MULTISTACK®

MSRA MINI SERIES

Modular Air Cooled Scroll Heat Pump Chiller

MSRA070
Nominal Capacity 32 to 512 kW(R)

Issue: 3.0 Date 02/11

Contents

Design Features

STRUCTURE

MULTISTACK Air Cooled Chillers are designed and constructed under the modular technology patent. A Mulitstack Chiller is a bank of individual chiller modules connected in parallel to operate as a single machine.

Each full module in the Multistack system delivers a nominal 64kW of cooling and 68kW of heating and contains two hermetically sealed scroll compressor units, two separate evaporators, two separate condenser coils, four fans and controls.

COMPACT AND SPACE-SAVING

With each module approximately 1590mm wide, you can install these quiet, compact units in small and confined spaces. In new buildings, you can reduce the size of plant rooms and save on structural costs

ADD-ON FLEXIBILITY

As your needs for cooling increases, Multistack has the solution. Being a modular chillller, it has never been easier to expand the system as larger cooling capacity is needed to meet increased building load demands, with no complicated changes to the room, piping system or control system, and all work can be done quite easily.

As many as 8 full modules can be connected together as a chiller bank, producing a total of 512kW cooling and 544kW for heating. The Multistack miniseries range has inbuilt flexibility, useful in tenancy changes and strata title applications.

SAFE AND RELIABLE

Every module works as an independent refrigeration circuit, with adjacent modules operating independently. In the event of a malfunction in the system, the computer selects the next available standby module to provide back up. One failed module will not disrupt the other chillers or system, giving you total piece of mind.

PEAK ECONOMY AT ALL LOADS

Automatic scheduling of the compressors allows the chiller to match the fluctuating cooling loads and conserve energy with each individual unit running at its peak efficiency. This is much more economical when compared to a large single unit running at part load.

SCROLL COMPRESSOR

High coefficient of performance (COP)-approximately 9% higher-than a reciprocating is achieved by very high volumetric efficiency, minimized pressure losses due to absence of valve plates and reduced heat transfer loss due to better separation of suction and discharge gases.

In addition, scroll compressor offer very low vibration and sound level than the hermetic reciprocating compressor due to absence of dynamic suction and discharge valve and smooth compression process.
Outstanding reliability due to few moving parts, low starting toque, tolerance to flood-back and rigidly-mounted internally.

WATERSIDE HEAT EXCHANGER

Our brazed plate heat exchangers are manufactured from type 316 stainless steel, and able to withstand a working pressure of 2400 kPa and 2000 kPa for the refrigerant and water side respectively. The nominal chilled water flow through the heat exchanger is 5.6L/s at a maximum pressure drop of 43kPa. The cooling capacity is selected with a fouling factor of 0.086 m2k/kW

INTERNAL WATER STRAINER

Internal water strainer is made under the Multistack's patent technology, and made from stainless steel. Internal water strainers are supplied and fixed inside both chilled water header pipes and condenser water header pipes for each module. It can be easily dismantled and removed. The internal water strainer can prevent particles contained in the water from getting into the heat exchanger.

Together with another patent product is a header pipe stub which connects to the end of the condenser pipe, which enables the user to flush, clean and drain to the condenser water system very conveniently.

MODEL NUMBER DESIGNATION

M	SR	A	070	C	-	5	A	B	F
1	2	3	4	5		6	7	8	9

1: Modular series
2: Scroll compressor
3: Cooling type
A:Air-cooled
W:Water-cooled
4: Model type
5: Chiller type
C: Cooling Only
H:Heat Pump chiller
6: The number of modules per chiller (0.5~8.0)
7. Power supply
A: AC380-420V/50Hz/3Ph
B: AC380V / 60Hz / 3Ph
C: AC440-460V/60Hz/3Ph
8. Configuration
B: Back to Back (Standard)
E: End to End (Optional)
9. Refrigerant
E: R134a
F: R22
R: 407c

C1 CONTROL

(*Also available with MV6 Control)

The C1 computer is a control and monitoring system that runs the Multistack chiller banks and schedules each compressor on or off depending on the cooling load required. With the optional Remote Control Monitoring software, the user is able to monitor the status of the chiller remotely.

SYSTEM WATER FLOW

The computer will stop the chiller from operating if the water flow through the condenser circuit or evaporator circuit falls below the limit that is set from the flow switches. This condition is monitored via flow switches and water pump interlock contacts (provided by installing contractor).

TEMPERATURE CONTROL

By monitoring the entering chilled water temperature, optimal control of the leaving chilled water temperature is maintained. The accuracy of the temperature control increases with the number of capacity steps. Integrated temperature calculation ensures reduced running costs.

COMPRESSOR SEQUENCE

At re-start or re-loading of the chiller the next compressor with minimum running time is selected as the lead compressor. If a compressor stops on a safety protection interlock, the next compressor in line will be selected.

COMPRESSOR LIMIT START TIMER

The computer has an adjustable ramp-on timer in addition to the inbuilt 4 minute start/stop delay of each compressor to prevent rapid cycling.

FAULT REPORT

The last recorded fault is displayed in conjunction with a built-in buzzer alarm.

SAFETY PROTECTION FEATURES

- High pressure cut out
- Low pressure cut out
- Low leaving chilled water temperature cut out for each slave and system
- Low refrigerant suction pressure cut out for each slave

Physical Data Per Module

R22

Model		MSRA070H	MSRA070C
Cooling	Nominal Capacity(kW)	64	
	Nominal Power Input (kW)	18.2	
Heating	Nominal Capacity(kW)	68	-
	Nominal Power Input (kW)	17.8	-
Compressor	Type	Hermetic Scroll	
	Number	2	
	Power	AC380V/50Hz/3Phase	
	Max. Continous Current (A)	27 x 2	
	Locked Rotor Amperage	147 x 2	
	Control Stage (%)	0, 50, 100	
	Refrigerant R22(Kg)	7.9 x 2	7.3 x 2
Evaporator	Type	Brazed Plate Heat Exchanger	
	Water Flow (L/S)	3.1	
	Water Pressure Drop (kPa)	45	
	Fouling Factor (m^2k/kW)	0.018	
	Max Working Pressure Water (kPa)	2000	
Condenser	Type	Coil	
	Type of Fan	Axial	
	No. of Fan	4	
	Fan Power Input (kW)	0.5 × 4	
	Air Flow Rate (m^3/h)	24000	
Water Connection		4"	
Dimension (W x D x H)mm		1590 × 1590 × 1880	
Operating Weight (Kg)		1000	960
Shipping Weight (Kg)		1050	1010

Nominal values based on:

Cooling:	Ambient	35°C	Heating:	Ambient	7°C
	Chilled Water Entering Temp.	12°C		Hot Water Entering Temp	40°C
	Chilled Water Leaving Temp.	7°C		Hot Water Leaving Temp.	45°C

Note:

Minimum Chilled Water Flow Rate Per module: Nominal Water Flow Rate less 10%

Contact Multistack Ltd. If lower flow rate is required.

Physical Data Per Module

R407C

Model		MSRA070H	MSRA070C
Cooling	Nominal Capacity(kW)	61	
	Nominal Power Input (kW)	19.8	
Heating	Nominal Capacity(kW)	67	—
	Nominal Power Input (kW)	19.8	—
Compressor	Type	Hermetic Scroll	
	Number	2	
	Power	AC380V/50Hz/3Phase	
	Max. Continous Current (A)	32 x 2	
	Locked Rotor Amperage	145 x 2	
	Control Stage (%)	0, 50, 100	
	Refrigerant R407c(Kg)	7.1 x 2	6.6 x 2
Evaporator	Type	Brazed Plate Heat Exchanger	
	Water Flow (L/S)	2.9	
	Water Pressure Drop (kPa)	45	
	Fouling Factor (m^2k/kW)	0.018	
	Max Working Pressure Water (kPa)	2000	
Condenser	Type	Coil	
	Type of Fan	Axial	
	No. of Fan	4	
	Fan Power Input (kW)	0.5 × 4	
	Air Flow Rate (m^3/h)	24000	
Water Connection		4"	
Dimension (W x D x H)mm		1590 × 1590 × 1880	
Operating Weight (Kg)		1000	960
Shipping Weight (Kg)		1050	1010

Nominal Values based on:

Cooling:	Ambient	35°C	Heating:	Ambient	7°C
	Chilled Water Entering Temp.	12°C		Hot Water Entering Temp	40°C
	Chilled Water Leaving Temp.	7°C		Hot Water Leaving Temp.	45°C

Note:

Minimum Chilled Water Flow Rate Per module: Nominal Water Flow Rate less 10%

Contact Multistack Ltd. If lower flow rate is required.

Physical Data Per Module

R134A

Model		MSRA070H	MSRA070C
Cooling	Nominal Capacity(kW)	42	
	Nominal Power Input (kW)	13.8	
Heating	Nominal Capacity(kW)	45	-
	Nominal Power Input (kW)	13.8	-
Compressor	Type	Hermetic Scroll	
	Number	2	
	Power	AC380V/50Hz/3Phase	
	Max. Continous Current (A)	32 x 2	
	Locked Rotor Amperage	145 x 2	
	Control Stage (%)	0, 50, 100	
	Refrigerant R134a(Kg)	7.5 x 2	6.9 x 2
Evaporator	Type	Brazed Plate Heat Exchanger	
	Water Flow (L/S)	2.0	
	Water Pressure Drop (kPa)	45	
	Fouling Factor (m^2k/kW)	0.018	
	Max Working Pressure Water (kPa)	2000	
Condenser	Type	Coil	
	Type of Fan	Axial	
	No. of Fan	4	
	Fan Power Input (kW)	0.5 × 4	
	Air Flow Rate (m^3/h)	24000	
Water Connection		4"	
Dimension (W x D x H)mm		1590 × 1590 × 1880	
Operating Weight (Kg)		1000	960
Shipping Weight (Kg)		1050	1010

Nominal Values based on:

Cooling:	Ambient	35°C	Heating:	Ambient	7°C
	Chilled Water Entering Temp.	12°C		Hot Water Entering Temp	40°C
	Chilled Water Leaving Temp.	7°C		Hot Water Leaving Temp.	45°C

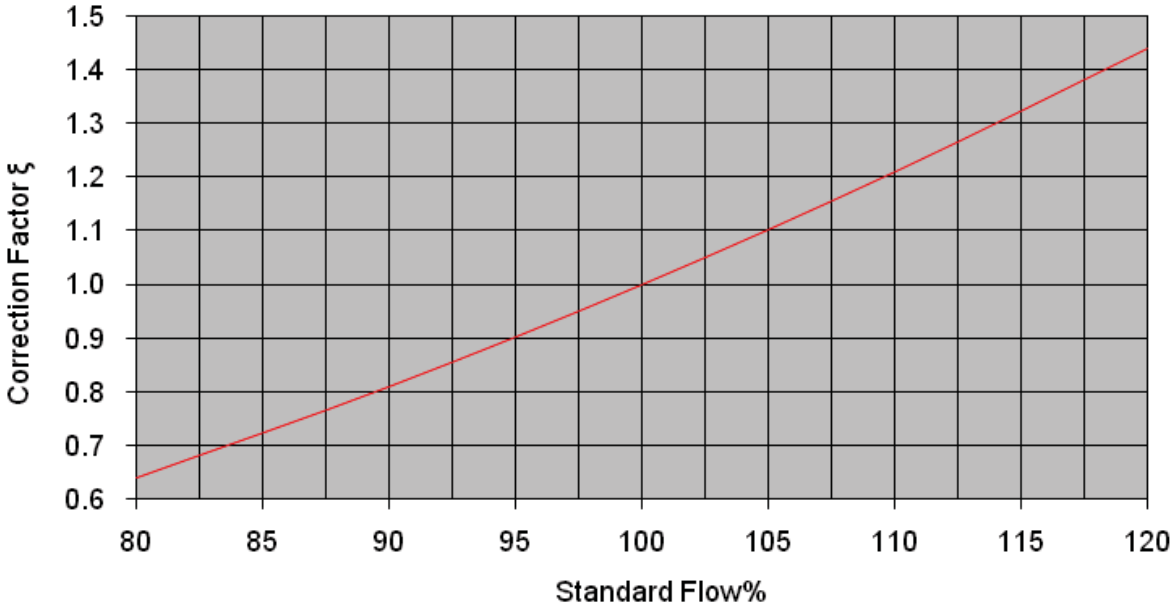
Note:

Minimum Chilled Water Flow Rate Per module: Nominal Water Flow Rate less 10%

Contact Multistack if lower flow rate is required.

HEAT EXCHANGER WATER PRESSURE DROP

Pressure drop correction factor chart for chilled water circuit. Do not extrapolate



Presure drop correction factor: k is related to the number of modules (n) in the chiller bank

N	0.5~3.0	3.5~4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0
MSRA070	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.05	1.06	1.07

N = Number of module

Note:

1 Water pressure drop calculation

Water flow %

$$= \frac{\text{Actual water flow}}{\text{Nominal water flow}} \times 100\%$$

Heat exchanger actual water pressure drop per module

= heat exchanger nominal water pressure drop × ξ

Total water pressure drop per chiller

= heat exchanger actual water pressure drop per module × k

2 Chiller minimum working water flow

Constant water flow system: no less than 80% of chiller total nominal water flow

UNIT CAPACITY PER MODULE - MSRA070C

Ambient Air Temp °C	R22		Leaving Chilled Water Temperature °C								R22	
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	67.1	14.7	70.0	14.7	74.4	14.7	77.6	14.7	82.4	14.7	89.6	14.9
30	62.4	16.3	64.9	16.3	69.0	16.4	71.8	16.4	76.4	16.4	82.9	16.5
35	57.9	18.1	60.3	18.1	64.0	18.2	66.5	18.2	70.7	18.2	76.5	18.3
40	53.7	20.4	55.9	20.4	59.3	20.4	61.6	20.4	65.3	20.4	70.7	20.6
45	51.4	22.8	52.6	22.8	55.0	22.8	57.2	22.8	60.5	22.8	65.3	22.9

Ambient Air Temp °C	R407c		Leaving Chilled Water Temperature °C								R407c	
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	64.0	16.0	66.7	16.0	70.9	16.1	73.9	16.1	78.5	16.1	85.4	16.2
30	59.5	17.8	61.9	17.8	65.7	17.9	68.5	17.9	72.8	17.9	79.0	18.0
35	55.2	19.7	57.4	19.7	61.0	19.8	63.5	19.8	67.4	19.8	72.9	19.9
40	51.3	22.2	53.3	22.2	56.5	22.3	58.7	22.3	62.3	22.3	67.4	22.4
45	49.0	24.7	50.2	24.7	52.4	24.8	54.5	24.8	57.7	24.8	62.3	24.9

Ambient Air Temp °C	R134a		Leaving Chilled Water Temperature °C								R134a	
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	44.1	11.2	45.9	11.2	48.8	11.3	50.9	11.3	54.1	11.3	58.8	11.3
30	40.9	12.4	42.7	12.4	45.3	12.5	47.1	12.5	50.1	12.5	54.4	12.6
35	38.0	13.7	39.5	13.7	42.0	13.8	43.6	13.8	46.4	13.8	50.2	13.9
40	35.2	15.4	36.7	15.4	39.0	15.5	40.4	15.5	42.9	15.5	46.4	15.6
45	33.8	17.1	34.5	17.1	36.1	17.2	37.5	17.2	39.7	17.2	42.9	17.2

CAPC Cooling Capacity (kW)

PI Compressor Power input (kW)

Note:

- This table is based on a 5°K difference in water temperature.
- Please contact your local Multistack Agent if you require performance data beyond the limits of the above table.
- Interpolation is permissible. Do not extrapolate.

UNIT CAPACITY PER MODULE - MSRA070H

Ambient Air Temp °C	R22		Leaving Hot Water Temperature °C						R22	
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	81.7	14.3	78.8	15.9	76.5	17.8	74.8	19.9	74.0	21.2
10	73.9	14.3	71.7	15.9	70.0	17.8	68.8	19.9		
7	71.5	14.3	69.4	15.9	68.0	17.8	67.2	19.9		
5	69.3	14.2	67.4	15.8	66.0	17.7	65.4	19.8		
0	61.0	14.2	59.8	15.8	59.2	17.7				
-5	54.1	14.1	53.5	15.7						
-10	46.8	14.1								

Ambient Air Temp °C	R407c		Leaving Hot Water Temperature °C						R407c	
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	80.5	15.9	77.6	17.7	75.3	19.8	73.7	22.1	72.9	23.6
10	72.8	15.9	70.6	17.7	69.0	19.8	67.9	22.1	67.2	23.6
7	70.4	15.9	68.4	17.7	67.0	19.8	66.2	22.1	66.0	23.5
5	68.2	15.8	66.4	17.6	65.0	19.7	64.4	22.0	64.1	23.5
0	60.1	15.8	58.9	17.6	58.2	19.7	58.0	22.0		
-5	53.2	15.7	52.7	17.5	52.1	19.6	51.7	22.0		
-10	46.1	15.7	45.8	17.5	45.6	19.6				

Ambient Air Temp °C	R134a		Leaving Hot Water Temperature °C						R134a	
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	54.0	11.2	52.1	12.4	50.6	13.8	49.5	15.4	49.0	16.3
10	48.9	11.2	47.4	12.4	46.3	13.8	45.6	15.4	45.2	16.4
7	47.3	11.2	45.9	12.4	45.0	13.8	44.5	15.4	44.3	16.4
5	45.8	11.1	44.6	12.3	43.7	13.7	43.2	15.3	43.2	16.3
0	40.3	11.1	39.6	12.3	39.2	13.7	38.9	15.3		
-5	35.7	11.1	35.3	12.3	35.1	13.6	34.9	15.2		
-10	31.0	11.1	30.7	12.2	27.6	13.6	27.6	15.2		

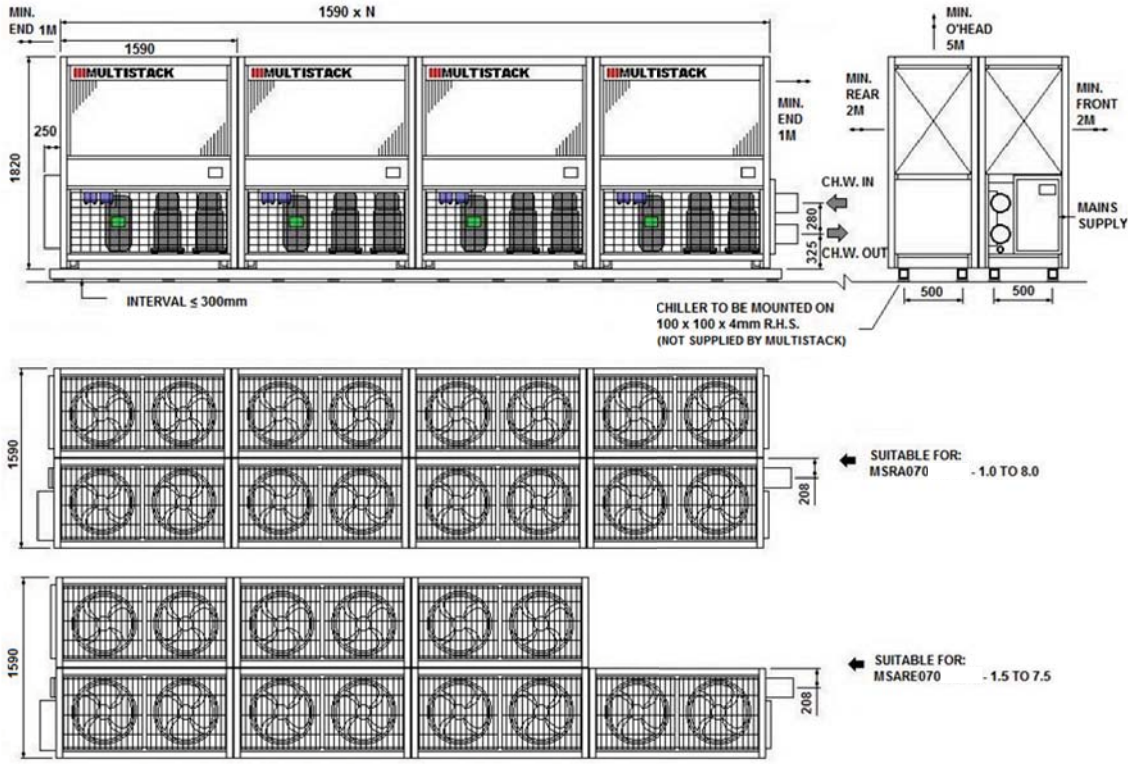
CAPH Heating Capacity (kW)
PI Compressor Power input (kW)

Note:

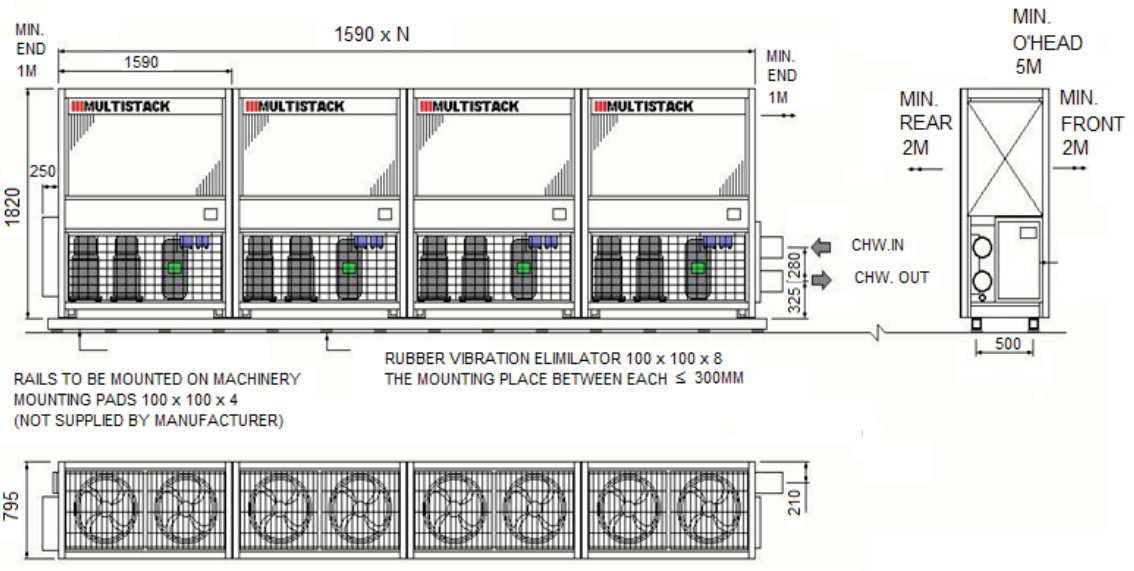
- This table is based on a 5°K difference in water temperature.
- Please contact your local Multistack Agent if you require performance data beyond the limits of the above table.
- Interpolation is permissible. Do not extrapolate.

Dimensional Data

BACK TO BACK CONFIGURATION



END TO END CONFIGURATION



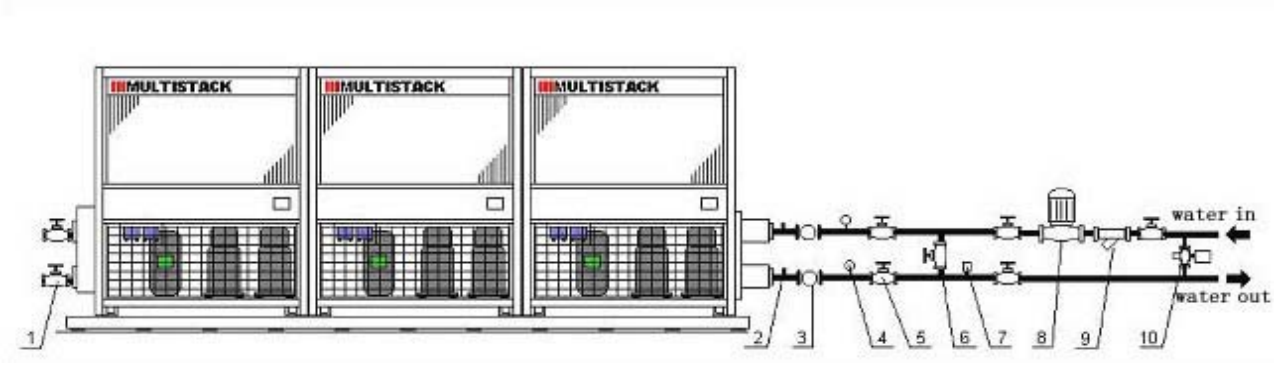
NOTE: (For all configuration)

1. All installations must include the following:
   3/8" BSP socket in all water connections adjacent to chiller for Multistack sensor installation. (Supplied by Multistack)
   Cooling tower by-pass control or other system to prevent over condensing.
   Pressure tapping for flow measurement (supplied by Multistack)
   60 mesh stainless strainers in water inlet piping.

2. Electrical mains entry may be made from either end of unit. Some larger machines (determined by the current drawn & cable size) require mains entry at both ends. Refer to electrical installation manual for details.

3. CH.W & C.W. main connections 100 N.B
   Chilled and condenser water connections may be interchanged end for end as required

Piping Schematic



Item	Description	Qty
1	Drain valve DN50	2
2	Temperature sensor socket 3/8"	2
3	Vibration eliminator	2
4	Pressure gauge	2
5	Isolation gate valve	4

Item	Description	Qty
6	Bypass valve	1
7	Flow switch	1
8	Water pump	
9	Strainer 25 mesh/inch	1
10	Pressure differential bypass valve	1

ACCESSORIES & OPTIONS

UNIT OPTIONS

- High external pressure fans
- Low temperature brine application
- Condenser coil protection coating

Chiller Selection

SELECT WATER-COOLED CHILLER ACCORDING TO FOLLOWING CONDITIONS:

Select air-cooled chiller to meet the following requirements:

1. Entering Chilled Water temperature (ECHW)…. 12.5°C
2. Leaving Chilled Water temperature (LCHW)…..…… 7°C
3. Chilled Water Flow Rate(CHWF)……..… 18.06 l/s
4. Ambient temperature (AT)……..…..…….. 35.0°C
5. Hot Water Leaving temperature (HWLT) …….. 45.0°C
6. Hot Water Entering temperature (HWET) ……. 40.0°C
7. Hot Water Flow Rate (CHWF)……..…… 16.67 l/s
8. Ambient temperature (AT)……..…..…….…. 0.0°C
9. Refrigerant..……...…….. R22
10. Power……...……. AC380V±10%/ 50Hz/ 3phz

Calculation

1. Determine cooling capacity required (kW)

Cooling Capacity

= CHWF × 4.187 ×(ECHW - LCHW)

= 18.06 × 4.187 ×(12.5-7)

= 416 kW required

Heating Capacity

= HWF × 4.187 ×(HWLT - HWET)

= 16.67 × 4.187 ×(45.0-40.0)

= 349 kW required

2. From capacity chart above,
   - 1 module at stated conditions will achieve;
   Cooling CAP= 64 kW per MSRA070C module
   Heating CAP= 68 kW per MSRA070H module

Divide the required capacity by achieved capacity at specified conditions to determine required number of modules:

= ~~416 kW required~~ = 6.5 modules
64 kW achieved

Select 6.5 modules of MSRA070

Cooling Capacity of 6.5 modules = 6.5 x 64 = 416kW

Heating Capacity of 6.5 modules = 6.5 x 68 = 442Kw

3. To establish Water Flow per module, divided new CHWF by number of modules:

(1) Nominal Water flow

= 6.5 x 3.1

= 20.15 l/s

Chilled Water Pressure Drop for nominal water flow per module is 45kPa

(2) Actual water pressure drop

18.06 ÷ 20.15 = 90%

Use the chart "Pressure Drop Correction Factor for chilled water Circuit", 6.5 modules of MSRA070 the correction ξ is 0.81 for 90% of water flow.

Use the table « Pressure drop correction factor: k », k=1.03 for the configuration: 6.5 modules of MSRA070

Actual chilled water pressure drop is:

45 × 0.81 x 1.04 = 38 kPa

(Contact Multistack if lower flow rate is required.)

Electrical Data Per Module

Model			MSRA070H/C					
Refrigerant			R22		R407C		R134a	
Power			AC380±10%V/3Ph/50Hz					
Compressor (each)	MCC (A)		27		32		32	
	MRC (A)		22.8		25.9		20.6	
	LRA(A)		147		145			
	RLA (A)	Cooling	17.8		19.8		14.5	
		Heating	17.5	-	19.5	-	14.4	-
Fan (each)	RLA (A)		1.1					
	STC (A)		5.6					
MSC			(2×N-1)× MRC + LRA					

Note:

N: Number of modules

MCC: Maximum Continuous Current

MRC: Maximum Rated Current

LRA: Locked Rotor Amperage

RLA: Rating Load Amperage

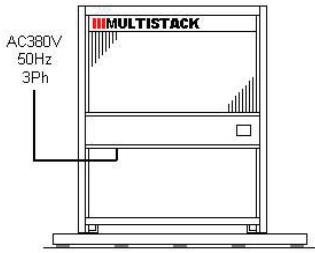
MSC: Maximum Starting Current

STC: Starting Currect

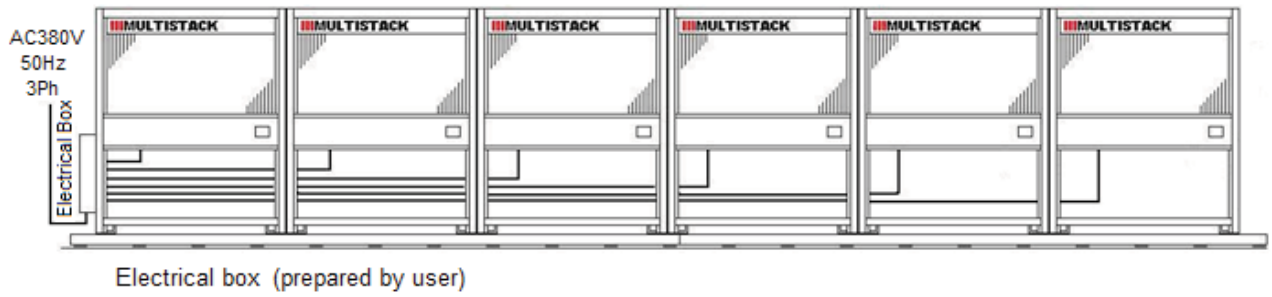
MSRA070 TERMINATION

No. of Modules	Mains Termination	
	Location	Connection Procedure
0.5 – 1.0	Half Module Electrical Cubicle	Terminal Block
1.5 – 8.0	Half Module Electrical Cubicle	Terminal Block

Number of module N = 0.5 -8.0

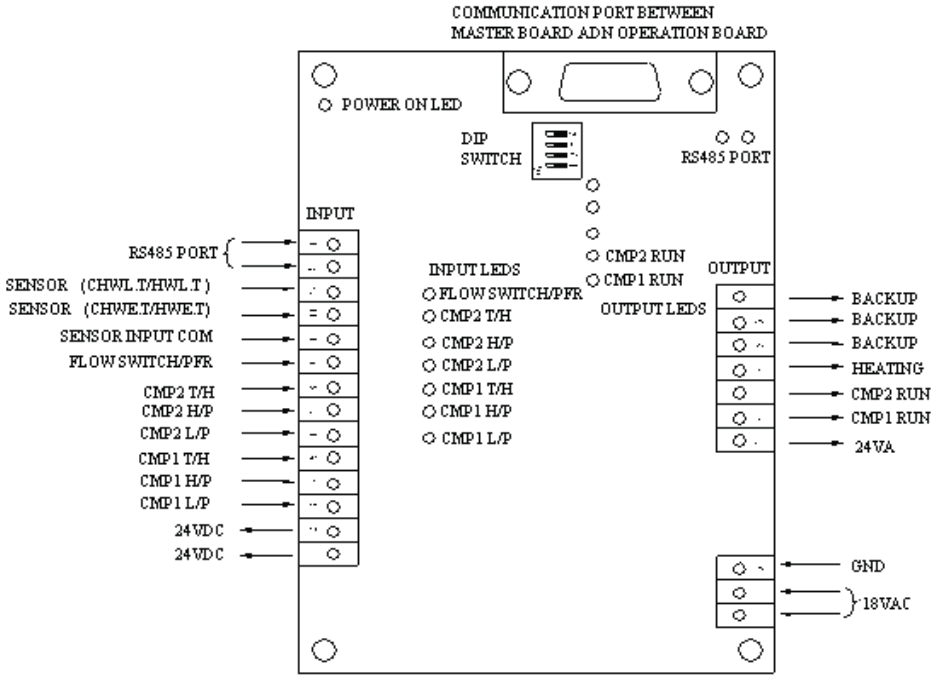


Number of module, 1.0 < N ≤ 8.0



Electrical box (prepared by user)

FIELD WIRING DIAGRAM



Installation Specification

1. Multistack modular air-cooled chillers can be installed conveniently in areas such as roofs, balconies etc. Sufficient ventilation space is needed to be left around the chiller to obtain good convective heat with outside environment. If more than one chiller bank are installed with air encounter surface oppositely, the distance between them should be above 3m.

2. It is unnecessary to prepare concrete foundation for chiller installation; however a flat ground is essential with square structural steel foot rails of 100×100×4mm installed on the floor, and rubber vibration eliminators (100×100×8mm) fitted at 300mm intervals under each foot rail.

3. If the chiller consists of a number of modules, adjust all water pipe centerlines of each module and align them in a straight line.

4. Flow switch is used to prevent the chiller from damage in the event of insufficient water flow and should be installed on the straight section off the horizontal pipe with a distance of at least 5 times of the pipe dia. to the front and back valves. And it's not acceptable to use pressure differential switches and sensor fixed on the main water pipe as a substitute for the flow switch.

5. The setting for the flow switch should ensure immediate cut out whenever the flow rate has dropped 80% or lower of the rated water flow.

6. To prevent stress on the headers and Victaulic couplings all water pipe work must be properly supported.

7. The water filter should not be less than 25# mesh and installed in the entering pipe of chiller. The strainer should be made of stainless steel and with enough strength to bear high pressures in the event of the strainer being blocked.

8. A copper sensor pocket (3/8") is placed in the entering/leaving pipe less than 1m to the chiller, after inserting the temperature sensor into the socket; fill the socket with heat paste to protect the sensor from being damaged by water accumulation inside the sensor pocket.

9. During the whole installation process, the isolation gate valves on both entering /leaving line to the chiller should be closed. The valves will stay closed until the piping installation; leakage check and cleaning are all completed.

10. The chiller's piping system should be cleaned thoroughly to get rid of any mechanical debris prior to operation. During pipe cleaning, close chiller's entering/leaving isolation gate valves and open the bypass valve to prevent the water circulation through the chiller.

11. All external piping parts will not be provided with the chiller and should be provided by the user.

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