

# INSTALLATION & OPERATION MANUAL

## MODULAR AIR COOLED CHILLER

Model: MAC160/210A



## CONTENTS

1. Features .....	page2
2. Nomenclature .....	page3
3. Specifications .....	page5
4. Performance Curve .....	page6
5. Technical data .....	page7
6. Outlines and Dimensions.....	page8
7. Control system .....	page9
8. Location and Installation .....	page11
9. Hydraulic system .....	page13
10. Trouble shooting .....	page17



### Warning

- **Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and experienced with this type of equipment.**
- **Moving machine and electrical power is hazardous. May cause severe personal injury or death. Disconnect and lock off power before servicing equipment!**

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# 1. Features

MAC units are high thermodynamic engineering products, studied with high accuracy in balancing compressors, condensers and evaporators in order to offer high performances and wide safety margins. The materials and the equipment adopted for the products have been chosen without any compromises, taking care of quality and long life purposes of products. The quality management system of McQuay meets ISO 9001 requirements, an assurance, beyond any doubts, of the high producing standards.

## **Working reliability**

In **summer mode** (the mode is simply selected by means of a switch) the unit produces chilled water through a plate exchanger while the condenser coils dissipate the heat rejection. In **winter mode** plate heat exchanger works as a water condenser to produce hot water while condenser coils dissipate cooling capacity to the ambient air. The periodic defrosting, necessary during low temperature functioning of the unit is run by the system by means of automatic switching of the 4-ways inversion cycle valve.

## **Modular Design**

MAC160/210A are designed as the original modules, different numbers of modules can be combined to satisfy different load. The largest combination is 10 modules. It is convenient for transportation and installation.

## **Highly flexible design**

The MAC units are available in sizes covering a range from 56 to 700 kW rated cooling capacity and with availability of many accessories, and the applications of high tech control and safety devices, give to these products high flexibility for their installation in commercial, residential and industrial environments. It couples with different types of fan coil or AHU, and satisfies different area by modular combination.

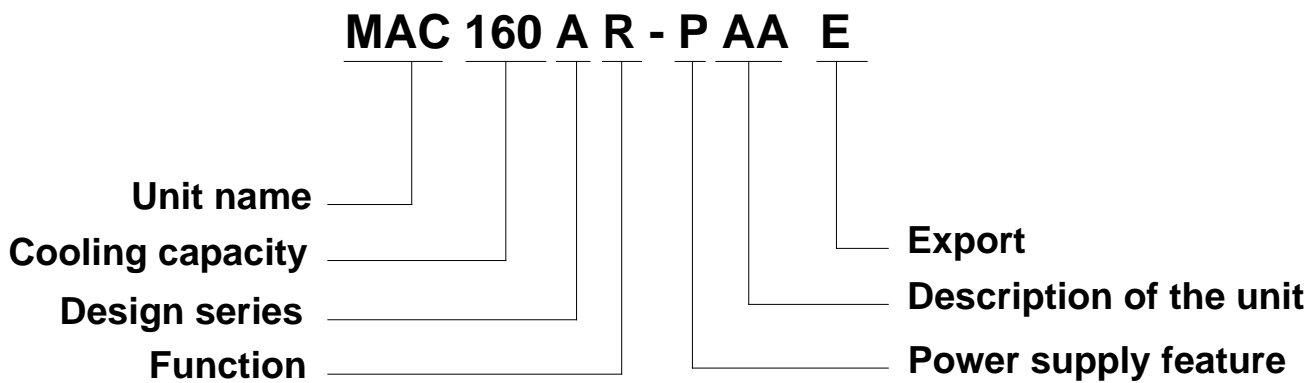
## **Low installation costs**

The complete assembly of the units and function testing at the factory reduce the cost of installation on site. A rigid steel base distributes the weight of the unit to the support points and allows simple installation by an easy access to the lifting points.

## **Factory testing**

Each unit is pressure tested, vacuum tested, evacuated and charged with refrigerant requested. It is then run at the factory's test bench under the design conditions specified by the customer. Upon request, a second series of tests can be carried out witnessed by the customer. Before shipment, each unit is re-checked for pressure and refrigerant charge control.

## 2. Nomenclature



# General Specification

## Compressor

McQuay Modular Air Cooled Chillers are equipped with highly efficient, reliable and silent compressors with internal overload protection. The compressors adopt hermetic type to further eliminate operating noise and vibration.

## Air-cooled Condenser

The two air cooled condenser coils with V-shaped consist of staggered rows of 3/8" OD seamless copper tube, mechanically expanded onto die formed aluminum fins to ensure optimum heat exchange capability.

## Condenser Fan Motor

To achieve the high air charge requirement, the unit is equipped with the high air flow propeller fan which is made of acryl styrene resin. The fan is directly driven by weather proof single-phase motor to ensure reliable continuous operation.

## Evaporator

The heat exchanger is made of stainless steel plates closely arranged and brazed together to ensure high heat exchange efficiency. The complete heat exchanger is insulated with thermal closed cell nitric rubber foam to give optimum thermal insulation.

## Refrigerant Circuit

The refrigerant circuit is factory brazed and evacuated before accurately charged with R22 to ensure optimum operating requirement. To ensure flawless continuous operation, each refrigerant circuit is equipped with a carefully sized thermostatic expansion valve.

## Additional Safety Protection

The modular air cooled chillers are equipped with intelligently designed safety control to ensure continuous safe operation. High and low pressure switch is provided in cooling models to prevent the compressor damage resulting from both abnormally high discharge head pressure or low pressure due to insufficient gas. The heat pump models are provided with a high pressure switch.

Flow switch is provided in the unit to protect against damage to the water pump.

The standard mechanical controller provides accurate water temperature control in the circuit by closely monitoring and reacting to the input from the water entering temperature, water leaving temperature and ambient air temperature.

Under normal condition, if the water leaving temperature falls below setting temperature (antifreeze temperature) the unit will be cut off automatically.

Flow switches and Power contactors with thermal relays for compressors, fan motors and water pumps are providing secondary protection for the unit.

## Anti-freezing Protection

The antifreeze heater is activated according to the temperature out of heat exchanger and the working time of the heat pump.

## 3. SPECIFICATIONS

### MODULAR AIR COOLED CHILLER

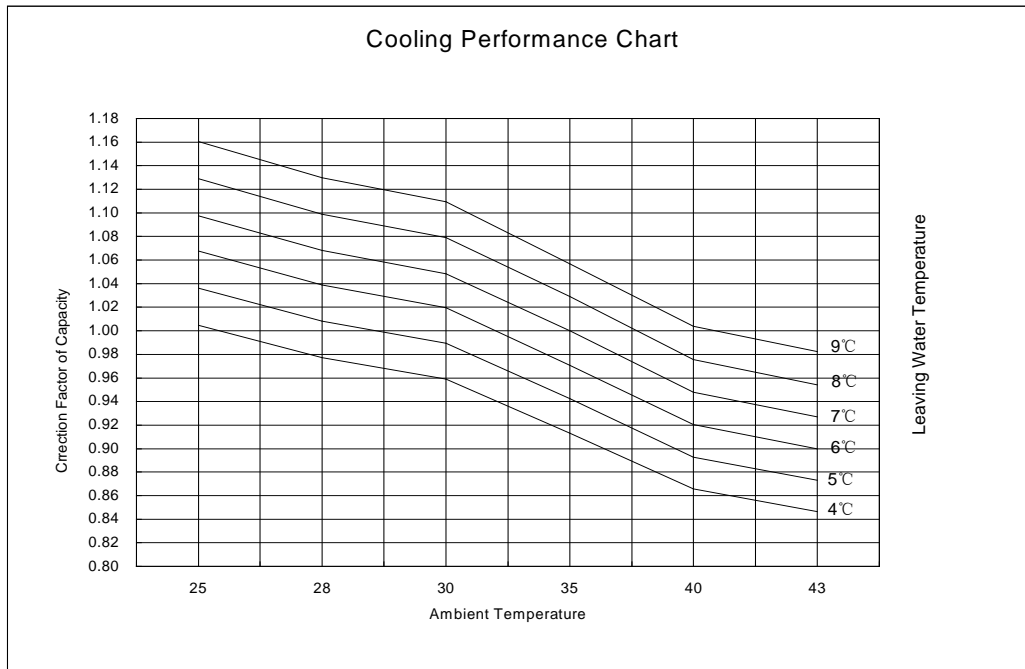
MODEL (60Hz)			MAC160A	MAC210A	MAC160A	MAC210A
Rated Cooling Capacity	Btu/h		191126	238908	191126	238908
	kcal/h		48000	60000	48000	60000
	W		56000	70000	56000	70000
Rated Cooling Input	W		22000	24500	22000	24500
Cooling Running Current	A		70.0	79.0	34.0	38.0
Power supply			208-230V / 3~ / 60Hz		460V / 3~ / 60Hz	
Dimension	Width	mm	1820	2056	1820	2056
	Depth	mm	1091	1140	1091	1140
	Height	mm	1843	2193	1843	2193
Net Weight	kg		620	730	620	730
Working Weight	kg		640	750	640	750
<b>Casing</b>						
Material			Electro-galvanized Mild Steel			
Finish			Epoxy Polyester Power			
<b>Evaporator</b>						
Type			Braze Plate Heat Exchange			
Plate Material			Stainless Steel			
<b>Water Line</b>						
Pipe Size	in		3	5	3	5
Water Pressure Drop	kPa		125	72	125	72
Maximum Water Pressure	bar		6			
<b>Condenser Coil</b>						
Fin	Material		Aluminum			
	Thickness	mm	0.11			
	Rows		3			
	Fin per inch		14	16	14	16
<b>Condenser Fan</b>						
Type/Drive			Axial Big Vane and Low Noise Blower			
Fan Motor	kW		2	2.7	2	2.7
Blade Material			Galvanized Steel			
Blade Diameter	mm/in		711.2/28			
<b>Compressor</b>						
Type			Scroll Compressor			
Protection Device			H/L pressure switch/Thermal and current overload protector			
<b>Refrigerant</b>						
Type			R22			
Charging Mass	kg		6.55 X 2	7.5 X 2	6.15 X 2	7.8 X 2
Control			Capillary	Thermostatic Expansion Valve	Capillary	Thermostatic Expansion Valve

**Notes:**

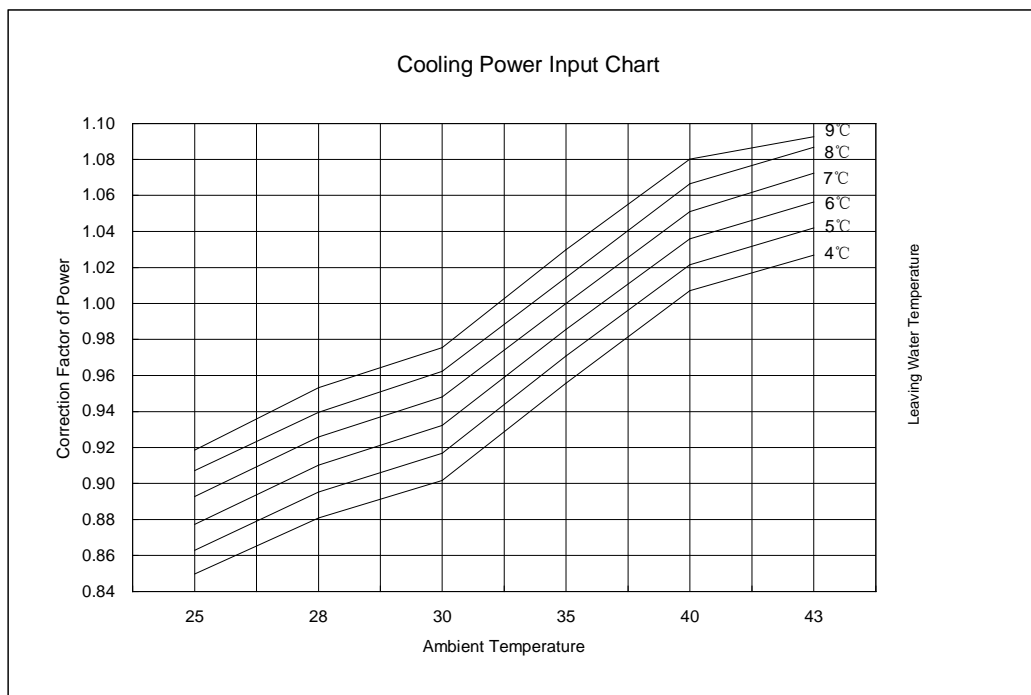
- Rated cooling capacity is based on 12°C entering water temperature/ 7°C leaving water temperature, 35°C air ambient temperature.
- All specifications are subjected to change by manufacturer without prior notice.

# 4. Performance Curve

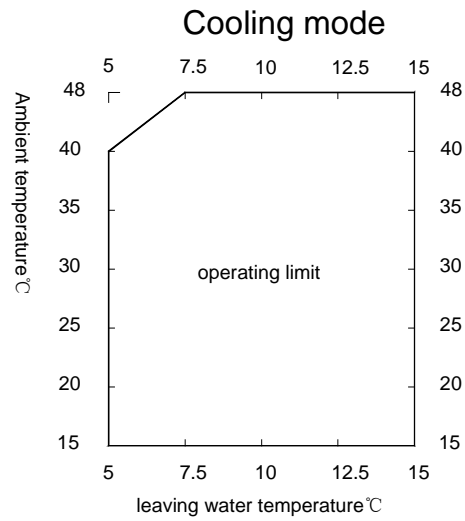
## 1. COOLING CAPACITY



## 2. COOLING POWER INPUT



### 3. OPERATING LIMIT



## 5. Technical data

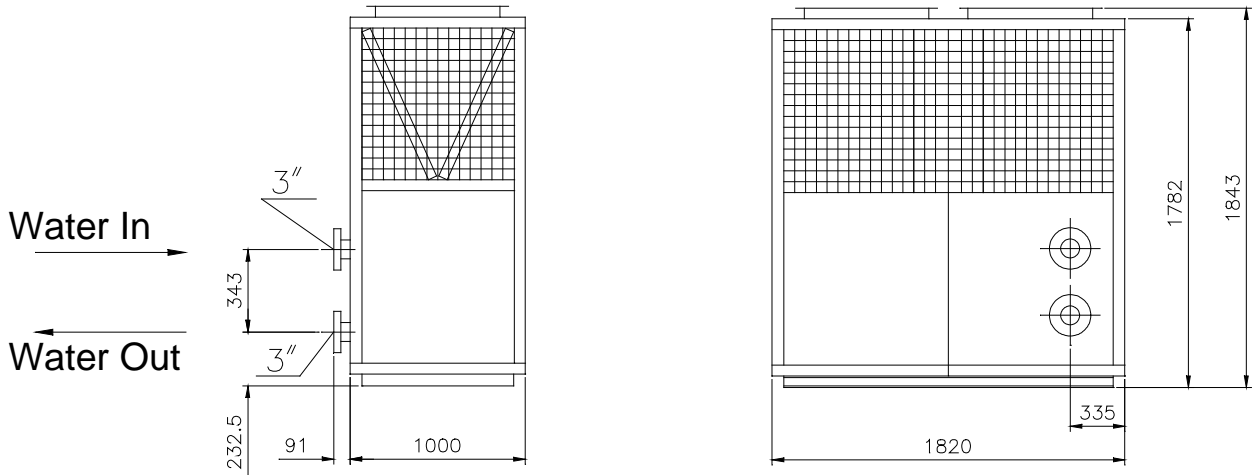
### Correction Factors With Glycol Use

GLYCOL%	COOLING CAPACITY	WATER FLOW	PRESSURE DROP
10	0.990	1.015	1.06
20	0.980	1.040	1.12
30	0.970	1.080	1.18
40	0.965	1.135	1.24



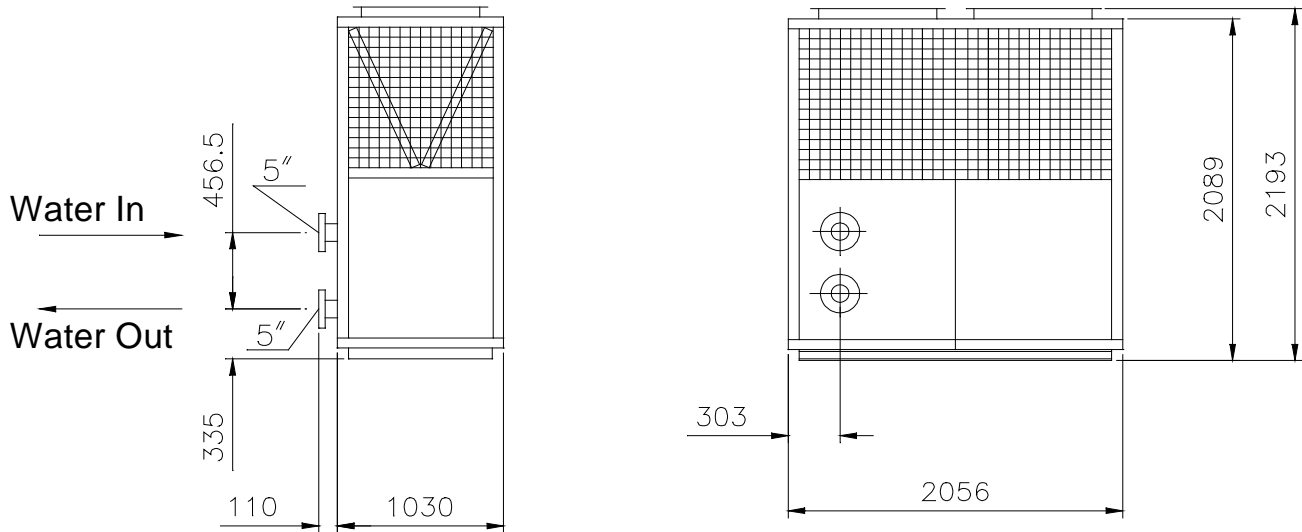
## 6. Outlines and Dimensions

Model: MAC160A



UNIT: mm

Model: MAC210A



UNIT: mm

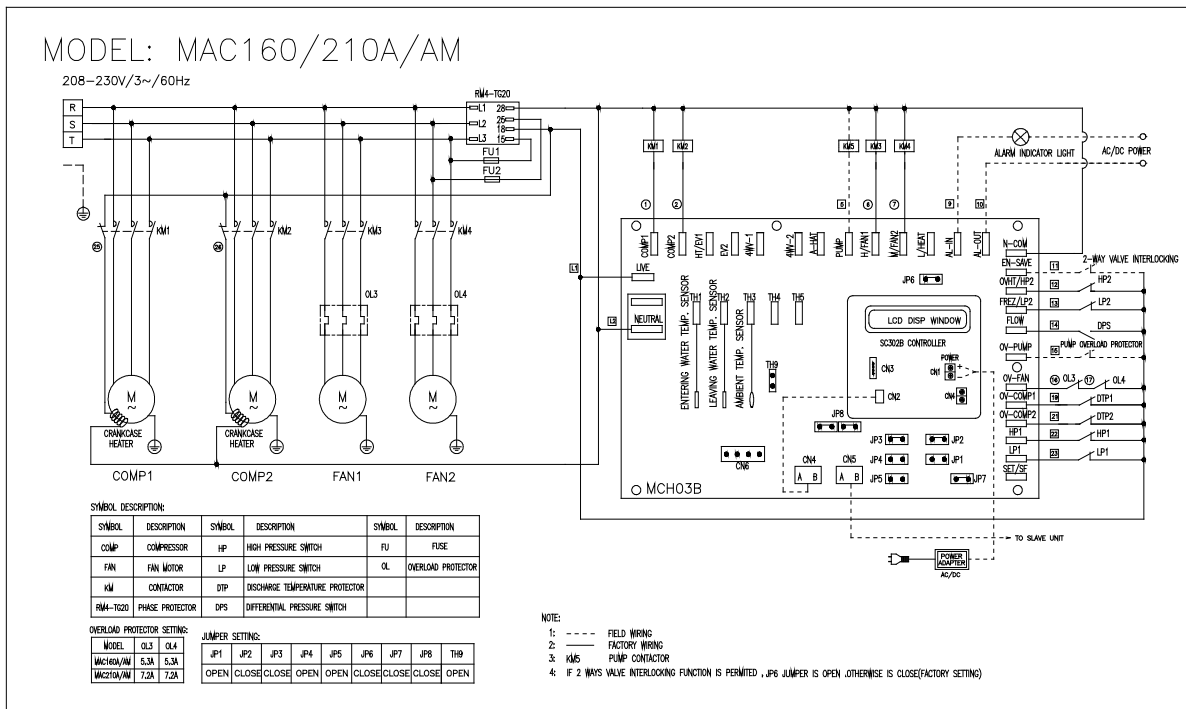
# 7.CONTROL SYSTEM

Ensure that the electrical source of the unit corresponds to that of the name plate before general precautions.

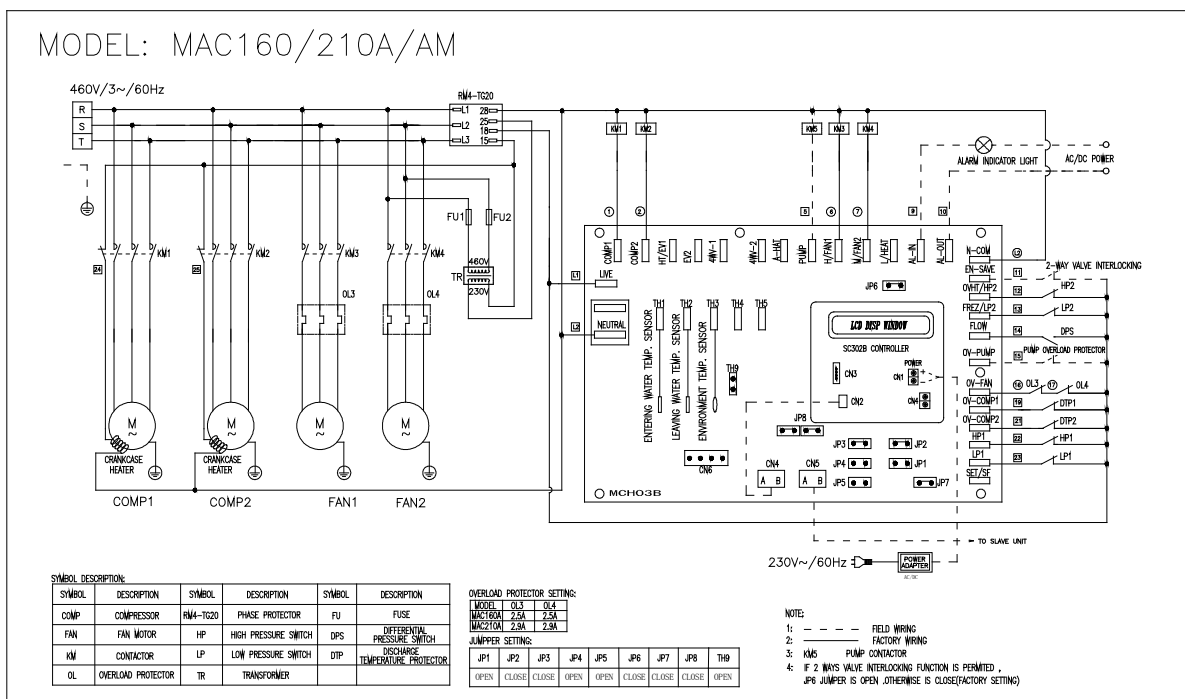
Provide a power outlet to be used exclusively for each unit. A power supply disconnects and a circuit breaker for over-current protection should be provided in the exclusive line.

The modular air-cooled chillers must be well grounded. It absolutely cannot be connected with gas-pipe, water pipe and telephone line.

## Wiring diagram: MAC160/210A 208-230V / 3~ / 60Hz



## Wiring diagram: MAC160/210A 460V / 3~ / 60Hz



**Electric parameter list of the unit (electronic control circuit).**

		MAC160A	MAC210A	MAC160A	MAC210A
POWER		208-230V / 3~ / 60Hz		460V / 3~ / 60Hz	
Power input (W)	Cooling	22000	24500	22000	24500
	Heating	---	---	---	---
Operation current (A)	Cooling	70.0	79.0	34.0	38.0
	Heating	---	---	---	---
Power Supply Wire					
Power Supply Wire	Wire (R/S/T)	Section area (mm <sup>2</sup> )	≥25	≥10	
		number	3		
	Earth Wire	Section area (mm <sup>2</sup> )	≥25	≥10	
		number	1		
Control wire	-	RVVP2×1mm <sup>2</sup>			

- The above data are based on unit electronic parameter.
- The wires should be well connected.
- Every wire can not contact pipes, compressor, fan motor or other movable parts.

## 8. Location and Installation

### 1. INSPECTION

All modular air cooled chillers are transported with pallet. Each unit has been filled with refrigerant. It is not necessary to fill it again.

As soon as the unit is received, it should be inspected for any damage that may have occurred in transit. And all the separated parts are received.

### 2. STORAGE OF THE UNIT

If the chillers are not installed for the moment, it is strictly prohibit stacking them.

### 3. LOCATION OF THE UNIT

- 3.1 Don't install the unit in air shaft, courtyard, or other places which is limited for the unit. Or it will maximize the vibration and noise because of the echo and resonance of the wall or other obstacles.
- 3.2 Space for access to front and sides of the equipment must be provided to accommodate such maintenance and service and to permit unobstructed flow of air to and from the unit.
- 3.3 Install the modular air cooled chillers in a way such that hot air distributed by the condensing unit cannot be drawn in again (as in the case of short circuit of hot discharge air). Allow sufficient space for maintenance around the unit.
- 3.4 Ensure that there is no obstruction of air flow into or out of the unit. Remove obstacles that block air intake or discharge.
- 3.5 The location must be well ventilated, so that the unit can draw in and distribute plenty of air thus lowering the condensing temperature.

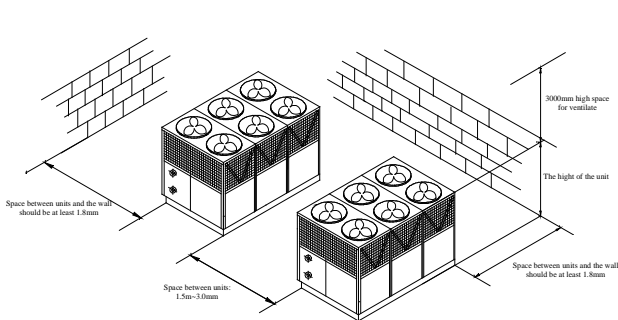


Figure 1

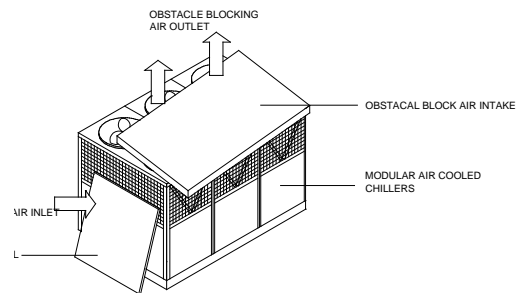


Figure 2

- 3.6 A place protected from direct sunlight, otherwise use an awning for protection from storm and rain, which should be 5m high from the unit and well ventilated.

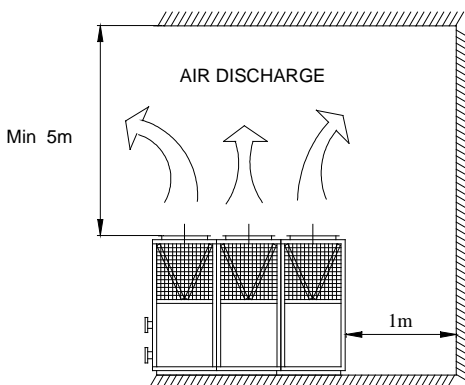


Figure 3

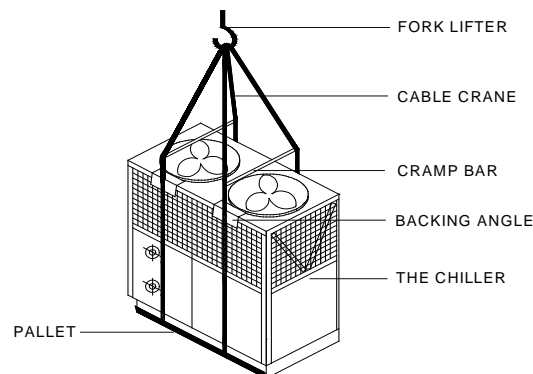


Figure 4

- 3.7 The location must not be susceptible to dust or oil mist to avoid condenser coil being choke by the contaminant. As the general safety precaution, it is advised that no flammable danger gas should be located near to the chiller.

**4. HANDLING**

Each modular air cooled chiller is skidded at the factory. Care should be taken during handing to avoid damage to the unit and internal components. Fork lifter or cable crane should be used for easy to schlep.

**5. LIFTING METHOD**

When the modular air cooled chillers are to be lifted and moved, attached ropes to the suspension plates provided on the top of the unit.

When it is lifted, hook should be as directly aligned over the center of gravity as possible.

Care should be taken to avoid contact with the main unit while carrying.

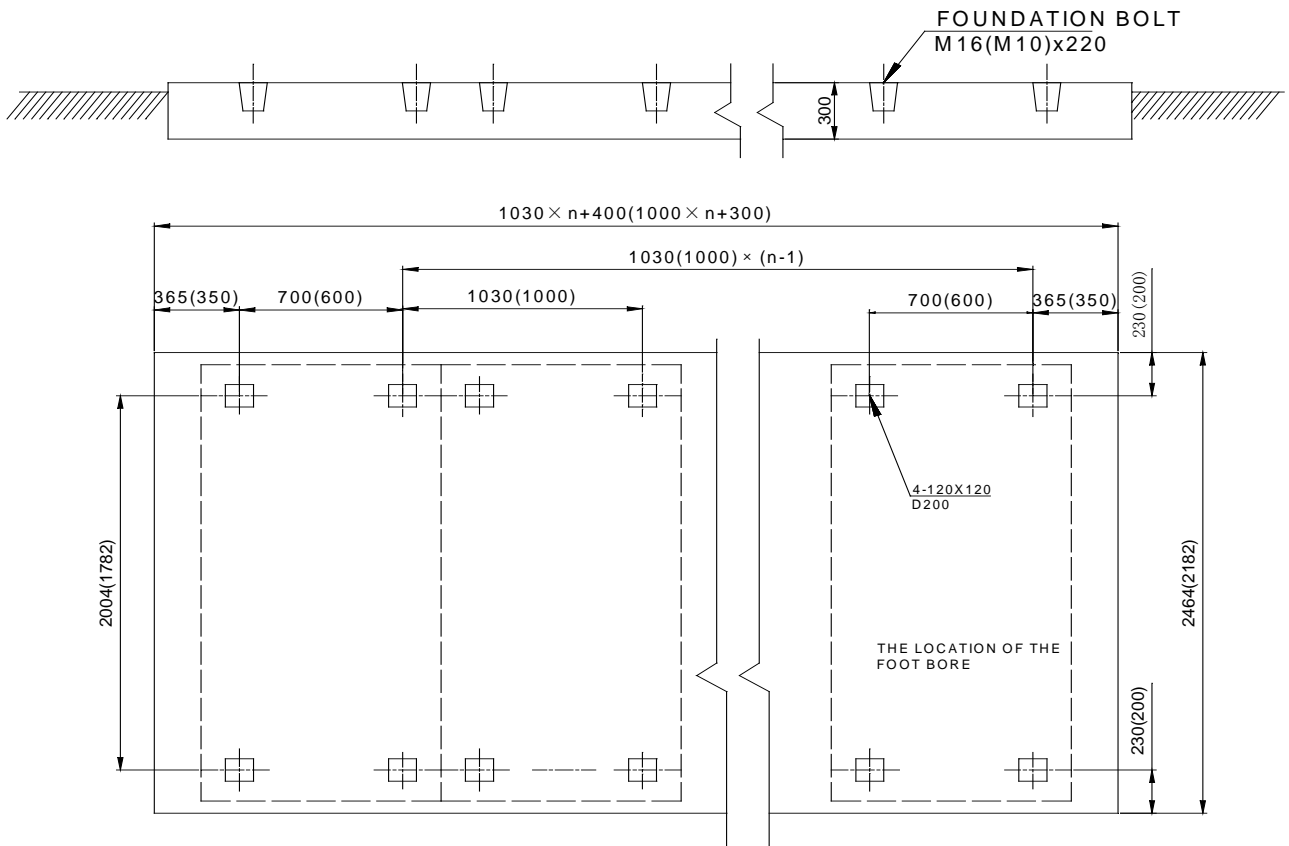
It is necessary to protect the chiller with the blanket or pallet so that the ropes should not injure the unit.

**6. INSTALLATION BASE**

6.1 The unit must be installed on a flat and level concrete foundation. It can be conveniently installed on rooftop, terrace and other proper places.

6.2 Drain pipe

6.3 Strong enough



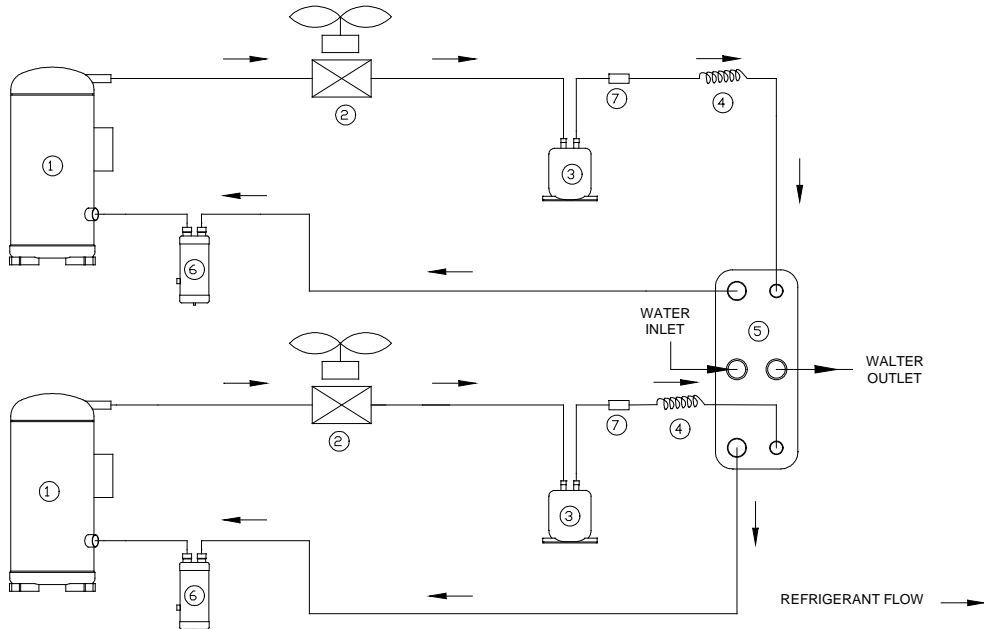
- NOTES: 1.FOUNDATION IS CONCRETE CONSTRUCTION OR CHANNEL STRUCTUR, FOUNDATION MUST SMOOTH.
- 2.20mm THICKNESS RUBBER SHOCK PAD IS NEEDED BETWEEN THE FOUNDATION AND THE FRAME.
- 3.4 M16(M10) BOLT FIX ONE UNIT.
- 4.n IS THE TOTAL MODULAR UNIT.
- 5.THE NUMBER IN ( ) IS MAC160

**MAC160A(R)/210A(R) MODULAR AIR COOLED CHILLERS' INSTALLATION**

# 9. HYDRAULIC SYSTEM

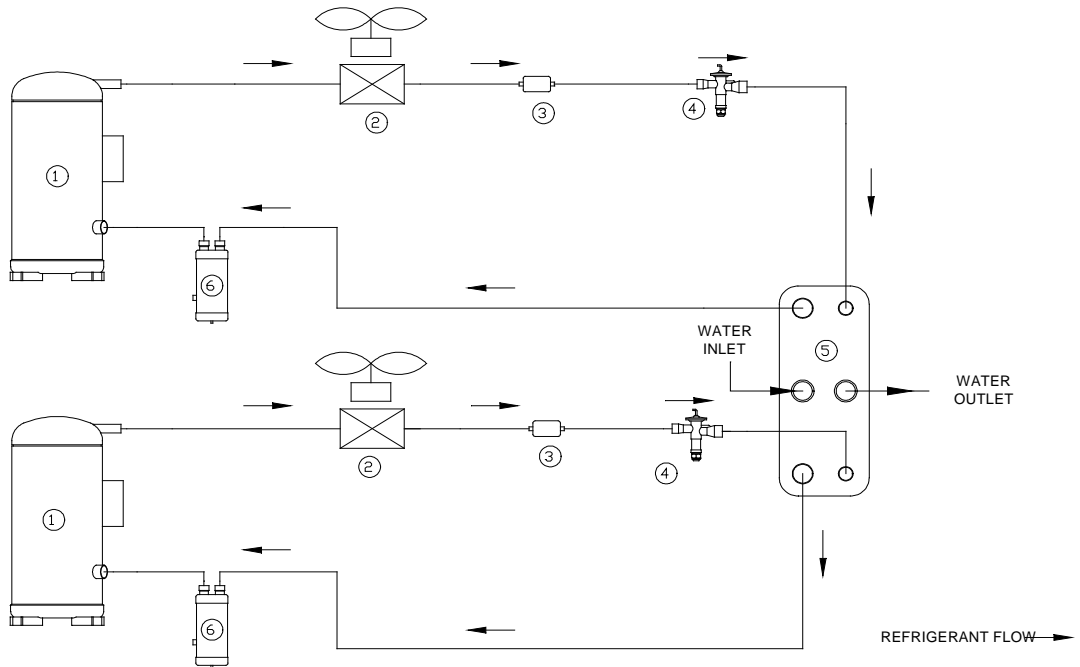
Inner schematic diagram of the inner hydraulic system:

**MAC160A:**



1 COMPRESSOR	2 HEAT EXCHANGER	3 RECEIVER	7 FILTER-DRIER
4 CAPILLARY	5 PLATE HEAT EXCHANGE	6 ACCUMULATOR	

**MAC210A**



1.COMPRESSOR	4.EXPANSION VAVLE	7.FAN MOTOR
2.HEAT EXCHANGER	5.PLATE HEAT EXCHANGER	
3.DRY-FILTER	6.ACCUMULATOR	

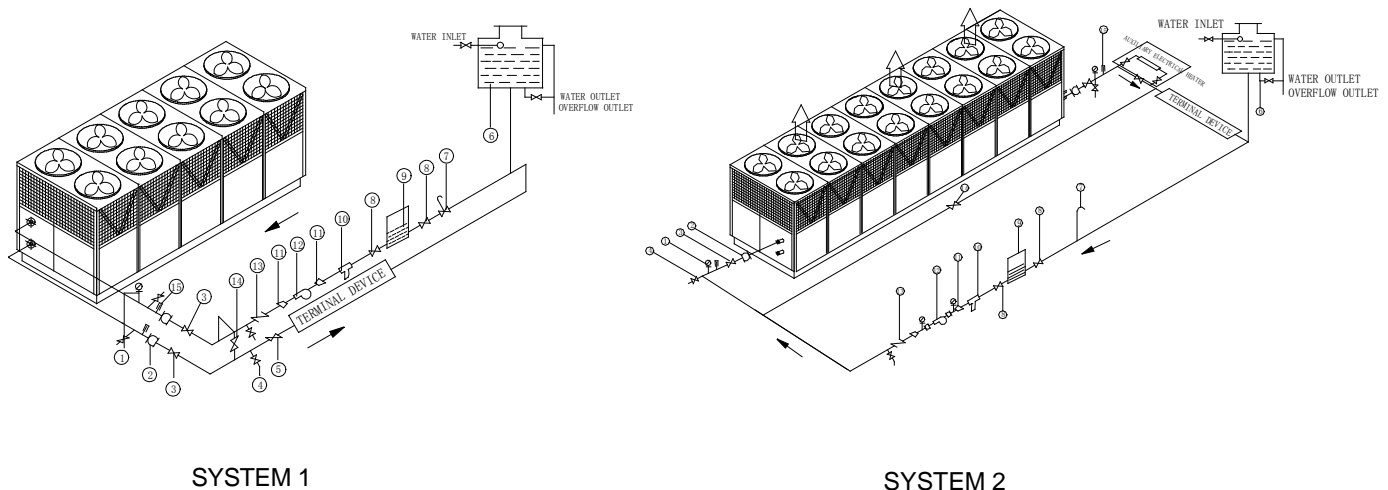
ITEM	DESCRIPTION	NOTES
1	PLATE HEAT EXCHANGER	Used as an evaporator when cooling.
2	COMPRESSOR	High efficiency and hermetic reciprocation compressor.
3	4-WAY VALVE	Change switch between cooling and heating.
4	RECEIVER	It can store the superfluous liquid refrigerant when heating
5	EXPANSION VALVE	Control the flow of the refrigerant
6	STRAINER	Remove impurity from system
7	HEAT EXCHANGER	Used as an condenser when cooling
8	CHECK VALVE	Control the direction of the refrigerant.
9	FAN MOTOR	Promote the efficiency of the heat exchange.

**Connect the water pipe on the water inlet and outlet on the side of the chiller.**

The following points should be noted for the waterworks:

- 1.Backwater should be demineralized water.
- 2.Water circulating pump should be provided.
- 3.Water flow should not be lower than the nominal value of the unit.
- 4.Suggesting insulating storage water tank is installed.
- 5.Water-supply safety valve is needed.

The following are typical application of WATER SYSTEM INSTALLATION.  
**Two types of installation:**



1	Pressure Gauge (0-1MPa)	7	Auto air vent valve	13	Check Valve
2	Flexible Joint	9	Water Tank	14	Bypass Valve
3,5,8	Gate Valve	10	Y-strainer	15	Thermometer(0-100℃)
4	Drain Valve	11	Reducer		
6	Expansion Tank	12	Pump		

Note: Both system 1 and system 2 are used on less than 6 units connection (Inc. 10 units). System 2 is most used on more than 10 units connection. This is helpful for balance of the hydraulic system.

Prior to starting up the unit, flushing of the water system is required:

1. Shut off the inlet and outlet valves and turn on the bypass valve.
2. Run the pump to circulate the water in the system for a while.
3. Open up the strainer to inspect the filter.
4. Clean the filter if necessary to ensure no debris trap in the piping system.
5. Shut off the bypass valve and turn on the inlet and outlet valves
6. System is ready for operation.

**⚠ Caution**

Be sure to use clean water when filling in the water circuit to avoid heavy corrosion and choking of the system.

If the chiller is operated under very oily, salty or acidic atmosphere or water, these substances may lead to capacity drop or failure of the unit.

**Hydraulic System Installation**



## Limit to the water volume of the single chiller



**If the system water volume is less than required water volume( $V_{min}$ ) while the chiller is operating, it will result in frequent ON/OFF.**

$V_{min}$  is referred to the below table:

Item	Model	Setting EWT( $^{\circ}$ C)	$V_{min}$ (L)
1	MAC160A	14	132
		13	152
		12	180
		11	220
		10	283
		9	396
2	MAC210A	14	181
		13	208
		12	246
		11	301
		10	387
		9	542

Note:

1. The total water volume of the entire hydraulic system includes the water in main pipe, water tank and terminal equipments , in which the 2-way valve is open.
2. If the water volume ( $V$ ) while the unit is running is less than  $V_{min}$ , it's recommended to install a water tank of  $(V_{min}-V)L$ , or it will cause the unit frequent ON/OFF.
3. The  $V_{min}$  in the table is calculated based on nominal cooling water flow and  $5^{\circ}$ C anti-freeze. If the water flow and anti-freeze temperature change, related  $V_{min}$  will change.
4. The table is applied for the water volume selection of normal chiller, not for the chiller under low leaving water temperature with glycol.

## 10. Trouble shooting

When any air conditioner malfunction is noted, immediately switch off the power supply to the unit and contact the local dealer, if necessary. Some simply trouble-shooting tips are given below:

<b>SYMPTOMS</b>	<b>POSSIBLE CAUSES</b>	<b>REMEDIAL ACTION</b>
Compressor stops without reason. (alarm lamp is on)	<ol style="list-style-type: none"> <li>1. Control system faulty.</li> <li>2. Compressor faulty.</li> </ol>	Contact local dealer.
Noisy and vibrancy	<ol style="list-style-type: none"> <li>1. Dirt or dust in fan motor.</li> <li>2. Compressor noisy.</li> <li>3. Vibrancy noise caused by floor or wall.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean away dirt or dust.</li> <li>2. Contact local dealer.</li> <li>3. Check the installation.</li> </ol>
Fan motor cease running.	<ol style="list-style-type: none"> <li>1. Circuit faulty.</li> <li>2. Overheat relay starting.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the circuit and repair when necessary.</li> <li>2. Contact local dealer.</li> </ol>
Insufficient cooling/heating.	<ol style="list-style-type: none"> <li>1. Compressor faulty.</li> <li>2. Contamination in hydraulic system.</li> <li>3. Clogged condenser coil.</li> <li>4. Low refrigerant charge.</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact local dealer.</li> <li>2. Clean hydraulic system.</li> <li>3. Clean the coil.</li> <li>4. Add refrigerant.</li> </ol>
Cycling water pump does not start.	<ol style="list-style-type: none"> <li>1. No power supply.</li> <li>2. Water pump motor faulty.</li> <li>3. water pump</li> </ol>	<ol style="list-style-type: none"> <li>1. Check power system.</li> <li>2. Check the water pump or change if necessary.</li> <li>3. Try to run the water vane or change the water pump if necessary.</li> </ol>
Water cycling faulty.	<ol style="list-style-type: none"> <li>1. Gas in cycling system.</li> <li>2. Deposit or dirt in the heat exchanger.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discharge the gas.</li> <li>2. Backwash heat exchanger.</li> </ol>
Unit does not start.	<ol style="list-style-type: none"> <li>1. Water flow switch faulty.</li> <li>2. Pressure switch faulty.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check water flow.</li> <li>2. Check system pressure.</li> </ol>



While utmost care is taken in ensuring that all details in the publication are correct at the time of going to press, we are constantly striving for improvement and therefore reserve the right to alter model specifications and equipment without notice. Details of specifications and equipment are also subject to change to suit local conditions and requirements and not all models are available in every market.