MULTISTACK
THAILAND

MSRA SERIES

Modular Air Cooled Scroll (Heat Pump) Chiller

MULTISTACK (THAILAND) CO.,LTD.
6 Moo 4, Tiwanon Rd., Mueang Nonthaburi,
Nonthaburi 11000, Thailand
Tel: 089-889-5555
Fax: 0-2951-4343, 0-2951-5535-36
Http://www.multistack.co.th
E-mail: info@multistack.co.th

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We are the creator and advocator of energy efficient chillers and the pioneer of magnetic levitating technology in refrigeration industry.

CONTENTS

World's First Oil-free Magnetic Levitating Centrifugal Compressor

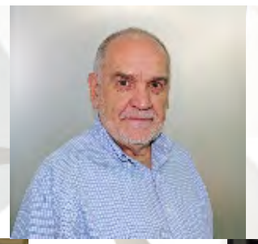
2005 Oil-free magnetic levitating centrifugal chillers were first manufactured in Panyu China and put into operation in Singapore.

1999 TURBOCOR was upgraded to an international project, moving from Melbourne Australia to Montreal City, Quebec, Canada.

1998 The first experimental magnetic levitating chiller was run-tested in MULTISTACK.

1993 The TURBOCOR research group was established by Mr. Ron Conry for the study of oil-free magnetic levitating centrifugal compressor.

1985 Modular chiller was invented in Australia by Mr. RON CONRY, the founder of MULTISTACK in 1986.



INTRODUCTION

MULTISTACK created the first modular chiller in Melbourne, Australia in 1985. This is a great invention riding the wave of industrial design of the 20th century, featuring energy saving, reliability and flexibility. Users all over the world benefit greatly from MULTISTACK's modular air conditioning technology. For decades, MULTISTACK continues to provide reliable products and professional services. We are undoubtedly the inventor and leader of modular magnetic levitating technology.

Features of MULTISTACK modular chillers:

ENERGY SAVING 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 traditional large single unit running at part load.

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 controller selects the next available standby module to provide back up. One failed module will not disrupt the other modules or system, giving you total piece of mind.

EASY INSTALLATION AND ADD-ON FLEXIBILITY Chillers could be field-assembled without the aid of a large lifting machine and dedicated doorways. Chilled/cooling water headers can be easily dismantled if necessary for easy transportation to the rooftop or basement through elevators. When larger cooling capacity is needed, just add on new modules to increase unit capacity without any complicated change to the equipment room, piping system and control system.

INTELLIGENT CONTROL SYSTEM MULTISTACK's original modular control system is based on micro-process control technology, combining modules to form a complete and integrated unit. Each module runs smoothly with peak efficiency based on system load demand. The control system features optimized compressor running, pro-long service life and automatic capacity control.

DESIGN FEATURES

STRUCTURE
MULTISTACK's MSRA modular air cooled (heat pump) chillers are designed and constructed with modular technology patent. A chiller bank consists of a number of modules connected in parallel to operate as a large complete unit, with cooling or heating capacity to match the load demand by varying the number of operating modules. The chiller modules start from a small half module, and are expandable, giving you full flexibility to increase the capacity as your needs increase. Each full module has its own refrigeration circuit, consisting of tandem twin scroll compressors, evaporator, condenser, and other sophisticated control and protection devices. The controller changes the chiller's capacity by either controlling the number of modules in operation or by regulating the number of running compressors.

COMPACT AND FLEXIBLE
The compact size of each module means easy access via standard doorways and elevators. You no longer need special access to install the chiller on rooftop.

ADD-ON FLEXIBILITY
MULTISTACK chiller modules are all built in the same standard structure. When larger cooling capacity is needed, just add on new modules to increase unit capacity without any complicated change to the equipment room, piping system and control system.

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 modules or system.

PEAK EFFICIENCY AT ALL LOADS
Efficiency of compressors in conventional single circuit chillers will decrease dramatically in part load conditions. However, MSRA series modular chillers can automatically schedule the compressors and make sure each individual module run at its peak efficiency at all loads.

SCROLL REFRIGERATION COMPRESSOR
Each module contains high efficiency hermetic scroll compressors without internal suction and discharge valve plates. With this design, gas flow losses are reduced, offering much higher efficiency and extremely low sound level.
Two scroll plates are the only moving parts in a scroll compressor. Flexible floating seals are used to seal the scroll plates. There are multiple oil grooves on the top of the cavity for sealing and lubricating. Moving parts of the compressor have no direct contact and are free of friction, which guarantees an unparalleled reliability and pro-long service life.
Scroll compressor can run at lower temperature with better heat pump performance.

STAINLESS STEEL PLATE HEAT EXCHANGER
Condenser and evaporator are highly efficient, compact and corrosion resistant MTB brazed plate heat exchangers, which is manufactured from AISI316 stainless steel. The heat exchangers definitely meet the requirements of the chiller for cleanliness, dryness and leak tightness.
Special structure design of the heat exchanger plates allows for turbulence flowing through the internal channels, improving heat transfer rate and slowing down the formation of scales.
Plate heat exchangers are pressure tested and helium leak tested and proved to be able to withstand a working pressure of max. 3.0 MPa and breakdown pressure of max. 17.5 MPa.

DESIGN FEATURES

COIL HEAT EXCHANGER

Fin tubes are utilized for air-refrigerant heat exchanger to increase heat transfer surface on the air side, enhance airflow disturbance and increase coefficient of heat transfer of air. Hydrophilic film on the fin surface not only protects the fins but also guarantees for a low contact angle to speed up the draining of condensed water, retard the formation of water blocks and reduce air side pressure drop.

Toothed spiral grooves on the inner wall of copper tubes greatly increase coefficient of heat transfer on the refrigerant side.

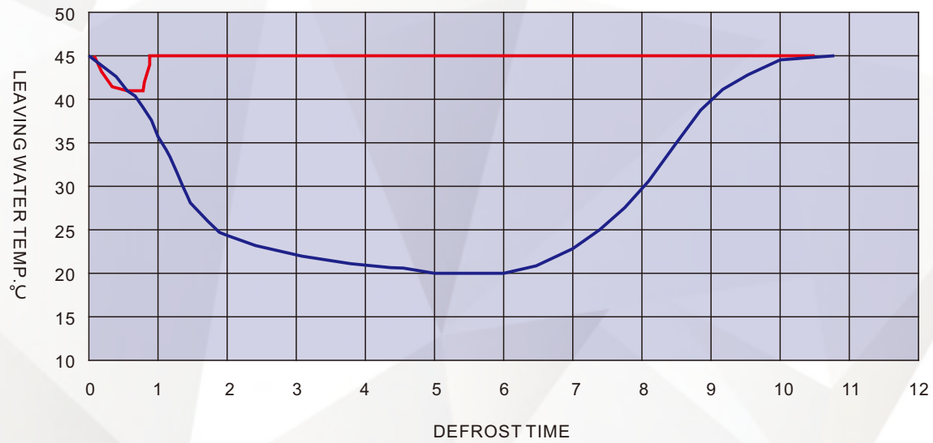
EXCLUSIVE DEFROSTING TECHNOLOGY

MULTISTACK MSRA series chillers adopt a dedicated heat pump cycle, which is specifically designed to improve heat pump operational performance and obtain a faster defrosting cycle. When severe frost build-up, it can be completely thawed in a very short time.

Defrosting cycle is only carried out when the demand for defrosting is present in each module, which means the modules that are frosted will defrost, while the others remain in heating operation, giving you a reliable and fully uninterrupted system.

This exclusive defrosting technology ensures complete defrosting even in the harshest environments, promising you with excellent heating performance, and a comfortable environment all year round.

Defrosting Process Comparison: MULTISTACK Heat Pump Chillers VS Other Competing Heat Pump Chillers



Red line: MULTISTACK Heat Pump Chillers

Blue line: Other Heat Pump Chillers

SAFE REFRIGERANT

Each module is factory charged and run-tested, ensuring that the running performance of the chiller meets factory standard.

Refrigerant R22, R407C or R410a are all applicable.

MV7 COMPUTER CONTROLLER

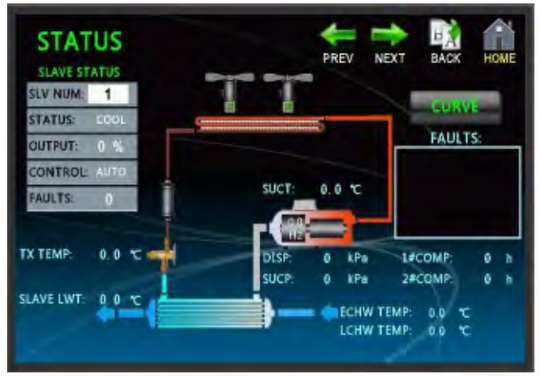
Mv7 is a powerful computer control system with 64-bit CPU for modular chillers. With this system and based on fuzzy mathematics, MULTISTACK develops an optimal solution for load regulation for a safe, precise and stable control of the chiller.

1. COMPOSTIONS

The control system consists of slave controllers and a master controller with a touch screen and on-board 64-bit micro processor. Slave controllers can either operate independently or communicate with the master controller via RS485 serial port to make up an online control system. This system is controlled through a touch screen, a master controller and a number of slave controllers via RS485 communication cables.

2. DISPLAY

The controller's 7" (optional 10'' or 15'') touch screen provides you with direct access to information enquiry interface. There are 5 sub-menus under the MAIN MENU, displaying operation data and variables such as running status, operation records, fault log, parameter setting and service information.



3. TEMPERATURE CONTROL

For a modular chiller, the compressor load of each module depends on the cooling capacity required by the system. The required compressor working load is determined by MV7 control system by calculating the temperature difference between actual leaving/entering water and set points.

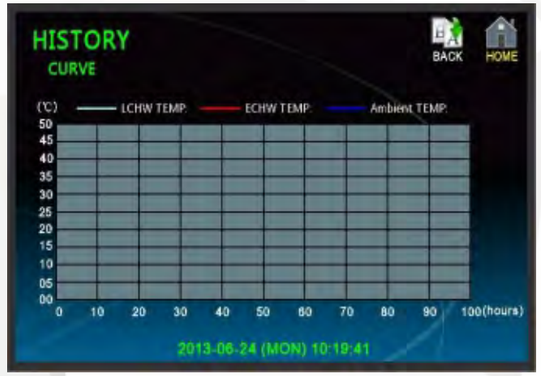
4. MODULAR CAPACITY CONTROL

MV7 controller is capable of controlling maximum 56 capacity levels based on actual demand and provides the users with comprehensive and flexible energy-efficient solutions.

5. FAULT PROTECTION

The computer continuously and comprehensively monitors the total operation of all modules in the chiller bank. It will also shut down individual module or the entire chiller system in the event that a fault occurs.

System faults include: low chilled/condenser water flow (for water-cooled chillers only), low chilled water leaving temperature, high hot water leaving temperature and external interlock fault/ protection, etc.



MODEL NUMBER DESIGNATION

MSRA	150	V	H	F	A		A	--	6.5
1	2	3	4	5	6		7		8

Model Number Identification:

1—Modular scroll air cooled
2—Model number 150, 340
3—Variable water flow
4—Chiller type H: Heat pump C: Cooling only
5—Refrigerant type
F: R22 R: R407C G: R410a
6—Electrical Specifications
A: AC380-420V/50Hz/3Ph B: AC440-480V/60Hz/3Ph
7—Development index
8—Number of modules per chiller 0.5~10

Example:

A heat pump chiller consisting of 6 MSRA150H modules, with AC380V/50Hz/3Ph power supply and HCF22 refrigerant is marked as **MSRA150H FA -6.5**

Optional:

1.Cable box (for MSRA150 series only):
As the number of modules increase in field installation, more power inlets are needed (one inlet cable for a half module). Users can get a junction box (optional, without cables) attached to the outside of chiller. All modules are pre-wired into the junction box which allows for single point connection to the external power source on the jobsite.

2.Variable water flow (VWF):
As the cooling capacity changes with the system heat load, VWF chiller automatically regulates working flows of chilled water to match up with the system operating load so that power consumption of both the chiller and the chilled water pump are greatly reduced.

3.Free cooling module (for MFCD(S) series only):
MFCD(S) modules for chillers with dual refrigeration modes are suitable for the circumstances where ambient temperature is below 0℃. The chiller runs with compressor cooling in summer mode and with free cooling mode in winter, which saves up to 15-70% operating cost annually.

4.Free control (for MFCA series only):
Free control application is based on MULTISTACK's modular patent technology, combing with new technology like network communication & separate controls and variable frequency control, which takes the modular chillers to a higher technical level in energy-saving, flexibility and reliability. Each module has water pump and other hydraulic parts. In addition, each chiller bank has a module with variable frequency system. Compressor's working frequency automatically regulates in the range of 30-90Hz. Minimum cooling capacity output is only 3.5 TR and maximum cooling efficiency up to EER 18 (COP5.26), which greatly reduce power consumption while meeting the minimum cooling demand.

5.Remote control:
MV7 is fitted with standard RS485 & RS232 serial ports, Ethernet interface and USB interface. Any of the three ways below is practical in data communication for remote monitoring of the chiller:
(1) Connect the control system to a PC and install the software (MULTISTACK Windows based only) and away you go. MULTISTACK's software gives you full access to the chillers controls and settings.
(2) The MV7 is open to the ASCII and Modbus communication protocol and communicates with BAS.
(3) MV7 control system has a 10M/100M Ethernet interface for data transmission. Just connect it to an Ethernet-card and with an IP address you can access the chiller over the Internet or local area network (LAN) established by the user, giving you absolute flexibility.

6.Water pump antifreeze:
MV7 control system is provided with the function of water pump antifreeze which works while the chiller stops in winter. Water pump automatically runs at low ambient temperature under control of MV7 controller and keeps a constant flow of water. In addition, the control system is equipped with electrical heating and relevant interfaces in case that when water temperature reaches second level antifreeze point, electrical heating will be started to prevent water freezing in water pipes; for air cooled heat pump chillers, in the event of second level antifreeze, chiller heating is activated.

7.Water pump and cooling tower control:
MV7 control system is also provided with system chilled water pump start/stop, system condenser water pump start/stop and cooling tower fan start/stop for overall energy-saving control.

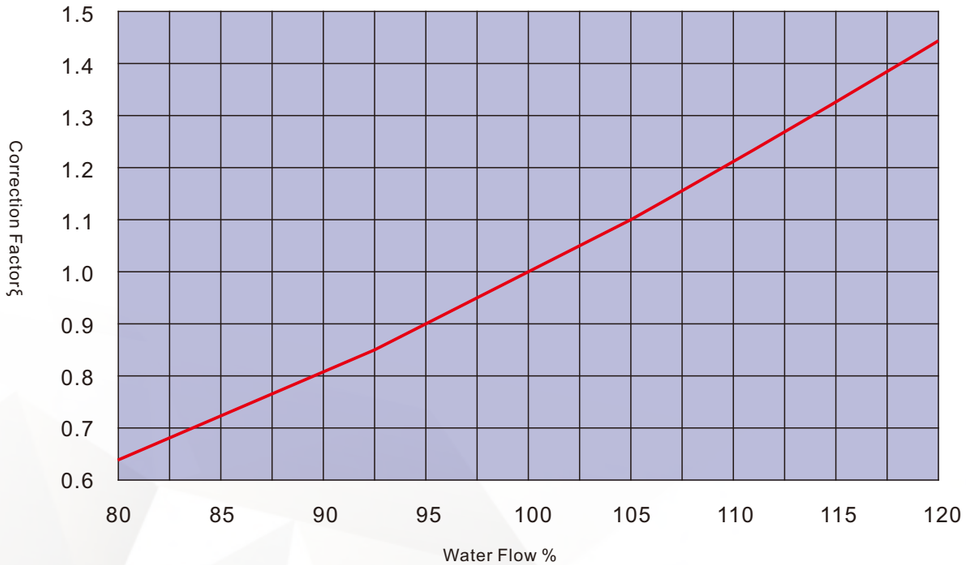
TECHNICAL DATA PER MODULE

Model		MSRA150H			MSRA150C			MSRA340H			MSRA340C		
		R22	R407C	R410a	R22	R407C	R410a	R22	R407C	R410a	R22	R407C	R410a
Cooling	Nominal Cooling Capacity (kW)	148	143	148	148	143	148	332	322	342	332	322	342
	Nominal Cooling Power Input (kW)	45.8	45.3	44.2	45.8	45.3	44.2	107.1	104.5	107.5	107.1	104.5	107.5
Heating	Nominal Heating Capacity (kW)	156	149	156	—	—	—	346	330	351	—	—	—
	Nominal Heating Power Input (kW)	45.3	45.0	43.8	—	—	—	106.5	104.0	107.0	—	—	—
Compressor	Type	Hermetic Scroll											
	Number	4											
	Power Supply	AC380V/50Hz/3Phase											
	Startup Current (A) per compressor	145						270					
	Full Load Ampere (A) per compressor	24.8	24.8	25	24.8	24.8	25	49.2	48.5	49.2	49.2	48.5	49.2
Control Stages		0 , 50% , 100%											
Number of Refrigerating Circuit		2	2	4	2	2	4	2	2	4	2	2	4
Refrigerant Charge (Kg/circuit)		16	14.5	8	14.5	13	7.5	45	41.4	25	37	32.4	18
Water Cooled Heat Exchanger	Type	Plate Heat Exchanger											
	Rated Water Flow (l/s)	7.1	6.8	6.3	7.1	6.8	6.3	15.9	15.4	16.3	15.9	15.4	16.3
	Rated Water Pressure Drop (kPa)	52						55					
	Fouling Factor (m2 k/kW)	0.018											
	Max Working Pressure Waterside (MPa)	2.0											
Air Cooled Heat Exchanger	Type	Fin Tube Heat Exchanger											
	Type of Fan	Axial Flow											
	Number	4											
	Power Input per fan (kW)	1.1	0.9	1.1	0.9	2.2	2.6	2.2	2.6				
	Air Flow (m^3/h)	60000	52000	60000	52000	128000	108800	128000	108800				
Connection Size		DN150				DN200							
Operating Weight (Kg)		1600	1640	1560	1600	2660	2720	2570	2630				
Shipping Weight (Kg/package)		780	800	740	760	2550	2610	2460	2520				
Physical Dimensions	L (mm)	1800	2000	1800	2000	2300	2680	2300	2680				
	W (mm)	1800	2000	1800	2000	2240	2246	2240	2246				
	H (mm)	2050	2180	2050	2180	2240	2200	2240	2200				
Number of modules per chiller (N)		0.5 -10											

Nominal conditions: Cooling: ambient 35℃; chilled water entering temp. 12℃; chilled water leaving temp. 7℃
Heating: ambient 7℃ DB / 6℃WB; hot water entering temp. 40℃; hot water leaving temp. 45℃

WATER PRESSURE DROP CORRECTION

Water Pressure Drop Correction for heat exchanger under various water flow



Water Pressure Drop Correction Factor (K) in regard to the total number of modules (N) per chiller

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	8.5	9.0	9.5	10.0
MSRA150	1.00	1.01	1.02	1.02	1.03	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.11	1.11
MSRA340	1.00	1.02	1.03	1.03	1.04	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.12	1.14

Notes:

1.Calculation of water pressure drop:

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

Actual water pressure drop (heat exchanger) per module = rated water pressure drop (heat exchanger) × ξ

Total chiller water pressure drop = actual water pressure drop loss (heat exchanger) per module × K

2.Minimum water flow of chiller: ≥ 80% of total rated water flow

LOW-TEMPERATURE COOLING PERFORMANCE CORRECTION

MSRA series modular air cooled scroll (heat pump) chillers can work at minimum -10℃ leaving water temperature, suitable for ice-making operation or manufacturing process control in industrial production. When operating at low temperature, glycol or other solutions with low freezing points are used to carry refrigerant. Do not use brine or other solutions which are corrosive to copper or stainless steel to prevent damage on the plate heat exchangers. For low temperature application, corrections should be applied to the cooling capacity, operating power input and heat exchanger water pressure drop.

(1) Actual cooling capacity = Nominal cooling capacity×C1×C2

(2) Actual operating power input = Nominal operating power input×C3×C4

(3) Actual water pressure drop (with glycol)= Actual water pressure drop (without glycol) x C5

Glycol Concentration Table

Glycol weight concentration %	0	5	10	15	20	25	30	35
Freezing point temperature ℃	0	-1.4	-3.2	-5.4	-7.8	-10.7	-14.1	-17.9
Minimum working temperature ℃	5.0	4.0	2.0	0.0	-2.0	-5.0	-8.0	-12.0
Cooling performance correction factor C1	1.000	0.997	0.992	0.988	0.985	0.982	0.980	0.978
Operating power input correction factor C3	1.000	0.999	0.997	0.996	0.995	0.994	0.993	0.993
Evaporator water pressure drop correction factor C5	1.00	1.050	1.102	1.220	1.305	1.423	1.536	1.740

Cooling Capacity Correction Factor C2 and Operating Power Input Correction Factor C4

Coil Air Inlet Temperature.℃	Leaving chilled water temperature℃							
	-10	-8	-6	-4	-2	0	2	4
	Cooling capacity correction factor C2							
9	0.521	0.566	0.614	0.663	0.726	0.794	0.883	0.962
15.5	0.484	0.531	0.580	0.632	0.688	0.732	0.861	0.916
28.5	0.462	0.505	0.553	0.607	0.658	0.714	0.791	0.869
35	0.433	0.480	0.528	0.577	0.624	0.672	0.732	0.822
	Operating Power Input Correction Factor C4							
9	0.727	0.754	0.781	0.805	0.833	0.852	0.876	0.902
15.5	0.778	0.805	0.831	0.858	0.884	0.903	0.932	0.992
28.5	0.820	0.851	0.892	0.923	0.954	0.987	1.107	1.112
35	0.866	0.879	0.936	0.980	1.011	1.196	1.204	1.231

PERFORMANCE CORRECTION TABLE

MSRA150C COOLING PERFORMANCE

Refrigerant: R22

Ambient Temp.℃	Leaving chilled water temperature℃											
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	149.7	37.9	155.3	37.9	163.9	38.0	169.9	38.0	179.1	38.1	192.0	38.1
30	142.5	41.6	147.9	41.6	156.2	41.7	162.0	41.7	170.9	41.8	183.3	41.8
35	134.8	45.7	140.0	45.7	148.0	45.8	153.5	45.8	162.0	45.9	173.9	45.9
40	126.9	50.4	131.0	50.4	139.4	50.5	144.7	50.5	152.9	50.6	164.3	50.6
45	118.7	55.6	123.4	55.6	130.6	55.7	135.7	55.7	143.4	55.8	154.3	55.8

Refrigerant: R407C

Ambient Temp.℃	Leaving chilled water temperature℃											
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	146.5	36.9	152.5	36.9	161.8	37.0	168.2	37.0	178.2	37.1	192.3	37.1
30	138.0	40.9	143.7	40.9	152.6	41.0	158.7	41.0	168.3	41.1	181.6	41.1
35	129.2	45.2	134.6	45.2	143.0	45.3	148.8	45.3	157.8	45.4	170.5	45.4
40	120.1	50.3	125.1	50.3	133.0	50.4	138.5	50.4	147.0	50.5	158.9	50.5
45	110.6	56.0	115.3	56.0	122.7	56.1	127.8	56.1	135.7	56.2	146.9	56.2

Refrigerant: R410a

Ambient Temp.℃	Leaving chilled water temperature℃											
	5		6		7		8		10		12	
	CAP	PI	CAP	PI	CAP	PI	CAP	PI	CAP	PI	CAP	PI
25	155.8	36.8	161.2	36.8	166.8	36.9	172.6	36.9	184.5	187.9	197.0	37.0
30	182.6	40.5	152.5	40.3	157.8	40.3	163.3	40.4	174.7	40.5	186.6	40.5
35	137.7	43.9	142.6	44.0	148.0	44.2	153.2	44.2	164.0	44.3	175.4	44.4
40	127.8	48.3	132.4	48.3	137.2	48.4	142.0	48.5	152.2	48.6	162.9	48.7
45	117.2	53.2	121.6	53.3	126.0	53.3	130.6	53.4	140.1	53.5	150.1	53.6

CAPC——Cooling Capacity (kW) PI——Power Input (kW)

PERFORMANCE CORRECTION TABLE

MSRA150H HEATING PERFORMANCE

Refrigerant: R22

Ambient Temp.℃	Leaving hot water temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	182.1	37.7	178.7	41.2	175.2	45.4	172.0	50.0	169.2	55.3
10	166.3	37.7	163.4	41.2	160.6	45.4	158.1	50.0	156.0	55.3
7	161.2	37.6	158.6	41.1	156.0	45.3	153.7	49.9	151.9	55.2
5	156.4	37.6	153.9	41.1	151.5	45.3	149.4	49.9		
0	138.1	37.5	136.4	41.0	134.8	45.2				
-5	121.9	37.5	120.7	41.0						
-10	104.1	37.4								

Refrigerant: R407C

Ambient Temp.℃	Leaving hot water temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	177.5	36.8	173.1	40.6	168.8	45.1	164.8	50.1	161.1	55.7
10	160.7	36.8	157.1	40.6	153.7	45.1	150.6	50.1	147.9	55.7
7	155.5	36.7	152.1	40.5	149.0	45.0	146.1	50.0	143.8	55.6
5	150.3	36.7	147.2	40.5	144.4	45.0	141.8	50.0		
0	131.4	36.6	129.2	40.4	127.3	44.9				
-5	114.7	36.6	113.3	40.4						
-10	96.5	36.5								

Refrigerant: R410a

Ambient Temp.℃	Leaving hot water temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	207.4	37.0	201.0	40.4	194.1	44.3	186.9	48.7	179.5	53.7
10	178.9	37.4	174.8	40.2	169.4	44.0	163.7	48.3	157.9	53.3
7	165.0	36.6	160.6	40.0	156.0	43.8	151.2	48.2	146.4	53.1
5	155.8	36.5	151.8	39.8	147.6	43.7	143.4	48.1	139.2	53.0
0	134.6	36.2	131.6	39.5	128.6	43.3	125.7	47.7	122.9	52.7
-5	116.2	35.8	114.1	39.2	112.1	42.9	110.3	47.4		
-10	100.2	35.3	98.9	38.7	97.8	42.5				

CAPH——Heating Capacity (kW) PI——Power Input (kW)

PERFORMANCE CORRECTION TABLE

MSRA340C COOLING PERFORMANCE

Refrigerant: R22

Ambient Temp.℃	Leaving chilled water temperature ℃											
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	337.1	90.0	350.1	90.0	370.3	90.1	384.2	90.1	405.8	90.3	436.0	90.3
30	320.0	97.6	332.4	97.6	351.7	97.7	365.0	97.7	385.7	97.8	414.6	97.8
35	301.9	107.0	313.7	107.0	332.0	107.1	344.8	107.1	364.5	107.2	392.1	107.2
40	283.3	115.6	294.5	115.6	311.9	115.7	323.9	115.7	342.6	115.8	368.9	115.8
45	264.3	126.4	274.9	126.4	291.3	26.5	302.6	126.5	320.3	126.6	345.1	126.6

Refrigerant: R407C

Ambient Temp.℃	Leaving chilled water temperature ℃											
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	327.1	85.2	340.0	85.2	360.2	85.3	374.2	85.3	395.9	85.4	426.2	85.4
30	310.3	94.1	322.7	94.1	342.0	94.2	355.4	94.2	376.2	94.3	405.3	94.3
35	291.8	104.4	303.6	104.4	322.0	104.5	334.7	104.5	354.5	104.6	382.3	104.6
40	271.9	114.2	283.0	114.2	300.3	114.3	312.3	114.3	331.0	114.4	357.3	114.4
45	250.6	125.6	261.0	125.6	277.2	125.7	288.4	125.7	305.9	125.8	330.5	125.8

Refrigerant: R410a

Ambient Temp.℃	Leaving chilled water temperature ℃											
	5		6		7		8		10		12	
	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI	CAPC	PI
25	361	90.1	372	90.1	383	91.0	394	92.0	417	93.9	453	95.9
30	342	97.8	352	97.8	363	98.8	374	99.8	395	101.7	429	104.6
35	322	106.5	332	107.5	342	107.5	352	108.5	373	110.4	405	113.3
40	300	116.2	310	117.2	319	118.2	329	119.1	348	120.1	379	123.0
45	278	127.8	287	128.8	296	129.8	304	129.8	323	131.7	351	134.6

CAPC——Cooling Capacity (kW)　　PI——Power Input (kW)

PERFORMANCE CORRECTION TABLE

MSRA340H HEATING PERFORMANCE

Refrigerant: R22

Ambient Temp.℃	Leaving Hot Water Temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	411.4	91.8	401.4	99.5	391.3	106.6	381.7	117.8	372.8	128.9
10	373.6	91.8	365.2	99.5	356.9	106.6	349.1	117.8	342.2	128.9
7	361.7	91.7	353.9	99.4	346.0	106.5	338.9	117.7	332.6	128.8
5	350.2	91.7	342.9	99.4	335.6	106.5	329.0	117.7		
0	307.5	91.6	302.1	99.3	297.0	106.4				
-5	270.0	91.6	266.3	99.3						
-10	229.6	91.4								

Refrigerant: R407C

Ambient Temp.℃	Leaving Hot Water Temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
15	391.4	86.6	383.2	95.6	374.1	104.1	364.2	116.0	354.1	127.7
10	354.8	86.6	348.0	95.6	340.5	104.1	332.4	116.0	324.4	127.7
7	343.3	86.4	337.1	95.5	330.0	104.0	322.5	115.9	315.0	127.5
5	332.1	86.4	326.3	95.5	319.7	104.0	312.8	115.9		
0	290.8	86.3	286.5	95.4	281.8	103.9				
-5	254.4	86.3	251.3	95.4						
-10	214.7	86.2								

Refrigerant: R410a

Ambient Temp.℃	Leaving Hot Water Temperature ℃									
	35		40		45		50		55	
	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI	CAPH	PI
12	412	87.1	405	96.6	398	107.9	392	111.7	386	111.7
7	360	86.2	355	96.6	351	107.0	347	111.7	343	111.7
4	333	86.2	329	95.6	326	107.0	323	110.8	320	110.8
0	302	85.2	300	95.6	298	106.1	296	110.8	294	110.8
-5	264	85.2	263	94.7	263	106.1	263	110.8		
-10	231	85.2	232	94.7	233	105.1				

CAPH——Heating Capacity (kW)　　PI——Power Input (kW)

CHILLER SELECTION

Select air cooled chillers according to the following conditions:

1. Summer cooling: chilled water entering temperature CHWE.T=12.5 ;
2. Summer cooling: chilled water leaving temperature CHWL.T=7.0 ;
3. Summer cooling: chilled water flow CHW.F=250m3/h=69.5 l/s;
4. Summer cooling: design ambient temperature AMB=35.0 ;
5. Winter heating: hot water leaving temperature HWL.T=45.0 ;
6. Winter heating: hot water entering temperature HWE.T=40.0 ;
7. Winter heating: hot water flow HW.F=220m3/h=61.1 l/s;
8. Winter heating: ambient temperature AMB=0.0 ;
9. Refrigerant: R22;
10. Power supply: AC380V/50Hz/3Ph;

CALCULATION

1.Determine cooling/heating capacity required (kW)

Cooling Capacity

= CHW.F×Cp×（CHWE.T-CHWL.T）

= 69.5×4.185×（12.5-7）

= 1600 kW

Heating Capacity

= HW.F×Cp×（HWL.T-HWE.T）

= 61.1×4.185×（45.0-40.0）

= 1278 kW

2.Determine module type and module number

If select MSRA340H chiller, we could get 332kW cooling capacity per module for MSRA340H when CHWL.T is 7.0℃ and ambient temp. is 35℃;

(1) Number of MSRA340H modules:

1600÷332=4.82

Select 5 modules of MSRA340H

Cooling capacity of 5 modules:

332×5=1660kW

(2) Verify heating capacity

If select MSRA340H chiller, we could get 297.0kW heating capacity per module for MSRA340H when HWL.T is 45.0℃ and ambient temp. is 0.0℃;

Total heating capacity:

297.0×5=1485kW＞1278kW

Module numbers selected above can meet the requirements for both cooling and heating.

(3) Chiller model:

MSRA340H-5.0-FA

3.Chilled water pressure drop

(1) Rated chilled water flow = 5×15.9

= 79.5l/s

Chilled water pressure drop for rated water flow per module is 55kPa;

(2) Calculate actual water pressure drop

Actual chilled water flow percentage=69.5÷79.5=87%

Use the chart “Water Pressure Drop Correction for heat exchanger under various water flows”, the correction factor ξ is 0.76 when water flow percentage is 87%.

Use the table “Pressure Drop Correction Factor (K)”, k = 1.03 when MSRA340 module number is 5

Actual chilled water pressure drop is:

55×0.76×1.03=43.05 kPa

ELECTRICAL PERFORMANCE DATA

1. MSRA150 ELECTRICAL PERFORMANCE

Model			MSRA150H	MSRA150C	MSRA150H	MSRA150C	MSRA150H	MSRA150C
Refrigerant			R22		R407C		R410a	
Power Supply			AC380±10%V/3Ph/50Hz					
Compressor	MCC (A)		32		32		31.5	
	MRC (A)		24.8		25.9		27	
	LRA (A)		145		145		145	
	RLA (A)	Cooling	20.0	20.0	19.8	19.8	18.0	18.0
		Heating	19.7	—	19.5	—	17.8	—
Fan (Each)	RLA (A)		2.74					
	Startup Current (A)		10.2					
MSC			(4×N-1) ×MRC+LRA					

2. MSRA340 ELECTRICAL PERFORMANCE

Model			MSRA340H	MSRA340C	MSRA340H	MSRA340C	MSRA340H	MSRA340C
Refrigerant			R22		R407C		R410a	
Power Supply			AC380±10%V/3Ph/50Hz					
Compressor (each)	MCC (A)		57.5		57.5		52.5	
	MRC (A)		49.15		48.45		44.3	
	LRA (A)		270		270		270	
	RLA (A)	Cooling	42.9	42.9	42.55	42.55	36.15	36.15
		Heating	84.3	—	83.9	—	35.55	—
Fan (Each)	RLA (A)		4.13				4.59	
	Startup Current (A)		13.7				15.2	
MSC			(4×N-1) ×MRC+LRA					

Notes:

1. The selection of main cables should base on the MRC, supply voltage, allowable voltage drop, ambient temperature and local electrical codes.
2. Each power circuit must have its own protection device with instruction label.
3. Ground wire of each module in the power supply cabinet must be earthed.

4.Codes explanation:

N——Number of modules

MCC——Maximum Continuous Current. When compressor load running current exceeds maximum continuous current, protection device in compressor motor will work.

MRC——Maximum Rated Current, which occurs in the initial operation period or when the chiller operation condition exceeds rated condition.

LRA——Locked Rotor Amperage, which occurs when compressor motor is in locked-rotor condition for 4 seconds.

RLA——Rated Load Amperage. Compressor load current in rated condition.

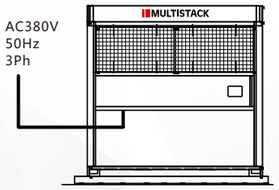
MSC——Maximum Startup Current. Chiller’s starting current is always equal to total current of all running compressors plus startup current of the next start up compressor.

POWER MAINS CONNECTION

MSRA150 & MSRA340 POWER MAINS CONNECTION

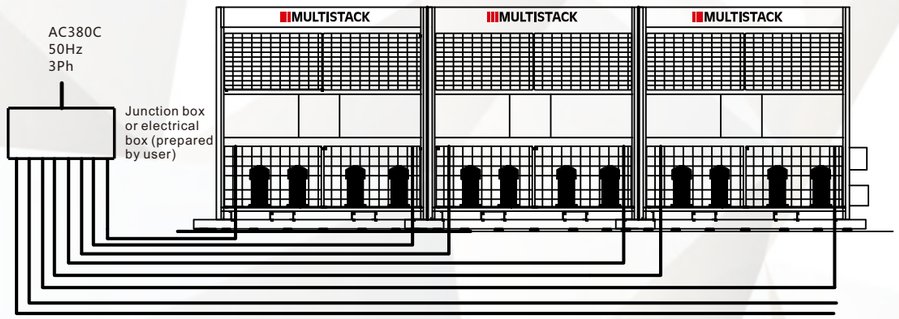
Model	No. of Modules	Mains Connection	
		Location	Description
MSRA150-N	0.5~1.0	Half module electrical box	Connect with main circuit breaker of each half module respectively
MSRA150-N	1.5~10.0	Junction box on the end module	Branch from junction box and connect with main circuit breaker of each half module respectively
MSRA340-N	0.5~10.0	Electrical box	Branch power circuits from junction box and connect with main circuit breaker of each module respectively. The number of power circuits is based on the number of modules, two circuits for each module.

MSRA150-N No. of modules N=0.5-1



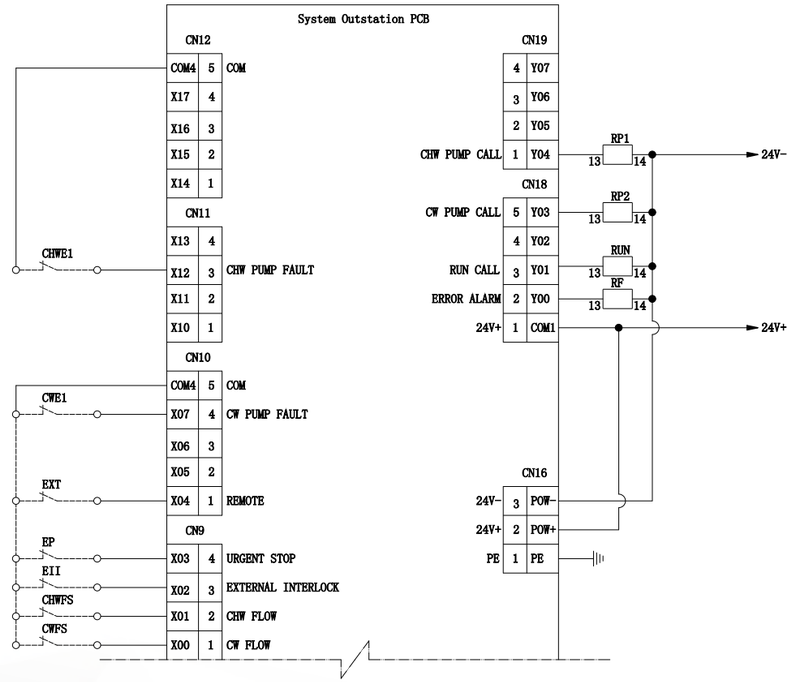
MSRA150-N No. of modules 1 < N≤10

MSRA340-N No. of modules N=0.5-10



FIELD WIRING DIAGRAM

External interlock contacts connecting with system PCB



External Interlock Devices:

CHWFS Chilled water flow switch, verifying water flow;
CWFS Condenser water flow switch, verifying water flow (for water cooled chiller only);
CHWE1 Chilled water pump fault signal;
CWE1 Condenser water pump fault signal (for water cooled chiller only);
EII External interlock signal;
EP External emergency stop input;
EXT External remote start/stop input;

Passive Output Contacts:

System control board provides 4 passive outputs for users.
RF Chiller fault status output;
RUN Chiller running status output;
PR1 Chilled water pump running signal output;
PR2 Condenser water pump running signal output;

Notes:

—— Control wire minimum section 1mm^2;
—— Over bridge the input signal terminals X02, X03 and X04 to common terminal COM3 as per wiring diagram if EII, EP and EXT are not used;
—— Passive output contacts maximum current is 5A;
—— Flow switch and external interlock devices are prepared by users or bought from MULTISTACK;
—— Solid lines for factory wiring and dotted lines for field wiring.

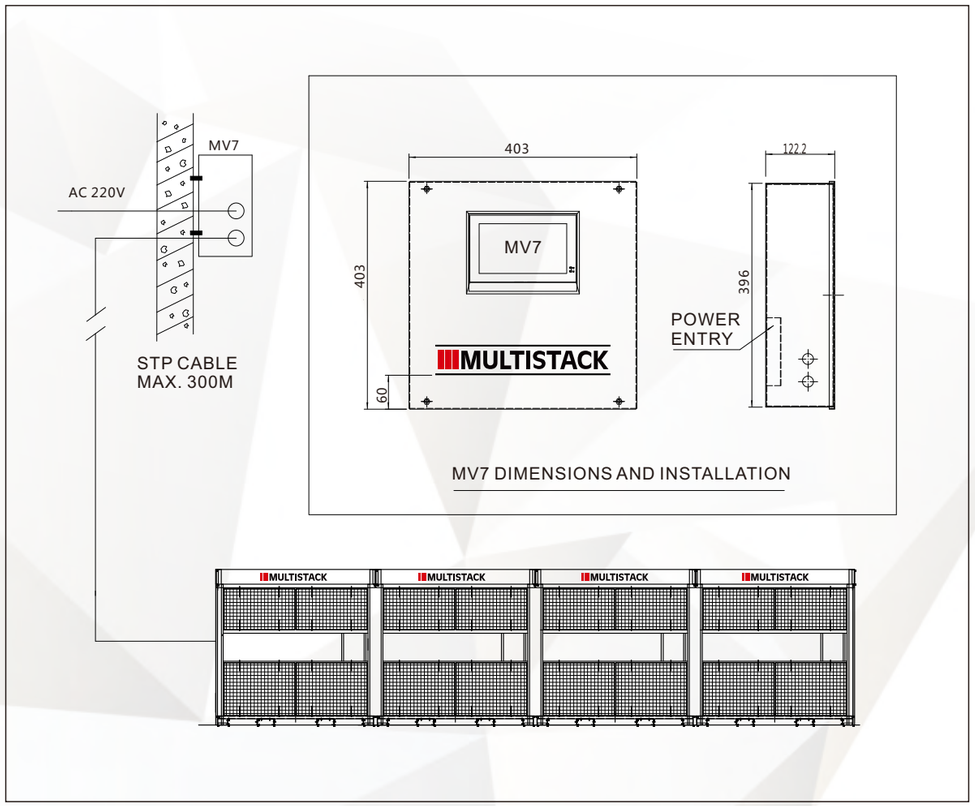
FIELD WIRING OF CONTROL CIRCUITS

Communication Connection of MV7 and Chiller

MV7 controller shall be installed indoors in the vicinity of the chiller for convenient operation and maximum reliability. MV7 housing should be wall installed. MSRA chiller comes with 50m STP communication cables to connect chiller system control interface with MV7 controller. User can wire longer STP communication cables, if necessary, between chiller and MV7 controller. Signal amplifier should be used if the cable exceeds 300m.

Power for MV7 controller is AC220V, out from chiller transformer 220V port and connecting with MV7 computer, or directly connecting to the power source in field installation. In the latter case, it is recommended that on-site power supply should be synchronized interlock with chiller power source, or else MV7 will display “communication failure” in the event of chiller power outage while the controller still energized.

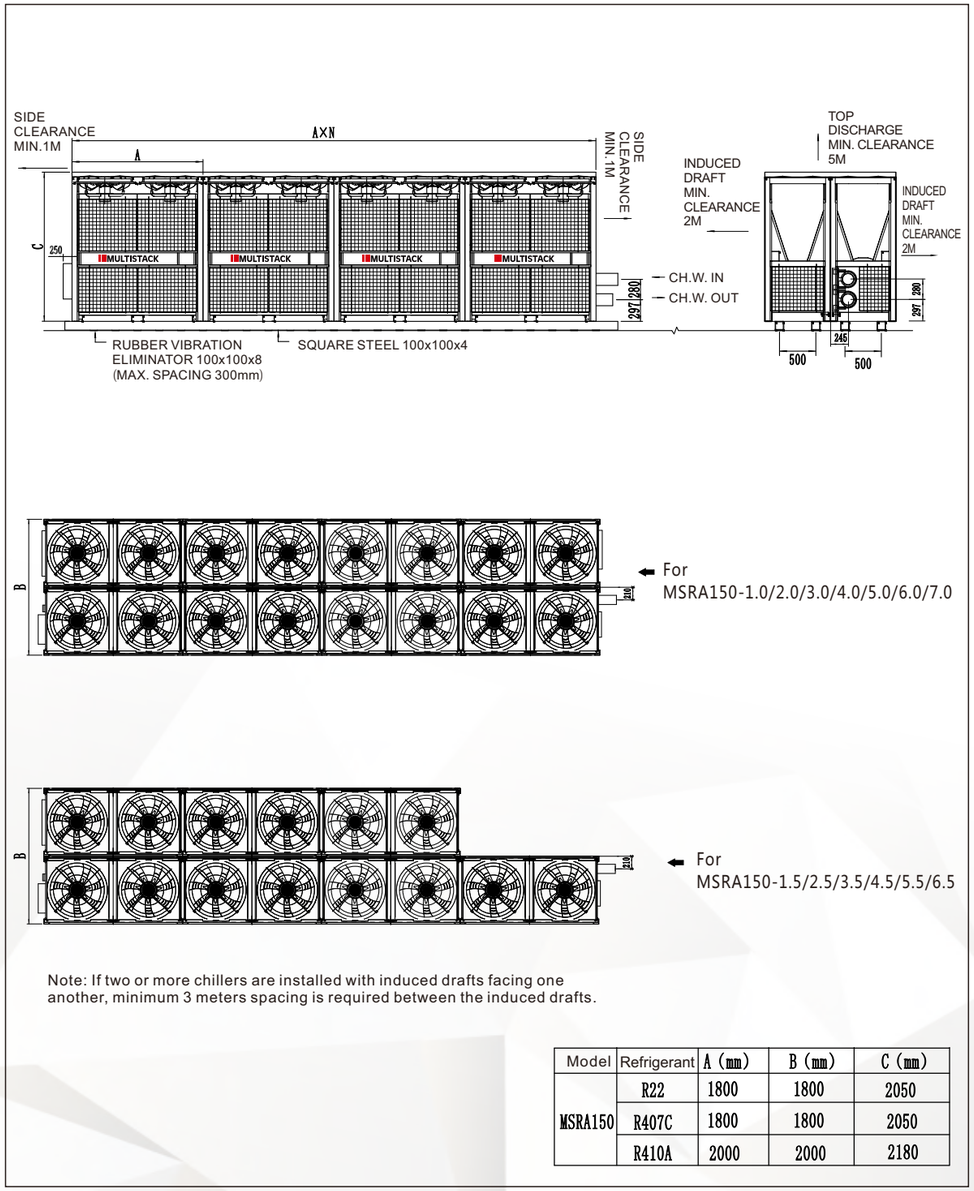
Communication Connection of MV7 and Chiller



MV7 DIMENSIONS AND INSTALLATION

PHYSICAL DIMENSIONS

1. MSRA150 STANDARD CONFIGURATION

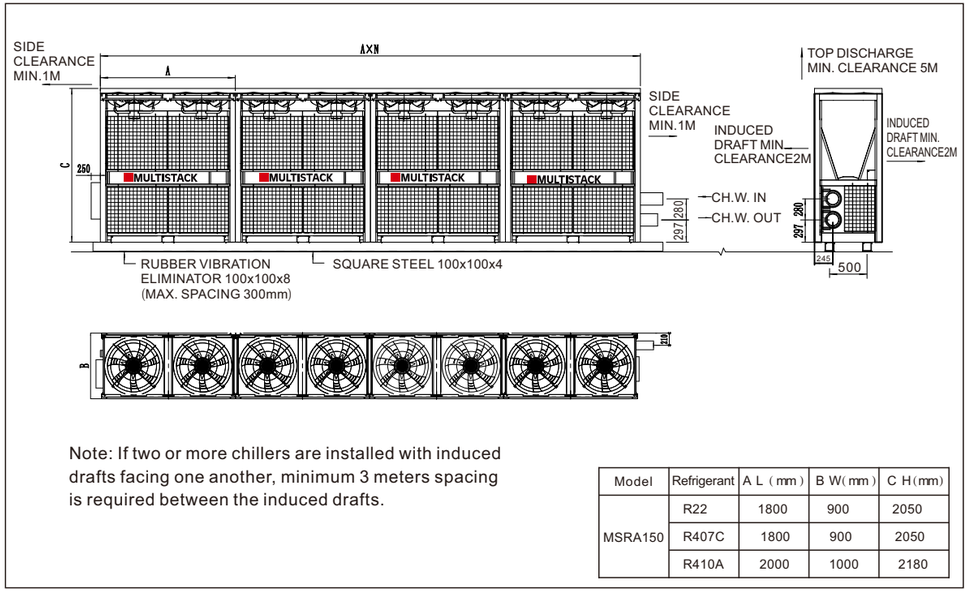


Note: If two or more chillers are installed with induced drafts facing one another, minimum 3 meters spacing is required between the induced drafts.

Model	Refrigerant	A (mm)	B (mm)	C (mm)
MSRA150	R22	1800	1800	2050
	R407C	1800	1800	2050
	R410A	2000	2000	2180

PHYSICAL DIMENSIONS

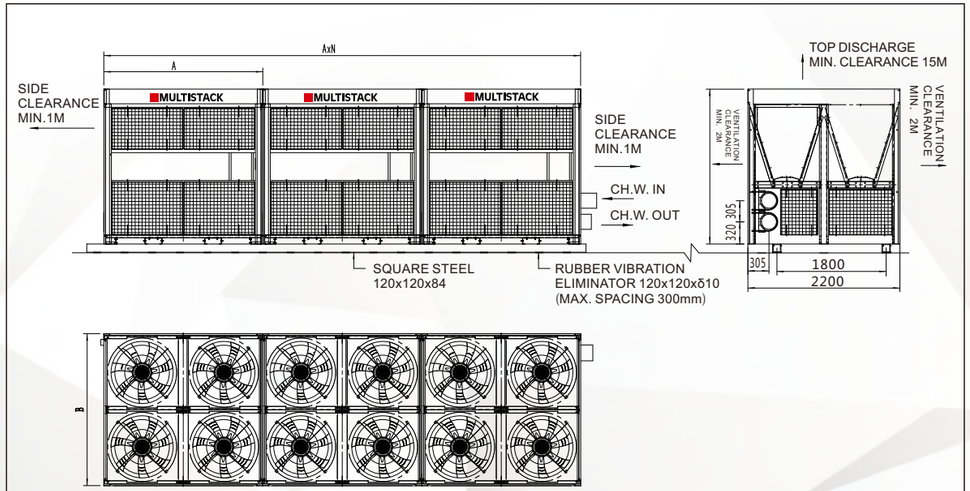
2. MSRA150 SIDE-BY-SIDE CONFIGURATION



Note: If two or more chillers are installed with induced drafts facing one another, minimum 3 meters spacing is required between the induced drafts.

Model	Refrigerant	A L (mm)	B W(mm)	C H(mm)
MSRA150	R22	1800	900	2050
	R407C	1800	900	2050
	R410A	2000	1000	2180

3. MSRA340 CONFIGURATION

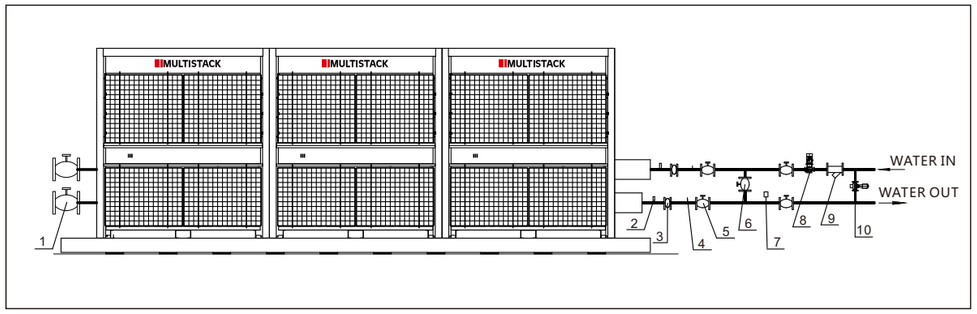


Note: If two or more chillers are installed with induced drafts facing one another, minimum 3 meters spacing is required between the induced drafts.

Model	Refrigerant	A L (mm)	B W(mm)	C H(mm)
MSRA340	R22	2300	2200	2240
	R407C	2300	2200	2240
	R410A	2680	2246	2200

WATER PIPING SYSTEM

1. WATER PIPING



No.	Item	Qty
1	Drain valve DN50	2
2	Temperature sensor well 3/8”	2
3	Vibration eliminator	2
4	Pressure gauge	2
5	Isolationg valve	4
6	By-pass valve	1
7	Flow switch	1
8	Water pump	
9	Water strainer, 25 meshes/inch	1
10	Differential pressure by-pass valve	1

2. Notes

(1)MULTISTACK modular air cooled chiller could be installed in places with sufficient ventilation, such as rooftop, balcony or just on the ground, to keep good convection heat transfer. If two or more chillers are installed with induced drafts facing one another, minimum 3 meters spacing is required between the induced drafts;
(2)If the chiller has multiple modules, water header’s center line of each module should be adjusted to the same center line;
(3)The distance between the flow switch and the upstream/downstream straight pipe should be at least 5 times pipe diameter to prevent damage on the chiller in the event of insufficient water flow. Flow switch is irreplaceable by differential pressure switch/transducer on the water headers;
(4)Required setting of the flow switch: open when water flow ≤80%;
(5)External pipes and valves shall have proper support so that their weights would not bear on the chiller to guarantee good sealing of pipe joints;
(6)The mesh number of the strainer in the inlet pipe should be minimum 25. The strainer should be stainless steel and sturdy enough in case that too much water pressure caused by partial blockage may damage the strainer;
(7)After the temperature sensors are inserted to the sensor wells, grease should be applied into the sensor wells to protect temperature probes from being damaged by water accumulation inside the sensor well;
(8)During the installation of chiller and leak check, all isolating valves should be closed. They are not allowed to open until the installing, leak check and cleaning are completed;
(9)Prior to chiller operation, the whole piping system must be thoroughly cleaned and removed of mechanical impurities. Close the isolating valves in the process of cleaning and open the bypass valve to avoid water circulating within the chiller;
(10)All piping components are prepared by the users.