1, MS050Z6, MS070R1, MS090R1

Highly Dependable

- Multiple independent systems.

Simple To Operate

- Thermostatically controlled.
- Automatic pump down during off cycles.

Easy to Install

- Compact modules fit through standard doorways and into elevators.
- Modules interconnect easily and quickly.
- All refrigeration systems are evacuated and shipped with a holding charge of nitrogen
- Each compressor is charged with oil (Additional oil may be required at the time of start-up to accommodate the direct expansion coil and interconnecting lines.

Design Flexibility

- Wide array of module combinations.
- Install only the capacity required at the time.
- Wide array of options available.

Simple to Service

- Does not require proprietary training.
- Service can often be performed on a convenient, non-emergency basis.
- Most components are standard, off the shelf design.

Single Module MS20C1-D • Entering Condenser Water Temperature															
	75°			80°			85°			90°			95°		
Saturated Suction °F	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER
35	22.6	11.9	22.1	22.2	12.4	21.4	21.8	13.0	20.0	21.3	13.7	18.7	20.8	14.4	17.3
37	23.5	11.9	23.6	23.1	12.4	22.2	22.6	13.1	20.8	22.1	13.7	19.4	21.7	14.5	18.0
39	24.4	11.9	24.5	24.0	12.5	23.0	23.5	13.1	21.6	23.0	13.8	20.1	22.5	14.5	18.6
40	24.9	12.0	24.9	24.4	12.5	23.4	23.9	13.1	21.9	23.5	13.8	20.4	22.9	14.5	19.0
41	25.3	12.0	25.4	24.9	12.5	23.9	24.4	13.1	22.3	23.9	13.8	20.8	23.4	14.5	19.3
43	26.3	12.0	26.3	25.8	12.5	24.7	25.3	13.1	23.1	24.8	13.8	21.6	24.3	14.6	20.0
45	27.3	12.0	27.2	26.8	12.6	25.6	26.3	13.2	23.9	25.7	13.8	22.3	25.2	14.6	20.7

Single Module MS30C1-D • Entering Condenser Water Temperature															
	75°			80°			85°			90°			95°		
Saturated Suction °F	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER
35	33.8	18.1	22.4	33.0	18.9	21.0	32.3	19.9	19.5	31.5	20.9	18.1	30.8	22.0	16.7
37	35.1	18.1	23.3	34.4	19.0	21.8	33.6	19.9	20.3	32.8	20.9	18.8	32.0	22.1	17.4
39	36.5	18.1	24.2	35.7	19.0	22.6	34.9	19.9	21.0	34.1	21.0	19.5	33.3	22.1	18.1
40	37.2	18.1	24.6	36.4	19.0	23.0	35.6	19.9	21.4	34.8	21.0	19.9	33.9	22.1	18.4
41	37.9	18.1	25.1	37.1	19.0	23.4	36.3	20.0	21.8	35.4	21.0	20.2	34.6	22.1	18.7
43	39.3	18.1	26.0	38.5	19.0	24.3	37.6	20.0	22.6	36.8	21.0	21.0	35.9	22.2	19.4
45	40.8	18.1	27.0	39.9	19.0	25.2	39.1	20.0	23.5	38.2	21.0	21.8	37.3	22.2	20.2

Single Module MS30C2-D • Entering Condenser Water Temperature															
	75°			80°			85°			90°			95°		
Saturated Suction °F	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER
35	33.9	17.9	22.7	33.2	18.8	21.2	32.4	19.7	19.8	31.7	20.7	18.3	30.9	21.8	17.0
37	35.3	17.9	23.6	34.5	18.8	22.1	33.7	19.7	20.5	33.0	20.7	19.1	32.2	21.8	17.7
39	36.6	17.9	24.5	35.9	18.8	22.9	35.1	19.7	21.3	34.3	20.8	20.0	33.4	21.9	18.3
40	37.3	18.0	25.0	36.5	18.8	23.3	35.7	19.7	21.7	34.9	20.8	20.2	34.1	21.9	18.7
41	38.0	18.0	25.4	37.2	18.8	23.8	36.4	19.8	22.1	35.6	20.8	21.0	34.8	21.9	19.0
43	39.5	18.0	26.4	38.7	18.8	24.6	37.8	19.8	23.0	37.0	20.8	21.3	36.1	21.9	
45	41.0	18.0	27.3	40.1	18.8	25.6	39.2	19.8	23.8	38.4	20.8	22.1			

All performance data is based on a 10°F water temperature drop through the condenser. For total performance multiply above outputs (TONS) and input (kW) by the number of modules. For selection procedure, see selection example.

NOTE: With sufficient notice, 1/2 modules are available when used with one or more full modules. (These modules are physically identical to full modules but with only one refrigerant circuit.)

Performance Tables

Single Module MS50Z6-D • Entering Condenser Water Temperature															
	75°			80°			85°			90°			95°		
Saturated Suction °F	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER
35	56.7	28.3	24.0	55.7	29.3	22.8	54.6	30.4	21.6	53.5	31.6	20.3	52.4	33.0	19.0
37	58.9	28.9	24.5	57.9	29.8	23.3	56.8	30.8	22.1	55.6	32.0	20.9	54.5	33.3	19.6
39	61.2	29.5	24.9	60.1	30.3	23.8	59.0	31.3	22.6	57.8	32.4	21.4	56.6	33.7	20.2
40	62.4	29.8	25.1	61.3	30.6	24.0	60.1	31.5	22.9	58.9	32.6	21.7	57.7	33.8	20.5
41	63.6	30.1	25.3	62.4	30.9	24.3	61.3	31.8	23.1	60.1	32.8	22.0	58.8	34.0	20.7
43	66.0	30.8	25.7	64.8	31.5	24.7	63.6	32.3	23.6	62.4	33.3	22.4	61.1	34.4	21.3
45	68.5	31.6	26.0	67.3	32.2	25.1	66.0	32.9	24.1	64.7	33.8	23.0	63.4	34.9	21.8

Single Module MS70R1-D • Entering Condenser Water Temperature															
	75°			80°			85°			90°			95°		
Saturated Suction °F	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER	Output Tons	Input kW	EER
35	74.2	41.0	21.7	72.9	42.0	20.8	71.4	43.2	19.8	69.8	44.8	18.7	68.0	46.7	17.5
37	77.0	41.8	22.1	75.7	42.7	21.3	74.2	43.9	20.3	72.6	45.4	19.1	70.7	47.2	18.0
39	80.0	42.7	22.5	78.7	43.4	21.7	77.1	44.6	20.8	75.4	46.0	19.7	73.6	47.8	18.5
40	81.5	43.1	22.7	80.2	43.8	21.9	78.6	44.9	21.0	76.9	46.4	19.9	75.0	48.1	18.7
41	83.0	43.6	22.9	81.7	44.3	22.1	80.1	45.3	21.2	78.4	46.7	20.1	76.5	48.4	19.0
43	86.2	44.5	23.2	84.8	45.1	22.5	83.2	46.1	21.7	81.4	47.4	20.6	79.5	49.1	19.4
45	89.4	45.6	23.5	88.0	46.1	22.9	86.4	46.9	22.0	84.5	48.2	21.1	82.5	49.8	19.9

All performance data is based on a 10°F chilled water temperature drop through the evaporator and condenser. For total chiller performance multiply above output (Tons) and input (kW) by the number of modules. For selection procedures, see selection example on page 5 of *Water Cooled Product Data Catalog*.

NOTE: With sufficient notice, 1/2 modules are available when used with one or more full modules. (These modules are physically identical to full modules but with only one refrigerant circuit.)

NOTE: This option is not available in the 70- or 90- ton modules.

Selection

To select a MULTISTACK Water Cooled Condensing unit, the following information is required:

1. Load in tons of refrigeration.
2. The saturated refrigerant suction temperature.
3. Condenser water temperature drop.
4. Leaving condenser water temperature.

Capacity Tables

Capacity tables are based on a saturated suction temperature and a 10°F temperature drop through the condenser.

Water Flow Rates

Condenser water flow using a 10°F temperature drop is determined as follows:

GPM=2.4 {(Tons) + (0.285)(Compressor kW)}

For other than 10°F temperature drop, apply the respective performance adjustment factors from Figure 1 to the GPM from the above equation.

Waterside Pressure Drop

Condenser waterside pressure drops are provided in Figure 2. To use Figure 2, divide the total condenser water GPM by the number of modules in the condensing unit.

Selection Example

(Assumes MS-50B Modules)
System load = 290 tons. A 40°F saturated suction temperature is needed. Leaving condenser water temperature of 100°F and 15°F temperature drop in the condenser.

1. Select the appropriate performance table based on module to be used based on a 10°F temperature drop in the condenser.
   Entering Condenser @ 10°F drop = 100°F - 10°F = 90°F
2. Read the capacity and kW of single module at the specified specifications.
   CAPACITY = 50.9 tons, kW=52
3. To find the number of modules required, divide equivalent tons required single module capacity from table:
   Modules required = 290 / 50.9 = 6 modules
   Unit capacity = (50.9)(6) = 305.4 tons
   Power input = (52)(6) = 312 kW
4. To determine condenser water pressure drops, first determine GPM at a 10°F temperature drop.
   Condenser GPM = 2.4{305.4 + (0.285)(312)} = 946 GPM
5. Apply the respective performance adjustment factors from Figure 1 to the GPM from above equation. For 15°F temperature drop, the table multiplier in .66.
   Condenser GPM with 15°F Drop = (946)(0.66) = 624 GPM*
6. With a 6 module unit, condenser pressure drops are read from Figure 2 as follows:
   Condenser = GPM/Module = 624/6 = 104 GPM
   Pressure Drop = 12.5 feet of water

Condenser Loop with Glycol

Ethylene Glycol adjustment factors (Figure 3) should be used to adjust performance depending on the percent of glycol used in the condenser circuit.
Capacity and kW should be obtained by extrapolating no more than 20°F from the highest entering condenser water temperature shown in the capacity tables.
Adjustment factors for Propylene Glycol are shown in Figure 4, and are used in the same way given in the following example.

Ethylene Glycol Selection Example

(Assumes MS-30C2 Modules)

1. Select the appropriate performance table based on module to be used based on:
   10°F drop = 105°F - 10°F = 95°F
2. Read the capacity and kW of single module at the specified specifications.
   CAPACITY = 30.0 tons, kW = 26.7
3. To determine condenser water pressure drops, first determine GPM at a 10°F temperature drop.
   Condenser GPM = 2.4{30.0 + (0.285)(26.7)} = 90.3 GPM
4. Apply the respective performance adjustment factors from Figure 1 to the GPM from the above equation. For 20°F temperature drop, the table multiplier is 0.5.

   Condenser GPM with 20°F Drop = (90.3)(0.5) = 45.2 GPM*
   Pressure Drop = 2.6 feet of water
5. To convert GPM and pressure drop for water to GPM and pressure drop with ethylene glycol read adjustment factors from Figure 3 at 30% Glycol.
   Condenser GPM adjustment 1.07
   Pressure Drop Adjustment 1.23
6. Calculate GPM and pressure drop with 30% ethylene glycol by multiplying GPM and pressure drop for water by adjustment factors.
   Condenser GPM 45.2 x 1.07 = 48.4 GPM
   Condenser Pressure Drop 2.6 x 1.23 = 3.2 feet of water

Figure 1, GPM Adjustment Factor

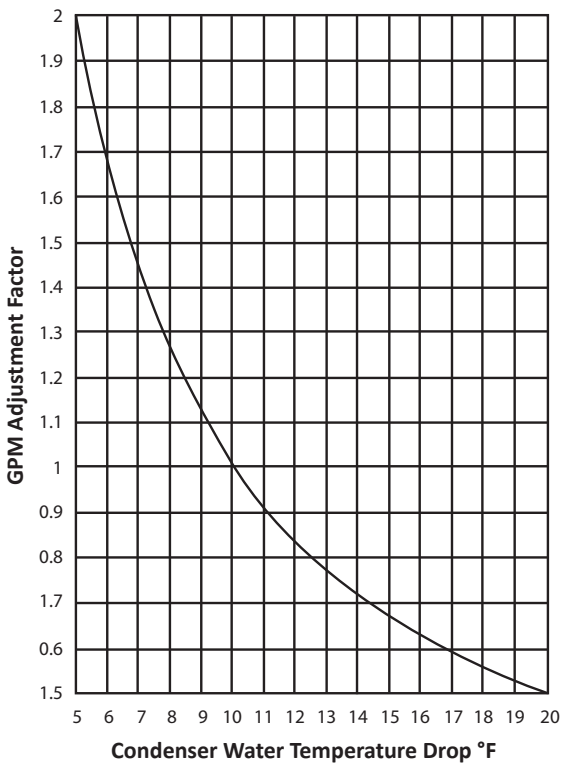


Figure 2, Water Pressure Drop

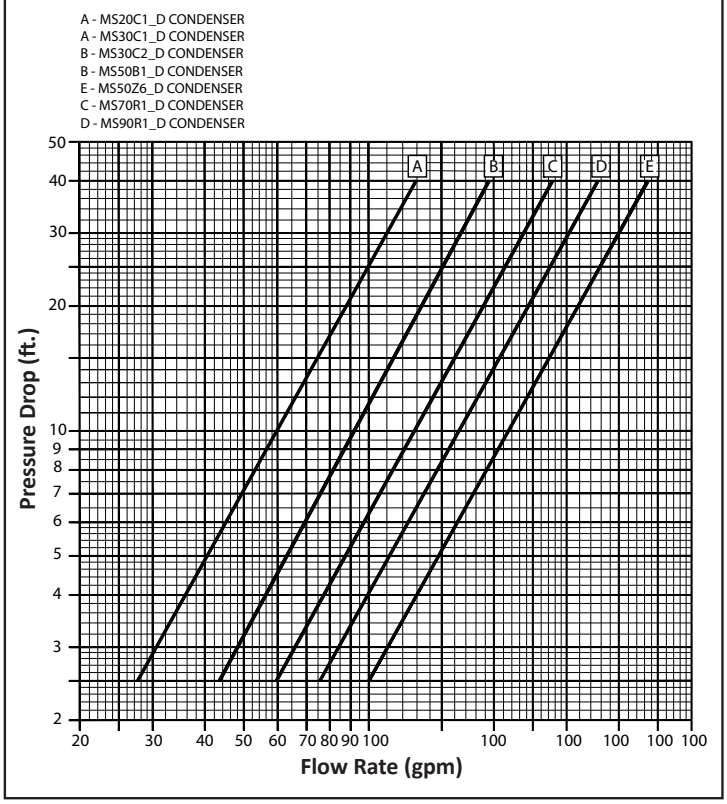


Figure 3, Ethylene Glycol Adjustment Factors

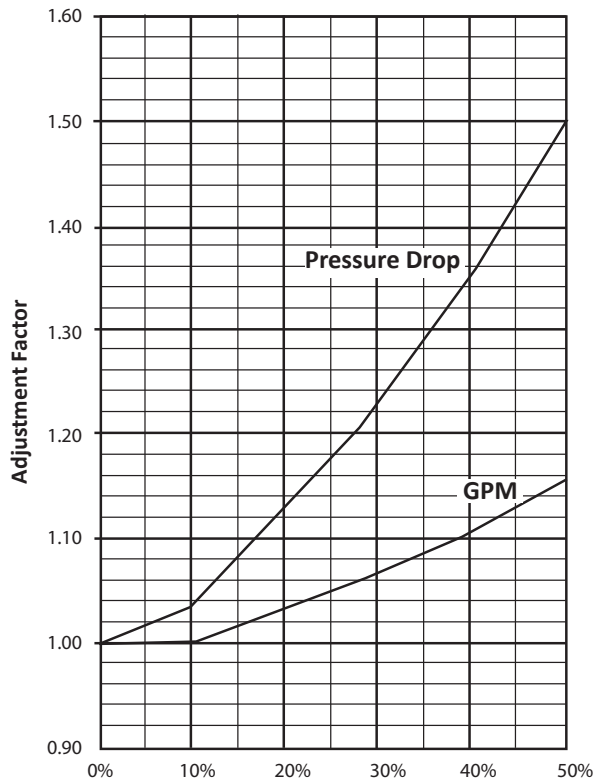
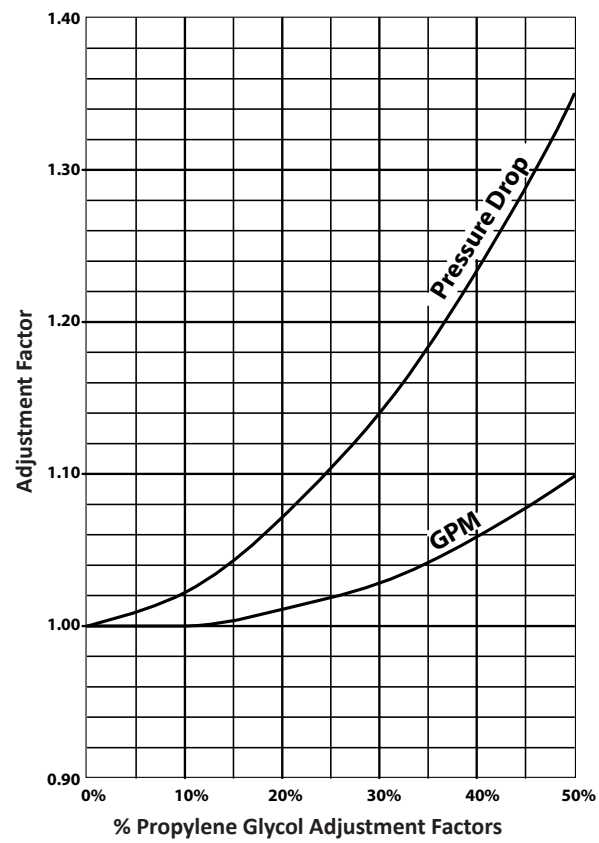
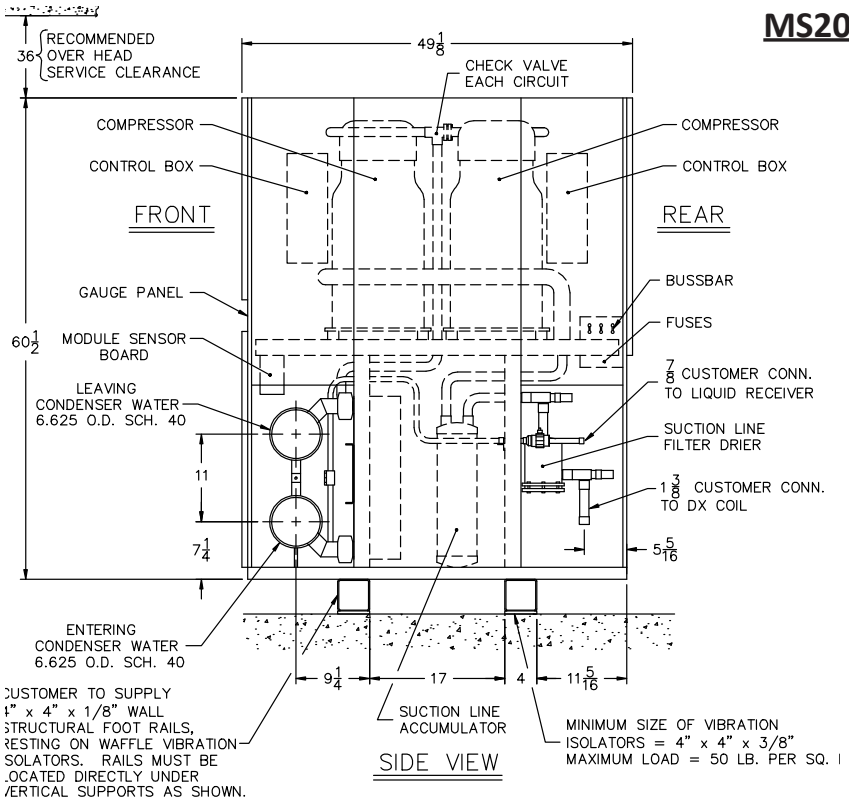


Figure 4, Propylene Glycol Adjustment Factors



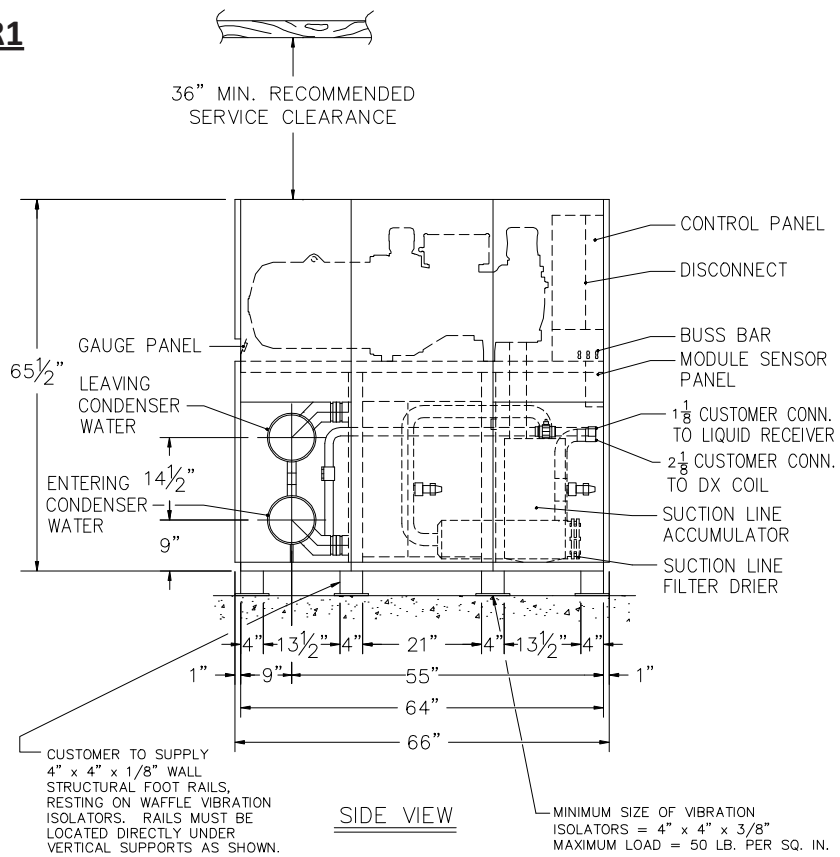
MS20C1, MS30C1, MS30C2, MS50B1, MS50Z6



NOTE: A =
MS50Z6 = 64"
MS20C, 30C, 50B = 60½

NOTE: B =
MS50Z6 = 1⅜"
MS20C, 30C, 50B = ⅞

MS70R1, MS90R1



REFRIGERATION COMPONENTS INSTALLED IN STANDARD UNIT

The following components are factory installed and shipped as part of the standard MULTISTACK® module.

- Suction line accumulator
- Suction line filter drier
- Liquid line manual shut off valve
- Compressor
- Discharge check valve
- Condenser

REFRIGERATION COMPONENTS SUPPLIED BY MULTISTACK INSTALLED BY OTHERS

The following recommended components are not part of the standard MULTISTACK module, but are supplied by MULTISTACK. These components are installed by the customer.

- Liquid line solenoid valve
- Refrigerant receiver tanks*
- Pressure relief valves
- Liquid line filter drier

**Refrigerant receiver supplied only if field sales engineer specifies size.*

REFRIGERATION COMPONENTS SUPPLIED BY OTHERS

The following recommended components are not part of the standard MULTISTACK module, but are supplied by others.

- Direct expansion coil
- Liquid line sight glass
- Interconnecting piping
- Metering device

INTERCONNECTING REFRIGERANT PIPING BETWEEN CONDENSING UNIT AND EVAPORATOR

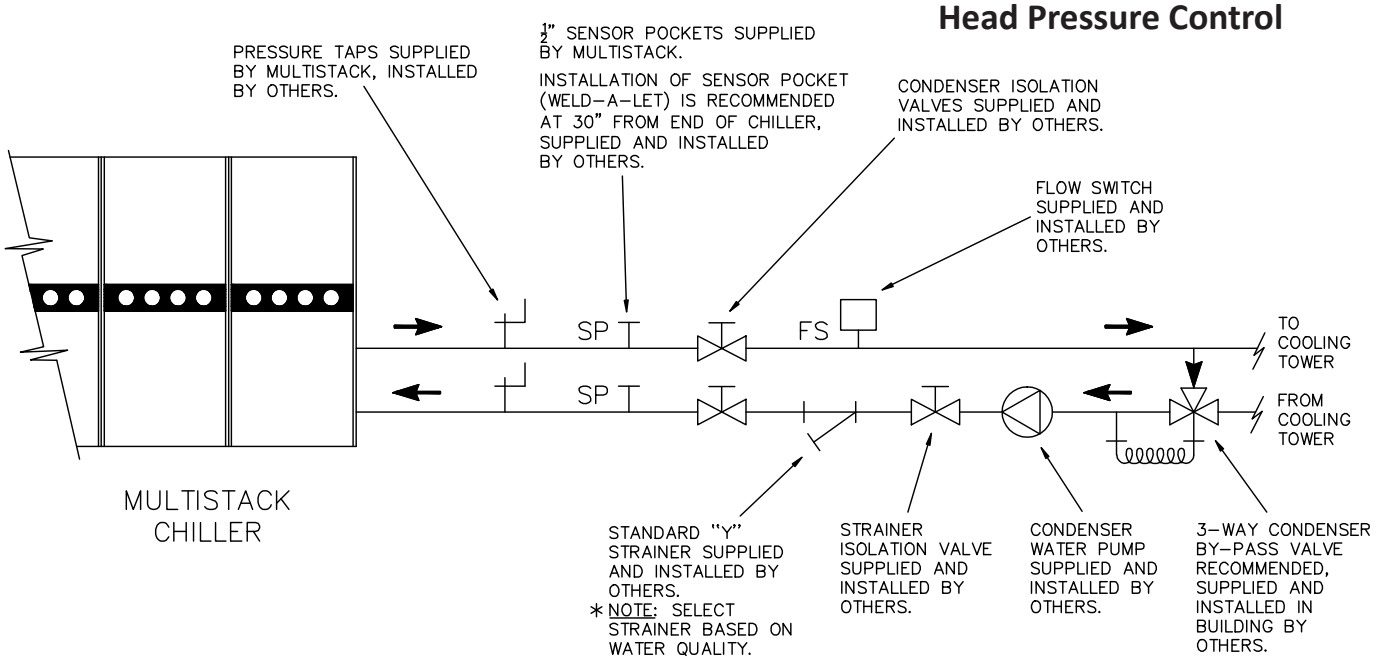
The interconnecting piping is supplied by others and good engineering practice should be used in sloping and trapping the lines. Recommended line sizes for use with specific MULTISTACK modules are:

	MS20C1-D	MS30C1/C2-D	MS50B1-D	MS50Z1-D	MS70R1-D	MS90R1-D
Suction lines:						
50 foot equivalent length	1 3/8	1 5/8	2 1/8	2 1/8	3 1/8	3 1/8
75 foot equivalent length	1 3/8	1 5/8	2 1/8	2 1/8	3 1/8	3 1/8
100 foot equivalent length	1 5/8	1 5/8	2 1/8	2 1/8	3 1/8	3 1/8
Liquid lines:						
50 foot equivalent length	3/4	7/8	1 1/8	1 1/8	1 3/8	1 5/8
75 foot equivalent length	3/4	7/8	1 1/8	1 1/8	1 3/8	1 5/8
100 foot equivalent length	3/4	7/8	1 1/8	1 1/8	1 5/8	1 5/8

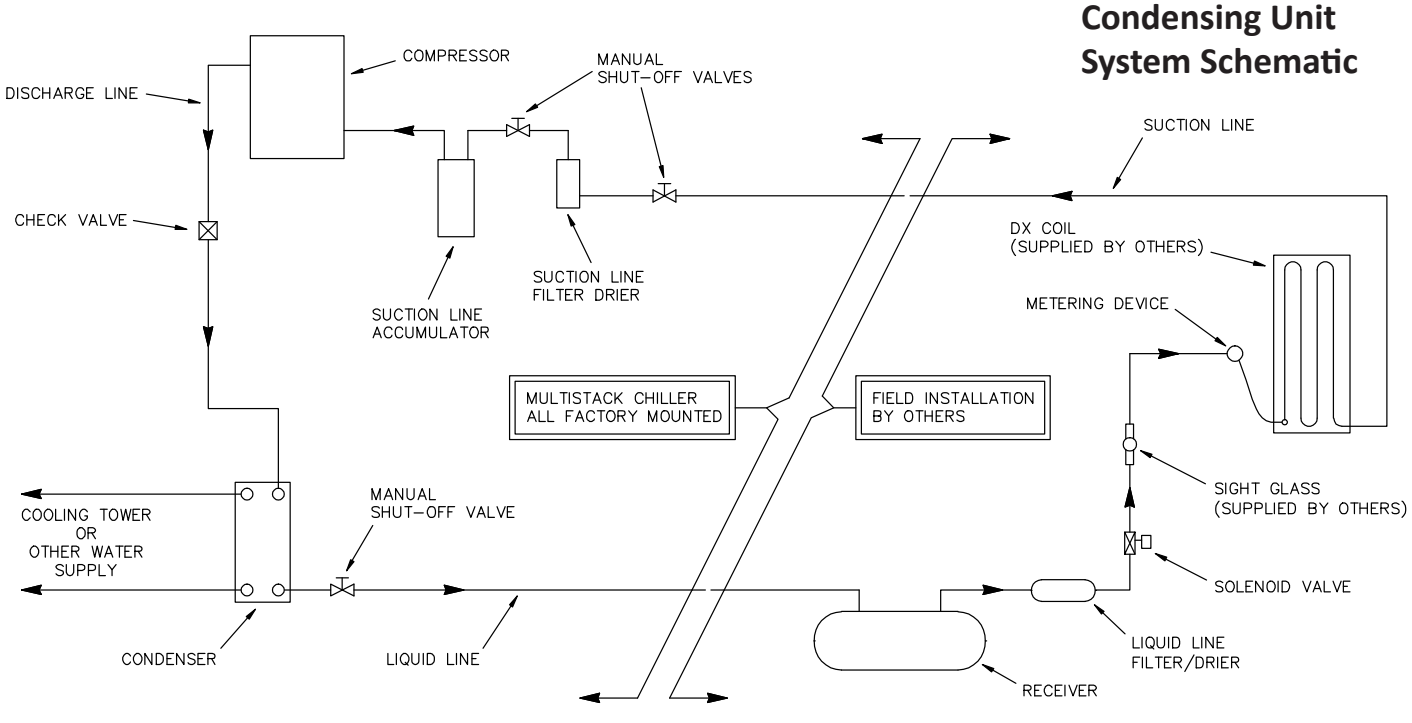
GENERAL DATA TABLE OF WATER COOLED STANDARD MODULES

Model	MS20C1-D	MS30C1-D	MS30C2-D	MS50B1-D	MS50Z1-D	MS70R1-D	MS90R1-D
Compressor Type	Scroll	Scroll	Scroll	Reciprocating	Scroll	Screw	Screw
Weight (lb. each)	160	227	227	268	407	1058	1091
Nominal Capacity (tons each)	10	15	15	25	25	70	90
Quantity	2	2	2	2	2	1	1
Oil Charge (pints)	8	14	14	14	12.5	21.1	21.1
Condenser	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate	Brazed Plate
Weight (lb. each)	53	53	75.5	75.5	188	222	250
Water Storage (gallons)	1.13	1.13	1.87	1.87	5.33	5.7	6.5
Quantity	2	2	2	2	2	1	1
Header System (gallons)	5.5	5.5	5.5	5.5	7	15.1	15.1
Refrigerant Type	407c	407c	407c	407c	407c	407c	407c
Number of Circuits	2	2	2	2	2	1	1
Operating Weight (lb.)	1150	1300	1400	1500	2050	2900	3000
Shipping Weight (lb.)	1100	1250	1375	1475	1750	2400	2500

Condenser Schematic With Head Pressure Control

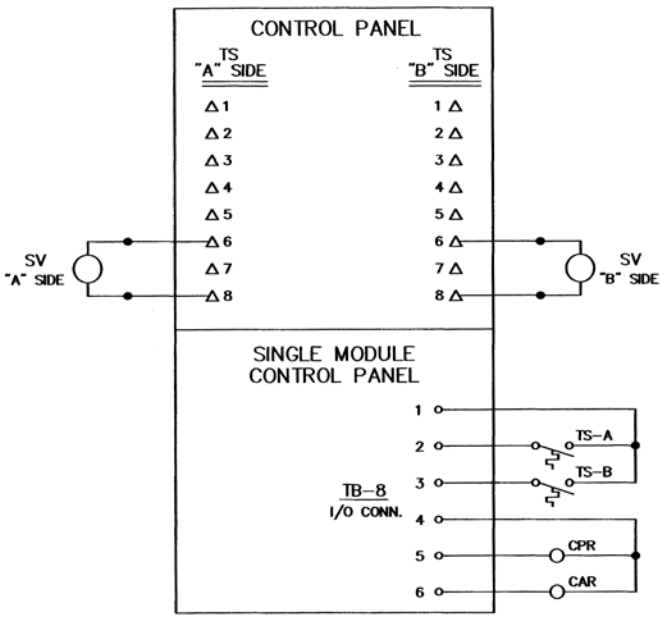


Condensing Unit System Schematic



Computer Power & External I/O Connections

External Input/Output Connections 20/30/50



INPUTS

TS–A THERMOSTAT INPUT TO START COMPRESSOR "A" OF THAT MODULE

TS–B THERMOSTAT INPUT TO START COMPRESSOR "B" OF THAT MODULE

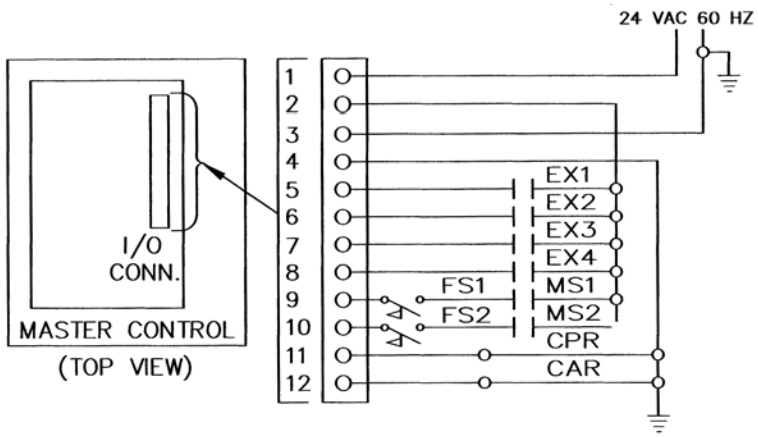
OUTPUTS

CAR – CUSTOMER ALARM RELAY (10 VA MAX)
CPR – CUSTOMER PUMP RELAY (10 VA MAX)
SV – LIQUID LINE NORMALLY OPEN SOLENOID VALVE (40 VA MAX.)
(SUPPLIED BY MULTISTACK FOR FIELD INSTALLATION)

NOTE: INTERLOCK WIRING TO BE 16 AWG MINIMUM AND FIELD SUPPLIED BY OTHERS. EXTERNAL RELAYS, CONTACTORS AND FLOW SWITCHES SUPPLIED BY OTHERS. FOR ADDITIONAL INFORMATION, SEE INSTALLATION MANUAL – WATER COOLED SUPPLEMENT

Computer Power & External I/O Connections

External Input/Output Connections 70/90



INPUTS

EX1 – CLOSE CIRCUIT TO OPERATE: OPEN TO STOP. MANUAL RESET REQUIRED.
EX2 – CLOSE CIRCUIT TO OPERATE: OPEN TO STOP. AUTO RESET. REMOTE START/STOP.
EX3 – CLOSE CIRCUIT TO OPERATE: OPEN TO STOP. MANUAL RESET REQUIRED.
EX4 – CLOSE CIRCUIT TO OPERATE: OPEN TO STOP. AUTO RESET.
FS1 – CONDENSER WATER FLOW SWITCH. (OR OPTIONAL PRESSURE DIFFERENTIAL SWITCH)
MS1 – CONDENSER WATER PUMP STARTER INTERLOCK
TB5 – 4-20 MA INPUT (NOT SHOWN)
TB6 – 0-10V INPUT (NOT SHOWN)

OUTPUTS

CPR – CONDENSER PUMP RELAY (24 VAC, 5 VA)
CAR – CUSTOMER ALARM RELAY (24 VAC, 5 VA)

NOTE: COMPONENTS AND WIRING BY OTHERS. INTERLOCK WIRING TO BE 18 AWG MINIMUM.

NOTE: FOR ADDITIONAL INFORMATION, SEE INSTALLATION MANUAL AND OPERATING INSTRUCTIONS.
CONTROL IS TO BE BY A 0-10V OR 4-20 MA CUSTOMER INPUT TO THE MASTER CONTROL

System Wire & Fuse Sizing Specifications

(Applicable codes may require different wire sizing)

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

Voltage	208	230	460	575
90T Screw	242/885	219/885	109/423	88/338
70T Screw	166/607	150/607	75/290	60/232
25T Scroll	69/500	62/500	31/250	25/250
25T Bristol	75/400	75/400	37/200	30/160
15T Scroll	42/337	44/376	27/178	17/143
10T Scroll	25/222	25/251	12/117	10/94

2. Wiring sizing: Minimum Circuit Ampacity (MCA)

MCA = (1.25 x RLA1)+RLA2+RLA3*

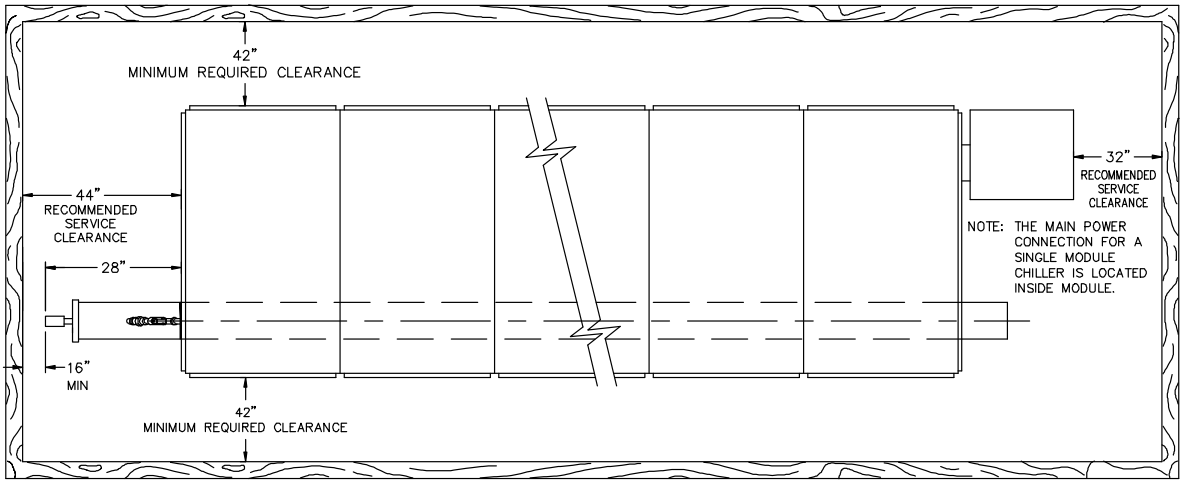
MCA	3 Conductors 1 Conduit	6 Conductors 2 Conduit
50	8	–
65	6	–
85	4	–
100	3	–
115	2	–
130	1	–
150	1/0	–
175	2/0	–
200	3/0	–
230	4/0	–
255	250 MCM	–
285	300 MCM	1/0
300	–	2/0
350	–	3/0
400	–	4/0
460	–	4/0
500	–	250 MCM

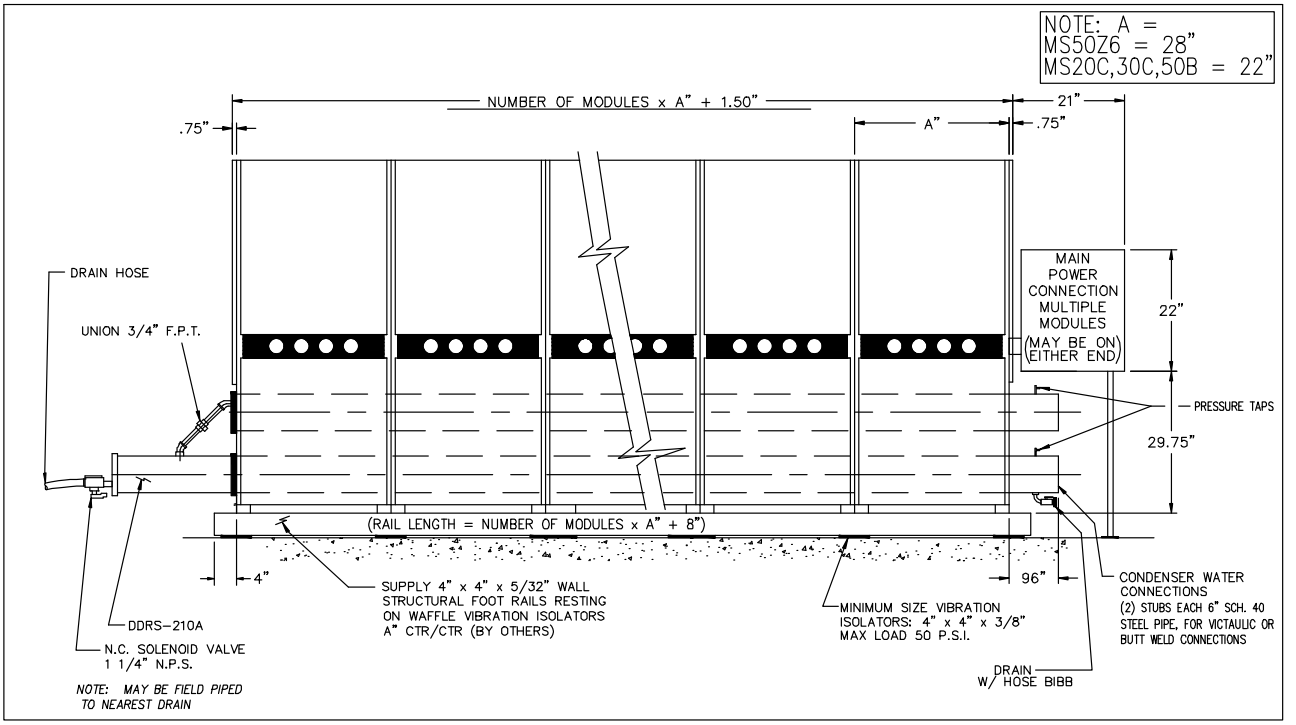
3. Fuse sizing: Maximum Fuse (MF), Type RK5 Fuse
   MF = (2.25 x RLA1*)+RLA2+RLA3…
   Where the MF does not equal a standard size fuse, the next larger size should be used.

Notes:

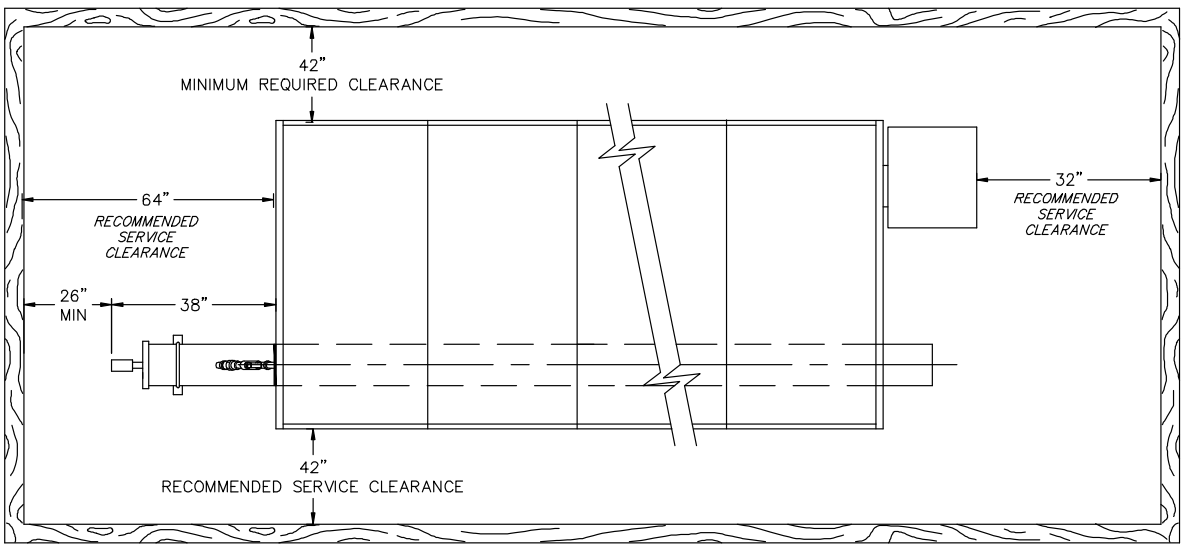
A. *RLA1 = RLA of the largest compressor in the system. RLA2 & RLA3 = RLA of the other compressors in the system.
B. The total system Minimum Circuit Ampacity (MCA) shall not exceed 500A.
C. Wire sizing is based on the National Electrical Code (NEC) rating for 90 °C copper wire, with three wires per conduit.
D. Wiring distance from branch circuit shall not exceed 100 feet.

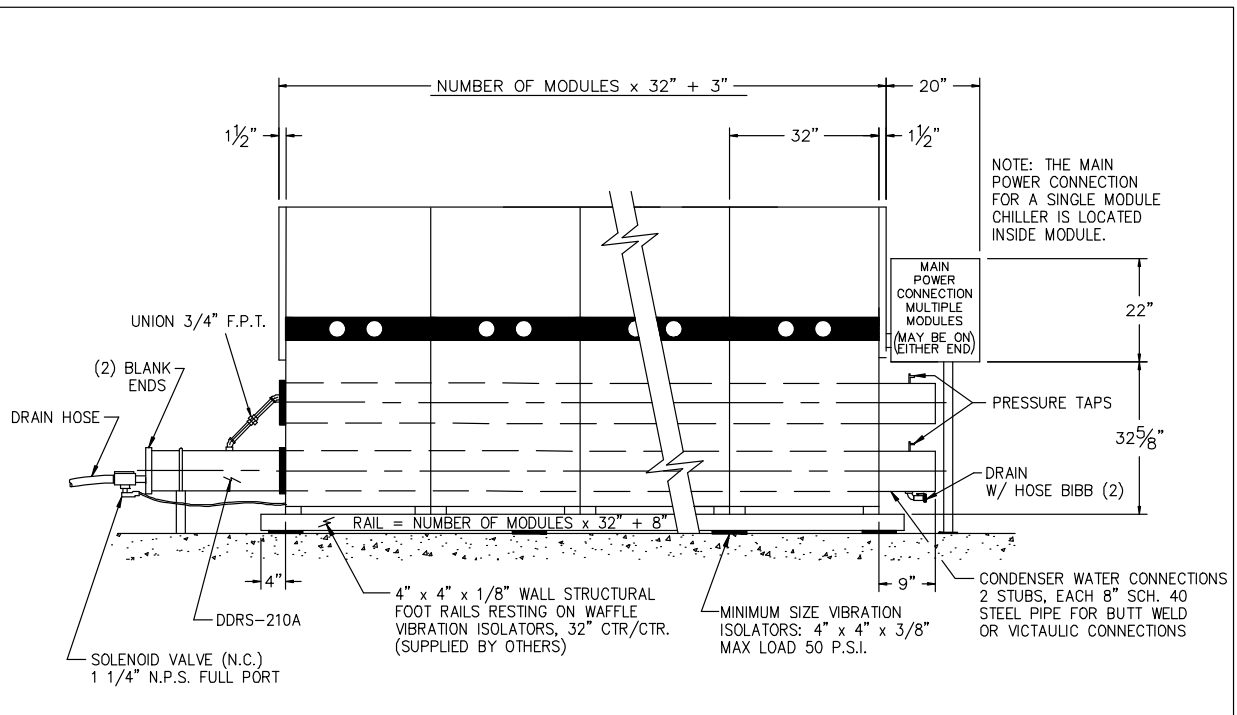
MS20C1, MS30C1, MS30C2, MS50B1, MS50Z6





MS70R1, MS90R1





General

Modules are ETL listed in accordance with UL standard 1995, CSA certified per standard C22.2 #236, and bear the ASME UM stamp on all heat exchangers.
Modules ship wired charged with oil and a holding charge of dry nitrogen.
Compressors, heat exchangers, piping and controls are mounted on a heavy gauge steel frame. Electrical controls contractors, and relays for each module, are mounted within that module.

Condenser Water Mains

Each module includes supply and return mains for the condenser water. Grooved end connections are provided for interconnection to customer piping with Victaulic type couplings. For 20-, 30-, and 50-ton modules 6-inch U.S. standard (6.625" outside diameter) piping is used. For 70- and 90-ton modules 8-inch U.S. standard (8.625" outside diameter) piping is used. Standard units include 30-mesh in-line strainers in the condenser supply headers. Standard on all units is the DDRS-210A automatic debris removal system.

Condensers

Each condenser is a brazed plate heat exchanger constructed of 316 stainless steel; designed, tested and stamped in accordance with ASME code for 360 psig working pressure.

Compressor

The 70- and 90-ton modules consist of a single semi-hermetic screw compressor containing a single refrigerant system. The 20-, 30-and 50-ton modules consist of two hermetic scroll compressors containing two refrigerant systems. The compressor in each system is mounted to the frame with rubber-in-shear isolators. Each system also includes high discharge pressure and low suction cutouts.

Central Control System

20-, 30-, 50-Ton Modules

Each compressor requires a customer supplied dry contact signal for start and stop control. This contact will need to be wired to the module control panel board which is located below the pressure gauges on each standard module (two dry contact signals required per modules).

MULTISTACK provides a normally closed refrigerant solenoid valve for each refrigerant circuit. This valve is intended to go between the filter drier and the sight glass (see condensing unit system schematic).

When the customer closes a contact to start a compressor, the solenoid valve will be energized (opened) for that refrigerant circuit. When the suction pressure reaches approximately 65 psig a pressure switch will close which will energize the compressor start circuit.

When the customer chooses to turn the compressor off, they will open the start contact. This will de-energize the solenoid valve and stop refrigerant flow to the compressor. When the suction pressure reaches approximately 35 psig, the pressure switch will open, and the compressor start circuit will be de-energized. This procedure is intended for pump down of the compressor.

The module control panel board monitors the following on each refrigeration circuit:

- Discharge pressure cut-out (300 psig)
- Suction pressure cut-out (10 psig)
- Compressor motor protector (thermal)

A fault condition from these controls will cause a shutdown and lockout of that compressor. The fault will be indicated by a red fault light located on the sensor board. A manual reset is required. Pressing the fault reset button on the module control panel board will clear the fault for that compressor on that module. It may also be required to reset the faulted safety device.

70-, 90-Ton Modules

The customer must provide either a 0-10-Volt or 4-20-mA input to the master controller to specify building load requirements. The lower value (0 V or 4mA) requests no load on the chiller while the upper value (10 V or 20 mA) requests the chiller operating at full load. Depending on chiller fault conditions, the chiller may or may not be operating at the customer's requested demand. Scheduling of the various compressors is performed by the microprocessor control. Compressors operating schedules are sequenced energy 24 hours to assure distribution of run time. This microprocessor monitors the following on each refrigeration system:

- Discharge pressure cut-out (300 psig)
- Suction pressure cut-out (10 psig)
- Compressor motor protector (thermal)

A fault condition from these controls or sensors will cause a shutdown of that compressor with the transfer of load requirements to another available compressor. When a fault occurs, the microprocessor records the reading of conditions at the time and stores the data for recall by operating personnel. This information can be recalled using the keys and displayed on the LCD screen. A running history of the fault occurrence is maintained (up to the last 20 occurrences) should it be required for trouble shooting.

Options

Options are available upon request.

MULTISTACK

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