WATER-COOLED MODULAR CHILLER

Models: FWMC 20-70

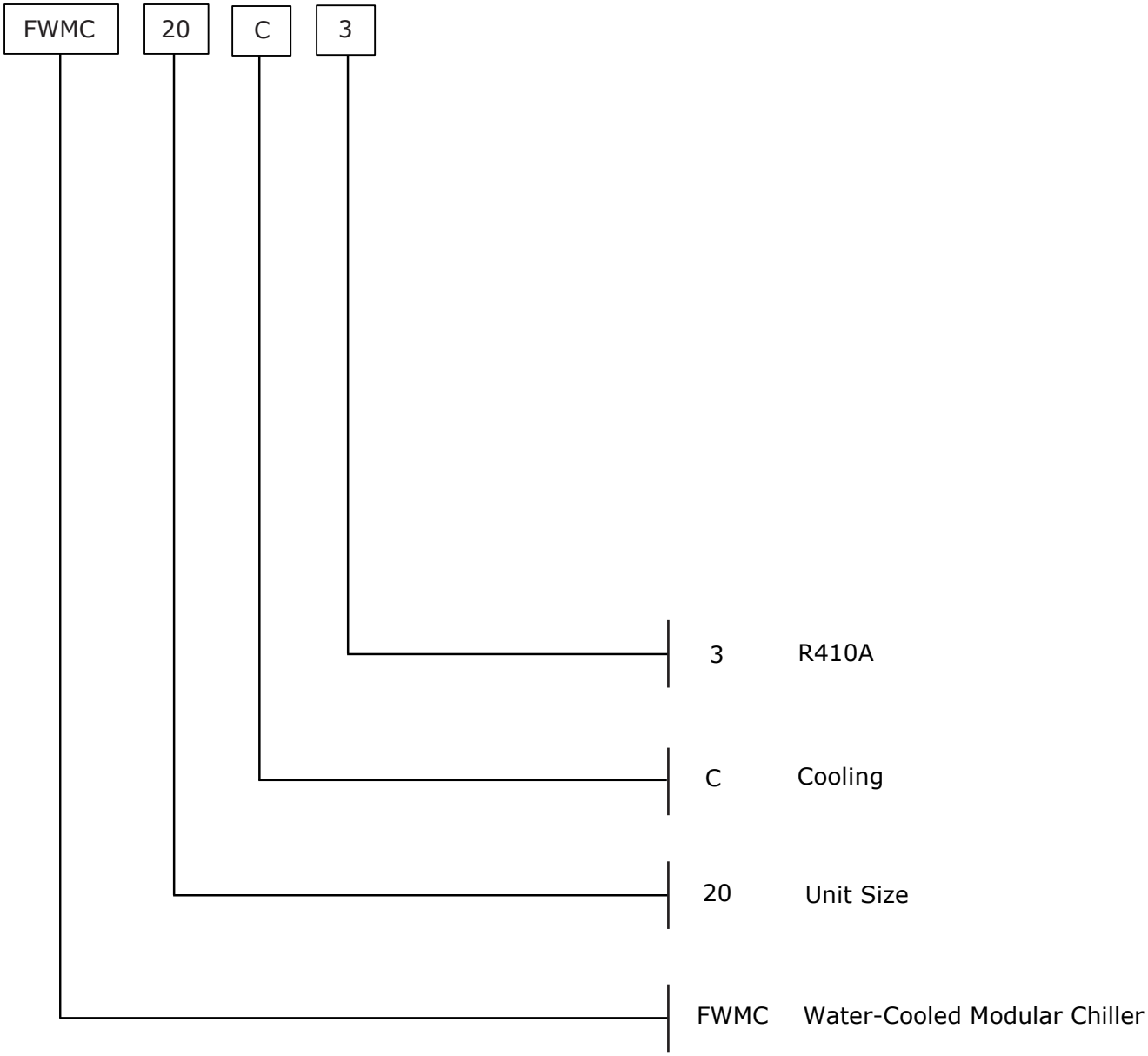
Chiller Products

FCH04-2022/23

Content

Product Nomenclature

Water-Cooled Modular Chiller



Features

Simple Installation

Compact and small footprint design of modular chillers minimizes the space needed for installation. The modular design reduces the cost of transportation and allows expansion of capacity when the needs arise in future, thus, reduce the initial investment.

Safety Protection

The modular chillers have built in protections for all sub- system, i.e. refrigerant system, electrical system and water system. Various overload protection devices, phase protection, temperature sensor, pressure switch, etc., have been installed to protect the system if it experiences any failure of components or abnormal external factors. Flow switch is provided as loose item as an additional protection. With these safety measures, the system is able to deliver high performance and at the same time ensure safe operation at all time.

Easy Maintenance

Wired LCD controller equipped with various operating mode, timer setting, temperatures display and self-diagnosis by error code. Through the precise and intelligent control algorithm, the load will be distributed evenly to all the modular chillers, thus greatly reduce the commissioning and troubleshooting time and prolong the service life of the compressors.

Flexibility & Energy Saving

Various combinations of modular chillers provide great flexibility of matching the exact load demand of applications. Up to 8 units of modular chillers can be combined to provide the necessary capacity and allow future expansion through easy add-on features. Besides, the modular system is able to adhere to different load profile precisely and deliver highest performance at all load condition.

High Efficiency

FWMC series come with high efficiency dry expansion type shell and tube heat exchanger. The inner grooved copper tubes are accurately expanded and mechanically bonded to the end plates to produce a high performance heat exchanger.

Casing

The modular chillers comes with an additional casing option that is made upon request.

Engineering Specifications

General Data - Water-Cooled Chiller (50Hz)

Model		FWMC	20	30	45	60	70
Total Cooling Capacity		kW	69.0	110.0	149.0	197.0	245.0
		RT	20.0	31.0	42.0	56.0	70.0
Total Input Power		kW	17.68	26.19	34.70	46.65	58.60
Total Running Current		A	32.4	47.4	62.4	82.0	101.6
Power Source		V/Ph/Hz	380-415 /3/50				
Operation Control			LCD Wired Micro-Computer				
Compressor	Type		Hermetic Scroll				
	Quantity		2	2	2	2	2
	Starting Method		Direct On Line Start (DOL)				
Stage of Capacity Control			0-50-100%	0-68-100%	0-50-100%	0-68-100%	0-50-100%
Refrigerant	Type		R410A				
	Number of Refrigerant Circuit		2	2	2	2	2
	Expansion Device		TXV				
	Charging Mass	kg	7.0 x 2	7.0+ 17.0	17.0 x 2	17.0 + 20.0	20.0 x 2
Condenser	Type		Direct Expansion Shell and Tube Condenser				
	Water Flow Rate	m^3/h	15.10	23.50	31.90	41.80	51.40
		gpm	66.41	103.50	140.43	184.02	226.34
	Water Pressure Drop	kPa	36	38	41	34	35
		ft.wg	12	13	14	11	12
	Water Pipe	mm(inch)	DN50(2")	DN65(2.5")	DN80(3")	DN100(4")	DN100(4")
Evaporator	Type		Direct Expansion Shell and Tube Evaporator				
	Water Flow Rate	m^3/h	11.9	19.0	25.6	33.9	42.1
		gpm	52.4	83.7	112.7	149.3	185.4
	Water Pressure Drop	kPa	34	37	38	42	42
		ft.wg	11.4	12.4	12.7	14.1	14.1
	Water Pipe	mm(inch)	DN50(2")	DN65(2.5")	DN80(3")	DN100(4")	DN100(4")
Dimension	Length	mm	1950		2200	2500	
	Width	mm	650		700	800	
	Height	mm	1600		1750	1830	
Unit Weight		kg	650	780	950	1100	1200
Operation Weight		kg	710	850	1030	1200	1300

Note:

1. Products are tested in accordance to AHRI STANDARD 551/591.
2. Cooling capacity is based on 12°C in/7°C out chilled water temperature; 30°C in/35°C out cooling water temperature.
3. Power supply is 380-415V/50Hz with allowable voltage fluctuation of ±10%.
4. The manufacturer reserves the rights to make changes to the above specifications without prior notice.
5. Refrigerant charge volume is factory charged

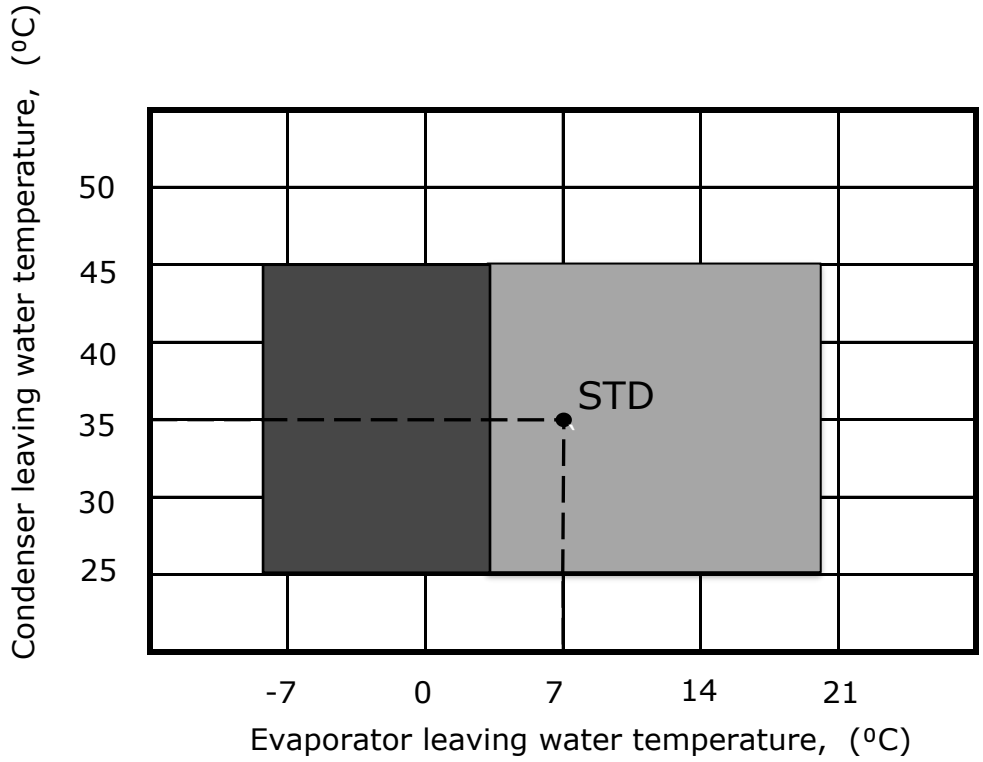
General Data - Water-Cooled Chiller (60Hz)

Model		FWMC	20	30	45	60	70
Total Cooling Capacity		kW	72.6	105.3	138.0	182.0	226.0
		RT	20.6	29.9	39.2	51.7	64.3
Total Input Power		kW	15.7	23.2	30.8	40.5	50.2
Total Running Current		A	30.0	43.5	57.0	74.2	91.4
Power Source		V/Ph/Hz	380-415V/60Hz				
Operation Control			LCD Wired Micro-Computer				
Compressor	Type		Hermetic Scroll				
	Quantity		2	2	2	2	2
	Starting Method		Direct On Line Start (DOL)				
Stage of Capacity Control			0-50-100%	0-66-100%	0-50-100%	0-62-100%	0-50-100%
Refrigerant	Type		R410A				
	Number of Refrigerant Circuit		2	2	2	2	2
	Expansion Device		TXV				
	Charging Mass	kg	7.0 x 2	7.0+ 17.0	17.0 x 2	17.0 + 20.0	20.0 x 2
Condenser	Type		Direct Expansion Shell and Tube Condenser				
	Water Flow Rate	m^3/h	15.9	23.2	30.4	40.1	49.8
		gpm	70.0	102.1	133.8	176.6	219.3
	Water Pressure Drop	kPa	38	38	39	33	34
		ft.wg	13	13	13	11	11
	Water Pipe	mm(inch)	DN50(2")	DN65(2.5")	DN80(3")	DN100(4")	DN100(4")
Evaporator	Type		Direct Expansion Shell and Tube Evaporator				
	Water Flow Rate	m^3/h	12.5	18.1	23.8	31.3	38.9
		gpm	55.0	79.7	104.8	137.8	171.3
	Water Pressure Drop	kPa	36	36	36	39	39
		ft.wg	12	12	12	13	13
	Water Pipe	mm(inch)	DN50(2")	DN65(2.5")	DN80(3")	DN100(4")	DN100(4")
Dimension	Length	mm	1950		2200	2500	
	Width	mm	650		700	800	
	Height	mm	1600		1750	1830	
Unit Weight		kg	630	820	1050	1130	1155
Operation Weight		kg	690	890	1130	1230	1255

Note:

1. Products are tested in accordance to AHRI STANDARD 551/591.
2. Cooling capacity is based on 12°C in/7°C out chilled water temperature; 30°C in/35°C out cooling water temperature.
3. Power supply is 380-415V/60Hz with allowable voltage fluctuation of ±10%.
4. The manufacturer reserves the rights to make changes to the above specifications without prior notice.
5. Refrigerant charge volume is factory charged

Operating Range Cooling

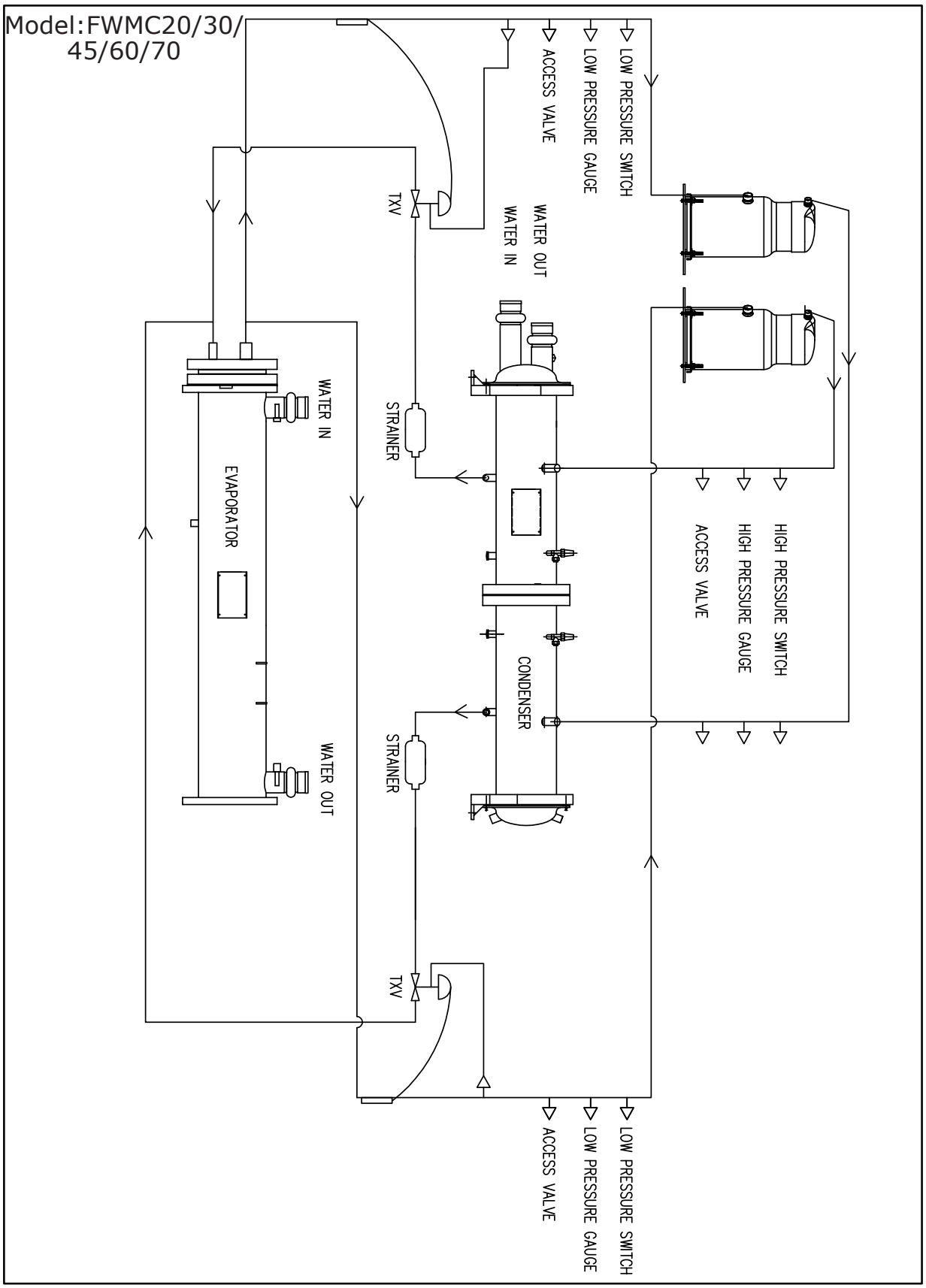


Note:

Without glycol solutions

With glycol solutions

System Schematic Diagram



Controller Features and Algorithm

1. Introduction

1.1 Specification

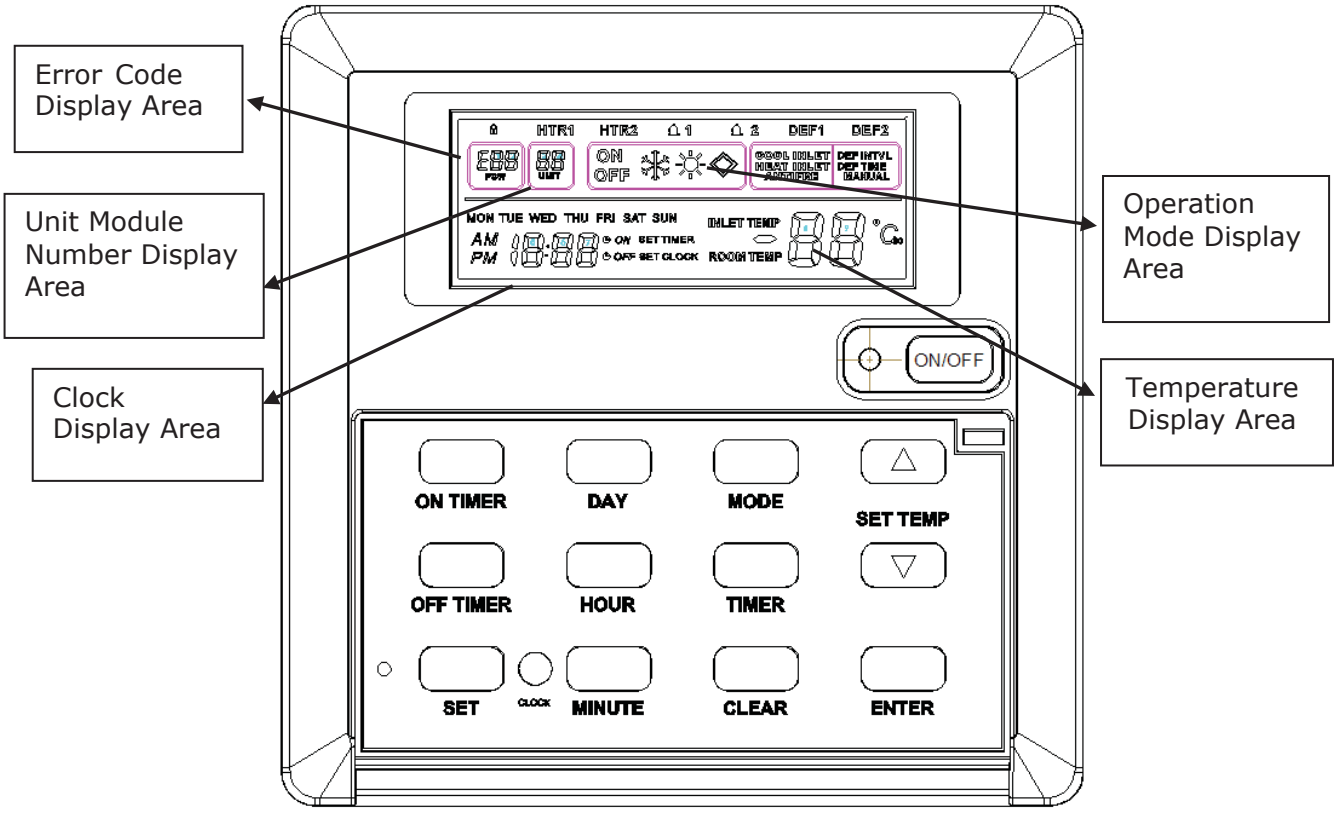
Model: GSWP01A wired controller (to be used with GSWM01A printed circuit board).

1.2 Product Specification

The device has a dual color (red and green) LED, a LCD screen, 12V DC power supply, and an input/output connecting port.

1.3 Main Features

a) Blue back lid LCD display.
b) Stand alone or modular control capable.
c) Real time clock.
d) ON / OFF timer setting (Monday – Sunday)
e) In / out water temperature display.
f) Multiple operating parameters setting.
g) Manual defrost capable.
h) Key-lock function.



1.4 Description of Controller Buttons

Button	Description	Button	Description
ON TIMER	Unit ON timer setting	MODE	Mode Setting
OFF TIMER	Unit OFF timer setting	TIMER	Timer setting
SET	Data setting	CLEAR	Delete / exit
CLOCK	Time setting	SET TEMP	Temperature setting
DAY	Day setting (Mon – Sun)	ENTER	Enter data/info
HOUR	Hour setting	ON/OFF	Unit on/off
MINUTE	Minute setting	▲/▼	+ / - value

1.5 LCD Indicators

Indicator	Indicator on	Indicator off	Indicator	Indicator on
ON	System on		1	Comp.1 ON
OFF	System off		2	Comp.2 ON
❄	Cooling mode			

2.0 Functional Description

2.1 Default Setting

Whenever the unit is turned on, the default setting as follow:
Mode: Cooling

2.2 Unit On/ Off

Unit may be turned on and off by:

(1) Timer setting

(2) "ON/OFF" button (manual)

(Note: LED colour display RED – unit OFF, GREEN – unit ON)

2.3 Day & Time Setting

Press the "**CLOCK**" button once to enter the clock "**YEAR**" setting mode, the minute position displays the year, and the current year is set by "**MINUTE**" Press the "**CLOCK**" button again to enter the clock "**MONTH DAY**" setting mode, the hour position displays "month", and the minute position displays "day". Set the current "month" with "**HOUR**" and the current "**DAY**" with "**MINUTE**" Press the "**CLOCK**" button again to enter the clock "Weeks: Minutes" setting mode. The week position displays "**WEEK**", the hour position shows "**HOUR**", and the minute position shows "**MINUTE**".
Set the current "**WEEK**" with " ", the current "**month**" with "**HOUR**", and the current "**day**" with "**MINUTE**"
Press the "**CLOCK**" button again to store the current settings and exit. In the clock setting mode, "**SET CLOCK**" will flash, If no input within 5 seconds, system will automatically exit the day and time setting mode.

2.4 ON / OFF Timer Setting

The system has ON TIME and OFF TIME setting (Monday – Sunday).
Press and hold " ON TIMER " (or "OFF TIMER") button for 5 seconds, the buzzer will beep once (long beep) and system will enter into ON TIMER (or OFF TIMER) setting, the clock display will show "--:--", and the LCD will show [SET TIME] and [ON] (or [OFF]) blinking, use "DAY", "HOUR" and "MINUTE" buttons to set the unit ON TIME (or OFF TIME), followed by press and hold " ON TIMER " (or "OFF TIMER") button to confirm setting, or press "CLEAR" button to cancel and exit unit ON/OFF TIME setting.
Whenever the [ON] and/or [OFF] indicator(s) shown on LCD, the ON TIMER and/or OFF TIMER is/are enabled. To cancel the ON/OFF TIMER setting, press and hold "CLEAR" button until the [ON] and/or [OFF] indicator(s) disappeared on LCD.

2.5 Key-lock Function

Pressing "ON TIMER" and "ENTER" simultaneously will enable/disable key-lock. A symbol " " will be shown on the LCD, indicates that all buttons being locked, only "ON/OFF" button is operational.

2.6 Error Code Enquiry for Each Module

The fault record can record a total of 20 faults, the first fault is the latest fault, and the fault code is displayed in the temperature zone.
Fault code display area.
The fault code is displayed on the left side, and the faulty module number is displayed on the right side (0-12, 0: Host >0: Slave module).
The temperature display area number indicates the first fault
The time zone corresponds to the display time, (week hour: minute) and (month day) alternately.

Operation method:
To view the fault code record, press and hold "▲" and then press and hold the button for 5 seconds to enter the fault record.
Press "▲" and "▼" to view the records 1-8.
Press the CLEAR button to exit.
When viewing the fault code record, press and hold "▲" and then press and hold for 5 seconds to clear the current 8 records and start recording again.To check the error code for other modules, press " ▲ " and " ▼ " buttons to select different module. To exit, press **"CLEAR"** button.
(Note: Refer error code description section for each error code description)

2.7 Temperature Enquiry for Each Module

To check for each module different ambient/water temperature, press and hold " ▼ " button for 5 seconds, the error code display area will show the module number and the buzzer will beep, meanwhile the unit module number display will show the respective module's different ambient/water temperature sub menu (6 sub-menu as listed in table). Example: 02 01, meaning module #2, sub-menu #1 (ambient temperature) is currently shown in the temperature display on LCD. To select different sub-menu (1 to 6), press " ▲ " and " ▼ " buttons. To exit, press "CLEAR" button.

Sub Menu#	Temperature Display
1	Ambient Temperature
2	N/A
3	Condenser Water Out Temperature (TH3)
4	Chilled Water Return Temperature (TH4)
5	Chilled Water Supply Temperature (TH5)
6	N/A
7	Overall Chilled Water Return Temperature (TH7)
8	Overall Chilled Water Supply Temperature (TH8)

2.8 Operational Data Inquiry

Press and hold "SET" button for 5 seconds, this will enable operational data inquiry, unit module number display area will show the 9 subs menu as listed in the following table, while the temperature display area will show the correspondent sub menu's operational data. Press" SET" button to select different sub menu (1 to 9). To exit, press "CLEAR" button.

Sub Menu #	Operational Data	Unit	Acceptable Operational Range and Default Value
1	Chilled Water Temperature Setting	°C	Chilled Water Setting: Supply - 5 to 30, default:7°C Return - 7 to 30, default:12°C
2	N/A	N/A	N/A
3	Compressor Minimum Running Time	Minutes	1 to 10, default: 5 minutes
4	Compressor Minimum Idle Time	Minutes	1 to 10, default: 4 minutes
5	Compressor Load Time Interval	Minutes	2 to 10, default: 3 minutes
6	Compressor Unload Time Interval	Minutes	1 to 5, default: 1 minutes
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	Condensing Water Out Low Temperature Protect	°C	5 to 20°C, default: 5°C
10	Temperature Differential Setting	°C	1 to 5°C, default: 2°C

2.9 Operational Data Setting

Press and hold "ENTER" button for 5 seconds, this will enable operational data setting, [PSW] and [UNIT] display will show "----", use " ▲ " and " ▼ " buttons to select number 1 to 9, as to enter the 4 digits password (password: 1688), then press "ENTER" button. The unit module number display area will show the 9 sub menu as listed in the following table, while the temperature display area will show the correspondent sub menu's operational data. To change the operational value of each sub menu, follow these instructions:

(a) Press "SET" button to select different sub menu (1 to 9).
(b) Press " ▲ " and " ▼ " buttons to change the operational value setting.
(c) Press "ENTER" button to save the operational value and exit setting, or press "CLEAR" button to cancel and exit setting.

Sub Menu #	Operational Data	Unit	Acceptable Operational Range
1	Chilled Water Temperature Setting	°C	Chilled Water Setting: Supply - 5 to 30 Return - 7 to 30
2	N/A	N/A	N/A
3	Compressor Minimum Running Time	Minutes	1 to 10 minutes
4	Compressor Minimum Idle Time	Minutes	1 to 10 minutes
5	Compressor Load Time Interval	Minutes	2 to 10 minutes
6	Compressor Unload Time Interval	Minutes	1 to 5 minutes
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	Condensing Water Out Low Temperature Protect	°C	5 to 20, default: 5°C
10	Temperature Differential Setting	°C	1 to 5°C, default: 2°C

2.10 Error Code Description

Error Code	Description
E01	N/A
E02	Wired controller offline
E03	Chilled water flow switch disconnected
E04	Condenser water flow switch disconnected
E05	N/A
E06	TH3- Condensing water outlet open or short circuit
E07	TH4- Overall chilled water return sensor open or short circuit
E08	TH5- Overall chilled water supply sensor open or short circuit
E09	N/A
E0A	Condenser water out low temperature
E0B	N/A
E0C	Modular unit(s) offline
E0D	Compressor 1 high pressure
E0E	Compressor 2 high pressure
E0F	Compressor 1 low pressure
E10	Compressor 2 low pressure
E11	System 1 overload protect
E12	System 2 overload protect
E13	N/A
E14	N/A
E15	Phase sequence error
E16	Anti-freeze protection
E17	Compressor 1 overload protect
E18	Compressor 2 overload protect
E19	N/A
E1A	N/A
E1B	N/A
E1C	TH7- Overall chilled water return sensor open or short circuit
E1D	TH8- Overall chilled water supply sensor open or short circuit

3.0 Modbus Protocol Specification- Optional

For WP01V_BMS V1.0

3.1 Communication protocol

The way of start communication：After the order is sent from master to slaver(WP01V_BMS), the communication is started。

3.2 The structure of Communication data

(a) Interface Communication style：RS485-2W
mode：RTU（Remote Terminal Unit）
Synchronization mode
Connector type：Blue Color Connector Mark **A B**

(b) The bit rate：9600[bps]

(c) The format of each datum:
Start bit: 1[bit]
Data bit: 8[bit]
Stop bit: 1[bit]

(d) Coil, input mode, remain record, input record definition

(e) Every one idu WP01V_BMS need a modbus unique ID, range from 1-16; Id 0 is use for broadcast Id

WP01V_BMS **SW1-4 Set Modbus Slaver ID**

SW-1	**SW-2**	**SW-3**	**SW-4**	Modbus ID
0	0	0	0	1
1	0	0	0	2
0	1	0	0	3
1	1	0	0	4
0	0	1	0	5
1	0	1	0	6
0	1	1	0	7
1	1	1	0	8
0	0	0	1	9
1	0	0	1	10
0	1	0	1	11
1	1	0	1	12
0	0	1	1	13
1	0	1	1	14
0	1	1	1	15
1	1	1	1	16

(f) Modbus Table Description 03 Function

Address	Description
Address 0	On/Off R/W 0=Off 1=On
Address 1	Error Code R Bit7-0: Error Fault Code Bit15-8: Which one error 0: Main Unit 1: module 1 2: module 2 .....
Address 2	Status Bit & Output Bit R Bit15: 0.Water Cool Type 1.Fan Cool Type Bit14: 0.Control Outlet Water Temperature 1.Control Inlet Water Temperature Bit13: 0.Run Cool Mode 1.Run Heat Mode Bit6: 0.FAN No2 Stop 1.FAN No2 Running Bit5: 0.FAN No1 Stop 1.FAN No1 Running Bit4: 0.Cooling Tower Fan Stop 1.Cooling Tower Fan Running Bit3: 0.Cooling Pump Stop 1.Cooling Pump Running Bit2: 0.Freeze Pump Stop 1.Freeze Pump Running Bit1: 0.Compressor2 Stop 1.Compressor2 Running Bit0: 0.Compressor1 Stop 1.Compressor1 Running
Address 3	Reserve R
Address 4	Reserve R
Address 5	Chilled Set Temp R E.g. 235=23.5C 190=19.0C
Address 6	Ambient Temp R E.g. 235=23.5C 190=19.0C
Address 7	Chilled Water Inlet Temp R E.g. 235=23.5C 190=19.0C
Address 8	Chilled Water Outlet Temp R E.g. 235=23.5C 190=19.0C
Address 9	Reserve R

System Performance Table

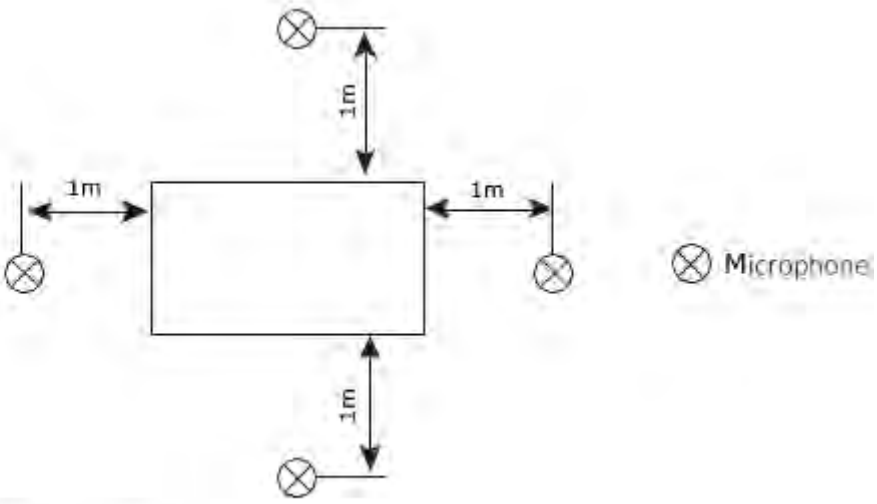
50Hz	Cooling					
Model	Leaving Chilled Water Temp (°C)	Leaving Cooling Water Temperature (°C)					
		20		25		30	
		Total CF (kW)	Power CF (kW)	Total CF (kW)	Power CF (kW)	Total CF (kW)	Power CF (kW)
FWMC	5	1.029	0.826	0.982	0.905	0.934	0.996
	6	1.065	0.830	1.017	0.908	0.968	0.999
	7	1.102	0.834	1.053	0.912	1.000	1.000
	8	1.141	0.840	1.088	0.915	1.036	1.005
	9	1.180	0.844	1.128	0.919	1.071	1.009
	10	1.219	0.850	1.167	0.925	1.109	1.012

60Hz	Cooling					
Model	Leaving Chilled Water Temp (°C)	Leaving Cooling Water Temperature (°C)					
		20		25		30	
		Total CF (kW)	Power CF (kW)	Total CF (kW)	Power CF (kW)	Total CF (kW)	Power CF (kW)
FWMC	5	0.943	0.816	0.907	0.895	0.864	0.979
	6	1.048	0.833	1.006	0.920	0.962	0.993
	7	1.088	0.838	1.045	0.916	1.000	1.000
	8	1.126	0.843	1.084	0.921	1.037	1.005
	9	1.168	0.846	1.122	0.926	1.074	1.011
	10	1.206	0.840	1.160	0.931	1.120	1.017

Note: Total CF = Total Capacity Correction Factor
Power CF = Power Input Correction Factor

Sound Data

Sound Pressure Test Setup



Test standard : JB/T 4330 – 1999

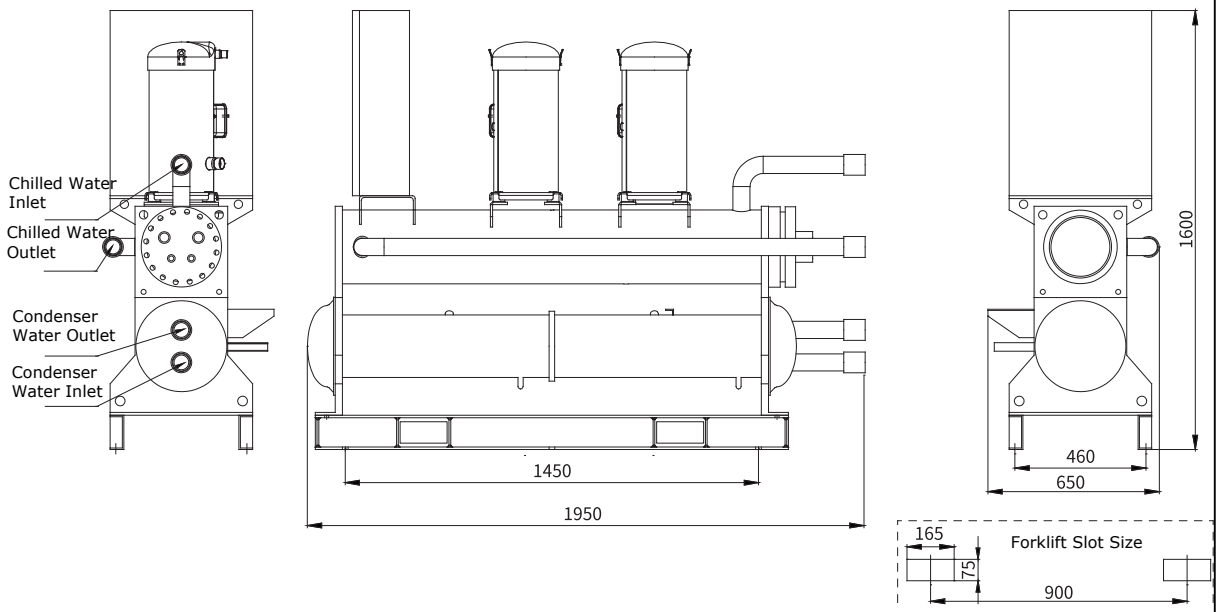
Summary Sound Data

Model	Sound Level, dB (A)
FWMC 20	83
FWMC 30	87
FWMC 45	91
FWMC 60	93
FWMC 70	95

Note: All units were tested in an open field with distance 1m

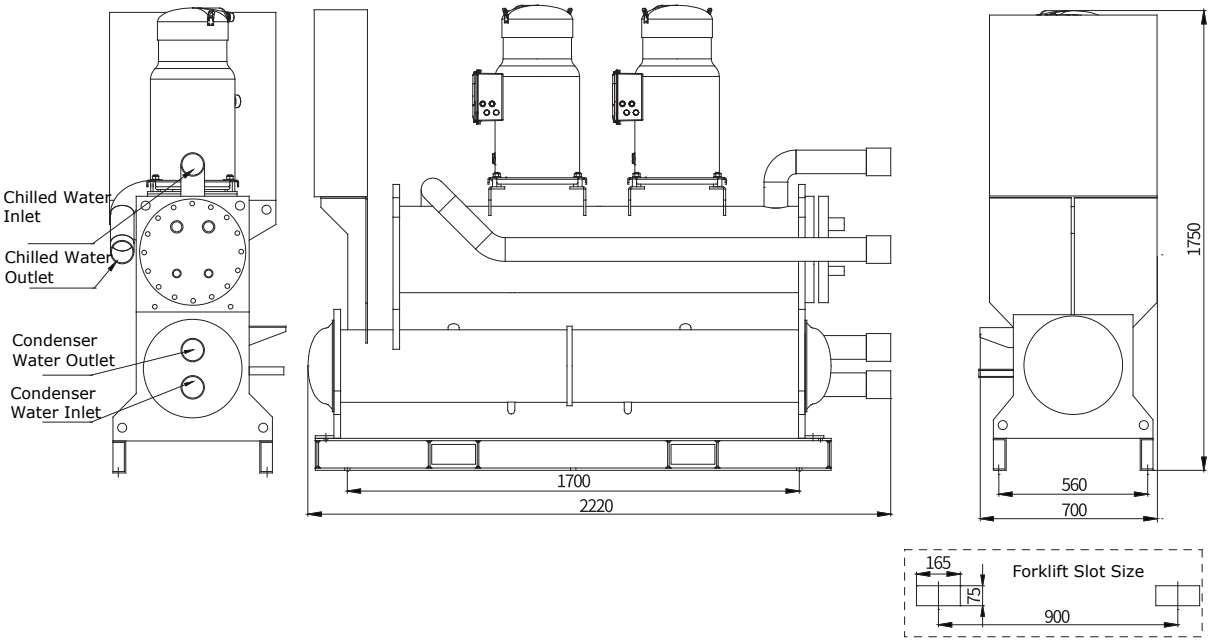
Dimensions

Model: FWMC20/30



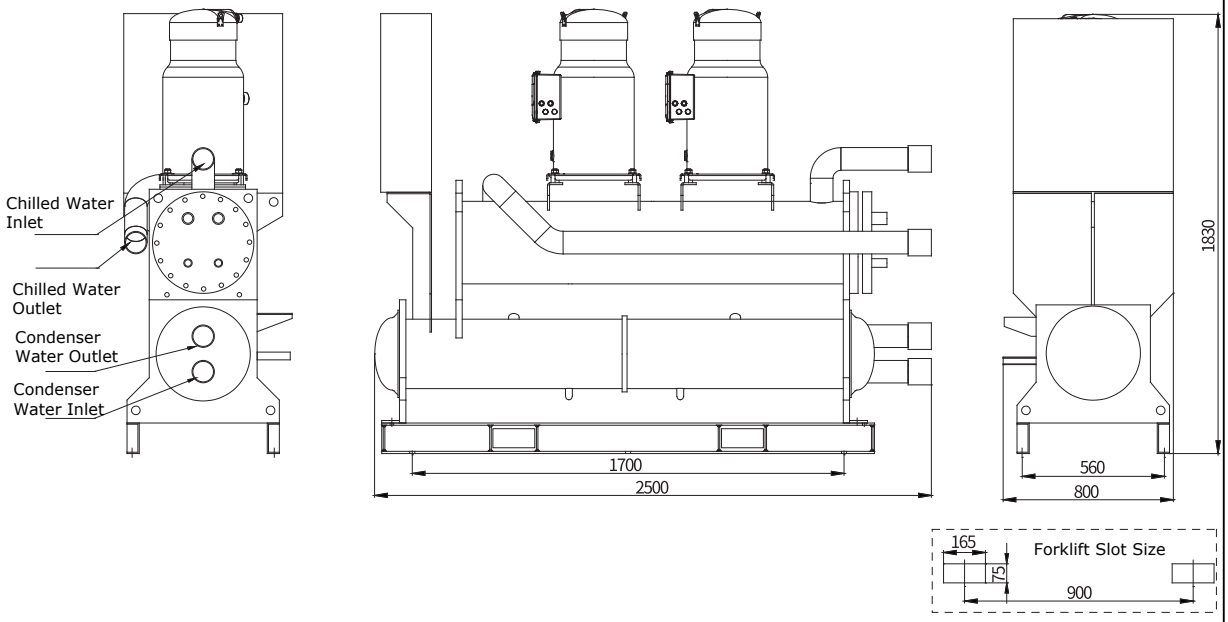
Dimension in: mm

Model: FWMC45



Dimension in: mm

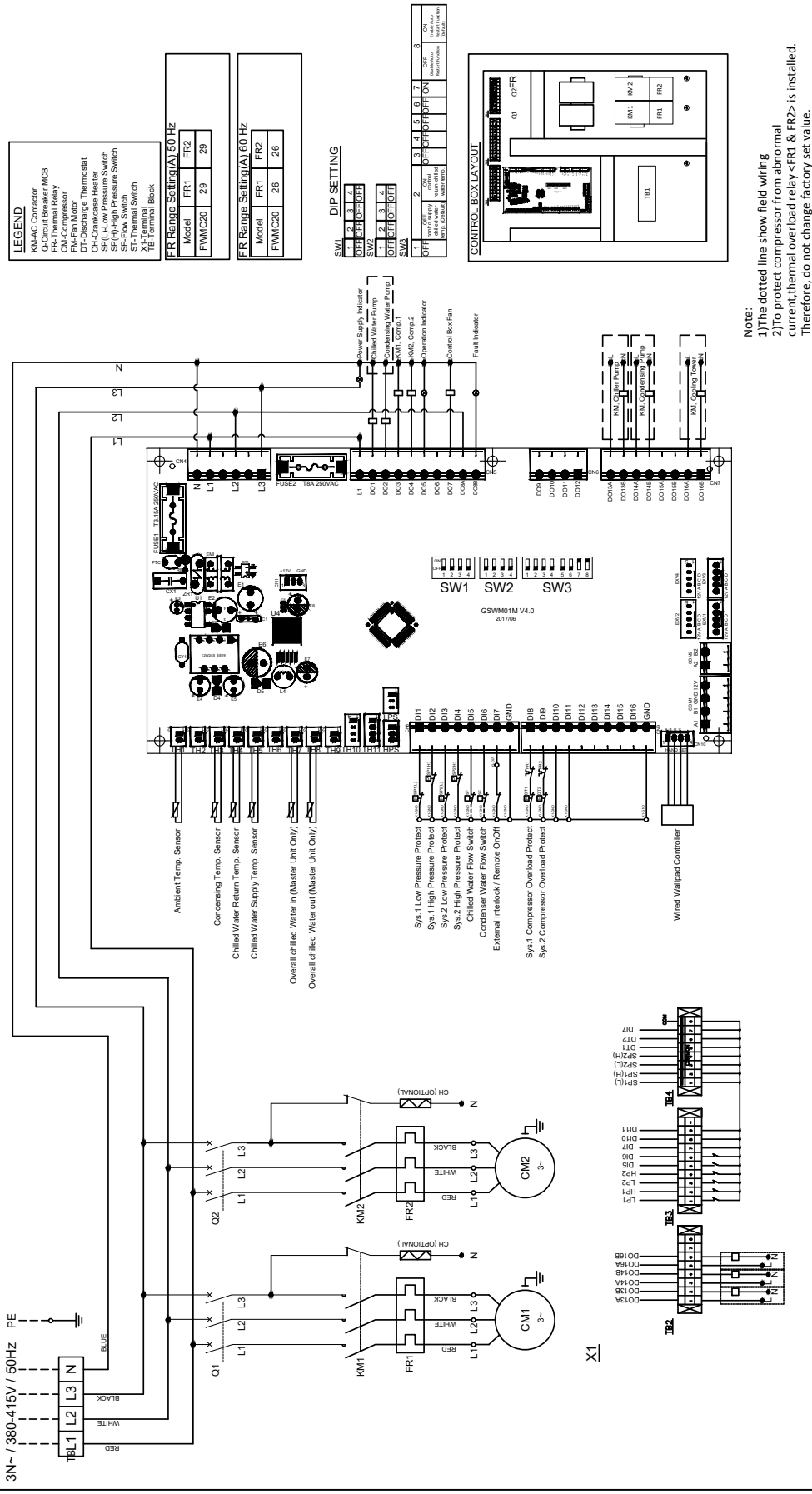
Model: FWMC60/70



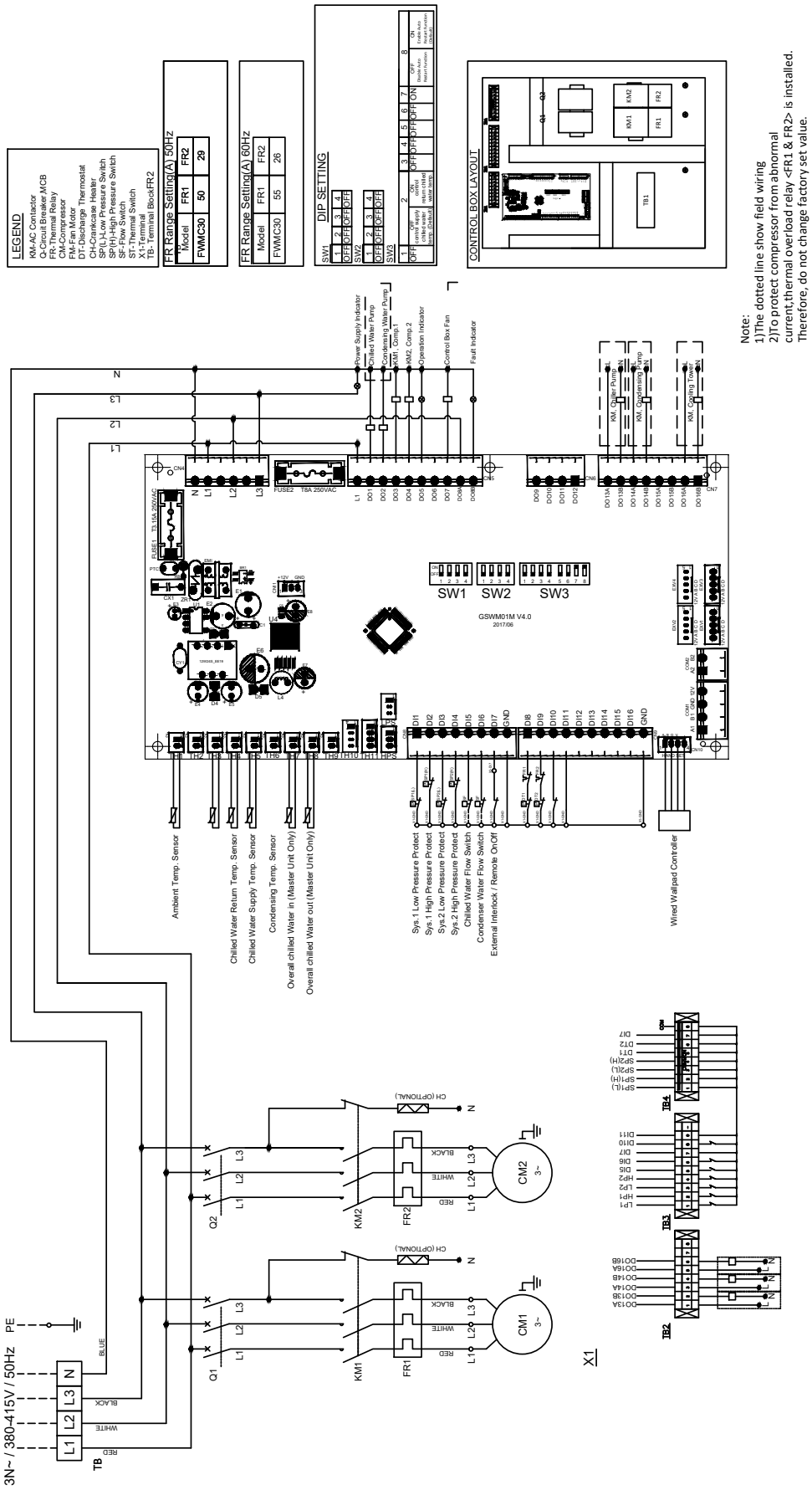
Dimension in: mm

Wiring Diagram

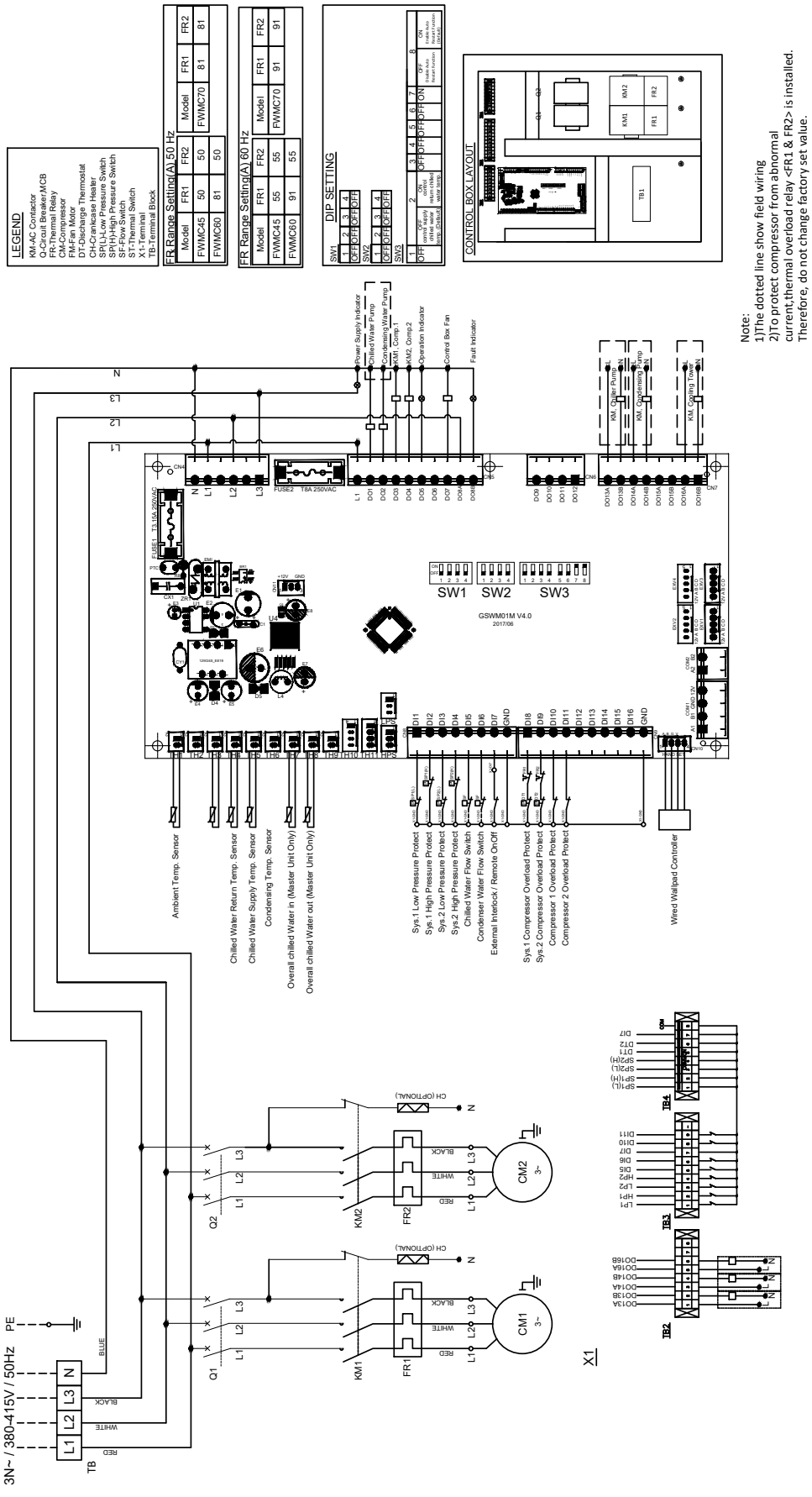
Model: FWMC20



Model: FWMC30



Model: FWMC45/60/70



DIP Switch Setting – Default

Single Unit Operating (Default)

Setting module unit

SW1	[1]	[2]	[3]	[4]
	OFF	OFF	OFF	OFF

Setting quantity of slave unit (set on master unit only)

SW2	[1]	[2]	[3]	[4]
	OFF	OFF	OFF	OFF

Function Setting

	SW3	
[1]	ON	
[2]	OFF > Control Chilled Water Out Temp. (Default)	ON > Control Chilled Water In Temp.
[3]	OFF	
[4]	OFF	
[5]	OFF	
[6]	OFF	
[7]	ON	
[8]	OFF > Disable Auto Restart Function	ON > Enable Auto Restart Function (Default)

DIP Switch Setting – Modular Unit

Setting module unit

SW1	[1]	[2]	[3]	[4]
Master Unit	OFF	OFF	OFF	OFF
Slave Unit No.1	ON	OFF	OFF	OFF
Slave Unit No.2	OFF	ON	OFF	OFF
Slave Unit No.3	ON	ON	OFF	OFF
Slave Unit No.4	OFF	OFF	ON	OFF
Slave Unit No.5	ON	OFF	ON	OFF
Slave Unit No.6	OFF	ON	ON	OFF
Slave Unit No.7	ON	ON	ON	OFF

Setting quantity of slave unit (set on master unit only)

SW2	[1]	[2]	[3]	[4]
No Slave Unit	OFF	OFF	OFF	OFF
1 Slave Unit	ON	OFF	OFF	OFF
2 Slave Units	OFF	ON	OFF	OFF
3 Slave Units	ON	ON	OFF	OFF
4 Slave Units	OFF	OFF	ON	OFF
5 Slave Units	ON	OFF	ON	OFF
6 Slave Units	OFF	ON	ON	OFF
7 Slave Units	ON	ON	ON	OFF

Function Setting

	SW3	
[1]	ON	
[2]	OFF > Control Chilled Water Out Temp. (Default)	ON > Control Chilled Water In Temp.
[3]	OFF	
[4]	OFF	
[5]	OFF	
[6]	OFF	
[7]	ON	
[8]	OFF > Disable Auto Restart Function	ON > Enable Auto Restart Function (Default)

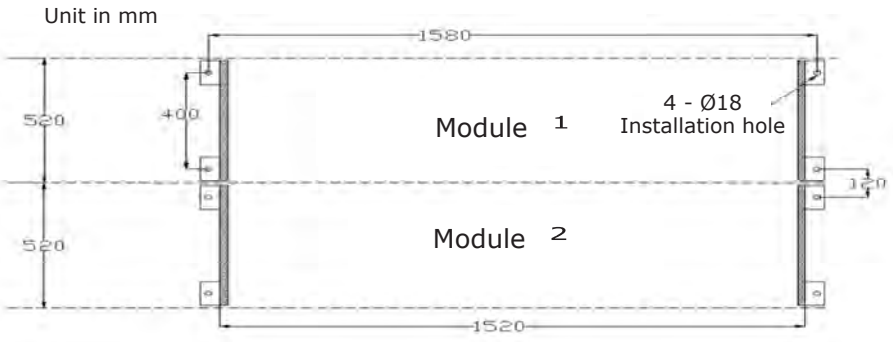
Installation

Location and Clearance

- Unit must be installed on a flat concrete base which could withstand the weight of the unit. Vibration isolator should be installed to give a minimal unit vibration.
- Do not install unit under explosive, combustive and corrosive environment.
- Do not expose unit to direct sunlight. Unit should be installed under shaded or covered area.
- Sufficient space must be allocated for water drainage, ventilation and service.

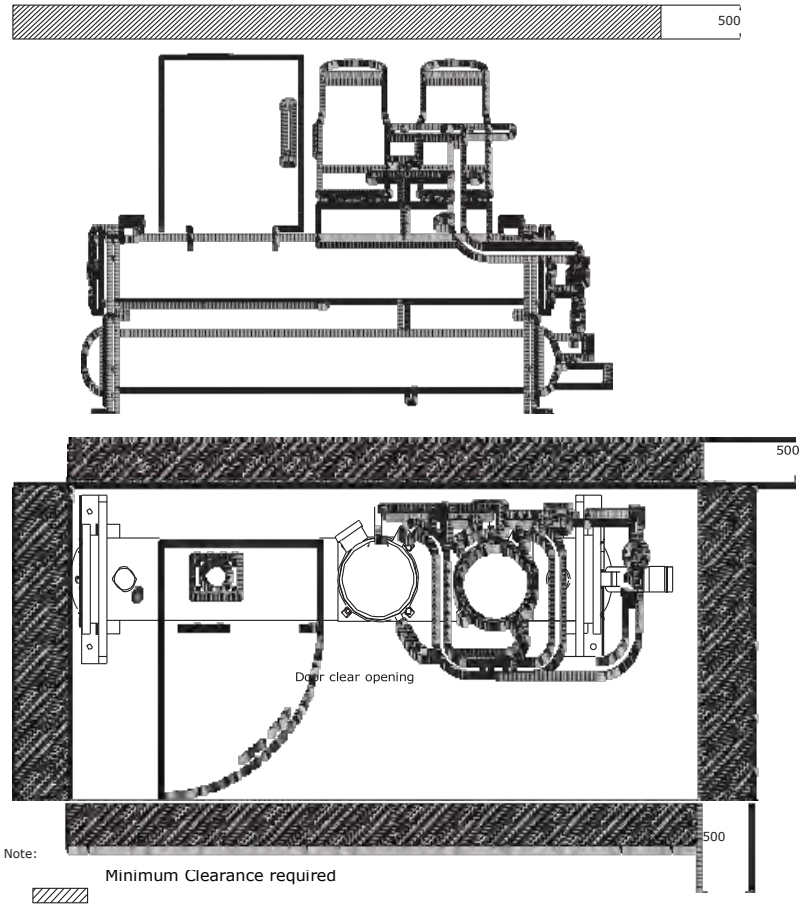
Caution: Every module has pre-set address via DIP switch setting on the PCB. Unit must place according to the numbering label on each module.

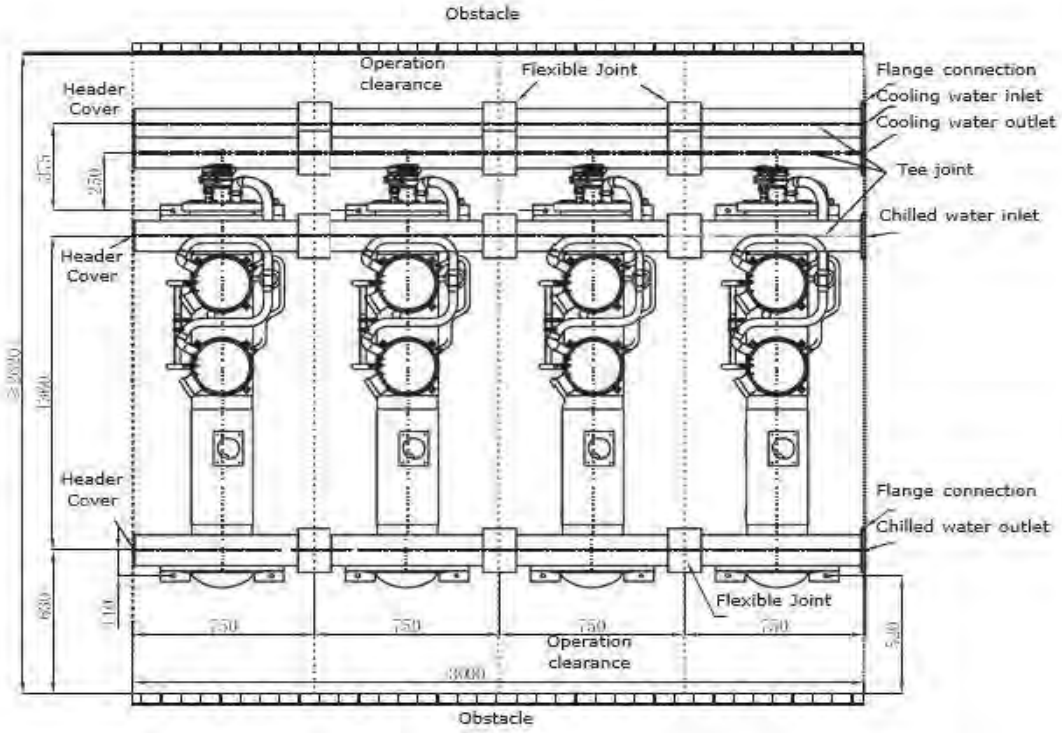
Foundation



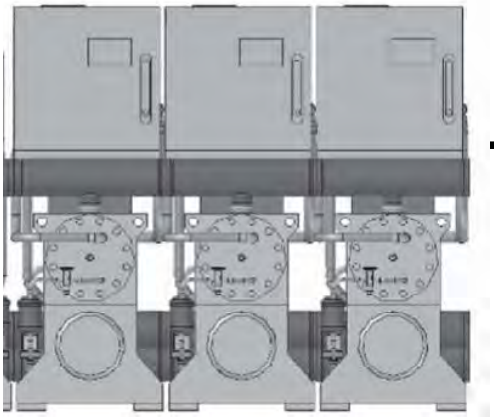
Installation Clearance

FWMC20/30





Note: Tee joint and flexible joint is optional upon request.



Sufficient space for clear opening of door.

Transportation

Unit should be wrapped and well-protected during transportation from the factory to the construction site. Always keep the unit leveled while lifting. Use the lifting holes provided to hoist the unit. Proper steps should be adopted to protect the surface of the unit while lifting. (For example, place a spreader bar to isolate the lifting cable from the unit).

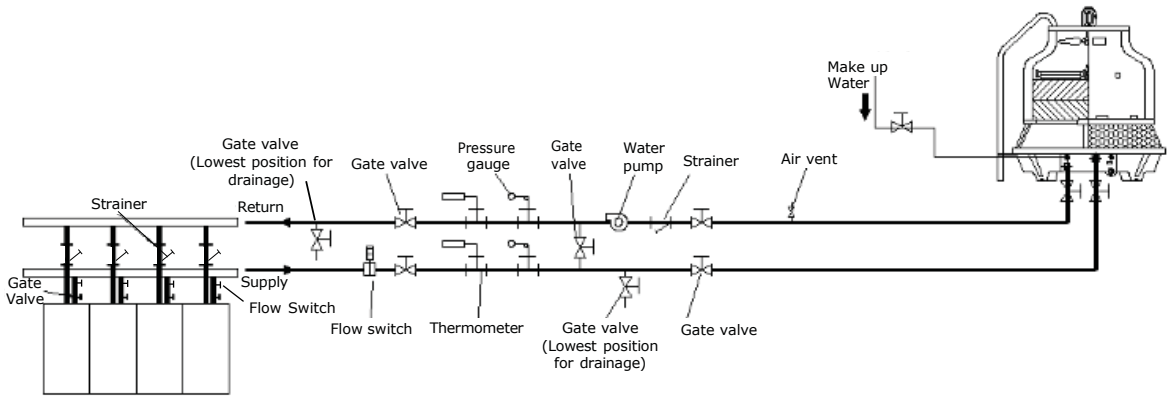
Water System Installation

Water pipe installation should comply with local codes and regulations. To save cost and to ensure good unit performance, reduce the usage of U-bends and vertical piping. Please refer to the following diagram and instructions for proper piping installation

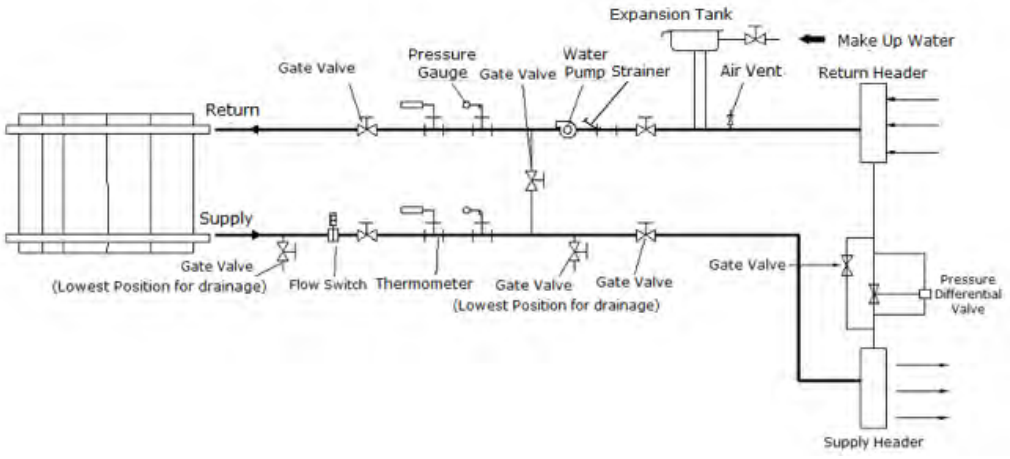
a) Gate valve, pressure gauge and thermometer should be installed at visible and accessible location.
b) Install 40 mesh cleanable strainers at water inlet and before water pump.
c) Install expansion tank in the piping system. Tank volume should be 0.03 ~ 0.034 of the system water volume.
d) Air vents at the highest points of water system to release the air trapped in the water system. A gate valve must be installed at the lowest point of water piping system to drain off the water when necessary.
e) The pipe size of each module is DN65. The pipe size of the chilled water supply and return are:

Cooling Capacity, Tons of Refrigerant	20~30	40~60	70~90	100~120
Pipes Diameter, DN(mm)	65	80	100	125

Cooling Water System



Chilled Water System



Remarks:

***Rubber clamp, Clamp, Fittings & Remote controller will be provided by manufacturer.**
***Other accessories like Flow Switch, Thermometer, Ambient Sensor, Valve & Strainer will be provided by contractor.**

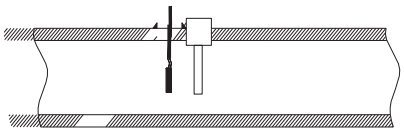
Under the same flow rate, the diameter of water piping will affect the amount of pressure drop for the water piping system. In order to reduce load to the pump, bigger diameter of water pipe is preferred whenever it is possible. Listed in the following table is the guideline for flow speed to maintain for different section of piping:

Recommended flow velocity in pipe

Position	Pump exit	Pump entry	Main pipe	Vertical pipe	Branch pipe
Velocity, m/s	2.4~3.6	1.2~2.1	1.2~4.5	0.9~3.0	1.5~2.1

Entering chilled water temperature on main water return

The entering and leaving water temperature sensor is connecting to the TH7 & TH8 of the master unit. Insert the sensor and sensor coil bracket into the main water return as shown in the diagram



Other Water System Components Selection

Component	Selection Method
Gate Valve	Selection based on the water pipe diameter.
Strainer	To filter solid particles in water system. Normally sized at 60 mesh and above.
Check Valve	Installed at outlet pipe of water pump to prevent water flush back. Selection based on the water pipe diameter.
Bypass Valve	Installed in between chilled water supply and return pipes. For usage during piping cleaning work.
Thermometer	For inspection of unit operation. Measurement range from 0 ~ 100°C.
Water Pump	*Volume = L*1.1(L-Water Flow Rate)* *Pump distance = [Unit Pressure Drop + Longest Pipe* *Length*(2%~5%) + Biggest Pressure Drop from Air-Side Products] * 1.1*
Automatic Air Vent	Installed at highest point of piping system, to release air trapped in water system.
Expansion Tank	Installed at highest point of water return pipe, to store excess water from the system to balance out the water pressure and to add water to the system when necessary. (VC = System Volume) Tank Volume, V = (0.03~0.034)VC

Water Quality Standard

Water treatment should be applied if the water source to the heat exchanger is not suitable for Air- conditioning usage. Refer table below for Water Quality Standard:

Description	Unit	Allowable value
Silica (sand)	—	<1/200000
Turbidity	mg/L	<10
pH	—	6.5~8.5
Ca2+, Mg2+	mg/L	<200
Fe2+	mg/L	<0.5
Cl–	mg/L	<100
SO_4^{2-}	mg/L	<200
H_2S	mg/L	<0.5
Silicic acid	mg/L	<175
Mg2+, SiO_3^{2-}	mg/L	<15000
Free residual chlorine	mg/L	0.5~1.0
Dissolved Solids	mg/L	<350
Oil and grease	mg/L	<5

Leak Test

Testing pressure for water pipe should be greater than 1.25 times the working pressure, and should not be less than 0.6MPa. Piping system is considered leak free if pressure drop is less than 0.02MPa after 5 minutes of pressure test. Water pressure test should not be carried out at ambient temperature lower than 5 C. Pressure gauge should be well-calibrated with step precision of not less than 1.5; full scale value should be 1.5 to 2 times the biggest tested pressure reading.

During water leak test, water should be added gradually from lower side of the system until it reaches tested pressure. Air vent should be purged to release trapped air. Stop water pump and inspect for pipe leakage. Do not repair leakage under pressurized piping system. Clean the piping system thoroughly after the water leak test (Equipment must be isolated), until the drained water is free from dust, iron and other foreign particles.

Electrical Installation

Electrical installation should be done according to the local codes and regulations. Unit should be installed by qualified personnel. Voltage tolerance should be kept at rated voltage ±10%. Phase imbalance must not be greater than 2%. Communication bus between control modules and wired controllers shall use no less than 0.25mm2 Shielded Twisted Pair cable size. Do not install data cable alongside the power cable, contactors, circuit breakers, inverters and etc. to avoid electromagnetic interference. Cable connections must be done using end connectors.

Model	Maximum Operating Amps (A)	Minimum Cross Section Area			Controller
		Phase	Neutral	Earth	
FWMC20	55.0	16	16	16	Controller comes with 15m wire
FWMC30	85.0	35	16	16	
FWMC45	114.0	50	25	25	
FWMC60	148.0	70	35	35	
FWMC70	180.0	95	50	50	

Servicing and Maintenance

Refrigerant System

- Moisture indicator should be checked to ensure system always in dry condition. Replace the filter drier if necessary.
- Check the refrigerant amount via the sight glass. The system requires additional refrigerant if bubbles are detected. Performance leak test if necessary.

Water Quality

- A strainer (60 mesh or greater) must be used on an open loop system to keep debris from entering the unit heat exchanger and to ensure a clean system. Regular checks (monthly) on the water strainer are recommended. Clean the strainer if dirty or clogged.
- Check the water pump, cooling tower or boiler at least once a day.
- Check the water quality regularly every week.
- Make sure the water pH value is between 7.8~8.5 to prevent the water pipe and boiler from corrosion.
- Should the water become contaminated with dirt and scaling as a result of bad water, the heat exchanger will have to be back flushed and cleaned with a chemical that will remove the scale. This service should be performed by an experienced service person.

Electrical System Maintenance
Control Box

- Control box should be used under ventilated environment with ambient temperature not greater than 45°C, its relative humidity smaller than 90%. Do not splash water to the control box.
- Do not deposit other foreign objects in the control box.
- Inspect contactor and switch at least once a year. Tighten the bolt and clean the dust and foreign particles.
- Please contact the manufacturer if any malfunction of PLC and Control Panel is found. User should only check if the wiring connection is firm and secured.

Contactor

- Clean the surface of auxiliary contact from grease and rust.
- Contactor should be mounted in vertical position. Its tilted angle should not exceed 5°.
- Tighten the screw to avoid loosening from vibration.

Transducer

- Transducer should be installed at relatively safe location to avoid collision or direct contact from lifting component or any other moving parts.
- The wiring connection of transducer should be inspected and tighten regularly to minimize measurement errors.
- Corrosive material should be isolated from transducer.
- Transducer shall use shielded cable to minimize interference of data transmission.
- Do not use transducer out of the operating range.
- Water and foreign particles should be refrained from entering internal part of transducer. Cable shall be well protected.
- Power supply shall be consistent and stable.

Wiring cable

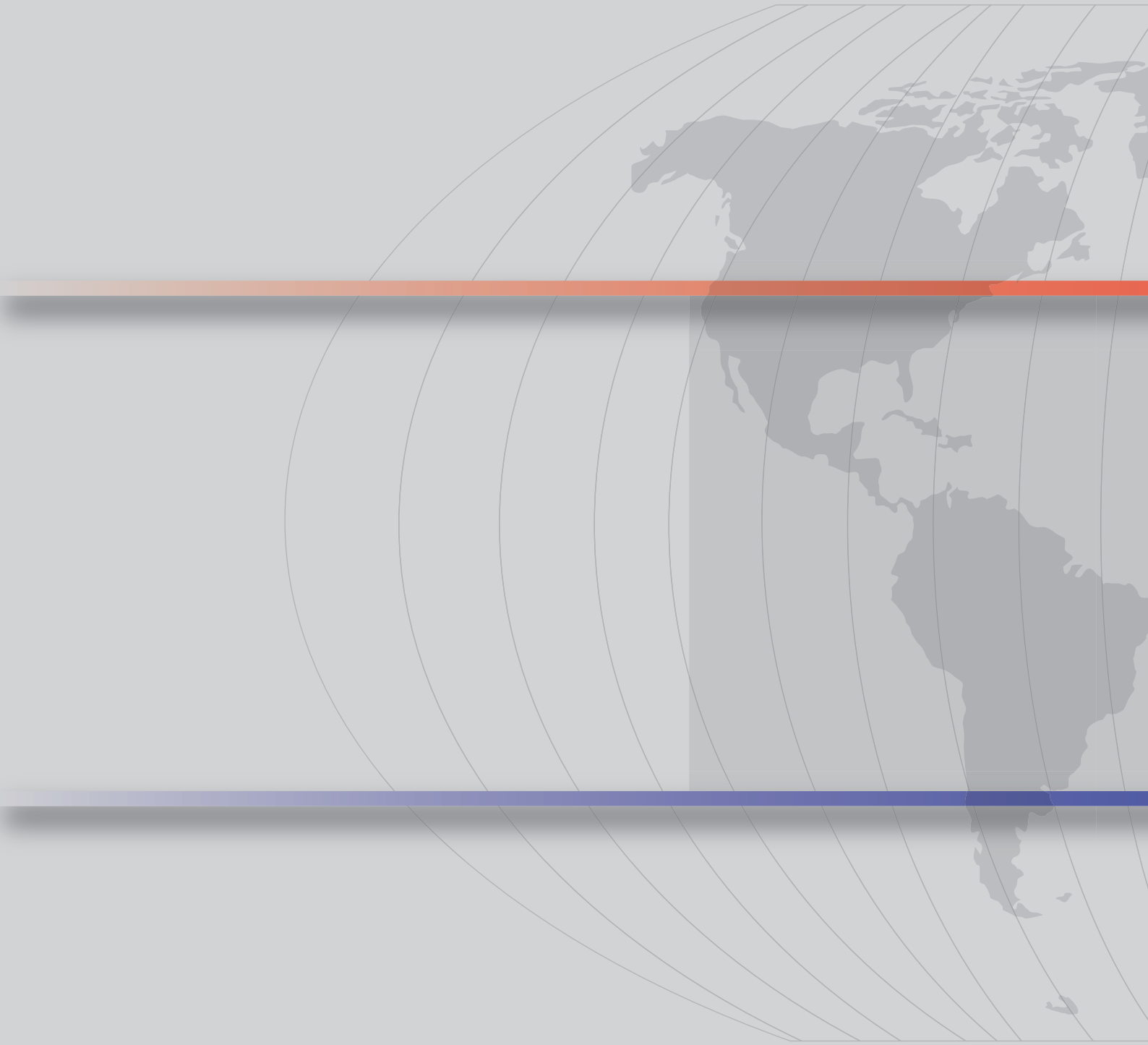
- Inspect cable condition regularly: running current, temperature rise, insulation material and etc.
- Cable should be isolated from heat, movement and avoid extreme bending during wiring work.

Troubleshooting

When any malfunction of the air conditioner unit is identified, immediately switch off the supply to the unit. Check for the following fault conditions and causes for some simple troubleshooting tips.

Fault	Possible Causes	Solutions
Compressor does not run	Power failure or communication bus failure.	Check the power supply and communication indicator on the controller.
	Shut down by protection device.	Check the error code and determine the causes.
	No load required.	Check the control setting.
Compressor frequent cut in / cut out	Over-charged or insufficient refrigerant.	Check the amount of refrigerant.
	Chilled water short cycling.	Check the water system. Add water tank if necessary.
	Wrong controller setting.	Check the control setting.
Compressor noisy	Power failure or wrong phase sequence.	Check the power supply.
	Refrigerant flow back.	Check expansion device superheat and valve opening position.
	Compressor internal problem.	Replace compressor.
Insufficient cooling	Insufficient refrigerant.	Check unit for leaks. Add refrigerant for the system.
	Water piping not proper insulated.	Check the water piping work.
	Wrong expansion device setting.	Check expansion device superheat and valve opening position. Replace it if necessary.
	Filter drier choked.	Replace filter drier.
Suction tube freeze	Insufficient chilled water flow.	Check the water pump, valve, strainer and pressure drop across evaporator.
	Water system choked/ air trapped.	Clean the water system. Release the air trapped.
Discharge pressure too high	Refrigerant over-charged.	Remove the excess refrigerant.
	Insufficient cooling water flow.	Check the water pump, valve, strainer and pressure drop across
	Evaporator tubes fouled.	Inspect the water quality. Clean the condenser.
	Non-condensable gas in the system	Purge the non-condensable gas.
Discharge pressure too low	Insufficient refrigerant.	Check unit for leaks. Add refrigerant for the system.
	Compressor malfunction.	Replace compressor.
Suction pressure too high	Refrigerant over-charged.	Remove the excess refrigerant.
	Excessive load - high water temperature	Reduce load or add additional equipment.
	Wrong expansion device setting.	Check expansion device superheat and valve opening position.
Suction pressure too low.	Insufficient refrigerant.	Check unit for leaks. Add refrigerant for the system.
	Insufficient chilled water flow.	Check the water pump, valve, strainer and pressure drop across evaporator.
	Expansion device malfunctioning	Check expansion device superheat and valve opening position. Replace it if necessary.
Water pump does not run.	Power failure.	Check the wiring.
	Water pump malfunction	Replace water pump.

This information is provided for guidance only and is not exhaustive. Please contact your local dealer/service personnel if the faults persist.



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