Engineered for flexibility and performance.™

Design & Installation Guide For

McQuay MDS Multi System

McQuay® Air Conditioning

We have used our best endeavor to make sure the information contained in this manual is accurate. As we are always committed to technological improvement, the units and specifications are subject to change without further notice. In addition, to meet local criteria and customer requirements, we may modify the units and specifications. Please also take notice that not all the models suit every market.

Discussed in this manual is a product made in China in compliance with the national standard □ GB/T18837-2002.

CONTENTS

CHAPTER 1

Overview

1.1 General Information

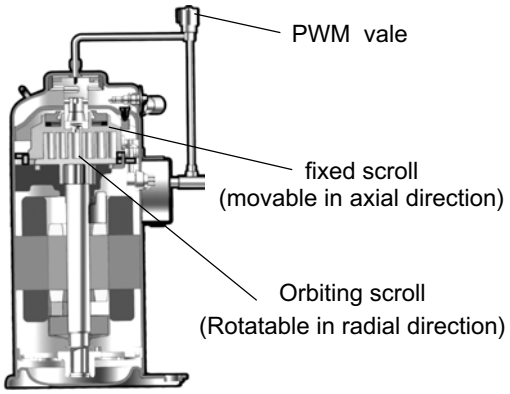
The MDS(Multi Digital Scroll) air conditioning system is operated by a digital compressor and is accommodated by multiple evaporators (indoor units). It is touted as the next-generation modular system in the world of high-efficiency air conditioning. It has undoubtedly changed the face of cooling associated with high-storied buildings. It provides a broad range of different applications for settings such as offices, hotels and schools. With its easy installation and simple controlling system, the MDS will more than meet the demands of the air conditioning market.

1.2 Working Principle & System Principle

1.2.1 Working Principle

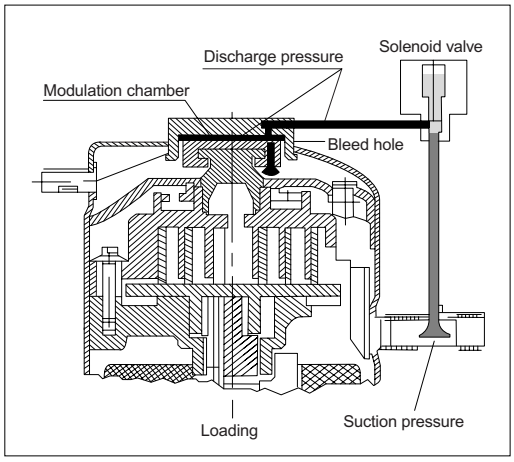
The beauty of this technology is its inherent simplicity. The standard digital scroll compressor has a unique feature called axial compliance. This allows the fixed scroll to move in the axial direction, by very small amounts, to ensure that the fixed and orbiting scrolls are always loaded together with the optimal force.

This optimal force holding the 2 scrolls together at all operating conditions ensure the high efficiency of Copeland scrolls. The Digital Scroll operation builds on this principle.

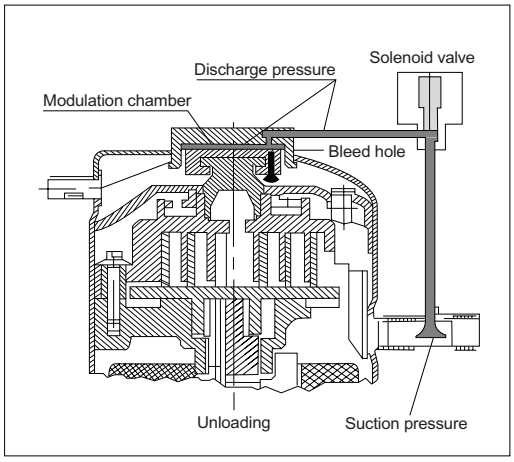


The Digital Scroll operates in two stages - the "loaded state", when the solenoid valve is normally closed and "unloaded state", when the solenoid valve is open. During the loaded state the compressor operates like a standard scroll and delivers full capacity and mass flow. However, during the unloaded state, there is no capacity and no mass flow through the compressor.

At this stage, let us introduce the concept of a cycle time. A cycle time consists of a "Loaded State" time and "Unloaded State" time. The duration of these 2-time segments determine the capacity modulation of the compressor. Example: In a 20 seconds cycle time, if the loaded state time is 10 seconds and the unloaded state time is 10 seconds, the compressor modulation is (10 seconds x 100% + 10 seconds x 0%)/ 20 = 50%. If for the same cycle time, the loaded state time is 15 seconds and the unloaded state time is 5 seconds, the compressor modulation is 75%. The capacity is a time averaged summation of the loaded state and unloaded state. By varying the loaded state time and unloaded state time, any capacity (10%-100%) can be delivered by the compressor.

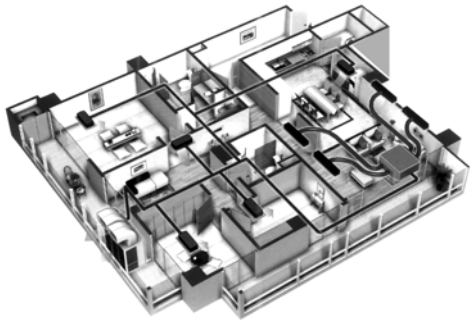


- PWM valve power off
- Valve close
- Fixed scroll move downwards
- Two scrolls gather together
- Loading

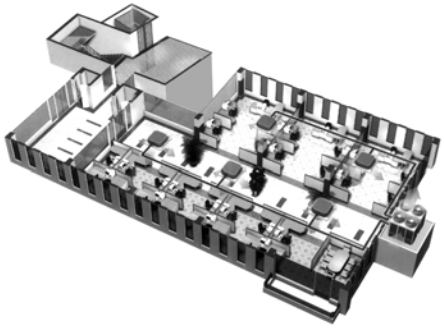


- PWM valve power on
- Valve open
- Fixed scroll moves upwards
- Two scrolls separate
- Unloading

1.2.2 Sketch Map of Installation



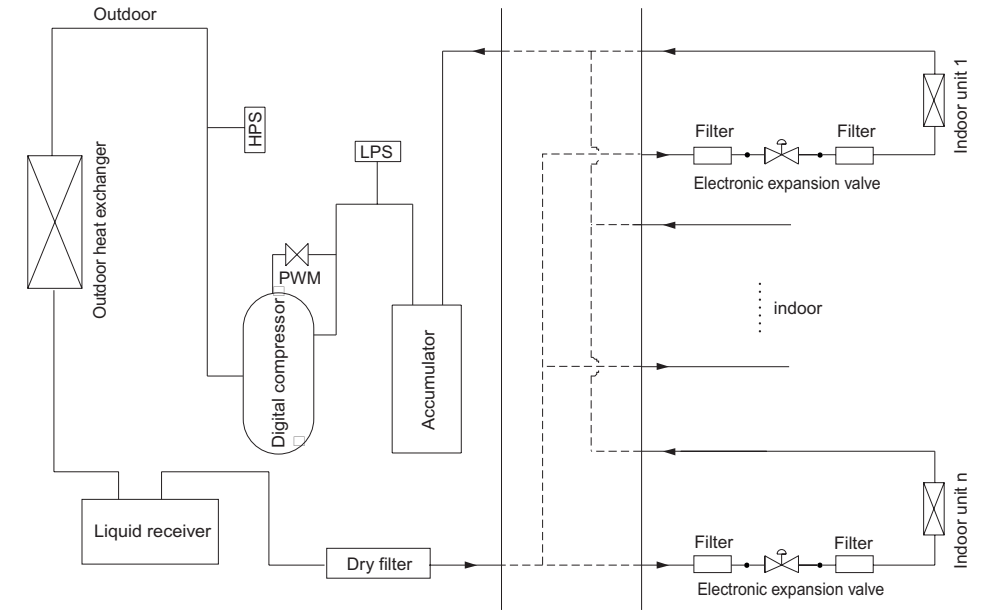
Resident system



Commerce system

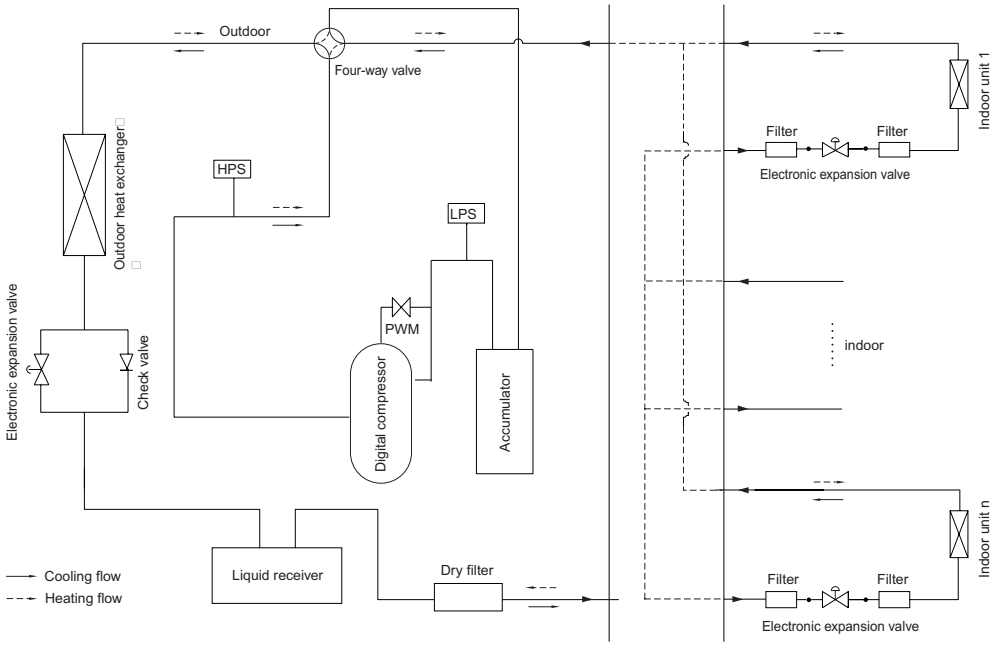
1.2.3 Diagram of the Unit System

MDS030A、MDS040A、MDS050A、MDS060A



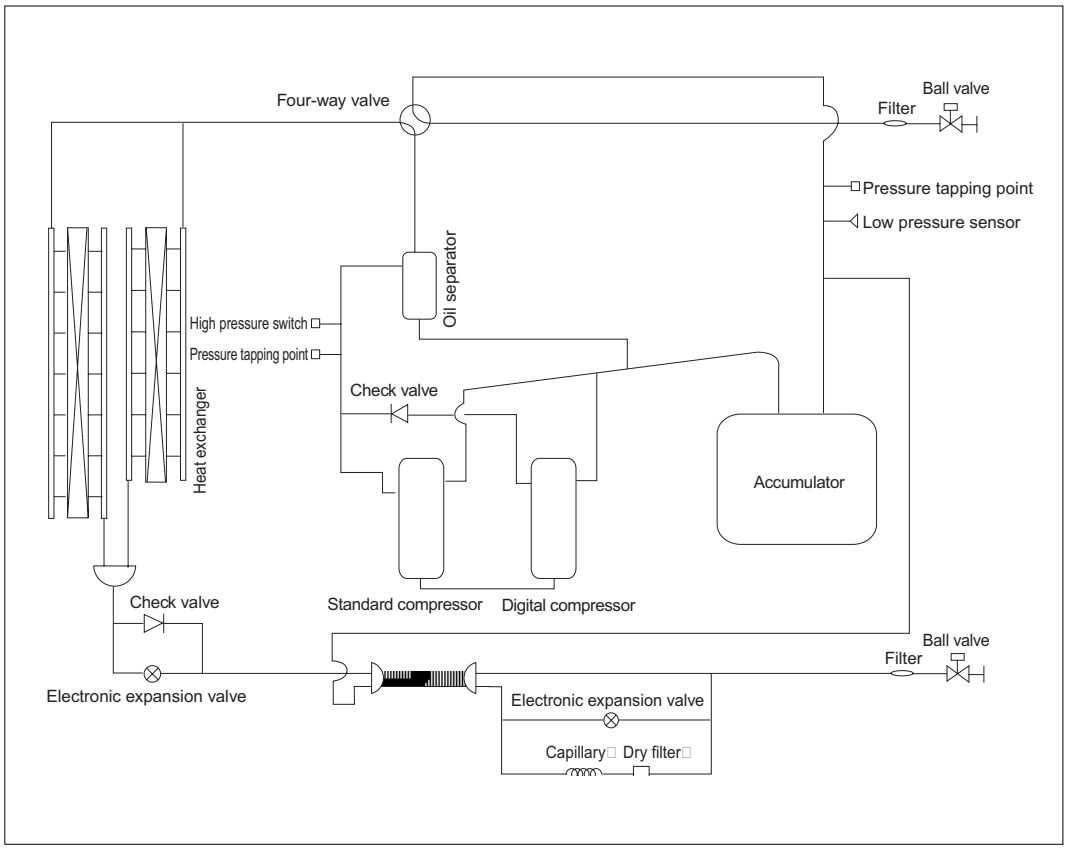
Note: The MDS030A unit excludes the reservoir.

MDS030AR、MDS040AR、MDS050AR、MDS060AR

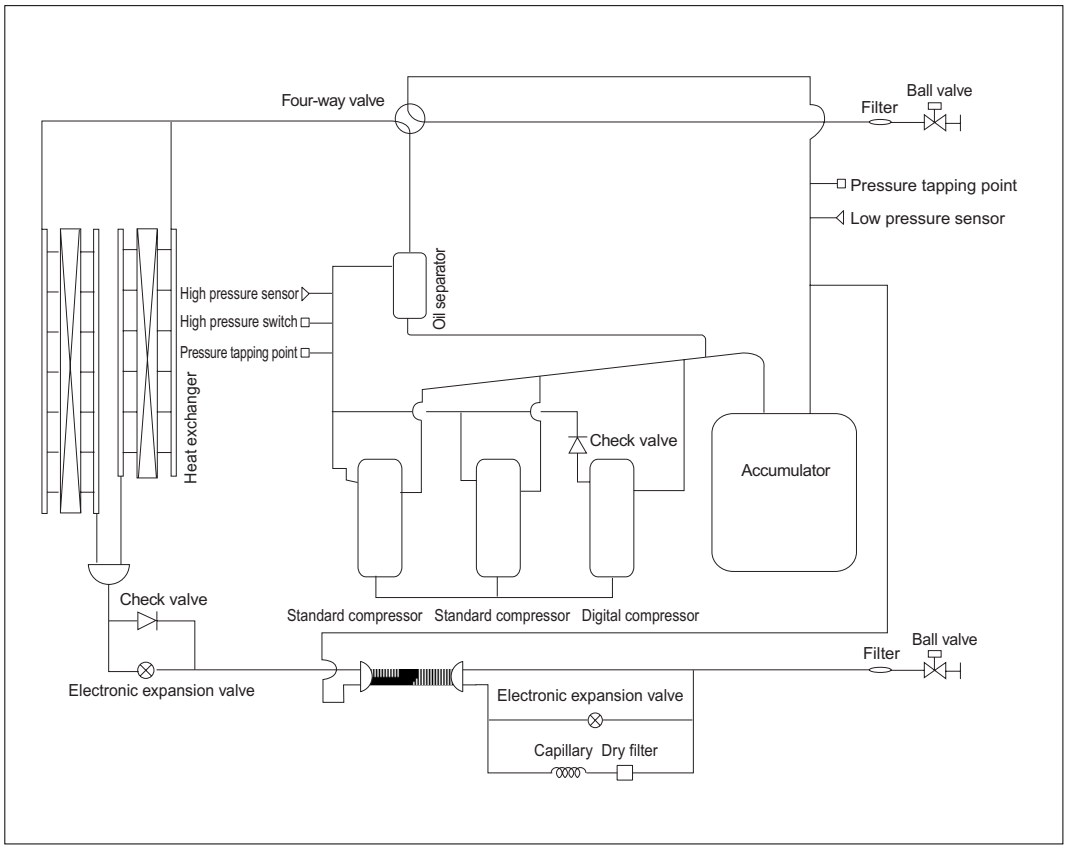


Note: The MDS030A unit excludes the reservoir.

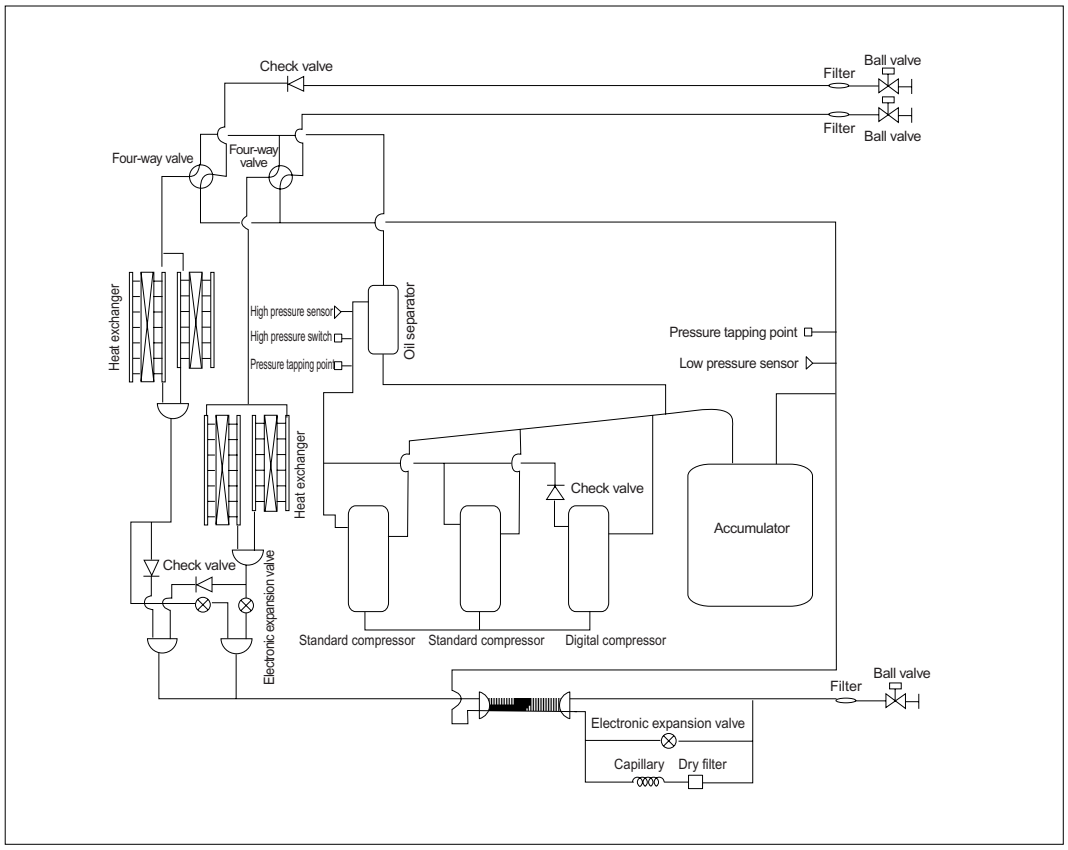
MDS080BR、MDS100BR、MDS120BR



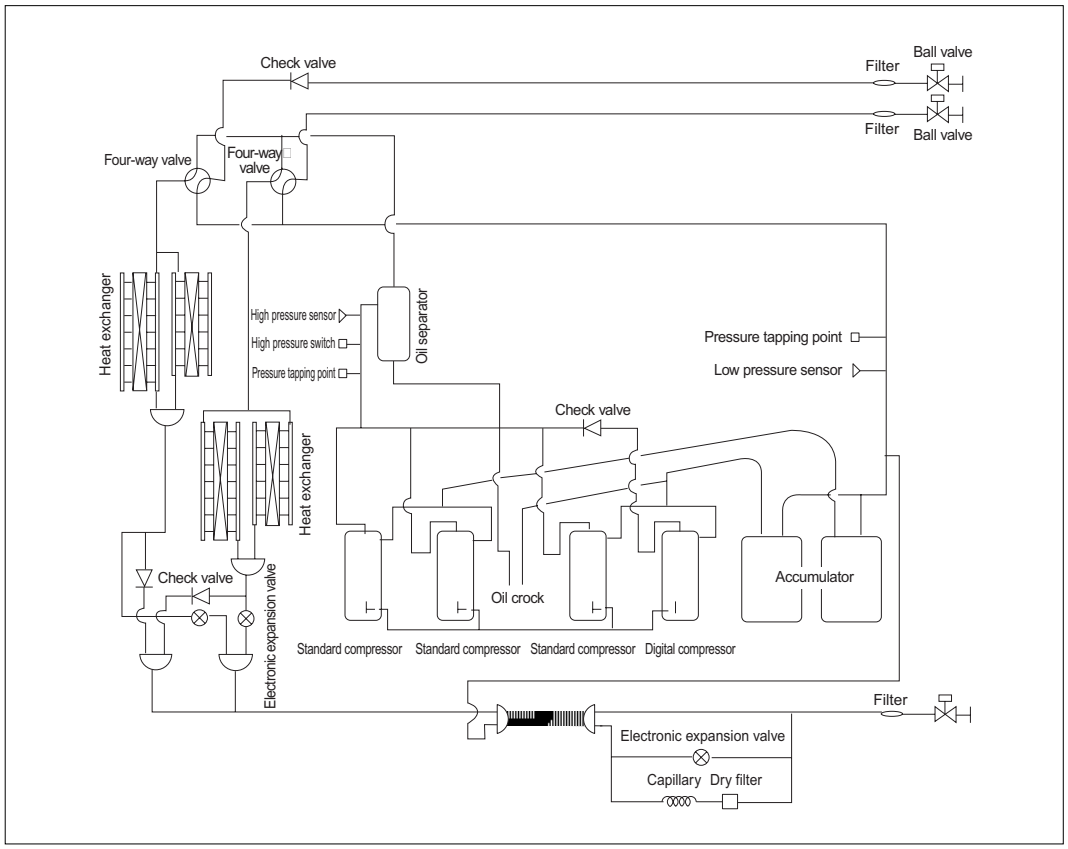
MDS150BR



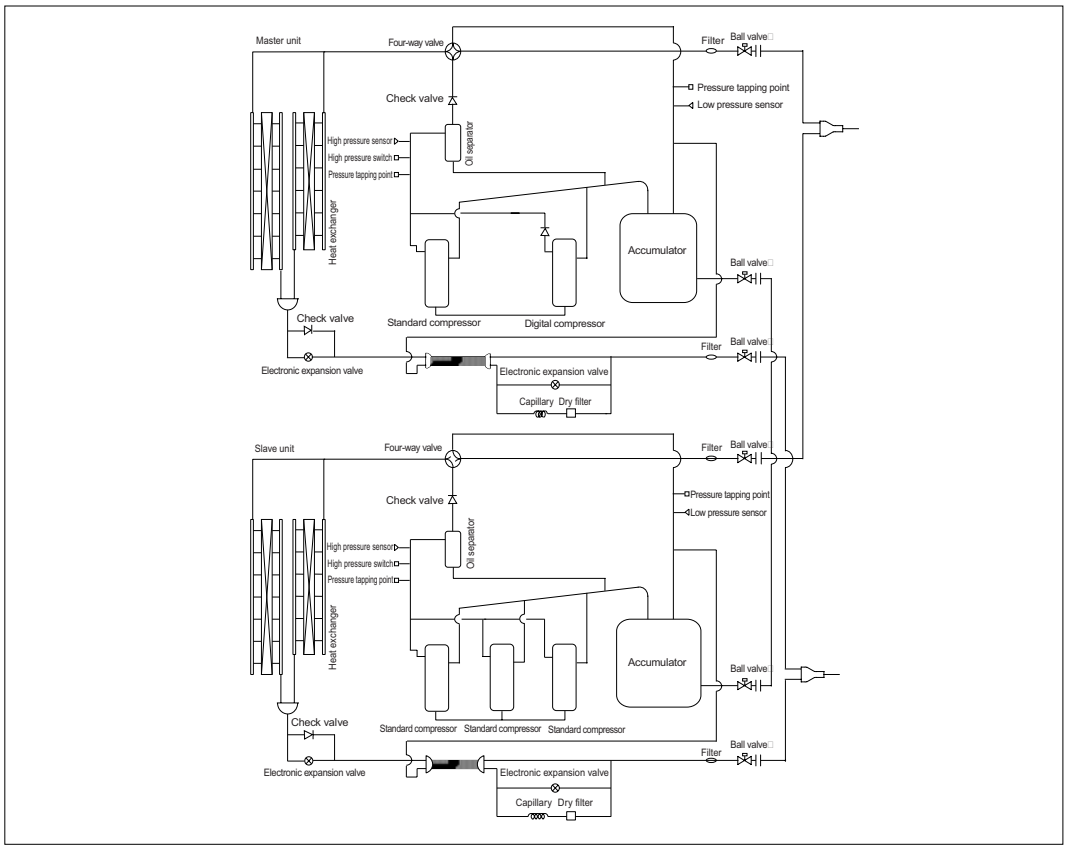
MDS180BR



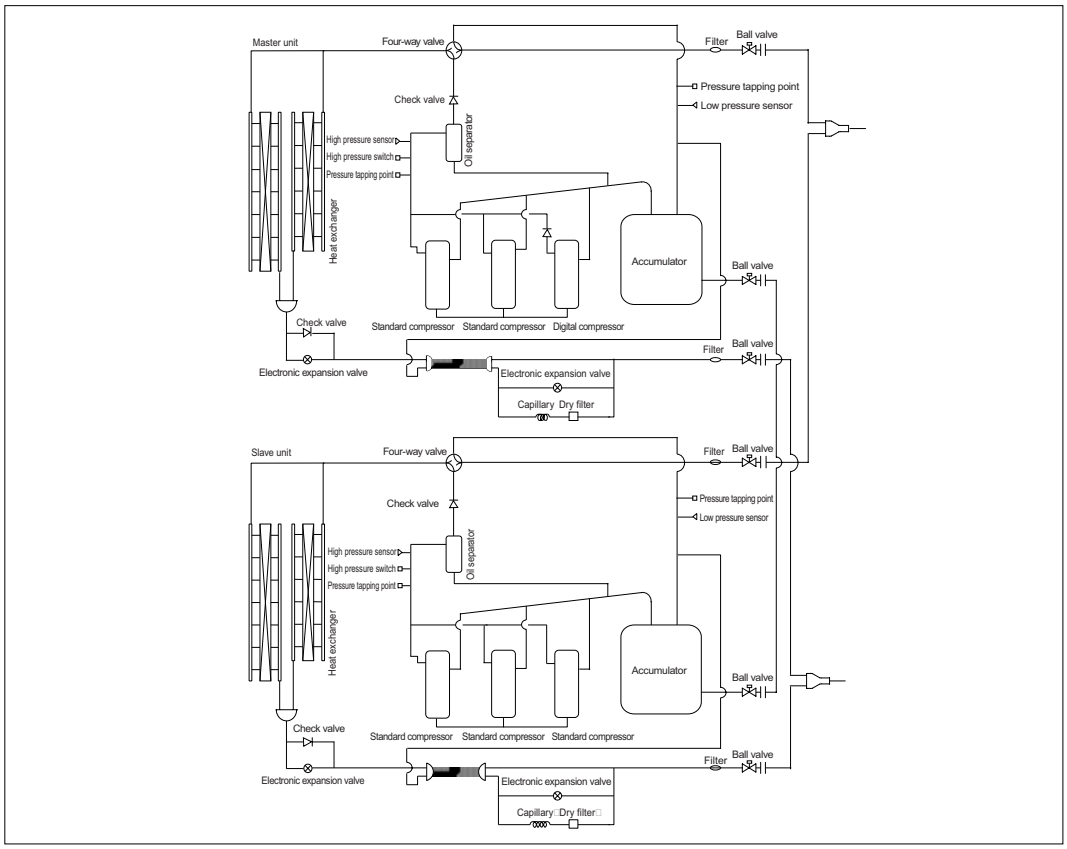
MDS200BR、MDS220BR、MDS240BR



MDS260BR



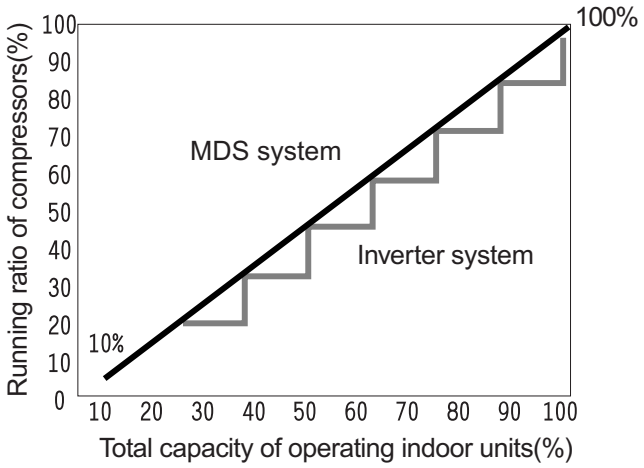
MDS280BR、MDS300BR



1.3 Main Features

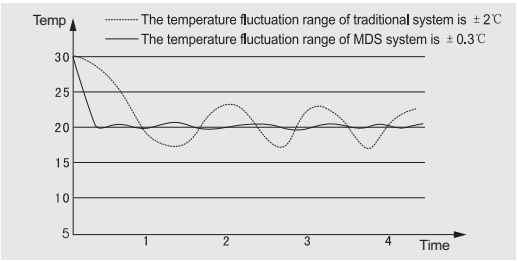
1.3.1 Wide Range and Stepless Capacity Modulation

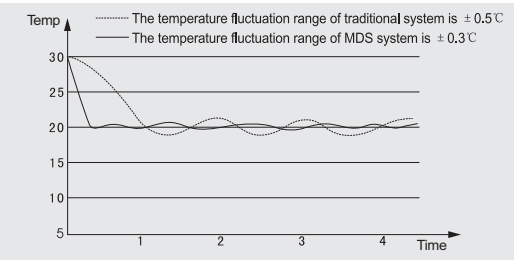
- Wide capacity modulation range（10%-100%）;
- According to changing the ratio of “loading time” and “unloading time, MDS can modulate the capacity steplessly;
- Lower the energy consumption and running cost.



1.3.2 Accurate Temperature Control and Quick Response.

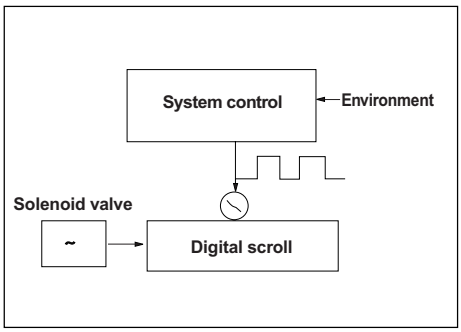
- The cooling/heating capacity of the indoor units is controlled by the EXV, which ensure the low temperature fluctuation of ± 0.3℃;
- Stepless capacity modulation;
- Quick response to output the capacity (40s).





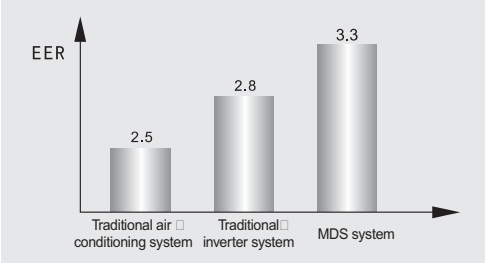
1.3.3 Simple, Reliable and Long Life

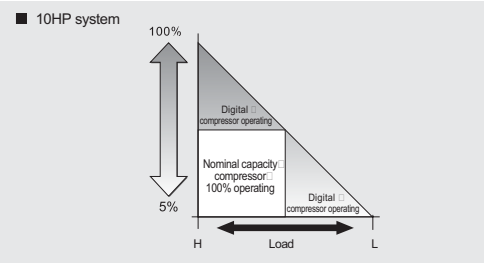
- The PWM valve has the longevity of 40 million times
- Wide range of capacity modulation makes sure the start/stop times reduces
- Less components
- No complicate inverter controller
- The compressor has an excellent oil return performance, there is no need for the oil return circuit
- Even the units run in 10% part load, the MDS system can be in good stage.



1.3.4 Energy Saving

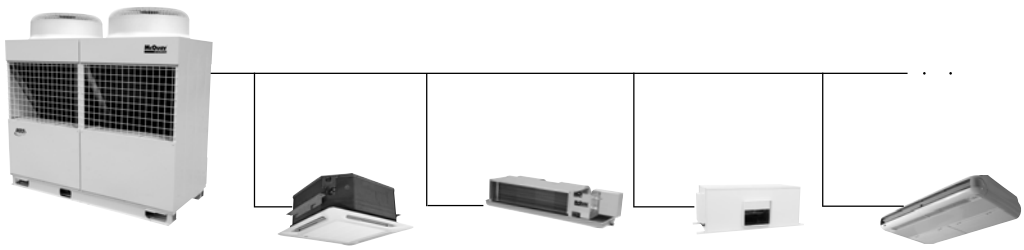
- The inverter system capacity modulation range is from 30% to 100%, while MDS system capacity modulation range is from 10% to 100%;
- Quick response to the capacity modulation;
- Min. power consumption is only 10% of the full load power consumption;
- Compared to the inverter system, there is no power consumption of transducer;
- Compared to the nominal capacity scroll system, it can save 20% energy consumption.





1.3.5 Flexible Combination of Indoor Units

- Max. capacity of the indoor units can reach 130% capacity of the outdoor unit;
- Number of the indoor units connected to the outdoor unit depends on the capacity of the outdoor unit;
- One outdoor unit can be connected up to 48 indoor units;
- Various types of indoor units are available according to the decoration of the room;
- There are various indoor units for option: ceiling cassette, ceiling concealed, high static pressure duct and ceiling exposed/floor standing.



1.3.6 Reliable Long Piping Connection Design

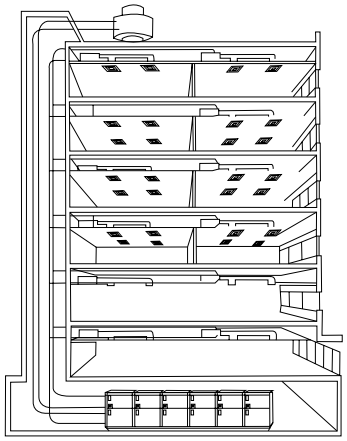
- Max. piping length is 150m (12HP-30HP), max. height between outdoor unit and indoor unit is 50m (8HP-30HP).

	Max. piping total length(m)	Max. piping length(m)	Height(m)	
			OT	IT
12~30HP	350	150	50	40
8~10HP	250	125	50	40
5~6HP	150	70	30	30
4HP	150	70	20	20
3HP	100	50	20	20

【Note】 OT means the outdoor unit is above the indoor unit. IT means the outdoor unit is below the indoor unit.

1.3.7 Space Saving

■ Compared to traditional central air conditioning, MDS system is higher centralized, no need for special equipment room to save more space, and bring more benefits.



Traditional central air conditioning

MDS system

1.3.8 Easy to Install and Simple to Maintain

■ Easy installation

- MDS system is simple, and the pipe layout is clear. The site installation is accompanied by little workload of easy indoor and outdoor units installation and pipe connection. The installation involves refrigerant piping system, and the maintenance is easy.

■ Independent system, installed by stages

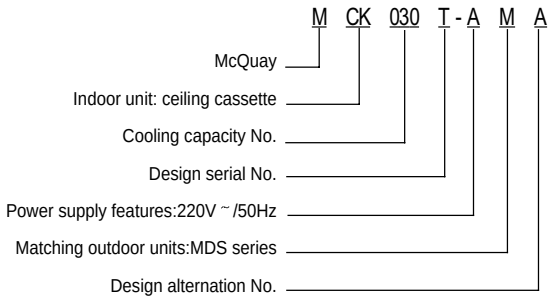
- Easy installation allows the owner to choose a suitable time for the MDS system installation in a longer period, greatly reducing the time limitation on the air conditioner installation during the construction stage;
- For new projects, installation by stages can reduce lump-sum investment;
- For alteration projects, it is easy for the owner to install.

■ No need for special maintenance

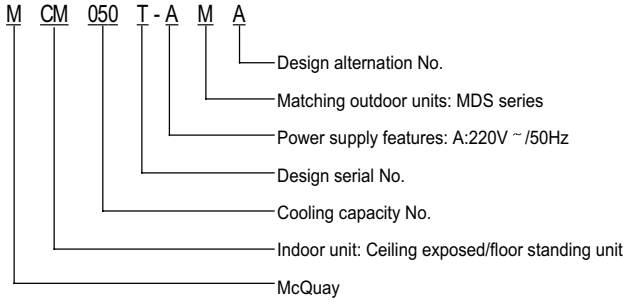
- It only involves simple refrigerant piping system , without complex maintenance;
- Compared with the water-cooled system, it has no water system. So, there is no need to clean water pipes, separate contaminant and maintain water system control devices. It is easy to use and it is not required to assign dedicated personnel to manage and maintain.

1.4 Nomenclature

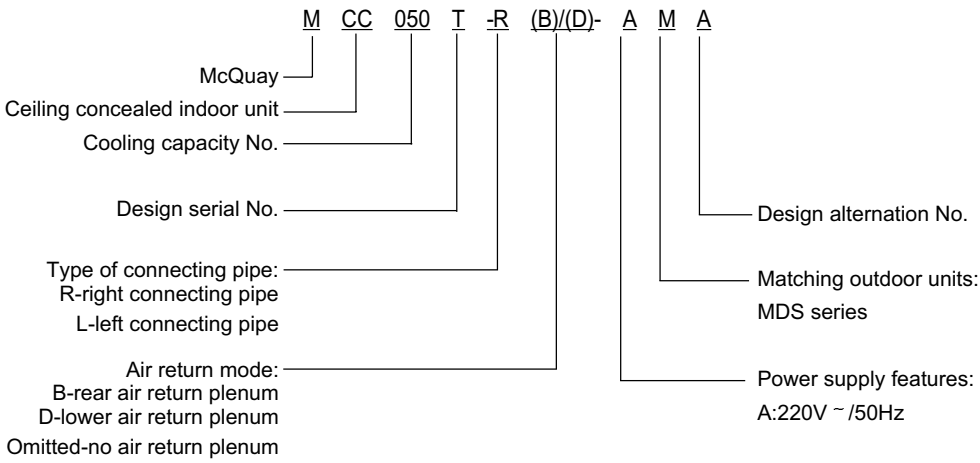
■ Indoor unit: ceiling cassette



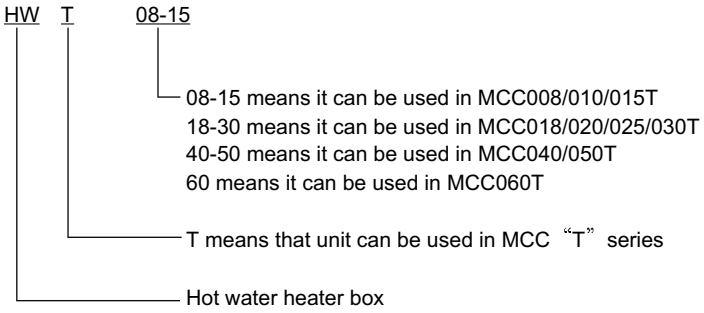
■ Indoor unit: Ceiling exposed/floor standing unit



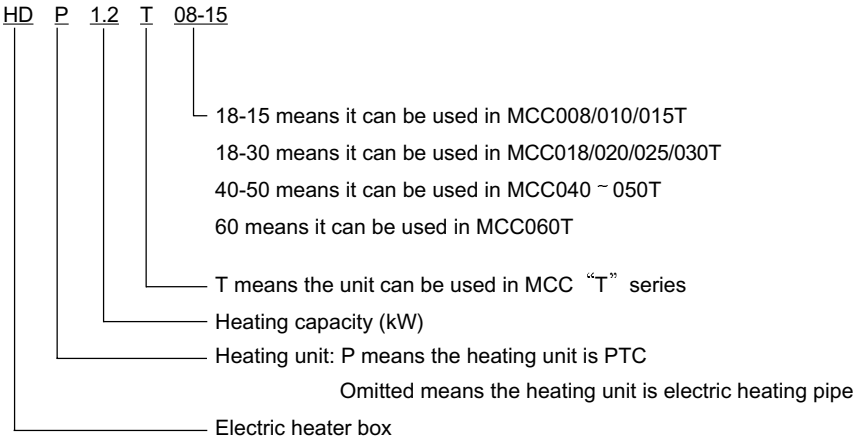
■ Indoor unit: ceiling concealed unit



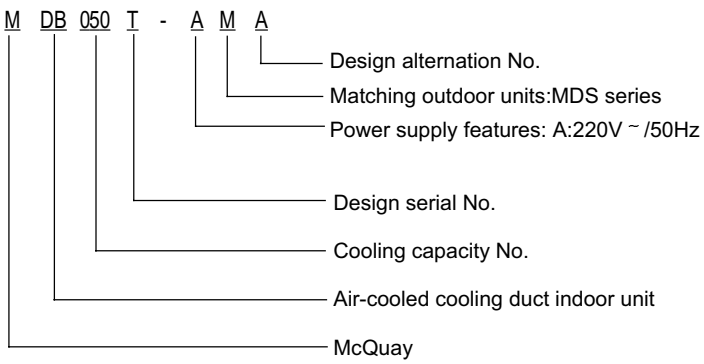
■ Hot water heater box



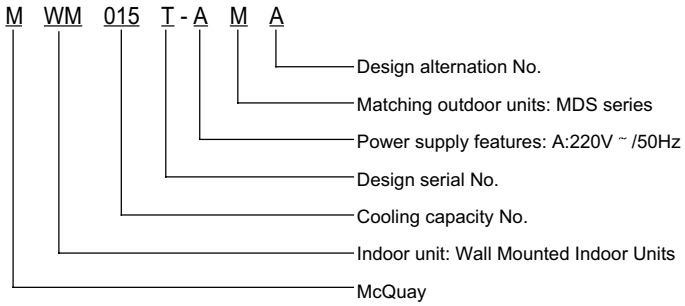
■ Electric heater box



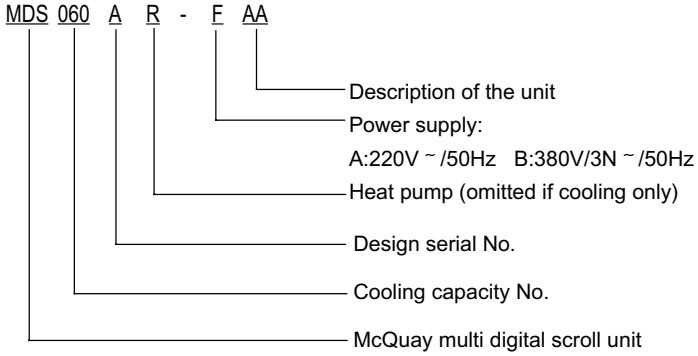
■ Air-cooled cooling duct indoor unit



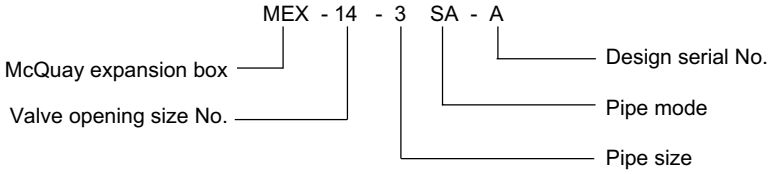
■ Indoor unit: Wall Mounted Indoor Units



■ Outdoor unit: MDS unit



■ MEX throttle box



McQuay ———— MEX:Throttle box (one expansion valve)
Valve opening size No. ———— Nominal diameter value × 10
Pipe size: ———— 2:1/4 inch
3:3/8 inch
4:1/2 inch
Pipe mode: ———— Flare fitting & nipple joint
Design serial No. ———— Primary design

1.5 Products Series

1.5.1 Outdoor Unit

Model		Capacity range													
		3HP	4HP	5HP	6HP	8HP	10HP	12HP	15HP	18HP	20HP	22HP	24HP	26HP	28HP	30HP
	MDS-A	●	●	●	●											
	MDS-B					●	●	●	●							
	MDS-B									●	●	●	●	●	●	●

1.5.2 Indoor Products

Model		Capacity range									
		0.8HP	1.0HP	1.5HP	1.8HP	2.0HP	2.5HP	3.0HP	4.0HP	5.0HP	6.0HP
	MCC	●	●	●	●	●	●	●	●	●	●
	MCK		●	●	●	●	●	●	●	●	
	MCM					●		●		●	
	MDB									●	●
	MWM	●	●	●		●	●				

1.6 Performance Parameter

1.6.1 Ceiling Concealed

Model		Indoor unit	MCC 008T	MCC 010T	MCC 015T	MCC 018T	MCC 020T	MCC 025T	MCC 030T	MCC 040T	MCC 050T	MCC 060T
Cooling capacity		W	2000	2500	3650	4500	5600	6500	7800	10600	12400	14400
Heating capacity		W	2200	2600	3700	4700	6100	7400	8900	11600	14500	17300
Nominal input		W	47	47	81	82	82	123	158	276	276	280
Power supply			220V ~ /50Hz									
Air flow	High	m^3/h	450	450	580	800	800	960	1200	1900	1900	2100
	Medium	m^3/h	370	370	470	650	650	780	950	1520	1520	1750
	Low	m^3/h	280	280	380	540	540	600	800	1300	1300	1460
ESP		Pa	15(0/30/50)						30(15/50/70)	50(15/30/70)		
Dimension		mm	1030x469x220			1290x490x250				1640x490x250		1900x490x250
Weight		kg	22	22	22	25	25	27	28	39	39	45
Sound(High/ medium/Low)		dB (A)	31/29/27	31/29/27	34/32/30	35/32/29	35/32/29	37/36/35	42/40/38	47/45/43	47/45/43	48/46/44
Piping size	Liquid pipe Φ	mm(in)	6.35 (1/4″)	6.35 (1/4″)	6.35 (1/4″)	9.52 (3/8″)	9.52 (3/8″)	9.52(3/8″)	9.52(3/8″)	9.52(3/8″)	9.52(3/8″)	9.52(3/8″)
	Gas pipe Φ	mm(in)	9.52 (3/8″)	9.52 (3/8″)	12.7 (1/2″)	15.88(5/8″)	15.88(5/8″)	15.88(5/8″)	15.88(5/8″)	19.05(3/4″)	19.05(3/4″)	19.05(3/4″)
	Drainage pipe	inch	R3/4									

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.
- The above parameters are the parameters of the heat- pump unit.

1.6.2 High Static Pressure Duct Unit

Model Indoor unit		Indoor unit	MDB050T	MDB060T
Nominal cooling capacity		W	12500	14000
Nominal heating capacity		W	14000	16500
Nominal input		W	615	789
Power supply			220V ~ /50Hz	
Air flow(High/Medium/Low)		m^3/h	2550/2040/1650	3000/2540/1920
ESP		Pa	100	100
Dimension		mm	1230 × 910 × 350	1430 × 910 × 350
Weight		kg	69	75
Sound Level(High/Medium/Low)		dB(A)	58/55/52	60/56/53
pipe size	Liquid pipe outside diameter Φ	mm(in)	9.52(3/8″)	9.52(3/8″)
	Gas pipe outside diameter Φ	mm(in)	19.05(3/4″)	19.05(3/4″)
	Drainage pipe	inch	R3/4	

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.

1.6.3 Ceiling Cassette

Model		Indoor unit	MCK010T	MCK015T	MCK018T	MCK020T	MCK025T	MCK030T	MCK040T	MCK050T
Nominal cooling capacity		W	2800	3600	4500	5400	6500	7500	10000	12500
Nominal heating capacity		W	3200	3900	5000	5900	7200	8000	11000	13500
Nominal input		W	26	34	36	42	75	84	110	140
Power supply			220V ~ /50Hz							
Air flow	High	m^3/h	520	600	650	700	1200	1300	1360	1650
	Medium	m^3/h	430	520	550	600	1100	1060	1200	1450
	Low	m^3/h	380	430	400	530	960	850	1110	1350
Dimension		mm	930X930X278				930X930X363			
Weight		kg	26		30		39.5			
Sound(High/medium/Low)		dB(A)	29/28/26	32/30/27	38/34/30	39/35/31	42/40/38	45/43/41	46/44/42	48/45/42
Piping Size	Liquid pipe Φ	mm(in)	6.35(1/4″)		9.52(3/8″)				9.52(3/8″)	
	Gas pipe Φ	mm(in)	9.52(3/8″)	12.7(1/2″)	15.8(5/8″)				19.05(3/4″)	
	Drainage pipe	mm	ϕ 20.5							

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.

1.6.4 Ceiling Exposed / floor Standing

Model		Indoor unit	MCM020T	MCM030T	MCM050T
Cooling capacity		W	5800	7500	12500
Heating capacity		W	5800	8000	13500
Air flow(High/Medium/Low)		m^3/h	1100/970/750	1300/1100/870	1850/1550/1200
Rated power input		W	81	116	161
Power supply			220V ~ /50Hz		
Dimension		mm	1214x670x214	1214x670x249	1714x670x249
Weight		kg	39	44	44
Sound(High/medium/Low)		dB(A)	48/45/42	50/46/43	52/48/44
PiPing Size	Liquid pipe outside diameter Φ	mm(in)	9.52(3/8″)	9.52(3/8″)	9.52(3/8″)
	Gas pipe outside diameter Φ	mm(in)	15.88(5/8″)	15.88(5/8″)	19.05(3/4″)
	Drain pipe	mm	ϕ 20.5		

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.

1.6.5 Wall Mounted Indoor Units

Model Indoor unit			MWM008T	MWM010T	MWM015T	MWM020T	MWM025T
Cooling capacity		W	2200	2780	3520	5400	6500
Heating capacity		W	2200	2780	3520	5400	6500
Air flow(High/Medium/Low)		m^3/h	460/330/270	510/420/320	590/500/370	860/720/590	1100/790/680
Rated power input		W	24	36	40	48	68
Power supply			220V~/50Hz				
Dimension(WxDxH)		mm	799x198x260	899x198x260	899x198x260	1062x222x304	1062x222x304
Weight		kg	25	30	35	36	36
Sound(High/medium/Low)		dB(A)	39/34/28	39/34/28	42/36/29	44/40/35	49/43/40
PiPing Size	Liquid pipe outside diameter Φ	mm(in.)	6.35(1/4)	6.35(1/4)	6.35(1/4)	6.35(1/4)	9.52(3/8)
	Gas pipe outside diameter Φ	mm(in.)	9.52(3/8)	9.52(3/8)	12.7(1/2)	15.88(5/8)	15.88(5/8)
	Drain pipe		ϕ 20.5				

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.

1.6.6 MDS-A Specification(Outdoor Unit)

Model		Unit	MDS030A	MDS030AR	MDS040A	MDS040AR	MDS050A	MDS050AR	MDS060A	MDS060AR
Nominal cooling capacity		kW	8.5	8.5	10	10	12.5	12.5	14.5	14.5
Nominal heating capacity		kW	-	9.0	-	11.5	-	13.5	-	16.5
Power supply			220V~/50Hz							
Dimension (L x W x H)		mm	840x408x900		1058x430x1044				1058x4230x1247	
Weight		kg	82	85	112	115	117	120	123	130
Cooling rated power input		kW	3.0	3.0	3.5	3.6	4.4	4.4	5.0	5.0
Cooling rated current		A	13.6	13.6	15.9	15.9	20	20	22.8	22.8
Heating rated power input		kW	-	2.5	-	3.4	-	4.2	-	4.2
Heating rated current		A	-	11.4	-	15.5	-	19	-	20.3
Refrigerant			R22							
Type of connecting pipe			copper flare fitting & nipple joint							
Piping size	Liquid pipe Φ	(mm/in)	9.52(3/8″)		9.52(3/8″)		9.52(3/8″)		9.52(3/8″)	
	Gas pipe Φ	(mm/in)	15.88(5/8″)		19.05(3/4″)		19.05(3/4″)		19.05(3/4″)	

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃.
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.
- The specification parameters may change with the product improvement; Please take the parameters listed in the nameplate of the unit as the reference parameter.

Model		Unit	MDS050A	MDS050AR	MDS060A	MDS060AR
Nominal cooling capacity		kW	12.5	12.5	15	15
Nominal heating capacity		kW	-	13.5	-	17
Power supply			380V/3N~/50Hz			
Dimension (L x W x H)		mm	1058x430x1044		1058x430x1247	
Weight		kg	117	120	123	130
Cooling rated power input		kW	4.4	4.4	5.0	5.0
Cooling rated current		A	8.4	8.4	9.6	9.6
Heating rated power input		kW	-	4.2	-	4.23
Heating rated current		A	-	8.0	-	8.8
Refrigerant			R22			
Type of connecting pipe	Liquid pipe		Copper flare fitting & nipple joint			
	Gas pipe		Copper flare fitting & nipple joint			
Piping size	Liquid pipe Φ	(mm/in)	9.52(3/8″)			
	Gas pipe Φ	(mm/in)	19.05(3/4″)			

Notes:

- The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃ , and the ambient temperature of 35℃/24℃
- The nominal heating capacity is gotten in the return air temperature of 20℃/15℃ , and the ambient temperature of 7℃/6℃.
- The specification parameters may change with the product improvement; Please take the parameters listed in the nameplate of the unit as the reference parameter.

1.6.7 MDS-B Specification (Outdoor Unit)

Model			MDS 080B	MDS 080BR	MDS 100B	MDS 100BR	MDS 120B	MDS 120BR	MDS 150B	MDS 150BR	MDS 180B	MDS 180BR	MDS 200B	MDS 200BR
Nominal cooling capacity		kW	24.5	24.5	28.0	28.0	32.5	32.5	40.0	40.0	47.5	47.5	50.0	50.0
Nominal heating capacity		kW	-	26.0	-	30.0	-	34.0	-	43.0	-	50.0	-	53.0
Power supply			380V/3N ~ /50Hz											
Sound level		dB(A)	62	62	64	64	66	66	67	67	66	66	66	66
Dimension (Lx W x H)		mm	990x840x1840						1290x840x1840		1990x840x1840			
Weight		kg	275	290	285	300	290	305	355	370	520	550	560	590
Cooling rated power input		kW	7.5	7.5	8.5	8.5	9.8	9.8	12.9	12.9	14.1	14.1	15.2	15.2
Cooling rated current		A	14.6	14.6	16.8	16.8	18.8	18.8	23.1	23.1	28.2	28.2	31.1	31.1
Heating rated power input		kW	-	7.2	-	8.3	-	9.0	-	11.1	-	13.2	-	14.7
Heating rated current		A	-	13.6	-	15.7	-	16.7	-	22.6	-	27.1	-	29.4
Refrigerant			R22											
Type of connecting pipe	Gas side		Welding & flange											
	Liquid side		Flare fitting & nipple joint											
Liquid pipe Φ		mm(in)	12.7(1/2″)				15.88(5/8″)							
Gas pipe Φ		mm(in)	28.6(1-1/8″)						34.9(1-3/8″)					

Model			MDS 220B	MDS 220BR	MDS 240B	MDS 240BR	MDS 260B	MDS 260BR	MDS 280B	MDS 280BR	MDS 300B	MDS 300BR
Nominal coolingcapacity		kW	55.0	55.0	65.0	65.0	70.0	70.0	75.0	75.0	80.0	80.0
Nominal heating capacity		kW	-	58.0	-	68.0	-	75.0	-	80.0	-	85.0
Power supply			380V/3N ~ /50Hz									
Sound level		dB(A)	66	66	68	68	68	68	69	69	69	69
Dimension (L x W x H)		mm	1990x840x1840				2280x840x1840		2580x840x1840			
Weight		kg	560	590	570	600	645	675	710	740	710	740
Cooling rated power input		kW	16.7	16.7	19.8	19.8	21.3	21.3	22.8	22.8	26.2	26.2
Cooling rated current		A	32.7	32.7	38.5	38.5	40.0	40.0	42.5	42.5	46.5	46.5
Heating rated power input		kW	-	16.2	-	18.5	-	20.9	-	22.0	-	23.6
Heating rated current		A	-	31.0	-	33.8	-	37.2	-	41.0	-	43.1
Refrigerant			R22									
Type of connecting pipe	Gas side		Welding & flange									
	Liquid side		Flare fitting &nipple joint									
Liquid pipe Φ		mm(in)	19.05(3/4″)				19.05(3/4″)					
Gas pipe Φ		mm(in)	38.1(1-1/2″)				41.3(1-5/8″)					

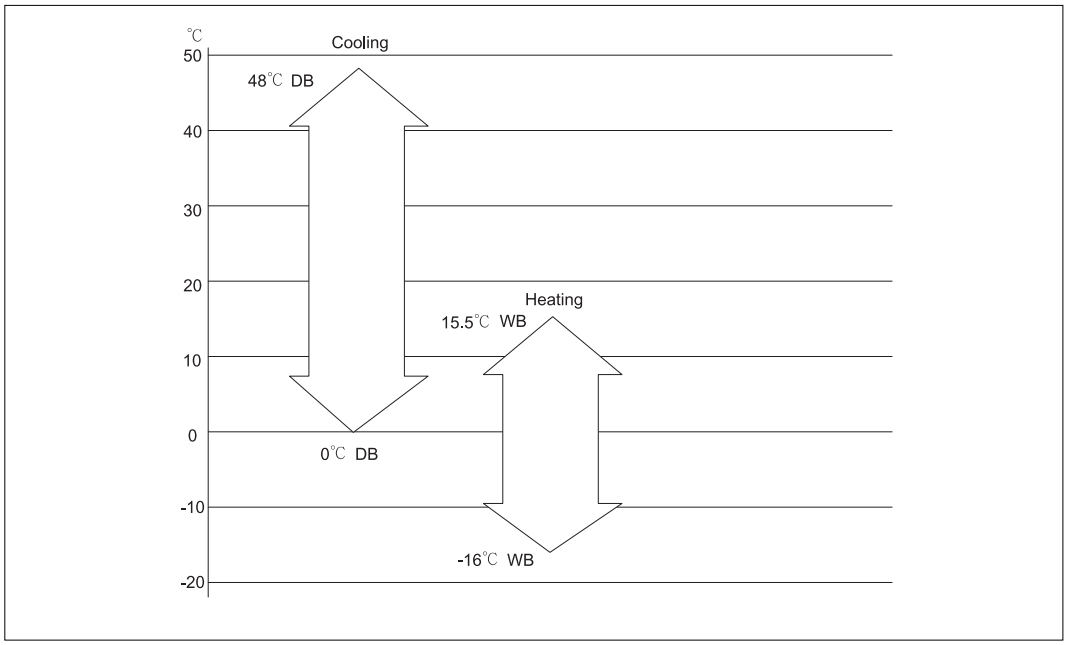
Notes:

◆ The nominal cooling capacity is gotten in the return air temperature of 27℃/19℃, and the ambient temperature of 35℃/24℃

◆ The nominal heating capacity is gotten in the return air temperature of 20℃/15℃, and the ambient temperature of 7℃/6℃.

◆ The sound level is gotten from the test room, it may differ in actual use due to the ambient noise or other causes.

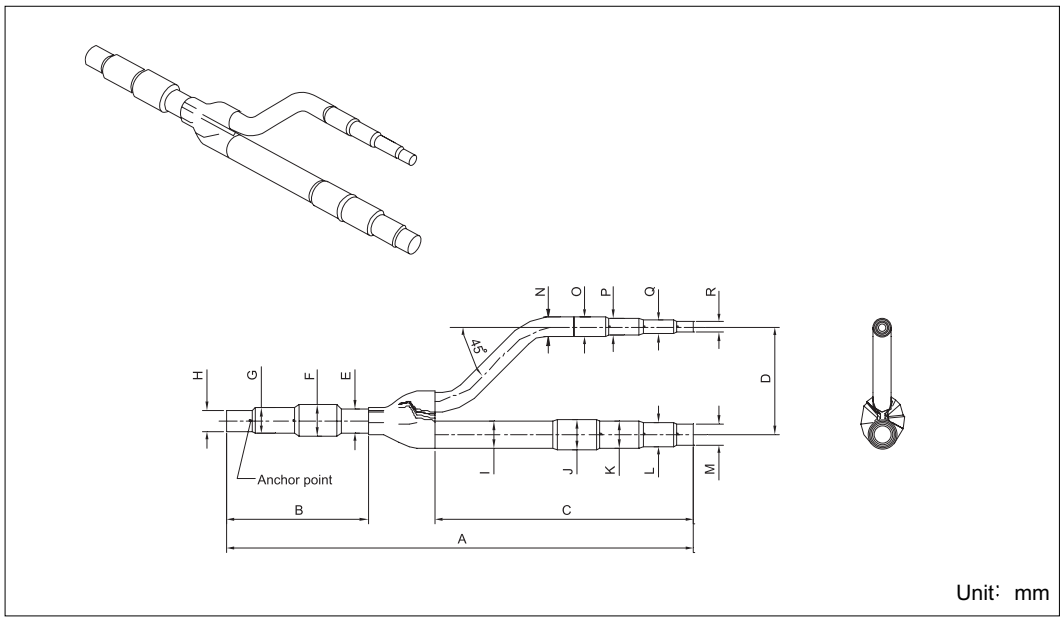
1.7 Operating Range



【Note】The table is gotten based on the equivalent length of 16m and the height is 0 m.

1.8 Refnet

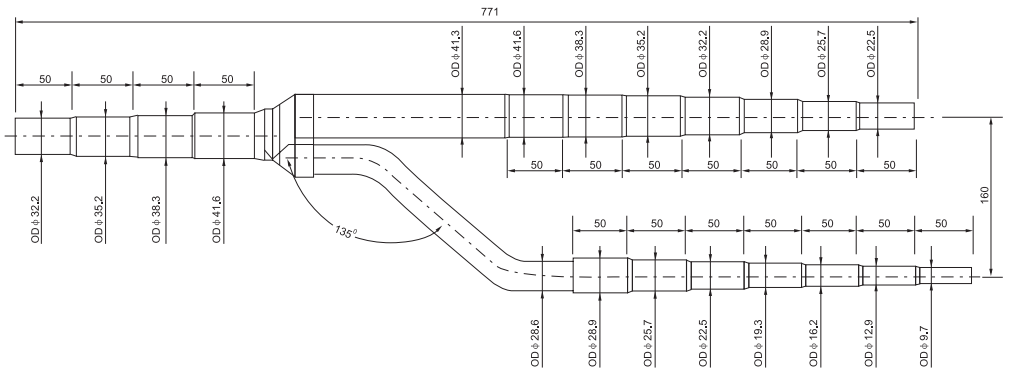
1.8.1 "Y" Type



Unit: mm

Refnet model	Length(mm)				Diameter Φ(mm)				Diameter Φ(mm)					Diameter Φ(mm)				
	A	B	C	D	E(outer diameter	F	G	H	I(outer diameter	J	K	L	M	N(outer diameter	O	P	Q	R
MDS-Y1	553	172	293	120	28.6	28.9	25.7	22.5	28.6	28.9	25.7	22.5	19.3	22.2	19.3	16.1	12.9	9.7
MDS-Y2	420	142	223	80	15.88	16.1	12.9	9.7	12.7	12.9	9.7	6.5		12.7	12.9	9.7	6.5	
MDS-Y3	420	142	223	80	15.88	16.1	12.9	9.7	12.7	12.9	9.7	6.5		15.88	16.1	12.9	9.7	
MDS-Y4	493	142	223	80	22.2	22.5	19.3	16.1	19.1	19.3	16.1	12.9	9.7	19.1	19.3	16.1	12.9	

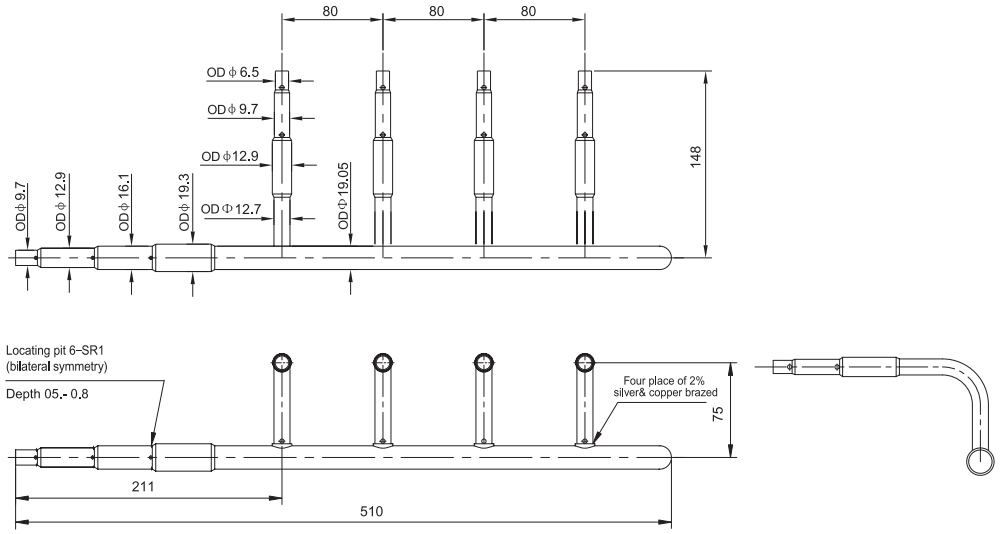
Type: MDS-Y5



Unit: mm

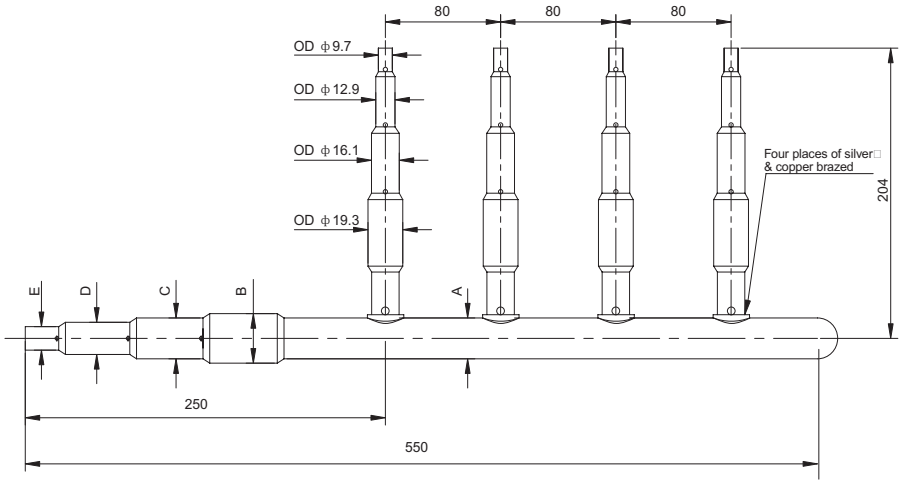
1.8.2 “C” Type

Type: MDS-C1



Unit: mm

Type: MDS-C2/C3

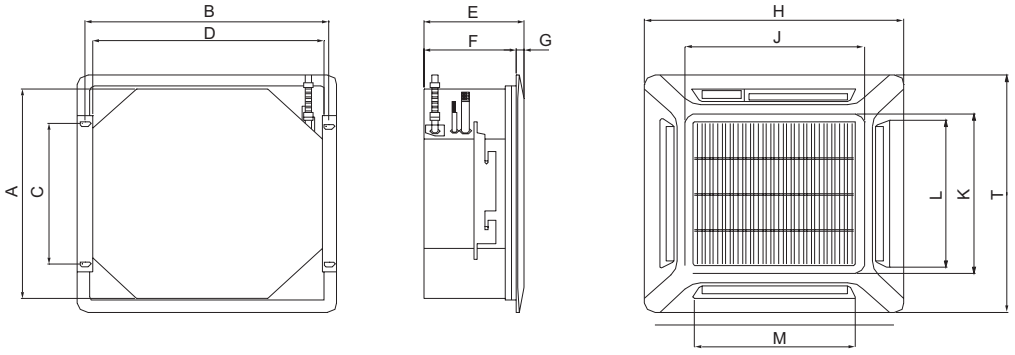


Refnet joint type	Refnet joint type φ(mm)				
	A(outer diameter)	B	C	D	E
MDS-C2	28.6	28.9	25.7	22.5	19.5
MDS-C3	25.4	25.7	22.5	19.3	16.1

Unit: mm

1.9 Outline of Indoor Units

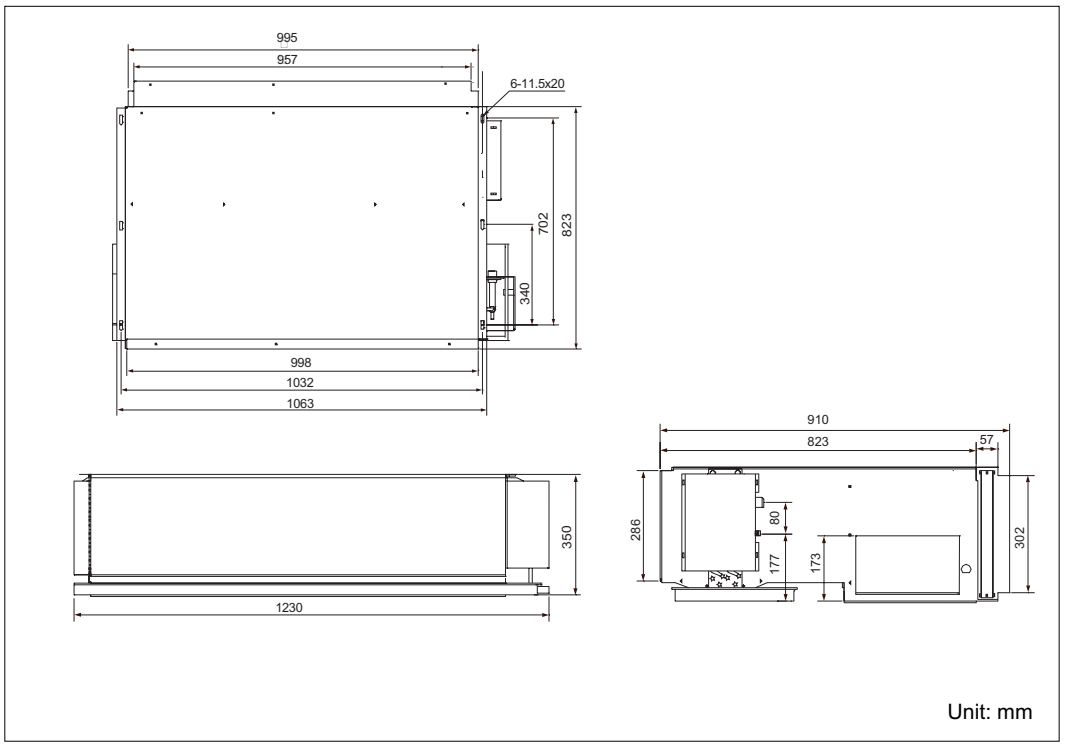
1.9.1 MCK010 ~ 050T



Unit: mm

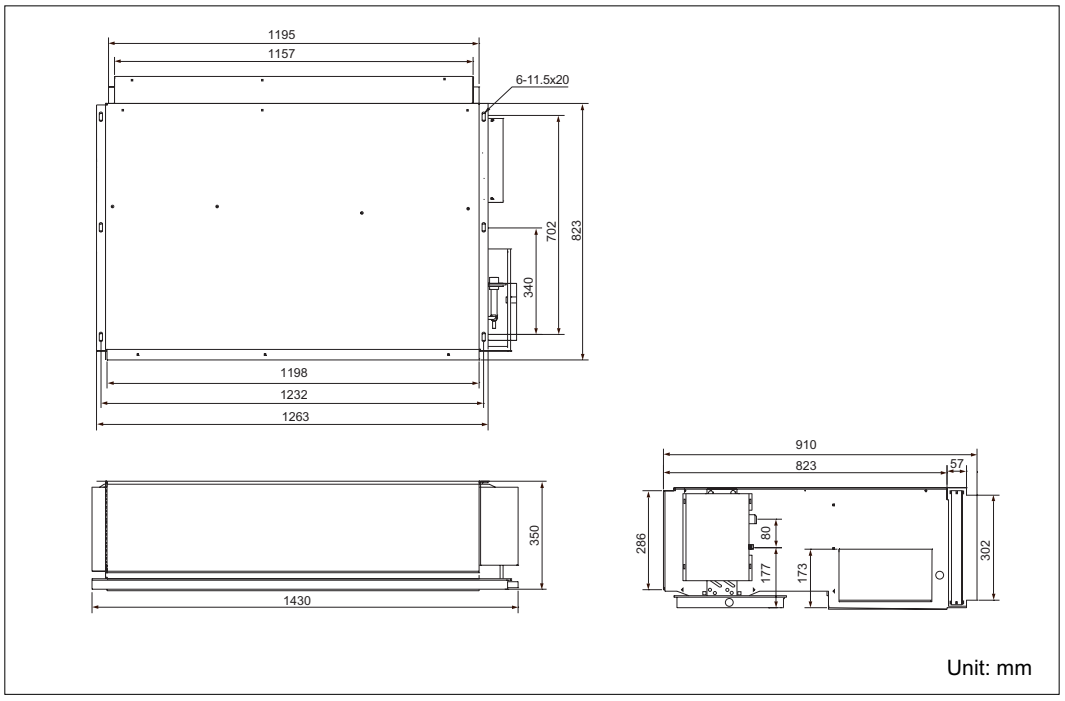
Model	A	B	C	D	E	F	G	H	I	J	K	L	M
MCK010 ~ 020T	820	875	548	820	278	250	28	930	930	642	622	555	555
MCK025 ~ 050T	820	875	548	820	363	335	28	930	930	642	622	555	555

1.9.2 MDB050T



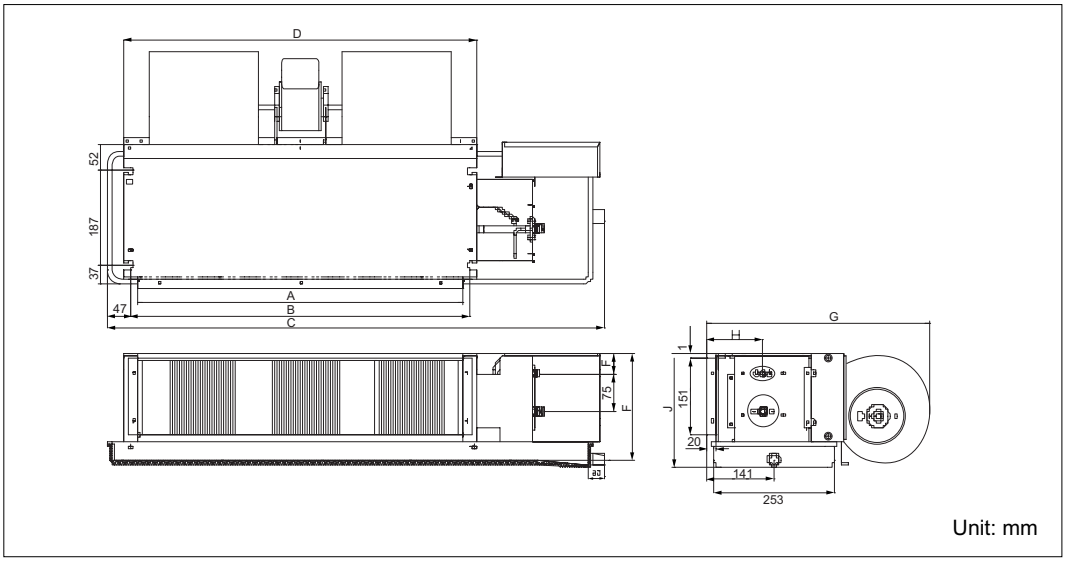
Unit: mm

1.9.3 MDB060T



Unit: mm

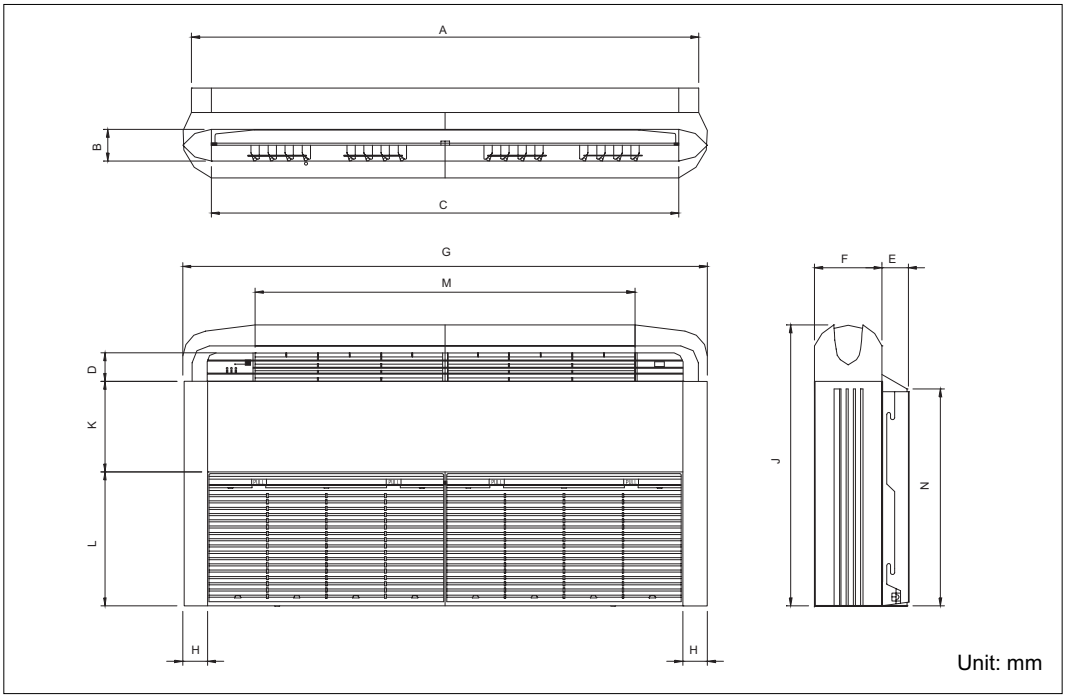
1.9.4 MCC008、010、015、018、020、025、030、040、050、060T



Unit: mm

Model	A	B	C	D	E	F	G	H	I	J	No.of fans
MCC008T	690	722	1054	751	39	210	469	118	9	220	2
MCC010T	690	722	1054	751	39	210	469	118	9	220	2
MCC015T	690	722	1054	751	39	210	469	118	9	220	2
MCC018T	950	981	1314	1005	32	248	490	81	14	251	2
MCC020T	950	981	1314	1005	32	248	490	81	14	251	2
MCC025T	950	981	1314	1005	32	248	490	81	14	251	2
MCC030T	950	981	1314	1005	32	248	490	81	14	251	2
MCC040T	1300	1331	1664	1355	32	248	490	81	14	251	3
MCC050T	1300	1331	1664	1355	32	248	490	81	14	251	3
MCC060T	1560	1591	1924	1615	32	248	490	81	14	251	4

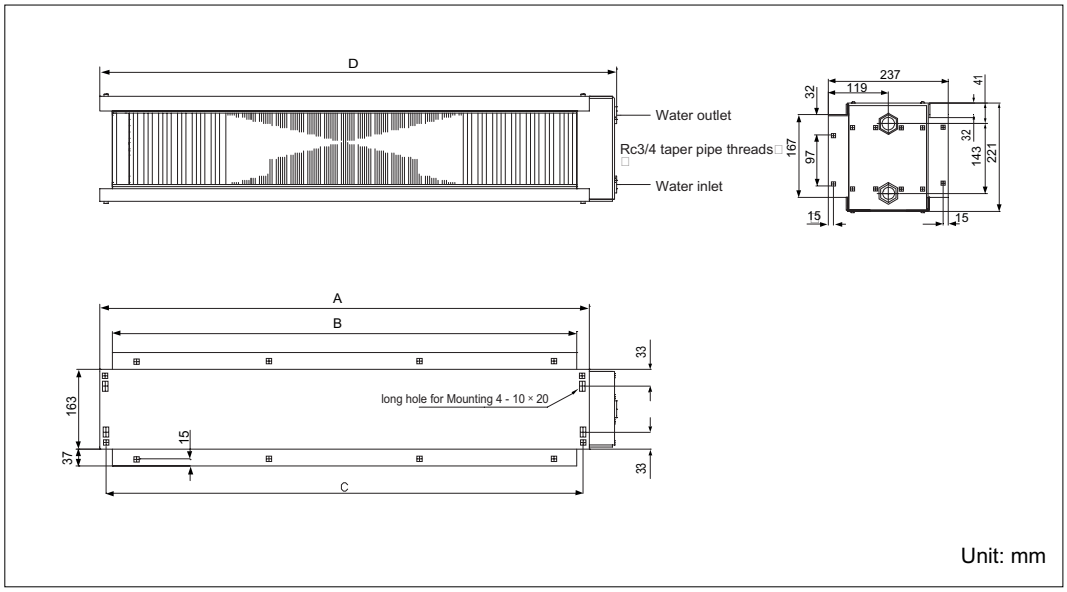
1.9.5 MCM020T、MCM030T、MCM050T



Unit: mm

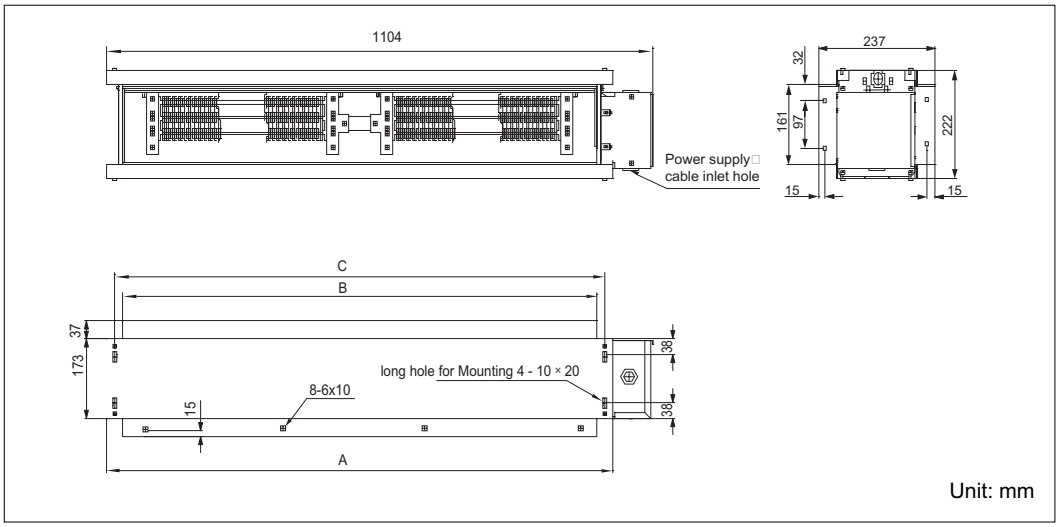
Model	A	B	C	D	E	F	G	H	J	K	L	M	N
MCM020T	1174	75	1082	68	58	156	1214	57	670	216	319	879	517
MCM030T	1174	75	1082	68	93	156	1214	57	670	216	319	879	517
MCM050T	1674	75	1582	68	93	156	1714	57	670	216	319	1379	517

1.9.6 Auxiliary Heating Coil



Model	A	B	C	D
HWT08-15	762	704	732	818
HWT18-30	1022	964	992	1078
HWT40-50	1372	1314	1342	1438
HWT60	1632	1574	1602	1688

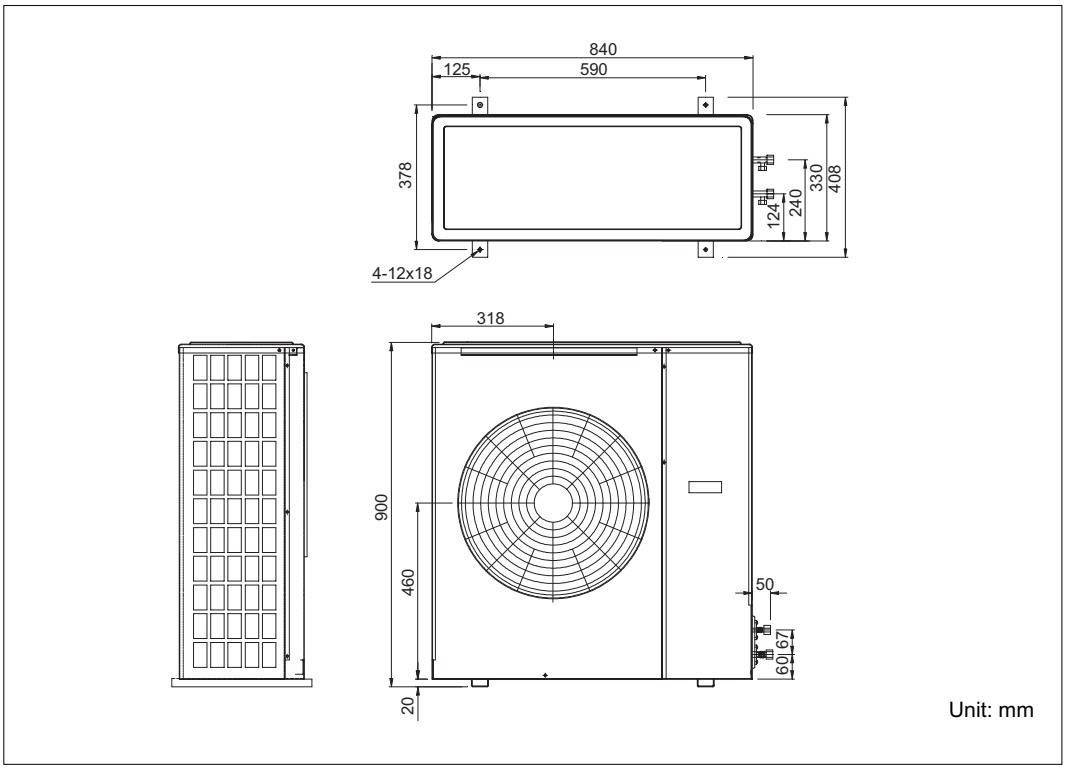
1.9.7 Auxiliary Electric Heating Box



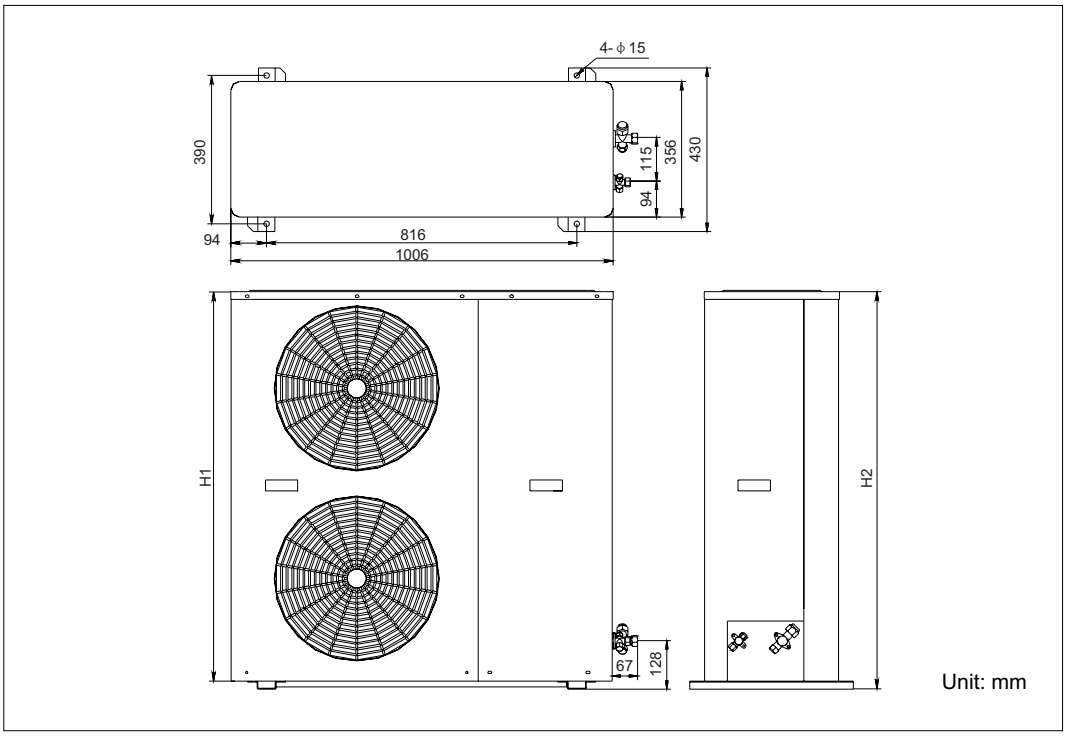
Model	A	B	C	D
HDP1.2T08-15/HDP2.4T08-15	762	704	732	844
HDP2.4T18-30/HDP3.6T18-30	1022	964	992	1104
HDP2.4T40/HDP3.6T40/HDP4.8T40-50/HDP7.2T40-50	1372	1314	1342	1454
HDP5.4T60/HDP7.2T60/HDP10.8T60	1632	1574	1602	1714

1.10 Outline of Outdoor Units

1.10.1 MDS030A(R)

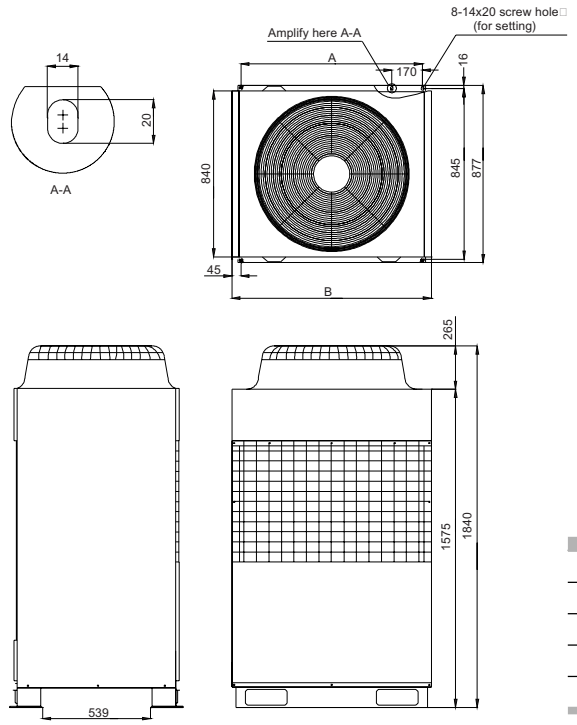


1.10.2 MDS040A(R)、MDS050A(R)、MDS060A(R)



Model	H1	H2
MDS040A(R)	1024	1044
MDS050A(R)	1024	1044
MDS060A(R)	1222	1242

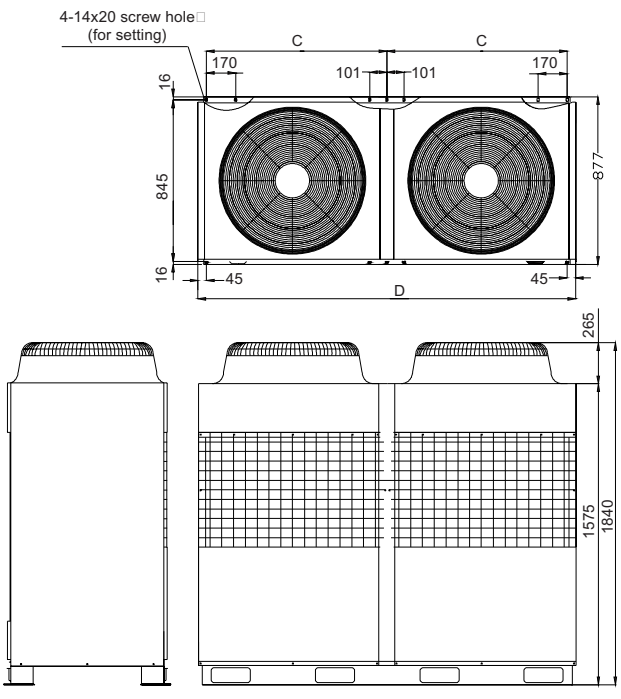
1.10.3 MDS080B(R)、MDS100B(R)、MDS120B(R)、MDS150B(R)



Unit: mm

Model	A	B
MDS080B(R)	900	990
MDS100B(R)	900	990
MDS120B(R)	900	990
MDS150B(R)	1200	1290

1.10.4 MDS180B(R)、MDS200B(R)、MDS220B(R)、MDS240B(R)



Unit: mm

Model	C	D
MDS180B(R)	950	1990
MDS200B(R)	950	1990
MDS220B(R)	950	1990
MDS240B(R)	950	1990

1.10.5 MDS260/280/300B(R) are Combined Units,Made up by a Master Unit and a Slave Unit

Model	Master unit+Slave unit	D
MDS260B(R)	MDS120B(R)+MDS150B(R)S	990+10+1290
MDS280B(R)	MDS150B(R)+MDS130B(R)S	1290+10+1290
MDS300B(R)	MDS150B(R)+MDS150B(R)S	1290+10+1290

CHAPTER 2

Unit Control

2.1 Introduction to the Controller

MDS system is controlled by the micro-computer. Several types of controller are available, including wireless controller, wire controller, wire controller + remote controller and central controller. One wireless controller can control one unit, one wire controller can control one unit or up to 48 units, while central controller can control up to 1536 units (32 groups).

2.2 Main Functions

- Cooling./heating/auto/air supply/dehumidity mode are available
- LCD wired controller and remote control are available, or remote control only
- Digital scroll compressor is used for load balancing to reduce the start/stop times of the constant-capacity compressor.
- Electronic expansion valve is used to control the refrigerant flow
- One outdoor unit can connect up to 48 indoor units
- Internetworking control is available
- Both the indoor and outdoor units have three-speed
- Timer for ON/OFF
- Energy saving can be setting when the unit is running in cooling or heating condition
- High/low pressure protection for the compressor
- Overload protection for the fan motor in indoor unit and outdoor unit
- Anti-icing function for the coil of indoor unit
- Function of auto restart after power
- Auto defrost and manual defrost can be set
- Auto check function for the sensor malfunction
- Overheat protection for the coil of indoor unit
- Three minutes delayed protection when auto restart after power failure
- Malfunction indicating
- Temperature unit can be ℃or °F.

2.3 Operation of the Controller

2.3.1 Main Features

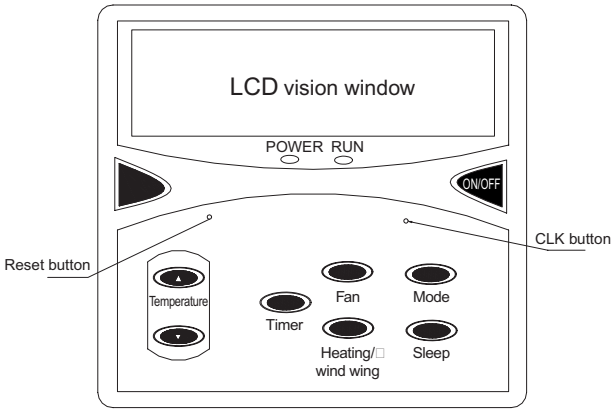
Both wired controller (using the key on board) and remote controller (equipped with infrared receiver to receive the order from the remote controller) to control the unit, and to perform such functions as parameter setting, working mode setting, status display and malfunction indicating.

Features:

- Working mode:
  Cooling only unit: Cooling/air supply/dehumidity;
  Heat pump unit: Cooling/heating/air supply/dehumidity.
- Indoor units have several speed: Auto/ Low/ Medium/ High.
- Temperature setting range: 16℃ /61 °F ~ 30℃ /78 °F.
- Timer for ON/OFF. Max. time is 24 hours.
- Sleep.
- Auxiliary electric heater & hot water heater control and the wind wing function.
- LCD indicator is available to slow the setting temperature, working mode, real time, week, and status of the units.

2.3.2 Operation of the Wired Controller

- Buttons on the wired controller panel



- Operation manual

  - The omitted parameter
    When the function of auto restart after power failure is not active: The unit is OFF and the temp is 24℃/75 °F, cooling mode, high speed, no sleep function, no defrost, no wind wing, no electric heater.
    When the function of auto restart after power failure is active: the unit is the same as that before power failure.

  - Temp setting
    In normal mode condition, press "△" or "▽" to increase or reduce the temp by 1℃ or 1 °F. Temp adjustment range is 16-30℃ (or 61-86 °F). When the temp reach the upper limit or floor limit, the "△" or "▽" is invalid.

● Temp unit setting

There is a switch on the PCB board. When switch OP1 is ON, the unit is ℃; when it is OFF, the unit is °F.Alternate method is as follows: Press "fan" key and last for 5 seconds in the normal condition, the temp unit setting will be successful and there will be a buzzer to indicate.

● Real time setting

Press "CLK" to enter, the first time is week setting and indicate its icon, press "△" or "▽" to adjust the week from Sunday to Saturday. If there is no press on any key within 5 seconds, the unit will exit from the real time setting and back to the normal status. If you press "CLK" one more time within 5 seconds, the setting will be OK and it is the real time setting icon, as well as the light is twinkling. At this time, you can press "△" to increase the hour while press "▽" to increase the minute. If there is no press on any key within 5 seconds, the unit will exit from the real time setting and the time setting is valid. If you want to confirm the setting, you need to press "CLK" one more time. If any other key is press during the setting, the system will exit and back to the normal condition without saving

● Mode setting

When the unit is in off status, you can press "Mode" to enter and the current mode is twinkling. The mode will be changed when you press "Mode" one more time. The mode changing sequence is as follows:

When outdoor unit is OFF:

Heat pump: Cooling ,heating, air supply, dehumidifying, cooling

Cooling only: Cooling, air supply, dehumidifying, cooling

When outdoor is in cooling condition: Cooling, air supply, dehumidifying, cooling

When outdoor is in heating condition: Heating, air supply, heating

Note: In one system, the follows are not available: some units are in cooling condition while the other is in heating condition.

● Air flow setting

In normal condition, when the "Fan" key is pressed, the air flow will be changed as the following sequence: High, Auto, Low, Medium, High. When the unit is in air supply condition, there is no "Auto" function.

● Sleep

Press "Sleep" key, the icon will be ON or OFF.

● Setting of auto restart after power failure

There is a switch on the PCB board to fulfill the setting of auto restart after power failure. When OP2 is set "ON", then this function is active and the icon is shown on the LCD.

● Manual defrost

When the unit runs in heating mode condition, press "Heater" key and last for 5 seconds, you will enter "manual defrost mode", and "Defrost mode" is shown on the LCD. When it is auto defrost, "Defrost mode" is also shown on the LCD and it will disappear when the defrost finishes.

● Timer setting

Press “Timer” to enter timer setting (When the unit is ON, it can only be set to OFF; When the unit isOFF , it can only be set to ON) and last timer will be shown on the LCD. If there is no press on any key within 5 seconds, it will exit and cancel the timer setting at the same time. During this 5 seconds, press “△” to increase the hour while press “▽” to increase the minutes, please press “Timer” within 5 seconds to confirm the setting.When it is timer setting, the system will show the real time and the setting time on the LCD. When the setting time is reaching, the unit will be Power on or off, and the timer setting function is cancel. When you need the timer setting function, you need to reset.

● Keyboard locked and unlocked setting

Press “Sleep” and last for 5 seconds, the keyboard will be alter between locked and unlocked. When it is locked, a icon will be shown on the LCD. During the locked stage, only the ON/OFF keyboard is valid.

● ON/OFF setting

Press “ON/OFF” keyboard, the unit will be alter between ON and OFF, and a relative icon will be shown on the LCD.

● Reset

This keyboard is used to restart the unit because of some uncertain factors.

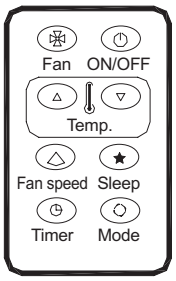
● Remote controller

The remote controller can be used with the wire controller and it has the same keyboard as the wire controller, But the keyboard “Fan”,“Sleep”,“ Heater” do not have the second function.

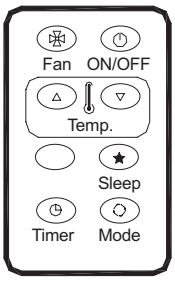
● Central control

The units can be central controlled by the computer or centralized controller. When it is locked, the keyboard on the wire controller is invalid and the key icon is twinkling. It can only be unlocked by the computer or by the centralized controller. When it is central control, the wire controller can communicate with the computer and the centralized controller.

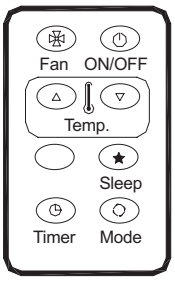
2.3.3 Wire Control Panel



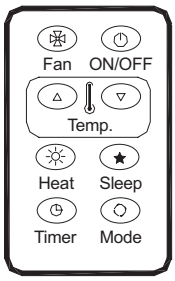
For three-speed unit with wind wing



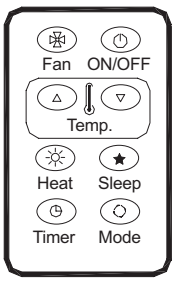
For the cooling and heat pump unit with three-speed



For the cooling and heat pump unit with single-speed

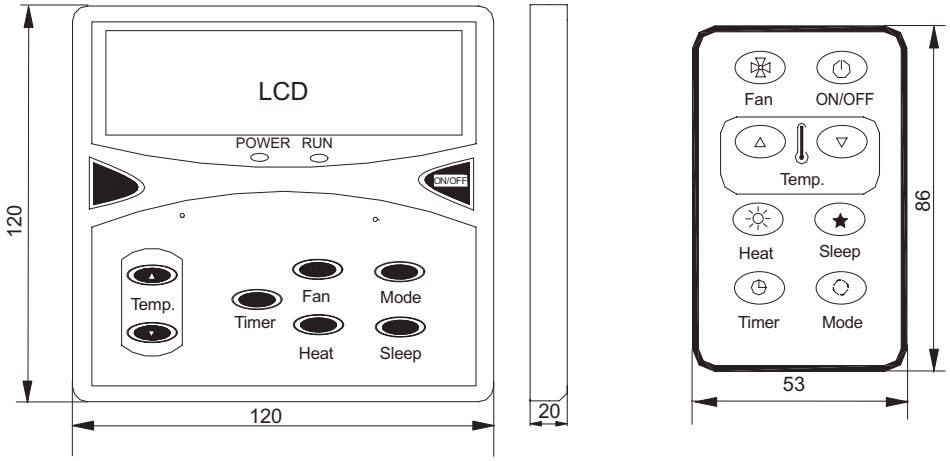


For three speed unit with auxiliary heater



For single speed unit with auxiliary heater

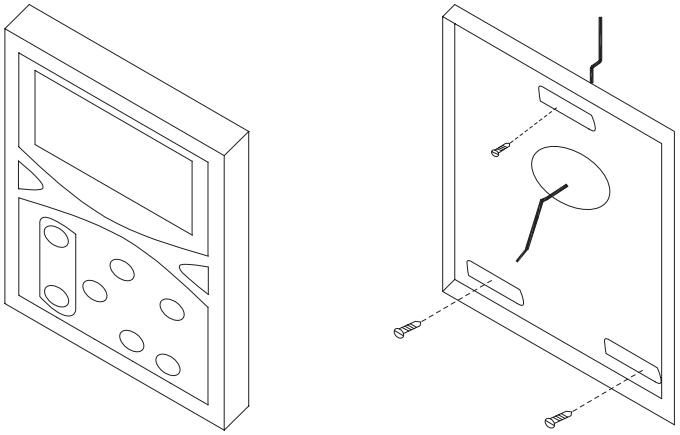
2.3.4 Outline and Dimension



Unit: mm

2.3.5 Installation Type

■ concealed installation



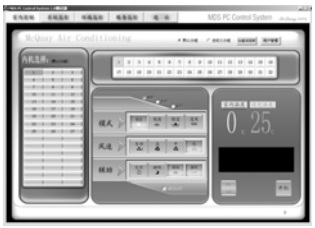
2.4 Software Management System

2.4.1 Real-time Monitor Software

■ System monitoring software: The real-time MDS unit monitoring software features powerful functions, including indoor monitoring, system monitoring, loop monitoring and service monitoring. With it, the user or service debugging personnel can view detailed unit parameters and have a deep understanding of the unit operation.

Main control functions:

Indoor monitoring



■ Set indoor unit mode/wind speed/auxiliary setting/temperature and ON/OFF. (You can select to operate on multiple units or multiple groups of units at the same time)

■ Both indoor and outdoor units can be set in different groups by self-defining. (The default group is set according to outdoor unit)

■ Alarm display and alarm information query. (you can choose outdoor unit No. or indoor unit No. to query the corresponding malfunction)

■ Set timer mode and indoor unit timer mode. (The timer mode can be set without limit and can be stored)

■ System monitoring

Display the model and status (such as alarm and timing) of all indoor units in the system

Introduction of the units

Indoor unit model	Icon				
	Stop:	Cooling	Heating	Dehumidity	Air vent
MCC					
MCK					
MCM					
MDB					

Indoor icon instruction

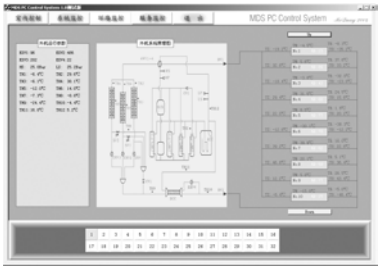
Small icon			
Introduction	The timer function has been started.	The line controller has been locked, we can not use it to control the indoor units at this time.	There is malfunction in this indoor unit, double-click the icon to know the details.

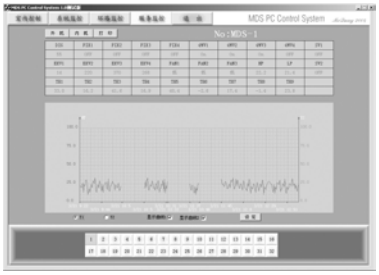
■ Loop monitoring*

Select and view the outdoor unit's system figure, operation parameters and the operation parameters of all indoor units.

■ Service monitoring*

Display the current operation parameters and history record curve of indoor/outdoor unit in the system.





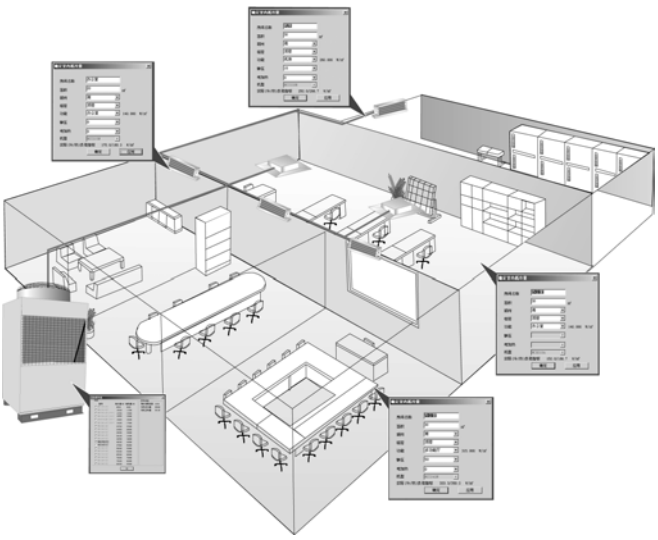
Note: Only the authorized maintenance personnel can operate on this interface

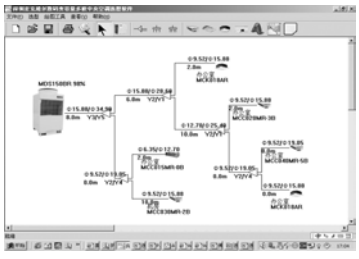
2.4.2 User-specific Biller

■ McQuay launches the user-specific billing software based on real-time monitoring software. With accurate flow control technology, this software makes calculation of power consumption more reasonable. It also allows users to group up to 1536 indoor units freely,and to implement electricity charging accurately in real-time. It features great flexibility,facilitating the change and statistic of grouped devices.This software also can be used to implement peak and trough power consumption billing by time. When a user owes fees,you can lock the user with the real-time monitoring software without affecting other users,and the management becomes easier according.

2.4.3 Unit Selection Software

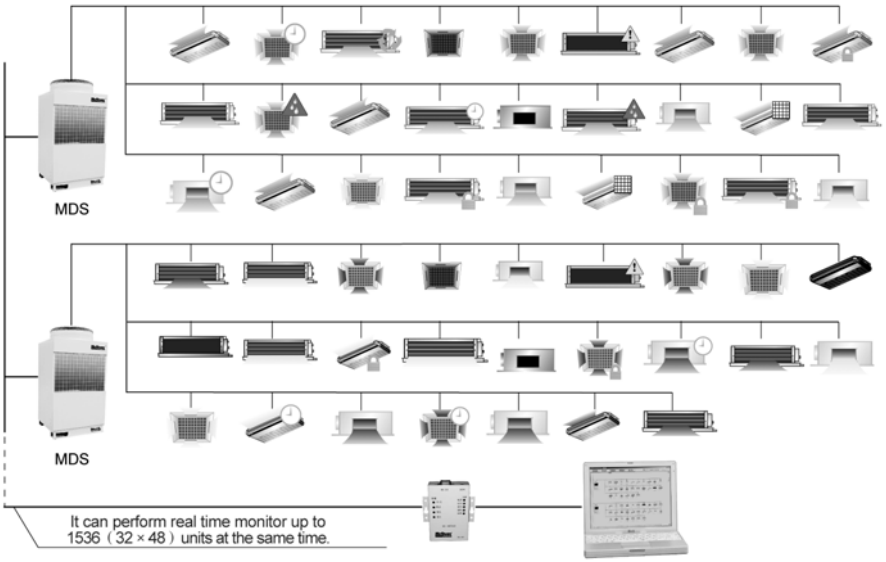
■ The unit selection software developed on the basis of unit model allows you to select and verify units as required by customers, and collect statistics on the model of indoor/outdoor units and the usage of refnet joints and copper pipes . In this way, the complicated unit design and model selection can be achieved easily.



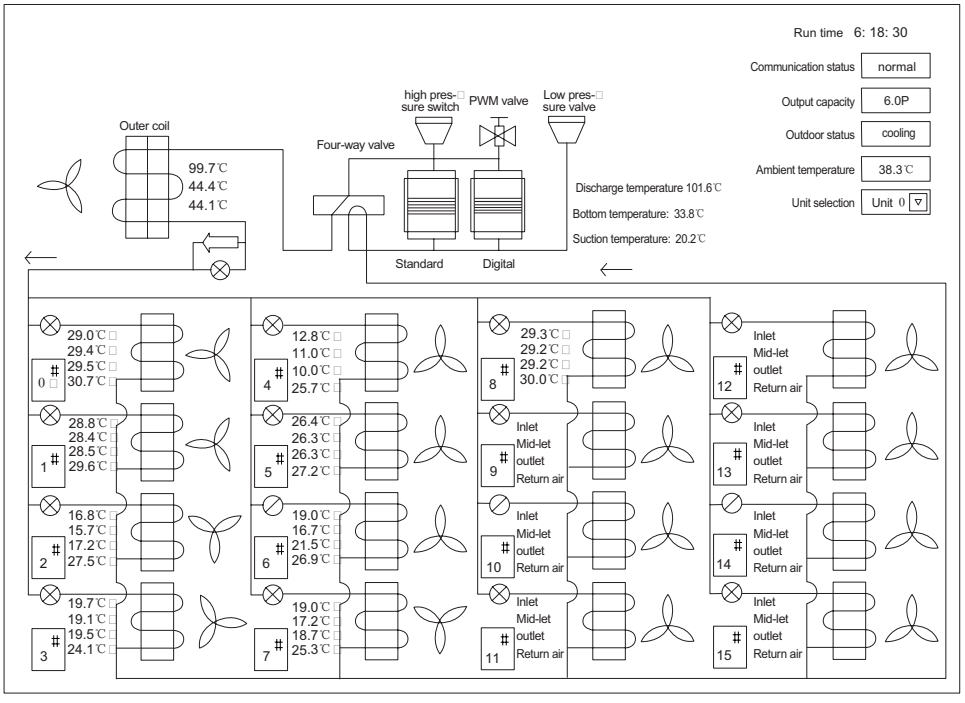


2.5 Network Central Control

■ One outdoor unit can be connected with maximum 48 indoor units.Control over up to 32 outdoor units can be realized by a centralized controller, and the monitoring software monitors up to 1536 (32x48) units simultaneously in real time.The cabling of outdoor and indoor units is simple.The MDS system features powerful fault display and query function greatly saving the maintenance time and costs.



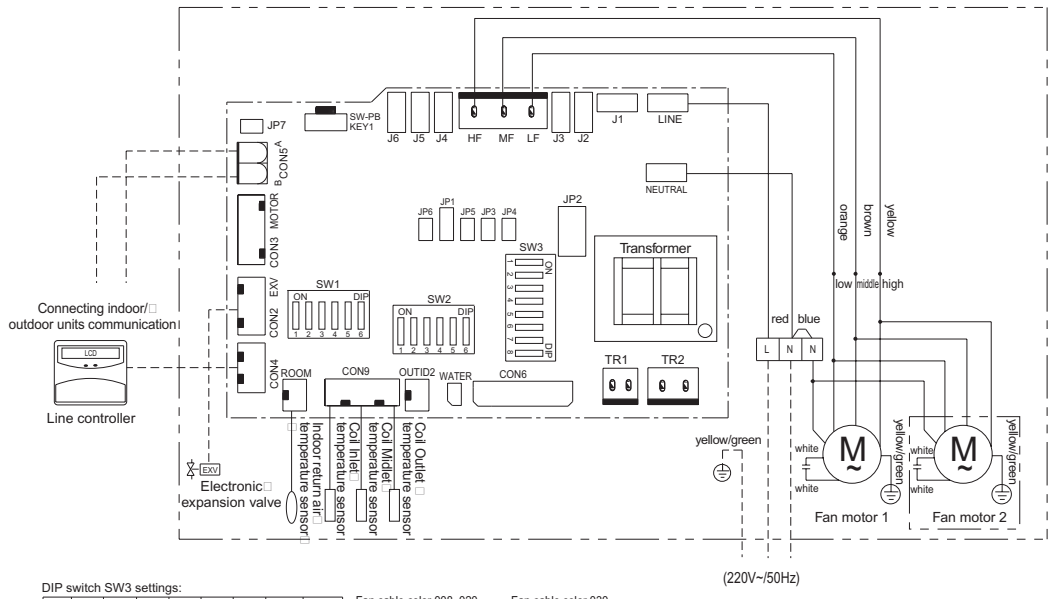
■ The real time monitor software of MDS is developed by McQuay and has huge performance. It can monitor each unit in the system and set the parameter in accordance with the requirement. It can also show the malfunction information, which can save the customer a lot of time and money.



2.6 Wiring Diagram

2.6.1 Wiring Diagram of Indoor Units

■ Model MCC008/010/015/018/020/025/030/040/050/060T



DIP switch SW3 settings:

Model	SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
008	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
010	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
015	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
018	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
020	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
025	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
030	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
040	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
050	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
060	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF

Fan cable color 008~020

Model	High	Middle	Low
50Pa	yellow	brown	orange
30Pa	brown	orange	red
15Pa	orange	red	green
0Pa	red	green	white

Fan cable color 030

Model	High	Middle	Low
70Pa	yellow	brown	orange
50Pa	brown	orange	red
30Pa	orange	red	green
15Pa	red	green	white

Fan cable color 025

Model	High	Middle	Low
50Pa	yellow	brown	green
30Pa	brown	red	green
15Pa	orange	green	white
0Pa	red	green	white

Fan cable color 040~060

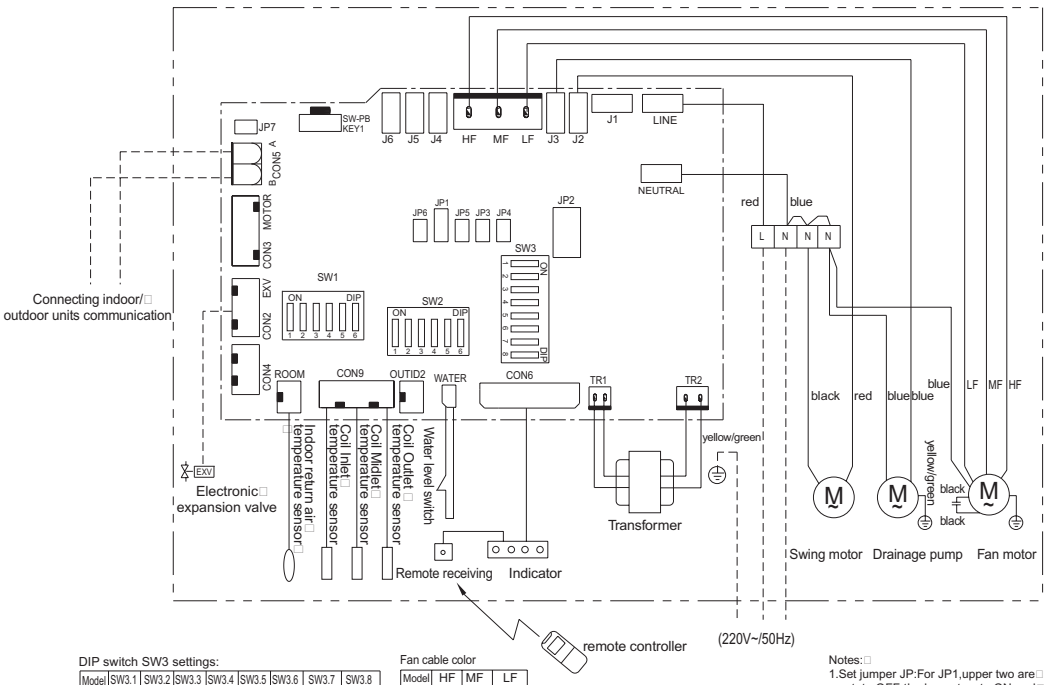
Model	High	Middle	Low
70Pa	yellow	brown	green
50Pa	brown	red	green
30Pa	orange	green	white
15Pa	red	green	white

Notes:□
□1. Set jumper JP:For JP1,upper two are set to OFF□ JP1
the lower two to ON,and other JPs are set to OFF.□
□2.Please shot water level switch WATER□
□3.SW2 sets this unit address□
□4.Fan motor 2 is not equipped with units under 040□
□5.Field wiring

DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

■ Model MCK010/015/018/020T



DIP switch SW3 settings:

Model	SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
010	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
015	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
018	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
020	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON

Fan cable color

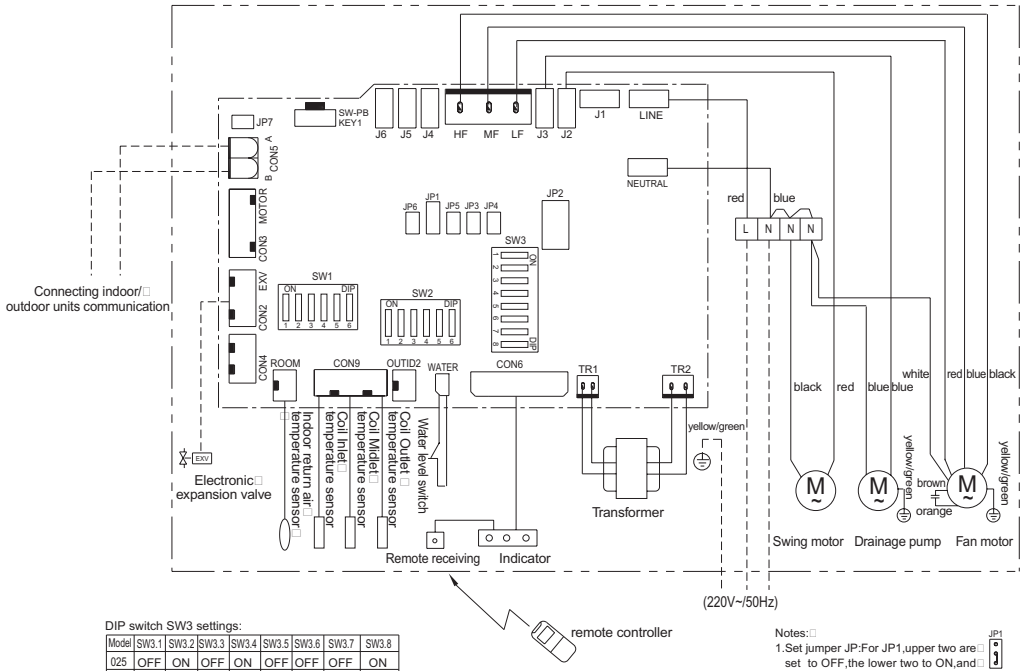
Model	HF	MF	LF
010	yellow	brown	orange
015	red	yellow	brown
018	yellow	brown	orange
020	yellow	brown	orange

DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

Notes:□
1.Set jumper JP:For JP1,upper two are□ JP1
set to OFF,the lower two to ON,and□
other JPs are set to OFF.□
2.SW2 sets this unit address.□
3.----------Field wiring□

■ Model MCK025/030/040/050T



DIP switch SW3 settings:

Model	SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
025	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
030	OFF	ON	ON	OFF	OFF	OFF	OFF	ON
040	OFF	ON	ON	ON	OFF	OFF	OFF	ON
050	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON

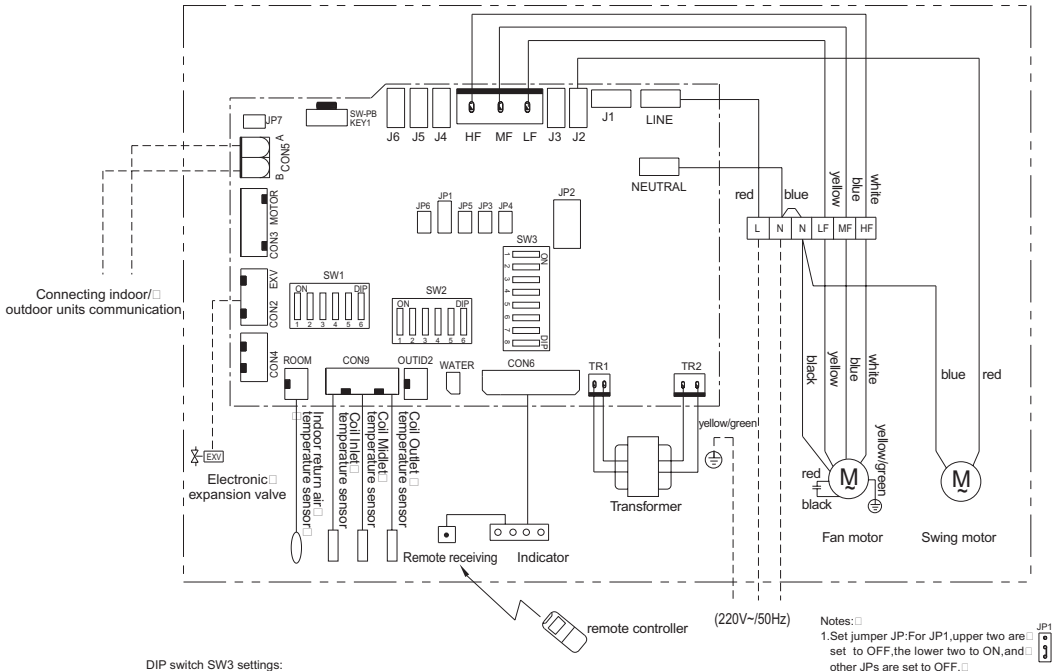
DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

Notes:□
1.Set jumper JP:For JP1,upper two are□ set to OFF,the lower two to ON,and□ other JPs are set to OFF.□
2.SW2 sets this unit address.□
3.----------Field wiring□

JP1

■ MCM020/030T



DIP switch SW3 settings:

Model	SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
020	OFF	ON	OFF	OFF	OFF	OFF	0N	OFF
030	OFF	ON	OFF	ON	OFF	OFF	0N	OFF

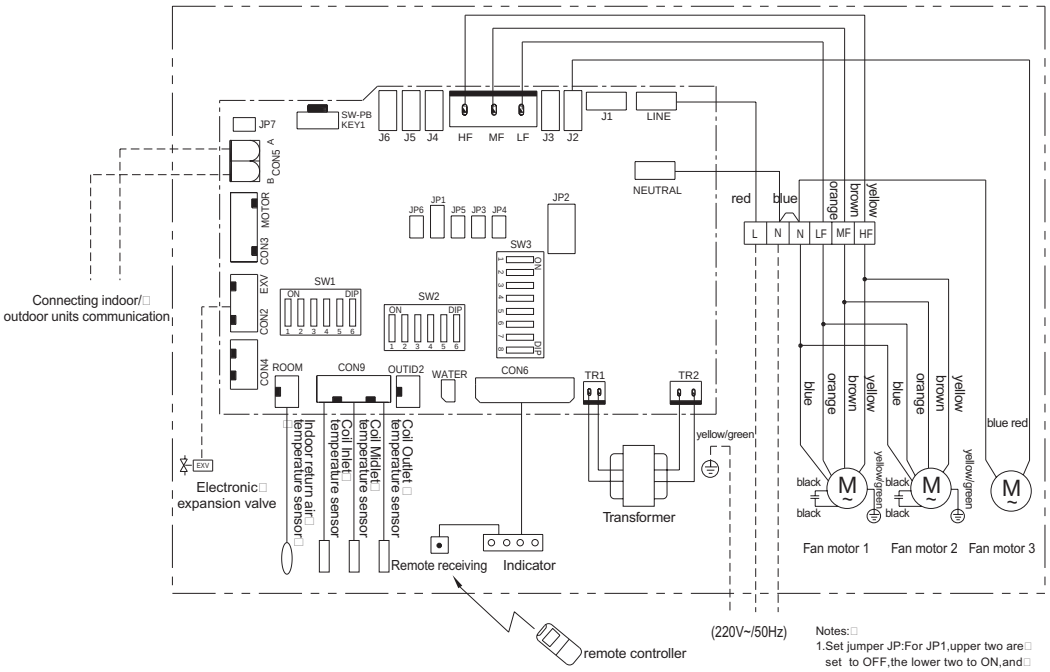
DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

Notes:□
1.Set jumper JP:For JP1,upper two are□ set to OFF,the lower two to ON,and□ other JPs are set to OFF.□
2.SW2 sets this unit address.□
3.Please shot water level switch WATER.□
4.----------Field wiring□

JP1

Model MCM050T



Notes:□
1.Set jumper JP:For JP1,upper two are□ set to OFF,the lower two to ON,and□ other JPs are set to OFF.□
2.SW2 sets this unit address.□
3.Please shot water level switch WATER.□
4.----------Field wiring□

JP1

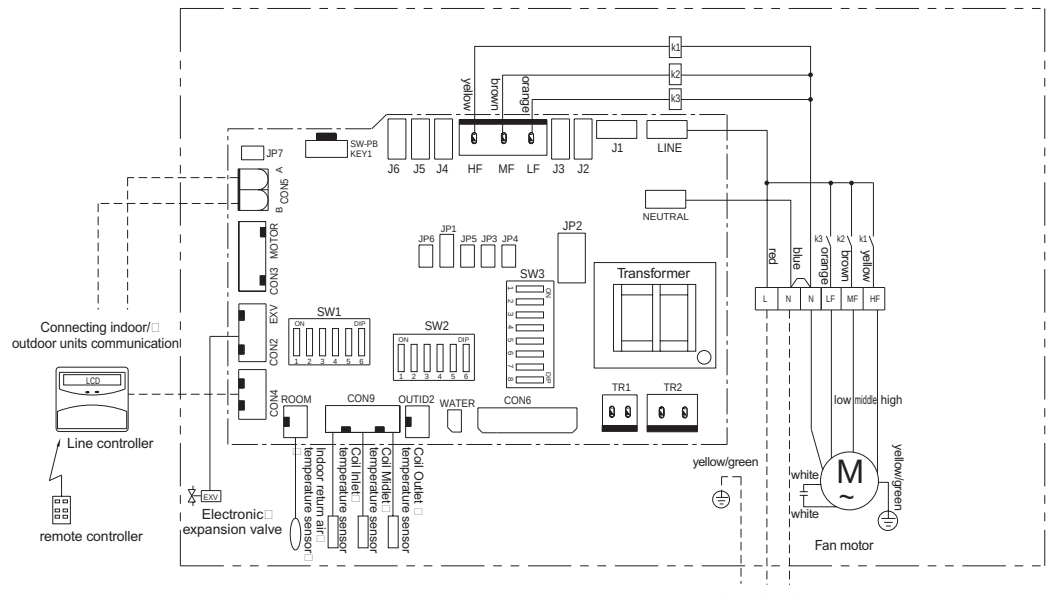
DIP switch SW3 settings:

SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
ON	OFF	OFF	OFF	OFF	OFF	0N	OFF

DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

Model MDB050/060T



Notes:□
1.Set jumper JP:For JP1,upper two are□ set to OFF,the lower two to ON,and□ other JPs are set to OFF.□
2.Please shot water level switch WATER.□
3.SW2 sets this unit address.□
4.----------Field wiring□

JP1

DIP switch SW3 settings:

Model	SW3.1	SW3.2	SW3.3	SW3.4	SW3.5	SW3.6	SW3.7	SW3.8
050	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF
060	ON	OFF	OFF	ON	OFF	ON	OFF	OFF

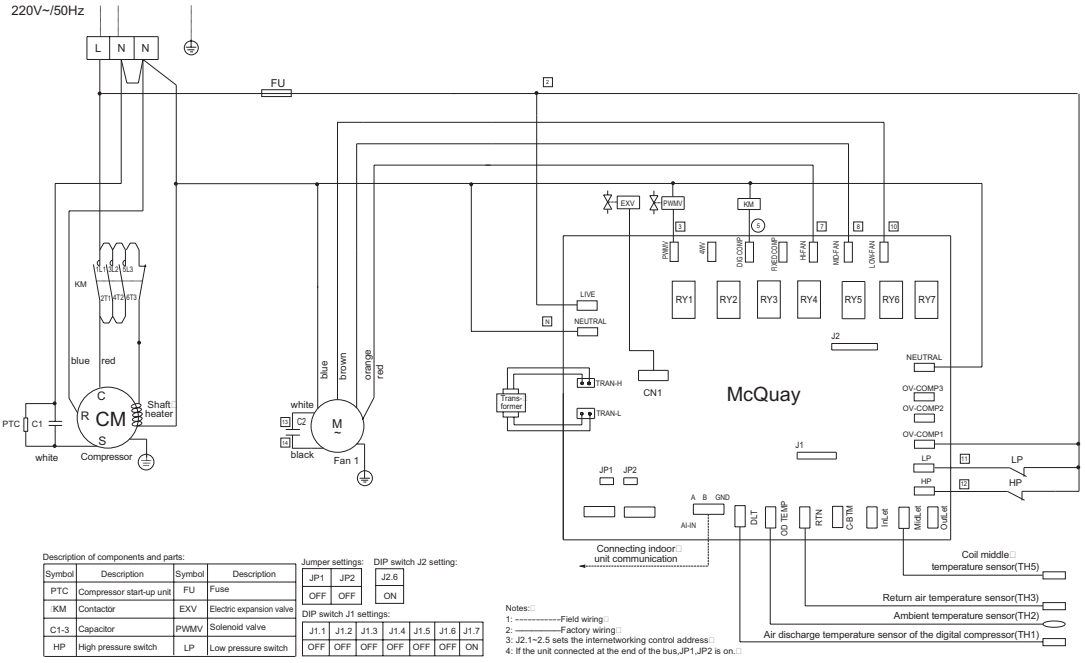
DIP switch SW1 settings:

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF	OFF	OFF	OFF	OFF	OFF

Model	High	Middle	Low
050	blue	black	brown
060	red	blue	black

2.6.2 Wiring Diagram of Outdoor Units

■ Model MDS030A



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
KM	Contactor	EXV	Electric expansion valve
C1-3	Capacitor	PWMV	Solenoid valve
HP	High pressure switch	LP	Low pressure switch

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

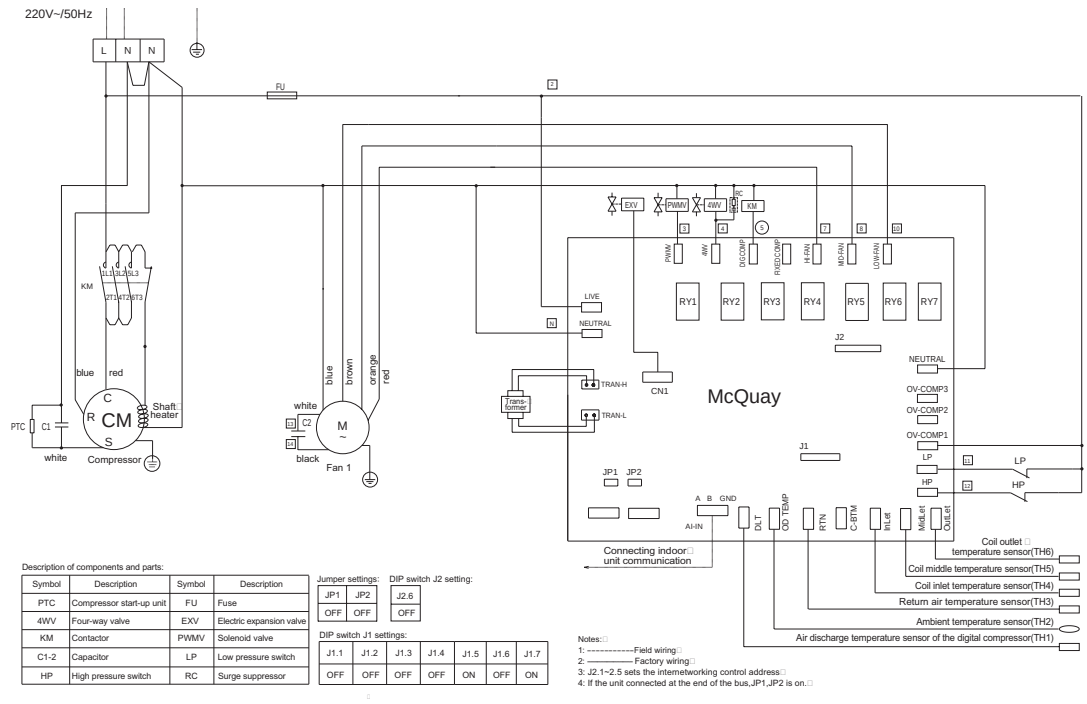
J2.6
ON

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	ON

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS030AR



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	LP	Low pressure switch
HP	High pressure switch	RC	Surge suppressor

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

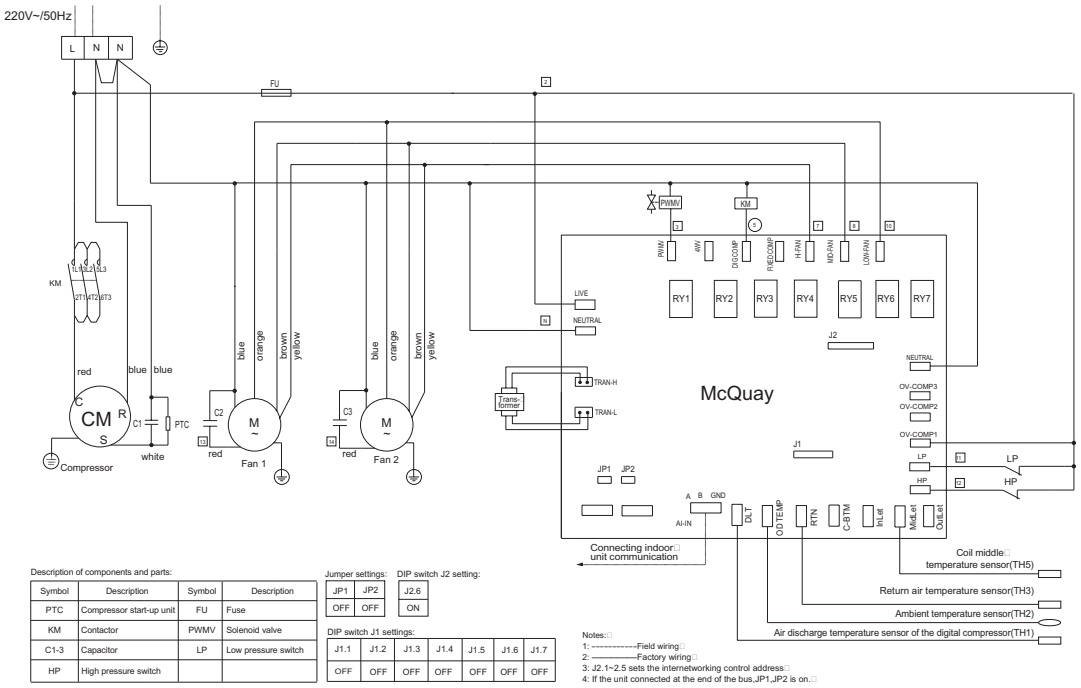
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	ON	OFF	ON

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS040A



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
KM	Contactor	PWMV	Solenoid valve
C1-3	Capacitor	LP	Low pressure switch
HP	High pressure switch		

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

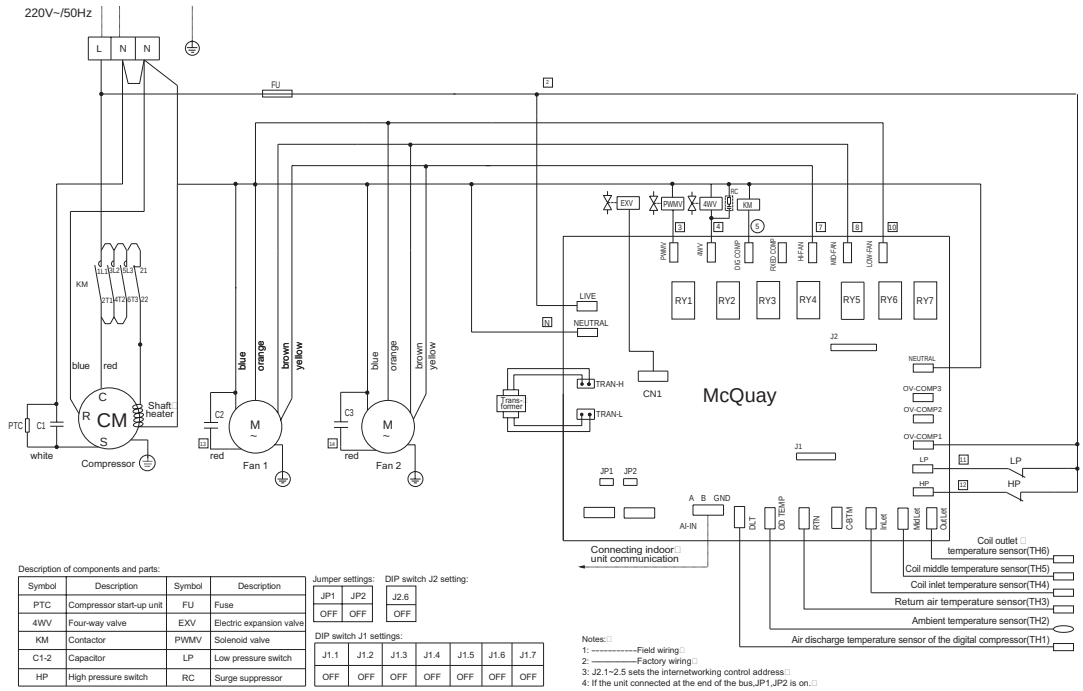
J2.6
ON

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS040AR



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	LP	Low pressure switch
HP	High pressure switch	RC	Surge suppressor

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

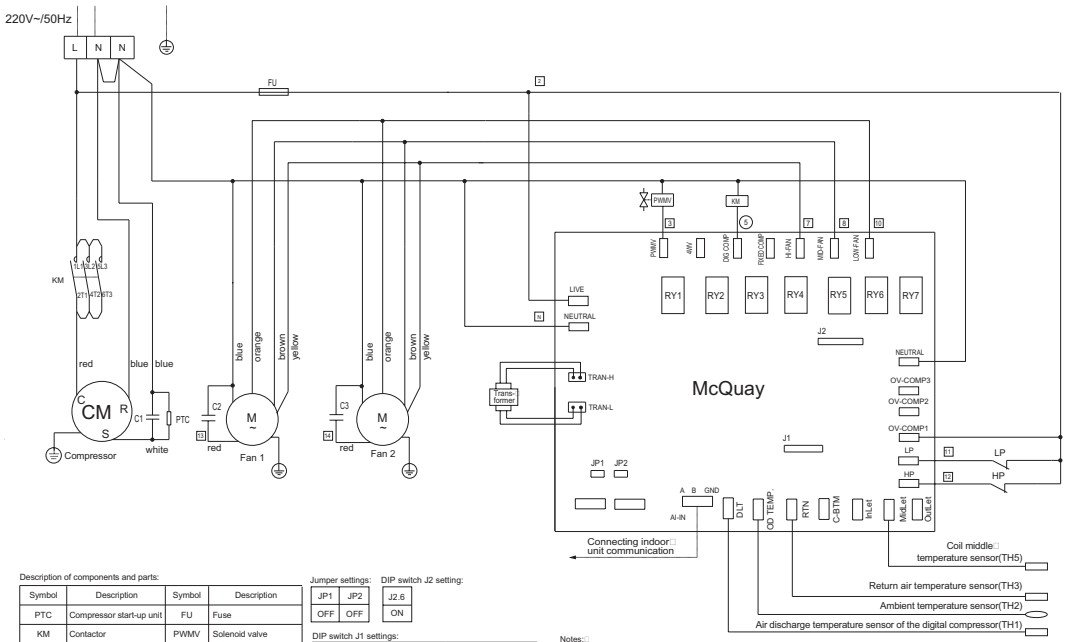
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS050A



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
KM	Contactor	PWMV	Solenoid valve
C1-3	Capacitor	LP	Low pressure switch
HP	High pressure switch		

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

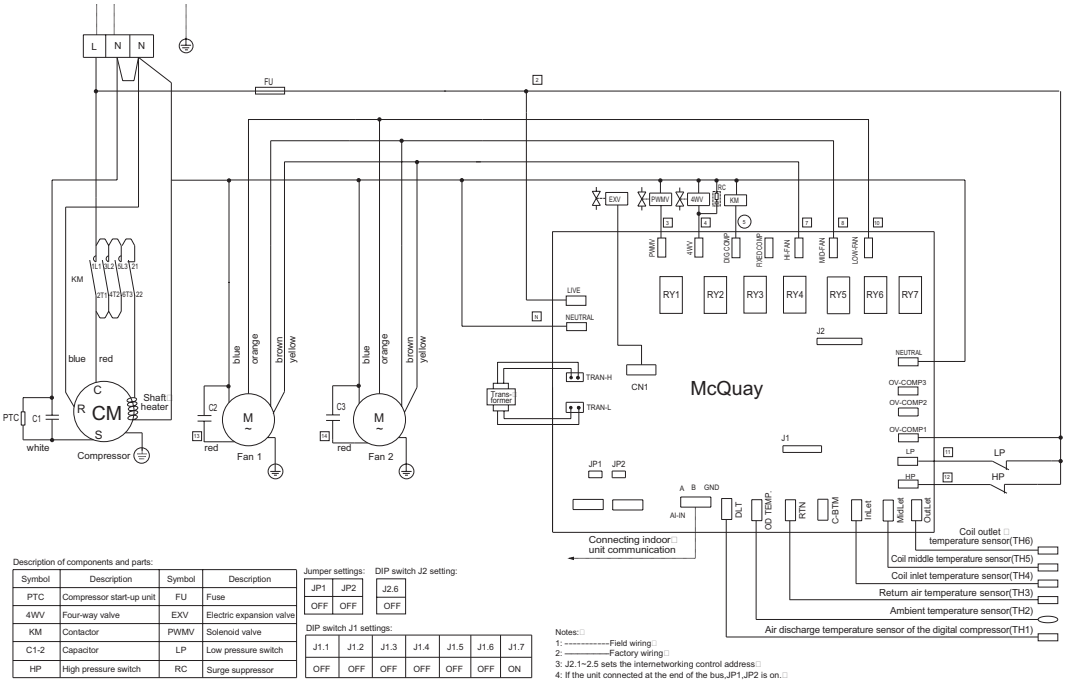
J2.6
ON

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	ON

Notes:□
1: ----------Field wiring□
2: ——————Factory wiring□
3: J2.1~2.5 sets the internetworking control address□
4: If the unit connected at the end of the bus,JP1,JP2 is on.□

■ Model MDS050AR(220V~/50Hz)



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	LP	Low pressure switch
HP	High pressure switch	RC	Surge suppressor

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

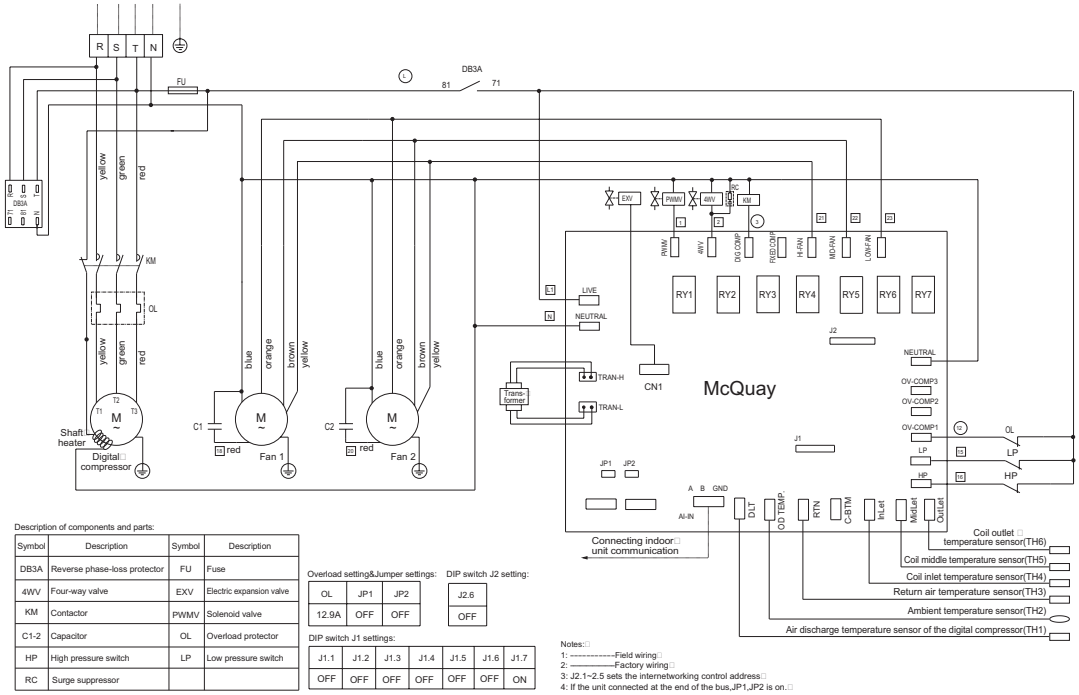
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	ON

Notes:□
1: ----------Field wiring□
2: ——————Factory wiring□
3: J2.1~2.5 sets the internetworking control address□
4: If the unit connected at the end of the bus,JP1,JP2 is on.□

■ Model MDS050AR(380V/3N~/50Hz)



Description of components and parts:

Symbol	Description	Symbol	Description
DB3A	Reverse phase-loss protector	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	OL	Overload protector
HP	High pressure switch	LP	Low pressure switch
RC	Surge suppressor		

Overload setting&Jumper settings:

OL	JP1	JP2
12.9A	OFF	OFF

DIP switch J2 setting:

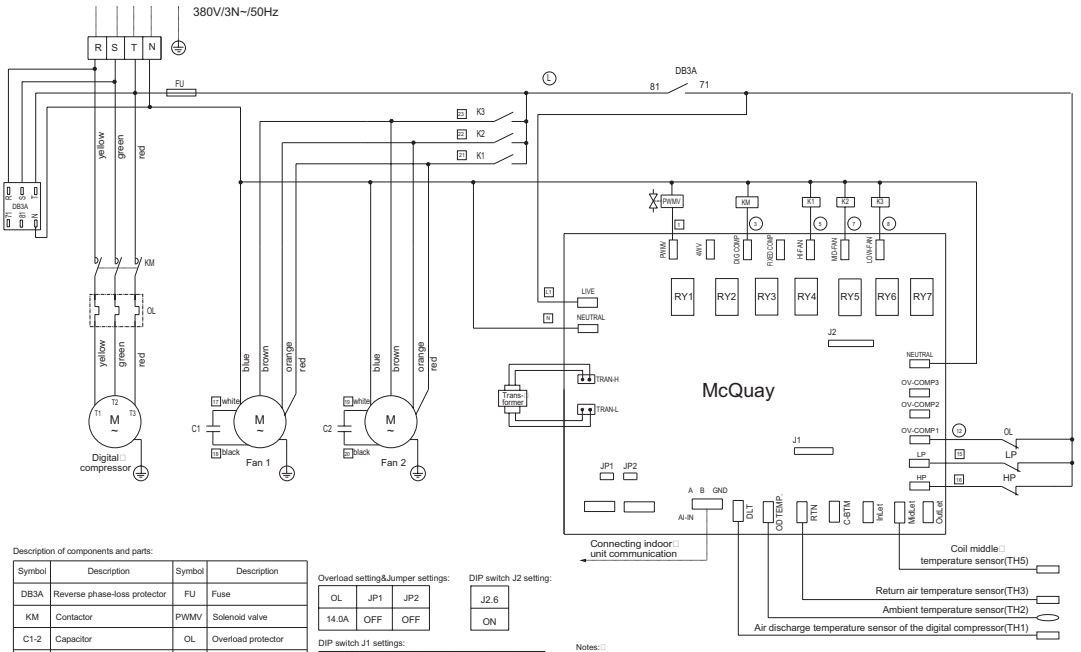
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	OFF	ON

Notes:
1: ----------Field wiring.
2: ----------Factory wiring.
3: J2.1~2.5 sets the internetworking control address.
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS060A



Description of components and parts:

Symbol	Description	Symbol	Description
DB3A	Reverse phase-loss protector	FU	Fuse
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	OL	Overload protector
K1-3	Relay	LP	Low pressure switch
HP	High pressure switch		

Overload setting&Jumper settings:

OL	JP1	JP2
14.0A	OFF	OFF

DIP switch J2 setting:

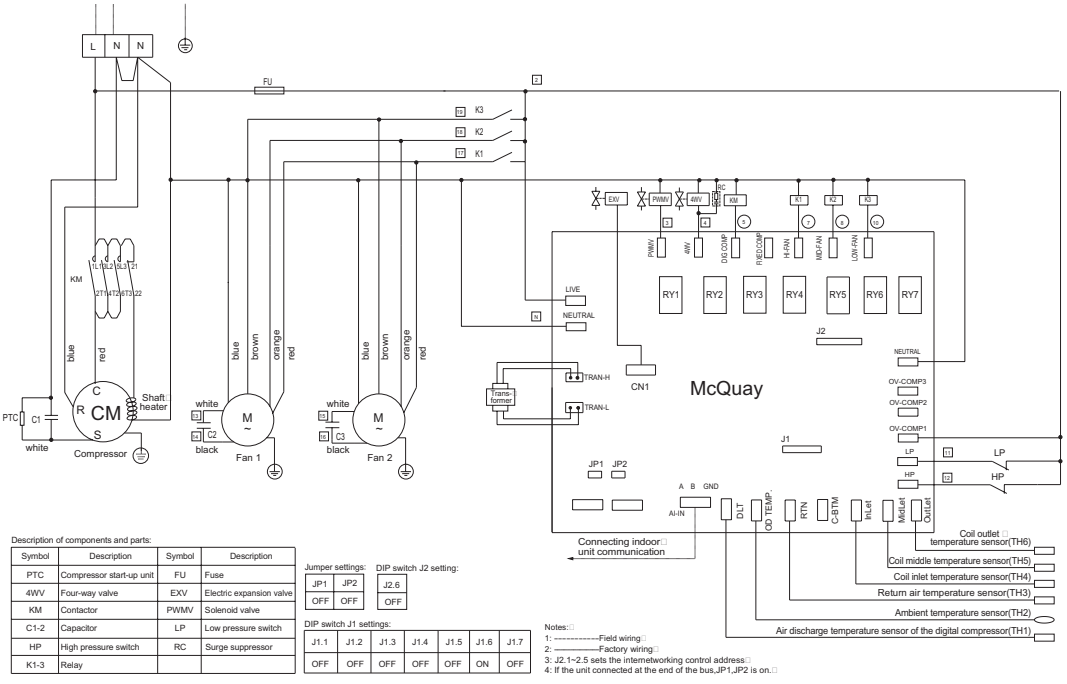
J2.6
ON

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	ON	OFF

Notes:
1: ----------Field wiring.
2: ----------Factory wiring.
3: J2.1~2.5 sets the internetworking control address.
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS060AR(220V~/50Hz)



Description of components and parts:

Symbol	Description	Symbol	Description
PTC	Compressor start-up unit	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	LP	Low pressure switch
HP	High pressure switch	RC	Surge suppressor
K1-3	Relay		

Jumper settings:

JP1	JP2
OFF	OFF

DIP switch J2 setting:

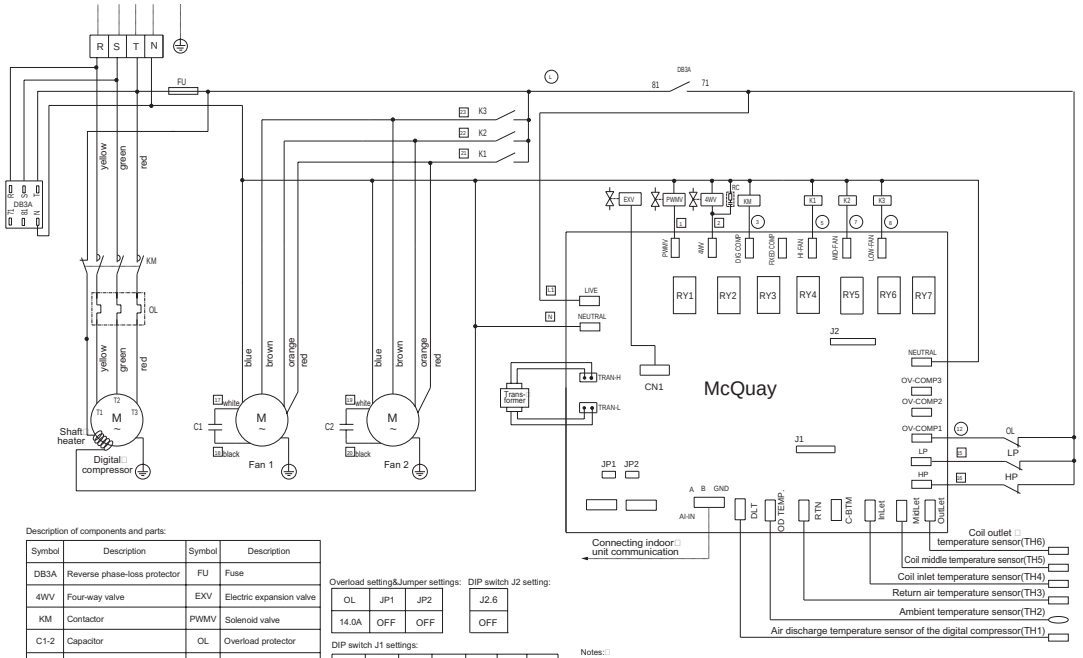
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	ON	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

■ Model MDS060AR(380V/3N~/50Hz)



Description of components and parts:

Symbol	Description	Symbol	Description
DB3A	Reverse phase-loss protector	FU	Fuse
4WV	Four-way valve	EXV	Electric expansion valve
KM	Contactor	PWMV	Solenoid valve
C1-2	Capacitor	OL	Overload protector
K1-3	Relay	LP	Low pressure switch
HP	High pressure switch	RC	Surge suppressor

Overload setting&Jumper settings:

OL	JP1	JP2
14.0A	OFF	OFF

DIP switch J2 setting:

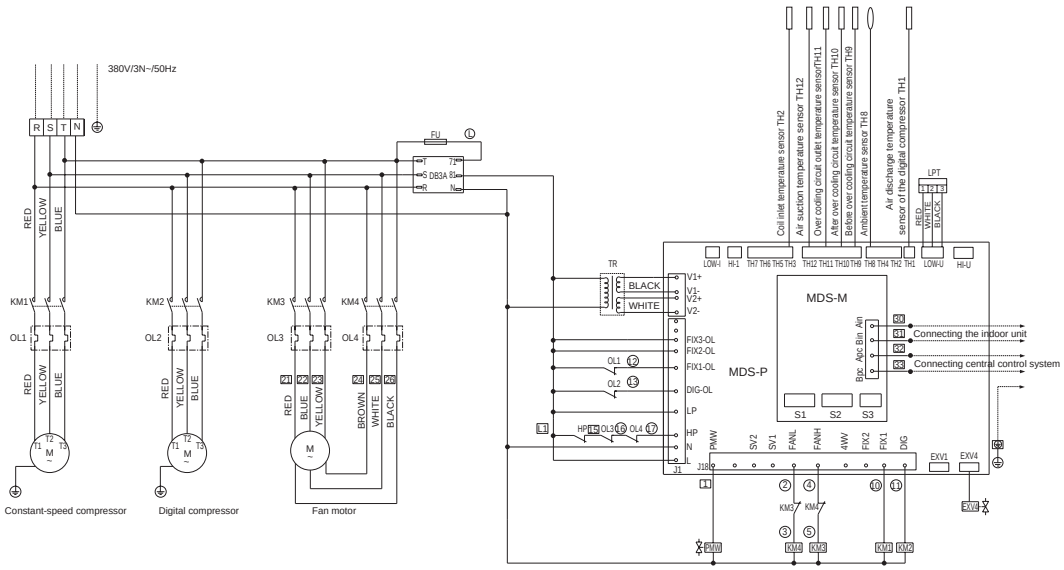
J2.6
OFF

DIP switch J1 settings:

J1.1	J1.2	J1.3	J1.4	J1.5	J1.6	J1.7
OFF	OFF	OFF	OFF	OFF	ON	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: J2.1~2.5 sets the internetworking control address
4: If the unit connected at the end of the bus,JP1,JP2 is on.

Model MDS080/100/120B



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
TR	Transformer		

Overload protection settings :

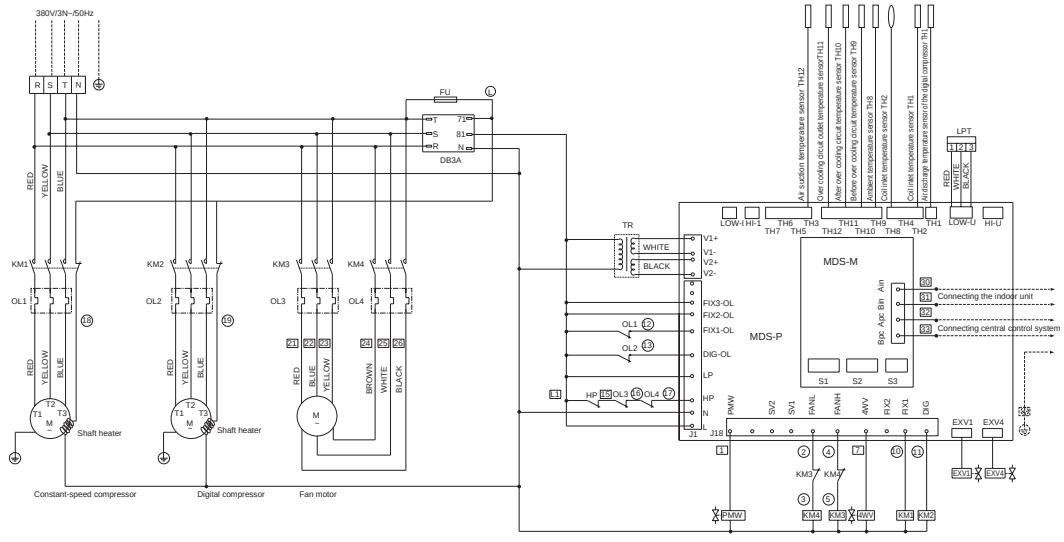
Model	OL1	OL2	OL3	OL4
MDS080B	11.6A	14.0A	1.9A	0.67A
MDS100B	14.0A	14.0A	1.9A	0.67A
MDS120B	14.0A	14.0A	3.3A	1.8A

DIP switch settings :

Model	S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS080B	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
MDS100B	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
MDS120B	OFF	ON	OFF	ON	OFF	OFF	ON	OFF

Notes:
1: ----------Field wiring.
2: ----------Factory wiring.
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

Model MDS080/100/120BR



Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve 1
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
TR	Transformer		

Overload protection settings :

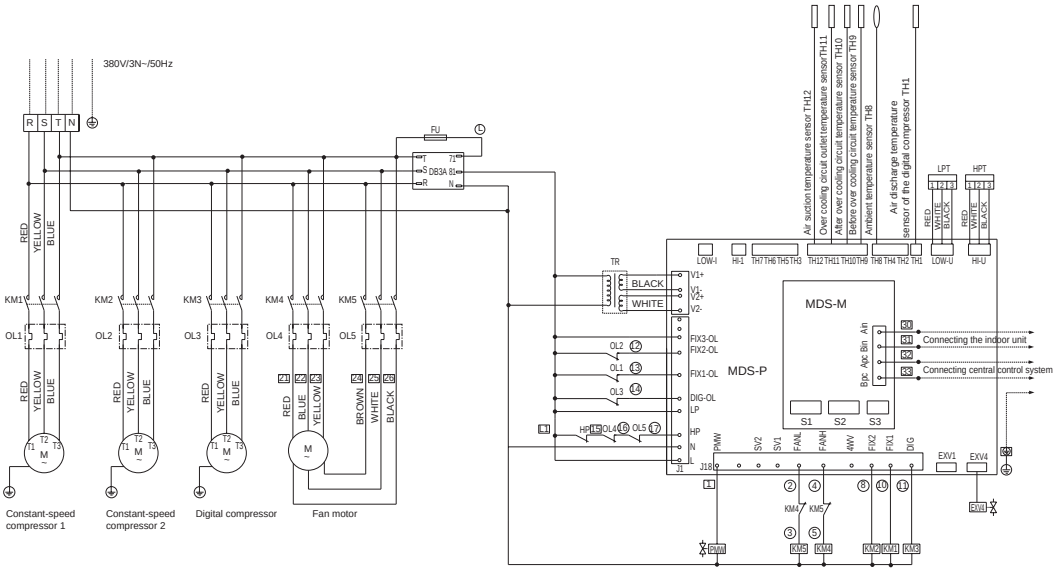
Model	OL1	OL2	OL3	OL4
MDS080BR	11.6A	14.0A	1.9A	0.67A
MDS100BR	14.0A	14.0A	1.9A	0.67A
MDS120BR	14.0A	14.0A	3.3A	1.8A

DIP switch settings :

Model	S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS080BR	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
MDS100BR	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF
MDS120BR	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF

Notes:
1: ----------Field wiring.
2: ----------Factory wiring.
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

■ Model MDS150B



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
HPT	High-pressure sensor		
TR	Transformer		

Overload protection settings :

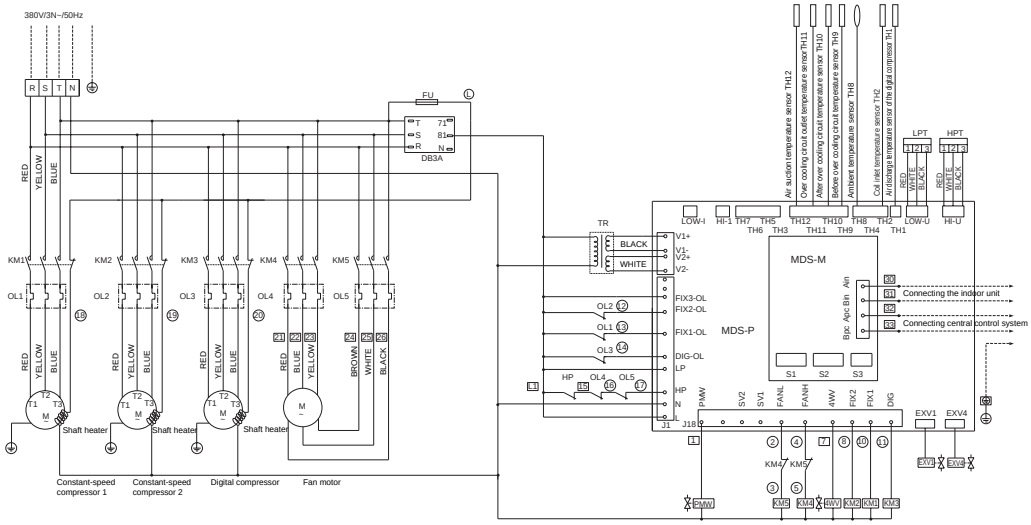
OL1	OL2	OL3	OL4	OL5
14.0	14.0	14.0	3.3A	1.8A

DIP switch settings :

S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
OFF	ON	OFF	ON	OFF	OFF	ON	ON

Notes:□
1: ----------Field wiring□
2: ————Factory wiring□
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the□ unit as a master/slave. For details of S2.4~S2.8.□

■ Model MDS150BR



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve 1
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
HPT	High-pressure sensor	TR	Transformer

Overload protection settings :

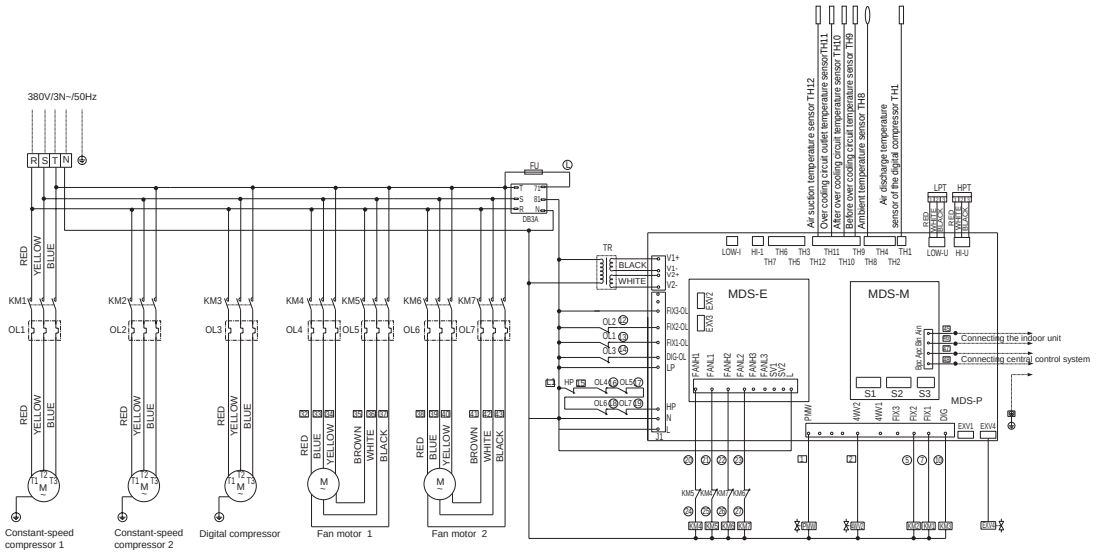
OL1	OL2	OL3	OL4	OL5
14.0	14.0	14.0	3.3A	1.8A

DIP switch settings :

S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
OFF	OFF	OFF	ON	OFF	OFF	ON	ON

Notes:□
1: ----------Field wiring□
2: ————Factory wiring□
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the□ unit as a master/slave. For details of S2.4~S2.8.□

Model MDS180B



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV4	Over cooling electronic expansion valve 4
KM	Contactor	PMW	Solenoid valve
HP	High-pressure switch	OL	Overload protector
LPT	Low -pressure sensor		
HPT	High-pressure sensor		
TR	Transformer		

Overload protection settings :

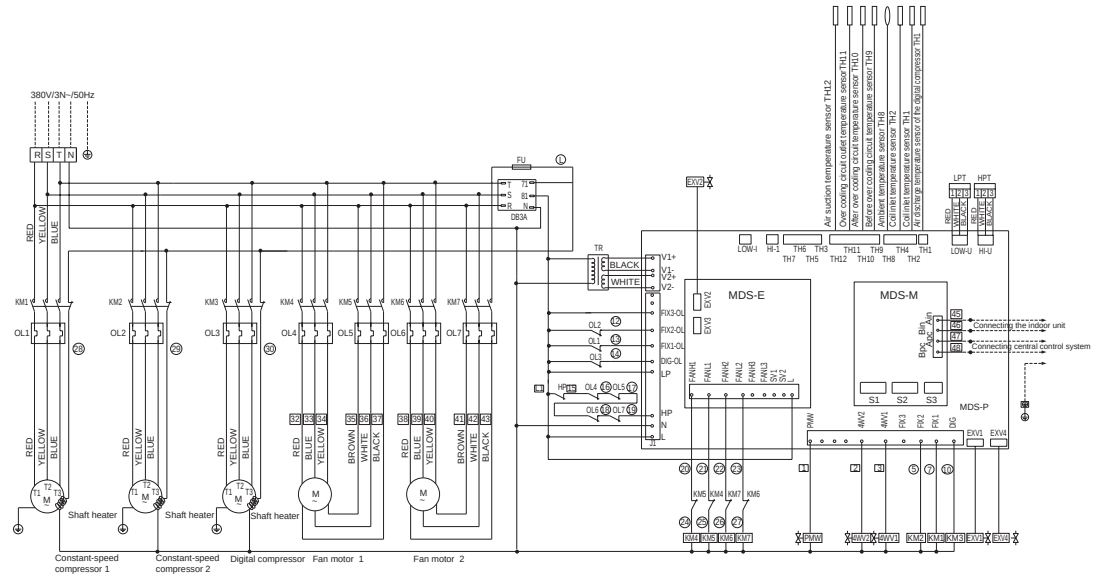
OL1	OL2	OL3	OL4	OL5	OL6	OL7
14.0	14.0	14.0	1.9A	0.67A	1.9A	0.67A

DIP switch settings :

S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
OFF	ON	OFF	ON	OFF	ON	OFF	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

Model MDS180BR



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve 1
KM	Contactor	EXV2	System electronic expansion valve 2
HP	High-pressure switch	EXV4	Over cooling electronic expansion valve 4
LPT	Low -pressure sensor	PMW	Solenoid valve
HPT	High-pressure sensor	OL	Overload protector
TR	Transformer		

Overload protection settings :

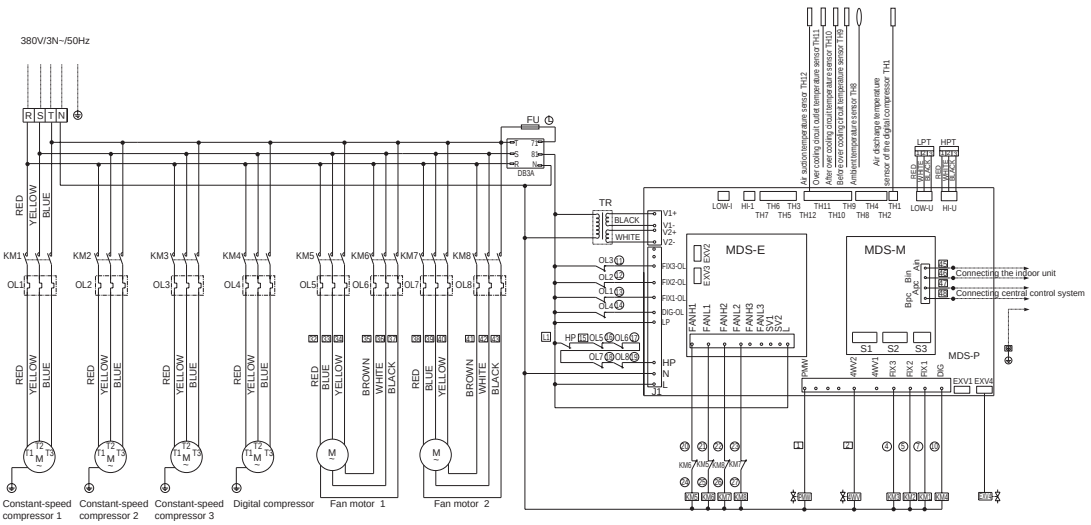
OL1	OL2	OL3	OL4	OL5	OL6	OL7
14.0	14.0	14.0	1.9A	0.67A	1.9A	0.67A

DIP switch settings :

S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
OFF	OFF	OFF	ON	OFF	ON	OFF	OFF

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

■ Model MDS200/220/240B



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV4	Over cooling electronic expansion valve 4
KM	Contactor	PMW	Solenoid valve
HP	High-pressure switch	OL	Overload protector
LPT	Low -pressure sensor		
HPT	High-pressure sensor		
TR	Transformer		

Overload protection settings :

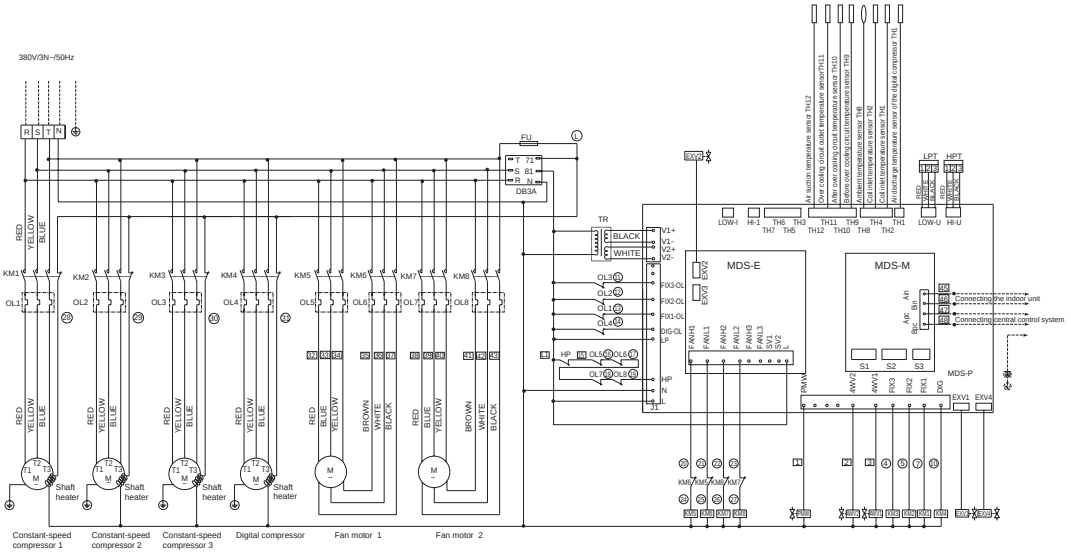
Model	OL1	OL2	OL3	OL4	OL5	OL6	OL7	OL8
MDS200B	14.0A	14.0A	14.0A	14.0A	1.9A	0.67A	1.9A	0.67A
MDS220B	14.0A	14.0A	14.0A	14.0A	1.9A	0.67A	1.9A	0.67A
MDS240B	14.0A	14.0A	14.0A	14.0A	3.3A	1.8A	3.3A	1.8A

DIP switch settings :

Model	S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS200B	OFF	ON	OFF	ON	OFF	ON	OFF	ON
MDS220B	OFF	ON	OFF	ON	OFF	ON	ON	OFF
MDS240B	OFF	ON	OFF	ON	OFF	ON	ON	ON

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

■ Model MDS200/220/240BR



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve 1
KM	Contactor	EXV2	System electronic expansion valve 2
HP	High-pressure switch	EXV4	Over cooling electronic expansion valve 4
LPT	Low -pressure sensor	PMW	Solenoid valve
HPT	High-pressure sensor	OL	Overload protector
TR	Transformer		

Overload protection settings :

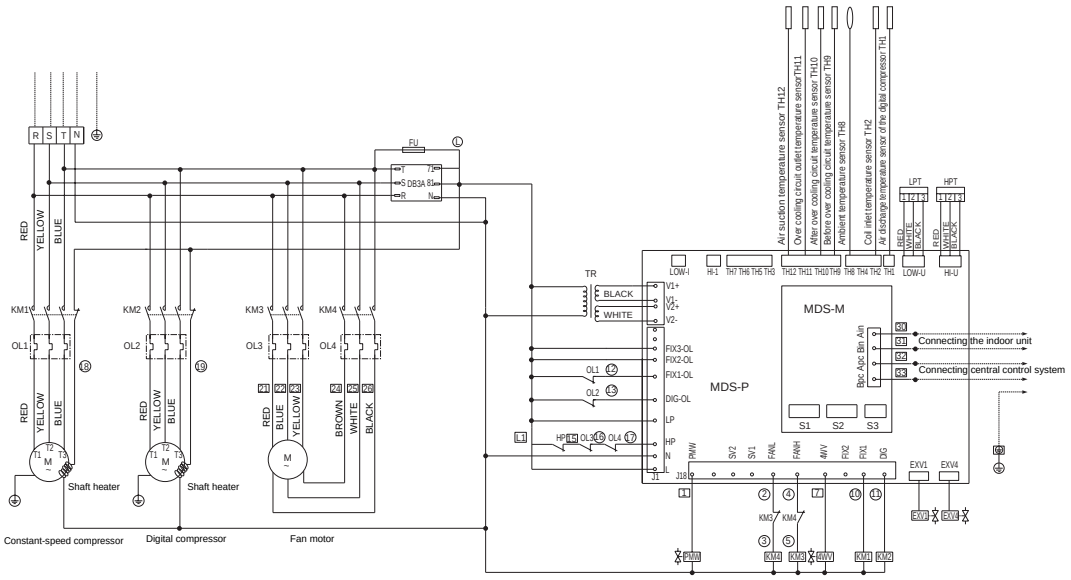
Model	OL1	OL2	OL3	OL4	OL5	OL6	OL7	OL8
MDS200BR	14.0A	14.0A	14.0A	14.0A	1.9A	0.67A	1.9A	0.67A
MDS220BR	14.0A	14.0A	14.0A	14.0A	1.9A	0.67A	1.9A	0.67A
MDS240BR	14.0A	14.0A	14.0A	14.0A	3.3A	1.8A	3.3A	1.8A

DIP switch settings :

Model	S1.1	S1.2	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS200BR	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
MDS220BR	OFF	OFF	OFF	ON	OFF	ON	ON	OFF
MDS240BR	OFF	OFF	OFF	ON	OFF	ON	ON	ON

Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

■ Model MDS260BR(Master Unit)



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve 1
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
HPT	High-pressure sensor	TR	Transformer

Overload protection settings :

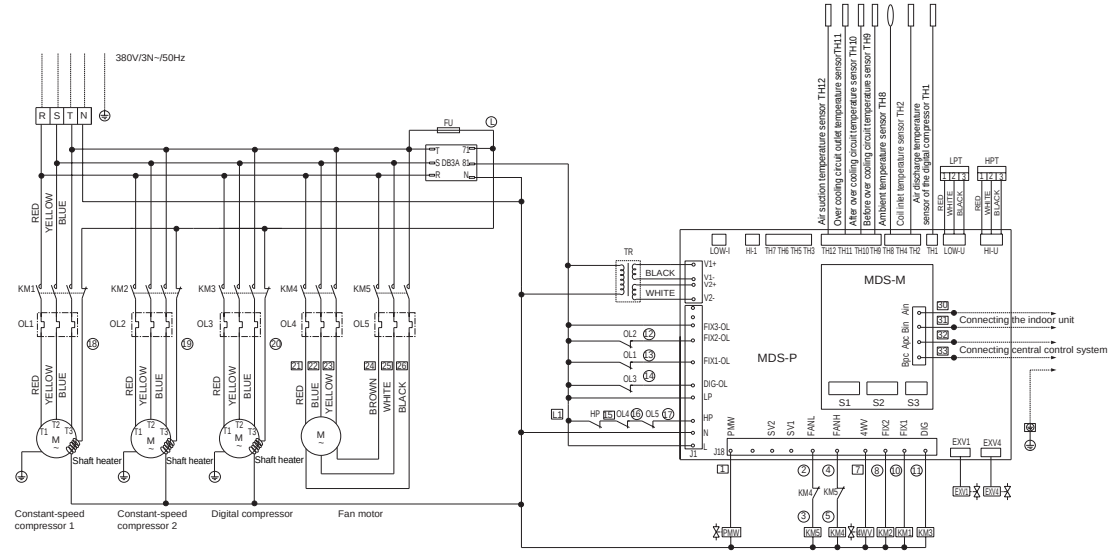
OL1	OL2	OL3	OL4
14.0A	14.0A	3.3A	1.8A

DIP switch settings :

S1.1	S1.2	S2.1	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
OFF	OFF	ON	OFF	ON	ON	OFF	OFF	OFF

Notes:□
1: ----------Field wiring□
2: ----------Factory wiring□
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the□ unit as a master/slave. For details of S2.4~S2.8.□

■ Model MDS280/300BR(Master Unit)



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	PMW	Solenoid valve
LPT	Low -pressure sensor	OL	Overload protector
HPT	High-pressure sensor	TR	Transformer

Overload protection settings :

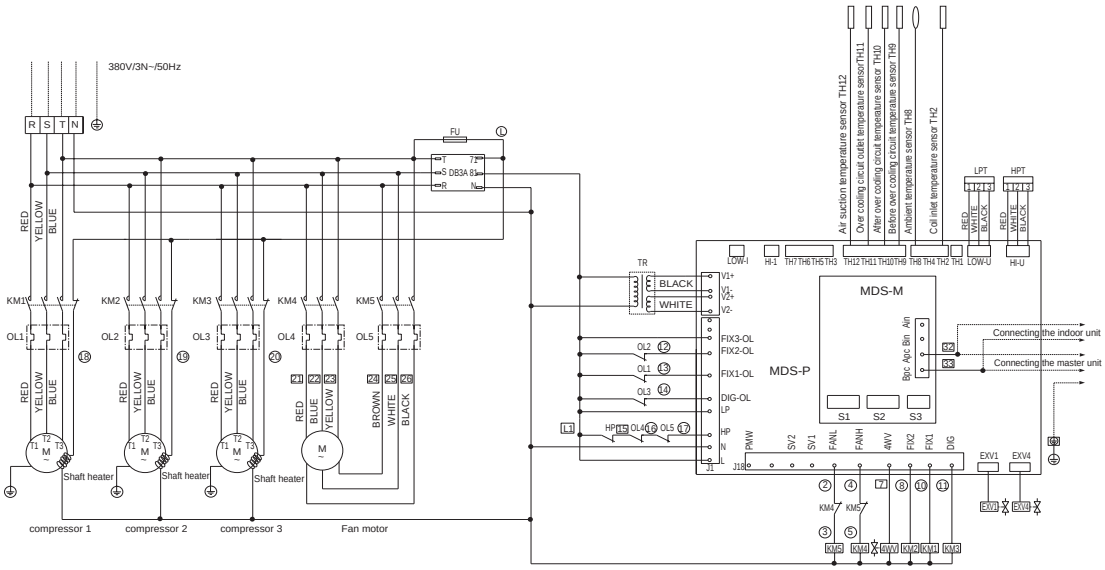
OL1	OL2	OL3	OL4	OL5
14.0	14.0	14.0	3.3A	1.8A

DIP switch settings :

Model	S1.1	S1.2	S2.1	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS280BR	OFF	OFF	ON	OFF	ON	ON	OFF	OFF	ON
MDS300BR	OFF	OFF	ON	OFF	ON	ON	OFF	ON	OFF
MDS320BR	OFF	OFF	ON	OFF	ON	ON	OFF	ON	ON

Notes:□
1: ----------Field wiring□
2: ----------Factory wiring□
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the□ unit as a master/slave. For details of S2.4~S2.8.□

■ Model MDS260/280/300BR(Slave Unit)



Description of components and parts :

Symbol	Description	Symbol	Description
DB3A	Phase-loss/reverse protector	FU	Fuse
4WV	Four-way valve	EXV1	System electronic expansion valve
KM	Contactor	EXV4	Over cooling electronic expansion valve 4
HP	High-pressure switch	OL	Overload protector
LPT	Low -pressure sensor	TR	Transformer
HPT	High-pressure sensor		

Overload protection settings :

OL1	OL2	OL3	OL4	OL5
14.0	14.0	14.0	3.3A	1.8A

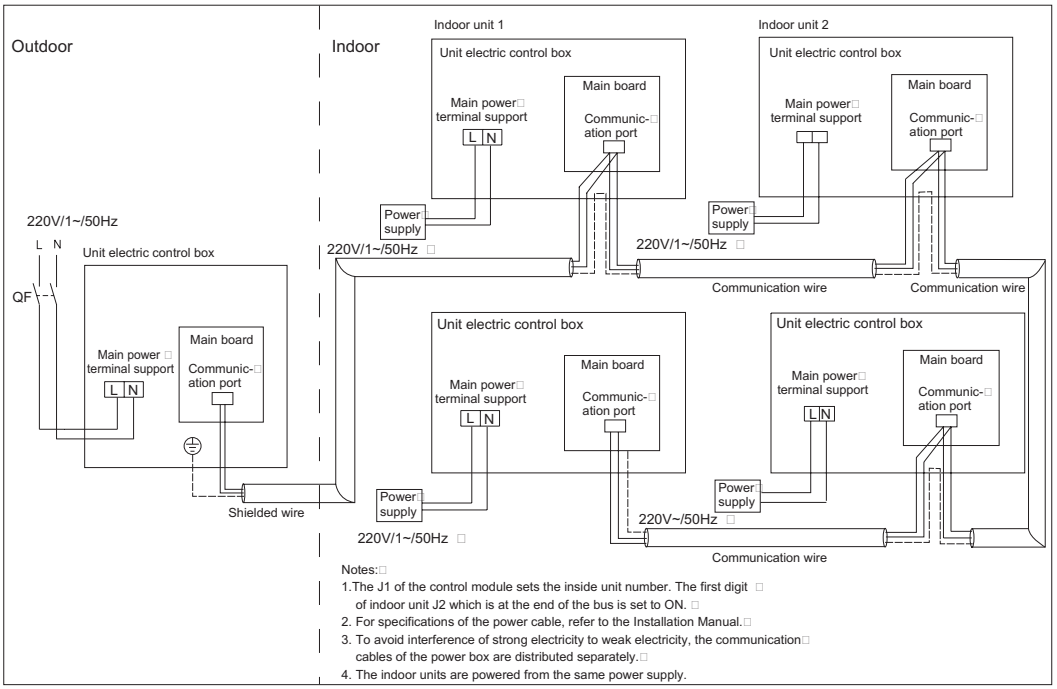
DIP switch settings :

Model	S1.1	S1.2	S2.1	S2.2	S2.3	S3.1	S3.2	S3.3	S3.4
MDS260BR	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
MDS280BR	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
MDS300BR	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF
MDS320BR	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	ON

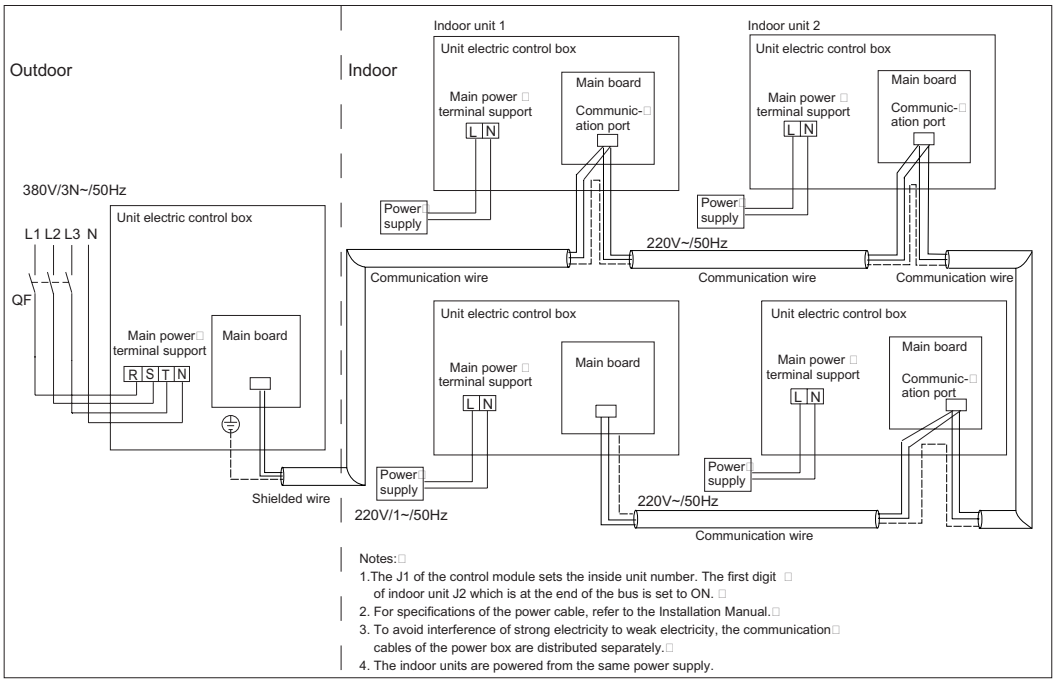
Notes:
1: ----------Field wiring
2: ----------Factory wiring
3: S1.3~S1.8 set the number of indoor units. S2.1 sets the unit as a master/slave. For details of S2.4~S2.8.

2.7 Electric Connection

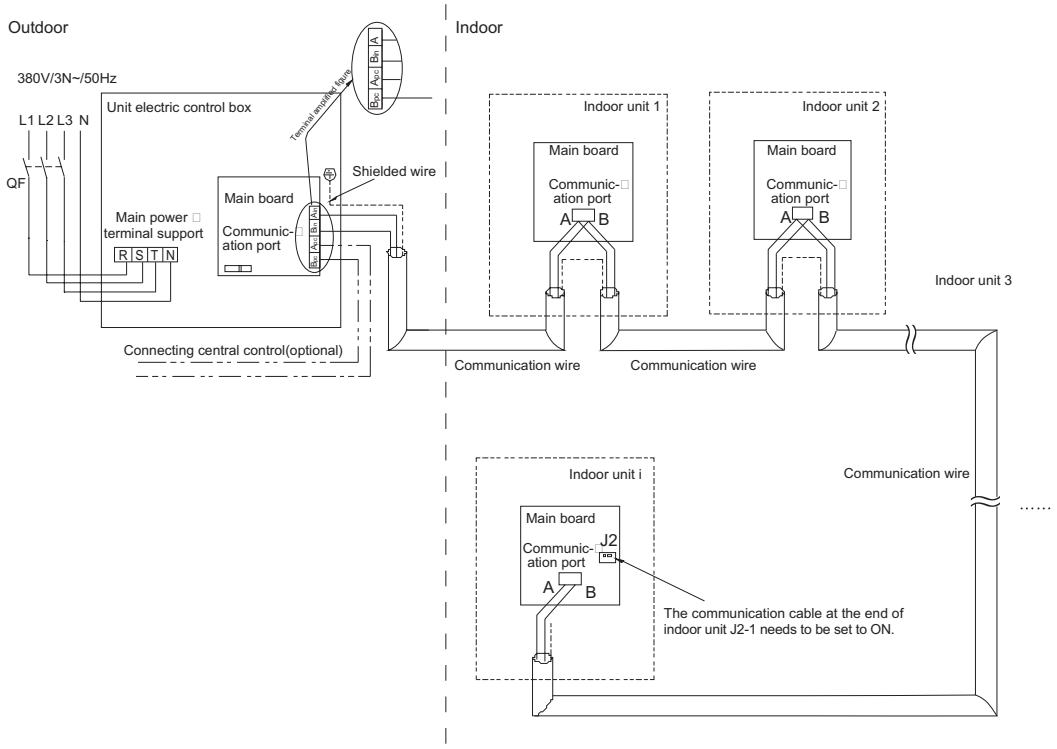
2.7.1 MDS030A/AR、MDS040A/AR、MDS050A/AR



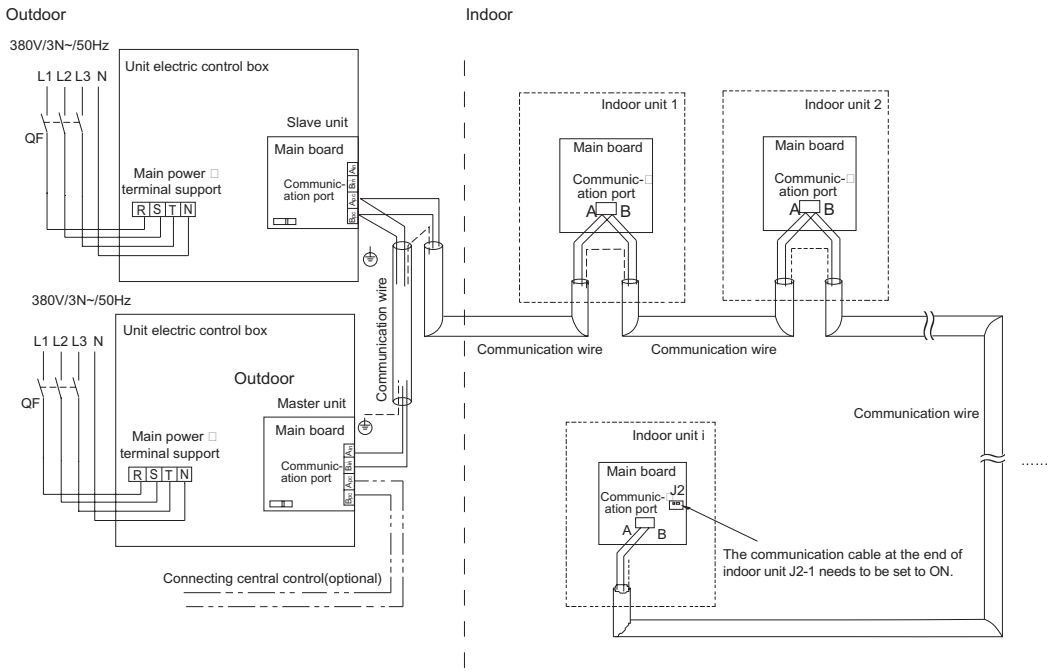
2.7.2 MDS050A/AR、MDS060A/AR



2.7.3 MDS080 ~ 240B/BR



2.7.4 MDS260 ~ 300B/BR



2.8 Electric Data

2.8.1 Outdoor Unit（MDS）

Model		MDS030A/ MDS030AR	MDS040A/ MDS040AR	MDS050A/ MDS050AR	MDS060A/ MDS060AR	MDS050A/ MDS050AR	MDS060A/ MDS060AR
Power supply		220V ~ /50Hz				380V /3N ~ /50Hz	
Power cable	Cross section area(mm^2)	6(2.5)				4(2.5)	
	Q.T.Y	2(1)				4(1)	

Model		MDS080B/ MDS080BR	MDS100B/ MDS100BR	MDS120B/ MDS120BR	MDS150B/ MDS150BR	MDS180B/ MDS180BR	MDS200B/ MDS200BR
Power supply		380V /3N ~ /50Hz					
Power cable	Cross section area(mm^2)	6			10		
	Q.T.Y	5					

Model		MDS220B/ MDS220BR	MDS240B/ MDS240BR	MDS260B/ MDS260BR	MDS280B/ MDS280BR	MDS300B/ MDS300BR
Power supply		380V /3N ~ /50Hz				
Power cable	Cross section area(mm^2)	10		16		
	Q.T.Y	5				

2.8.2 Indoor unit（MCC）

Model		MCC008T	MCC010T	MCC015T	MCC018T	MCC020T	MCC025T	MCC030T	MCC040T	MCC050T	MCC060T
Power supply		220V ~ /50Hz									
Power cable	Cross section area(mm^2)	1.5		2.5							
	Q.T.Y	3									

2.8.3 Indoor unit（MCK）

Model		MCK010T	MCK150T	MCK180T	MCK020T	MCK025T	MCK030T	MCK040T	MCK050T
Power supply		220V ~ /50Hz							
Power cable	Cross sectionarea(mm_2)	1.5		2.5					
	Q.T.Y	3							

2.8.4 Indoor unit（MDB）

Model		MDB050T	MDB060T
Power supply		220V ~ /50Hz	
Power cable	Cross section area(mm^2)	2.5	
	Q.T.Y	3	

2.8.5 Indoor unit（MCM）

Model		MCM020T	MCM030T	MCM050T
Power supply		220V ~ /50Hz		
Power cable	Cross section area(mm^2)	2.5		
	Q.T.Y	3		

2.8.5 Indoor unit（MWM）

Model		MWM008T	MWM010T	MWM015T	MWM020T	MWM025T
Power supply		220V ~ /50Hz				
Power cable	Cross section area(mm^2)	1.5			2.5	
	Q.T.Y	3				

Note:

- All the wiring should be fixed;
- Electric wiring must not touch the refrigerant pipe, compressor and fan motor;
- All wiring between indoor unit and outdoor unit should be neoprene copper core, and section area of cable should be in accordance with above requirements.

CHAPTER 3

Selection

3.1 Load Calculation

3.1.1 Planning and Cooperation

McQuay recommends you to estimate and plan the following before engineering.

- Based on the air conditioning area function, calculate cooling/heating load (depending on the temperature,humidity, and ventilation).
- Query related meteorologic information, especially the sun light, wind direction in winter and summer, the ambient cooling/heating sources, and other external factors that may affect the running of the units. Then decide the place and azimuth to place the units based on the environmental factors favoring the normal running of the units. For the outdoor meteorologic parameters of each city in China, see "Annex 1 Outdoor meteorologic parameters of major cities in China". However, the description about selection in this manual is only for your reference; for actual engineering, please consult with a professional design institute or related construction unit in this area.
- Develop the project schedule, plan the installation space of the unit, and adjust the engineering associated with the constructional engineering and inside finishing.
- Through field survey, ascertain the size of the entrance for the air conditioner, the weight capacity of the place to put or hang the equipment, the range of the auxiliary engineering, and the location of the power supply.
- Check and verify the calculated of the design. Confirm and determine the model and specifications of the unit.

3.1.2 Cooling Load Calculation

- The cooling load of the air conditioning area is determined by the real-time maximum cooling load or accumulated calculated cooling load of each room based on the area, storey height, and usage of the room serviced. It also includes the additional cooling load caused by the ventilator blower, the exhauster, and the air pipe system. In actual engineering, the total cooling load is calculated as follows:

  $Q_{total} = F_1q_1 + F_2q_2 + \cdots + F_nq_n$

  Where,

  F_1 -----The air conditioning area of each calculated unit (Unit: m^2.)

  q_1 -----The cooling load per unit area of each calculated unit (Unit: W/m^2).
- Annex 2 (1) lists the estimated indexes and design parameters of the air conditioner cooling load of different buildings for your reference.

3.1.3 Heating Load Calculation

- The heating load of the air conditioning system is closely related with the heat insulation performance of the walls, doors and windows, and roof. It is also affected by the penetration of cool wind from outdoors, open frequency of the outside door, and the use of the indoor appliances. It is calculated basically in the same way as the cooling load. If the heating load per unit area of the building q_F is known (see Annex 2), the heating load of the building is as follows:

$Q = Fq_F$

Where,

F -----The construction area (Unit: m^2)

■ If we know the heat performance index q_v[W/(m^3 . ℃)] and outside volume V (m^3), we can calculate the heating load
as follows:
$Q_{total} = aq_vV(t_n–t_w)$
Where,
a is the correction factor. For details, see the table.
q_v is the heat performance index of the building. It is the heating load when the difference between the indoor temperature and the outdoor temperature is 1℃. For details, see the table.
V is the outside volume of the building. (Unit:m^2)
(t_n -t_w) is the calculated difference between the indoor and outdoor temperatures. (Unit:℃)

Heating correction factor a:

Heating outdoor temperature （℃）	a	Heating outdoor temperature （℃）	a
0	2.05	-25	1.08
-5	1.67	-30	1.00
-10	1.45	-35	0.95
-15	1.29	-40	0.9
-20	1.17		

Heat performance index of the building

Building type	V (10^3 m^3)	q_vW/m^3℃	t_n （℃）	Building type	V(10^3 m^3)	q_v W/m^3℃	t_n （℃）
Office building	≤ 5 5 ~ 10 11 ~ 15 ＞ 15	0.6 0.53 0.49 0.56	18	Workshop	5 ~ 10 11 ~ 20 21 ~ 30 ＞ 31	3.38 2.73 2.04 1.45	14
Club	≤ 5 5 ~ 10 ＞ 11	0.72 0.65 0.58	16	Equipment room	≤ 0.5 0.6 ~ 1.0 1.1 ~ 2.0 ＞ 2.1	2.30 0.82 0.71 0.50	12
Hospital	≤ 5 6 ~ 10 11 ~ 15 ＞ 16	0.81 0.75 0.67 0.64	20	Auxiliary room	≤ 0.5 0.6 ~ 1.0 1.1 ~ 2.0 ＞ 2.1	0.83 0.72 0.56 0.51	18
Cinema	≤ 5 6 ~ 10 11 ~ 15 16 ~ 20 21 ~ 30 ＞ 31	0.92 0.82 0.79 0.70 0.65 0.61	14	Fire engine house	≤ 2.0 2.1 ~ 5.1 ＞ 5.1	0.72 0.63 0.60	15
Public area	≤ 5 6 ~ 10 ＞ 11	1.22 1.14 1.05	14	Bathroom	≤ 5.0 5.1 ~ 10.0 ＞ 10	1.49 1.38 1.25	25

【Notes】

■ During selection, you must consider the following factors which affect the cooling and heating attenuation and correction: 1) Length of the pipe connecting the indoor unit and outdoor unit; 2) Difference between the actual ambient temperatures of the indoor/outdoor units and the rated working temperatures of the MDS for cooling/heating.

■ If the heating pump system is selected according to the cooling load, you must verify its heating capacity. Especially in the areas north to Yellow River, inadequate heating capacity must be compensated with a model with an auxiliary electric heater or hot-water coil pipe.

■ The MDS unit is designed according to GB/T 18837-2002. There is a negative difference of about 5% between the actual cooling capacity and the rated capacity. Therefore, you must fully consider this factor during selection and ensure certain cooling capacity factor.

3.2 Selection of Indoor Units

- The selection of indoor unit should be based on the several factors, including customer's requirement, indoor air distribution, indoor decoration, etc. Ceiling concealed, ceiling cassette, high pressure duct unit and ceiling exposed are available now.
- The indoor unit should be selected to meet the actual indoor load demand. The nominal cooling capacity should be is more than or equal to the actual indoor load demand.
- As the indoor total capacity is different from the outdoor total capacity, the actual indoor cooling capacity may be different from the nominal capacity, and it should be calculated in accordance with the outdoor capacity table.

For ceiling concealed and duct unit, McQuay has several types such as standard unit, auxiliary electric heater, auxiliary hot water heater, etc.

- The selection is based on the following factors:
  - Cooling capacity/ heating capacity
  - Auxiliary heater capacity (optional)
  - Air flow
  - External static pressure
  - Dimension
  - Power supply and others.

- Selection step
  - Select the type of the indoor unit:

  1. Are the units ceiling concealed, ceiling cassette, high pressure duct unit or ceiling exposed ?
  2. Are the units cooling only, heat pump, auxiliary electric heater or auxiliary hot water heater?

  - Calculate the cooling capacity and heating capacity
  - Confirm the model and the quantity
  - According to the cooling capacity, heating capacity, return air temp, ambient temp, humidify and air flow, we can choose the model and confirm the quantity.
  - The ESP of the unit can be confirmed according to the air flow and the duct parameter.
  - Confirm the heating capacity. If the unit selected can meet the heating requirement, then it is OK, but if can not, then we should select auxiliary hot water heater or auxiliary electric heater.
  - For the cooling only unit, the actual total cooling capacity can be gotten through the following formula: Actual total cooling capacity = Actual capacity x QTY
  - For the heating only unit, the actual total heating capacity can be gotten through the following formula: Actual total heating capacity = Actual capacity x QTY + (Auxiliary heating capacity)
  - The best selection is that both the cooling capacity and the cooling capacity can meet the requirement. Please note that the nominal cooling capacity and the nominal heating capacity is obtained in the standard condition. When the units run in nonstandard condition, the actual cooling capacity and the actual heating capacity are different from the nominal cooling capacity and the nominal heating capacity.

3.3 Selection of Outdoor Units

For the allowed combinations, please refer to the "Total Capacity Indexes of a Combination of Indoor Units" table.

The standard combination is the one with which the total indoor unit capacity is most proximate to but less than 100% of the capacity of the outdoor unit combination.

3.3.1 Capacity Indexes of Outdoor Units

Outdoor unit	Rate of a combination of indoor units								
	130%	120%	110%	100%	90%	80%	70%	60%	50%
MDS030A(R)	111	102	94	85	77	68	60	51	43
MDS040A(R)	130	120	110	100	90	80	70	60	50
MDS050A(R)	163	150	138	125	113	100	88	75	63
MDS060A(R)	195	180	165	150	135	120	105	90	75
MDS080B(R)	319	294	270	245	221	196	172	147	123
MDS100B(R)	364	336	308	280	252	224	196	168	140
MDS120B(R)	423	390	358	325	293	260	228	195	163
MDS150B(R)	520	480	440	400	360	320	280	240	200
MDS180B(R)	618	570	523	475	428	380	333	285	238
MDS200B(R)	650	600	550	500	450	400	350	300	250
MDS220B(R)	715	660	605	550	495	440	385	330	275
MDS240B(R)	845	780	715	650	585	520	455	390	325
MDS260B(R)	910	840	770	700	630	560	490	420	350
MDS280B(R)	975	900	825	750	675	600	525	450	375
MDS300B(R)	1040	960	880	800	720	640	560	480	400

3.3.2 Capacity Indexes of Indoor Unit (MCC)

Unit spec	008	010	015	018	020	025	030	040	050	060
Capacity index	20	25	37	45	56	65	78	106	124	144

3.3.3 Capacity Indexes of Indoor Unit (MCK)

Unit spec	010	015	018	020	025	030	040	050
Capacity index	28	36	45	54	65	75	100	125

3.3.4 Capacity Indexes of Indoor Unit (MCM)

Unit spec	020	030	050
Capacity index	58	75	125

3.3.5 Capacity Indexes of Indoor Unit (MDB)

Unit spec	050	060
Capacity index	125	140

3.3.6 Capacity Indexes of Indoor Unit (MWM)

Unit spec	008	010	015	020	025
Capacity index	22	28	35	54	65

3.3.7 Actual Capacity Calculation

■ Based on the model and combination rate of the outdoor unit, select an appropriate door unit capacity table. Then find out the capacity of the outdoor unit (kW) and that of each indoor unit (kW) according to the related temperatures of the indoor and outdoor units.The formula is as follows:

$$I_{UC}=O_{UC} \times (I_{NX}/T_{NX})$$

Where,

I_{UC} is the actual capacity of each indoor unit.

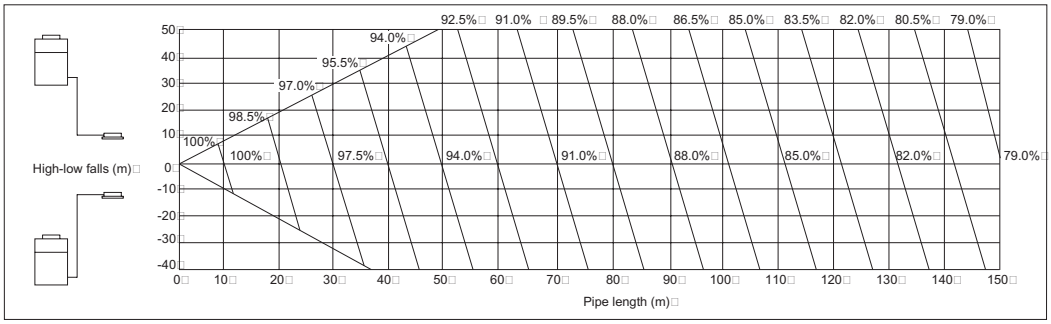
O_{UC} is the capacity of the outdoor unit. unit: kW.

I_{NX} is the capacity index of each indoor unit.

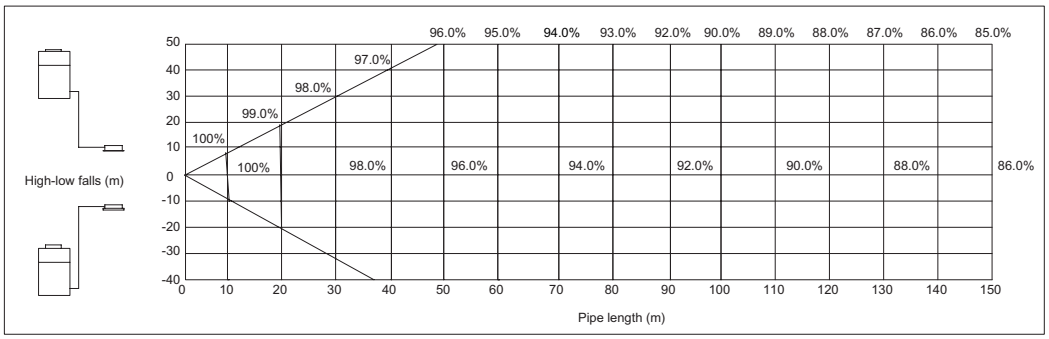
T_{NX} is the total capacity index.

■ The capacity of indoor units changes with the length of the refrigerant pipe. If the capacity after change is less than the load, replace the unit with one with larger capacity and calculate and select the model again.

3.3.8 Change of Cooling Capacity (3-30HP)



3.3.9 Change of Heating Capacity (3-30HP)

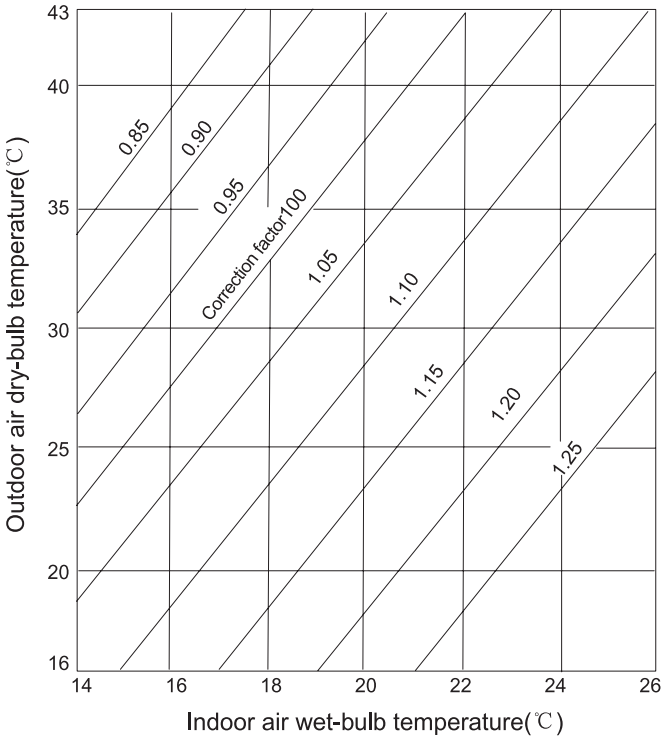


■ Read the performance correction factor of the refrigerant pipe length and height drop from the figure. When the height drop is negative, the outdoor unit is installed below the indoor unit.

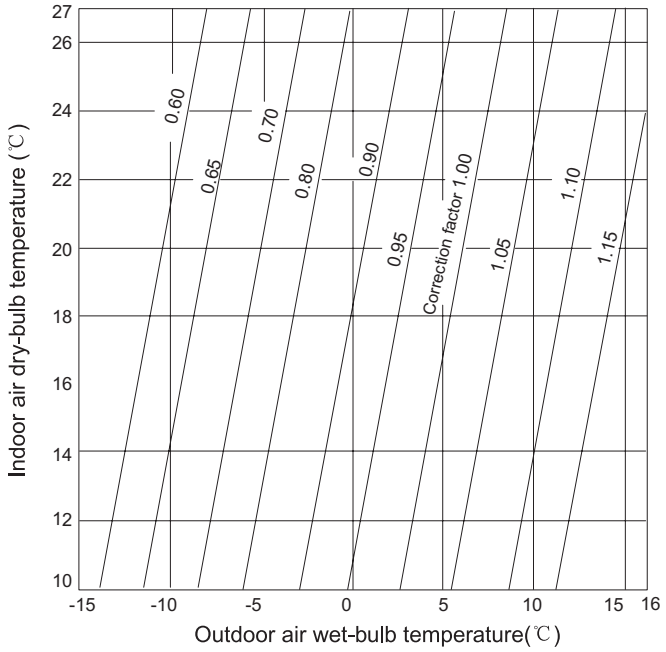
■ If there is snow on the heat exchanger or the outdoor temperature drops to 7℃ ~ -5℃ when the air conditioning system is heating, frosting occurs. As this will reduce the heating performance, the air conditioner will automatically defrost once every 40 min to 70 min. During the defrosting, the air conditioner will stop heating and the fan of the indoor unit will also stop for three to ten minutes.

■ The heating capacity tables of outdoor and indoor units do not reflect the reduction of performance caused by defrosting.

3.3.10 Temperature-related Cooling Capacity Correction Factors



3.3.11 Temperature-related Heating Capacity Correction Factors



3.4 Design of Air System

The air cooled pipeline unit is an important and complex part of the air system. The air system must be designed in compliance with Design Code for Heating, Ventilation and Air Conditioning and Code of Design on Building Fire Protection.

The air pipe diameter, processing, air outlet, muffling static pressure box, fire protection valve, insulation and indoor airflow layout must be designed professionally and well implemented, so as to achieve an ideal effect of comfortableness and energy saving. The following information or data is a reference for users to design.

3.4.1 Design of the Air Flow, Air Pipe and Air Outlet

The air should be supplied to the indoor space in a volume corresponding to the load at a most comfortable speed, so as to achieve comfortable air conditioning.

■ Air outlet design & calculation

- Air supply is to supply cool/hot air to a room or specified air conditioning area, and to mix the indoor air and supply airflow to the room temperature.
- The direction and guiding force of the air outlet vary with the outlet shape and type. Select according to the purpose.
- Determine the volume and arrival distance of air supply from a single outlet according to the para-meters in the product catalog. Select the air outlet and return outlet type that matches the ceiling pattern according to the room shape. In addition, the relationship between air speed and noise should be considered to determine the outlet air speed. Annex 3 is for your reference only.

■ Air flow pattern

No.	Return air flow pattern	Range	Advantages and disadvantages
1	Side air supply upper air return	The room with low floor height or large depth	Staffs are in the return air flow area, need for little or no space, and the air vent can be adjusted freely. But, the exposed ceiling in the room has two difference heights or there are two exposed ceilings.
2	Upper air supply upper air return	The room with high floor height and only for cooling in Summer	The fan coil of air pipe in the exposed ceiling makes the fittment easy. But, higher floor height is required and certain exposed ceiling space is occupied.
3	Side air supply side air return	The room with low floor height	Staffs are in the return air flow area, the fan coil of the unit does not occupy the indoor space in the corridor, and the air vent can be adjusted freely.But, short-flow may occur easily.

■ Air outlet selection

In the designing of the air-flow pattern, determine the type of the air outlet according to air conditioning accuracy, air-flow type, air outlet installation position and construction fittment art.

● Common types of the air outlet

◆ Side air outlet

The shutter air outlet is generally used. The shutter can be louver shutter to adjust the air flow and direction. Besides, grille air outlet and slotted air outlet are also used. These two outlets can well match with the construction decoration.

◆ Air diffuser

The air diffuser is the air outlet installed in the ceiling, supplying air flow from top to bottom.

◆ Orifice plate air outlet

The orifice plate air outlet features even air supply and fast air flow attenuation. It applies to the room where even air flow and little temperature difference are needed.

◆ Jet air outlet

The jet air outlet features long range and low noise. It applies to large public buildings, such as gymnasium and cinema.

◆ Whirl air outlet

The whirl air outlet features good mixture of supplied air and indoor air and fast-speed attenuation. It applies to the floor air supply in the computer room.

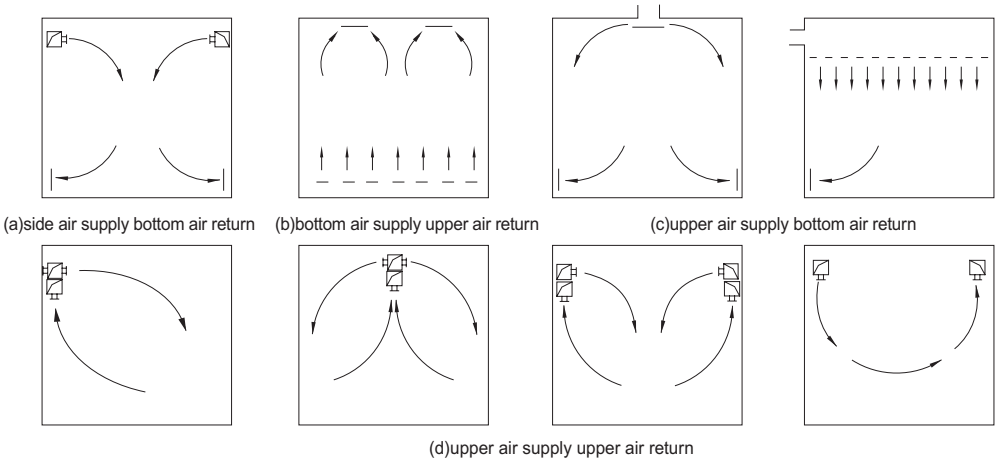
The conflux of the return air inlet brings little affect on the air flow pattern in the room. So, its structure is simple. Some only have a metal mesh in the orifice, or a shutter or grille.

- The return air inlet location and shape depend on the air flow pattern. If it is installed in the lower area of the room, the lower edge of the inlet must be at least 0.15 m away from the ground.
- The return air inlet structure may be simple, but should be equipped with air volume adjustment device.

■ Size of the air outlet

Determine the air volume and type of a single air outlet according to the number of air outlets to be installed and the volume requirements in the room where the air conditioner will be installed. Make sure there is no overlapping between the set air volume and the minimum diffusion radius, and the maximum diffusion radius covers the whole room. In addition, check whether the vertical arrival distance is adequate, and determine the air speed in the air outlet at the acceptable noise level.

Air flow pattern diagram



Air flow pattern diagram

3.4.2 Calculation of the Air Pipe Resistance

The air resistance in the air outlet and return air inlet cause pressure loss when the air pipe is being used, and the unit can supply air only when it overcomes the resistance. It is equal to the air pressure of the unit with pressure loss, that is, exterior static pressure (ESP).

The pipe resistance must be equal to the ESP. Otherwise, the air volume will be too large or too small causing the unit failure.

To determine the ESP of the unit, get the whole-static pressure of the air pipe. In this case, it is generally required to calculate the static pressure loss of the air pipe at the farthest point or maximum static pressure.

■ Calculation method of the air pipe resistance

- Preliminary determination of the air pipe resistance:
  Air pipe resistance=$R_m L(1+K)$ (Pa)
  R_m=0.8~1.5Pa/m
  L: Total length of the air pipe with the loop of most resistance, m
  K: Ratio of local resistance loss to frictional resistance. If there are few local components, k=1~2; if there are many local components, k=3~5
- Draw the ventilation system diagram, mark the air flow by segment and number each pipe segment.
- Assume the air speed (refer to annex 4), and calculate the cross-section dimension and the pipe diameter.
- Check the air speed according to the actual pipe diameter, and calculate the actual speed, which should not be higher than the recommended value in the design manual.

- Select the loop with most resistance and that with minimum resistance, and then calculate the frictional resistance and local resistance loss of each pipe segment.
- Check the unbalance ratio of the loop of most resistance to that of minimum resistance must be less than 15%. Otherwise, redesign the air pipe system, or satisfy the balance ratio requirements by adjusting with the valve.

3.4.3 Air Pipe Design

To improve the operational efficiency of air conditioning, carefully consider and fully install such fittings as material, adjustment valve and fire protection valve.

■ Material of the air pipe

The air pipe is always made from metal material, such as sheet steel, galvanized sheet or aluminum sheet. It also can be made from non-metal material, such as hard polyvinyl chloride, glass reinforced plastic or other composite materials. The air pipe in the construction space or duct channel also can be used according to the actual conditions. The air pipe surface should be polished, straight and smooth. Some air pipes should even be painted. The air duct channel should be waterproofed. The air pipe in the room with corros ive gas may be made from glass reinforced plastic or plastics and tightly sealed.

■ Air pipe shape

- The cross-section of the air pipe is generally rectangle or round. It also can be designed to ellipse, semicircle or spiral.
- The round air pipe has the advantages of high strength and low material loss, but it occupies large useful space and its elbow and tee should be of long distance. Generally, the flexible round air pipe is used for the new air pipe, small volume air refnet joint (such as in toilet with small area).
- The rectangle air pipe occupies small space, and is easy to install and neat for surface mounting. It has been widely applied.
- For the convenience of mechanical processing of the air pipe and flange and configuring standard valves, try to improve the utilization of the air pipe cross section. The air pipe dimension should be designed according to Calculation Form of National Universal Air pipe. The ratio of the height of the rectangle air pipe to its width should be less than 4, based on the outer diameter or length of external sides. The following table shows the standard specifications of the air pipe.

Specifications of the rectangle air pipe Unit: mm

Side size of the air pipe				
120	320	800	2000	3000
160	400	1000	2200	3500
200	500	1250	2500	4000
250	630	1600	2800	

Specifications of the round air pipe Unit: mm

Diameter of the air pipe					
Basic series	Auxiliary series	Basic series	Auxiliary series	Basic series	Auxiliary series
100	80/90	320	300	900	850
120	110	360	340	1000	950
140	130	400	380	1120	1060
160	150	450	420	1250	1180
180	170	500	480	1400	1320
200	190	560	530	1600	1500
220	210	630	600	1800	1700
250	240	700	670	2000	1900
280	260	800	750		

The high-speed air pipe is generally round spiral pipe with a larger thickness.

■ Wall thickness of the air pipe

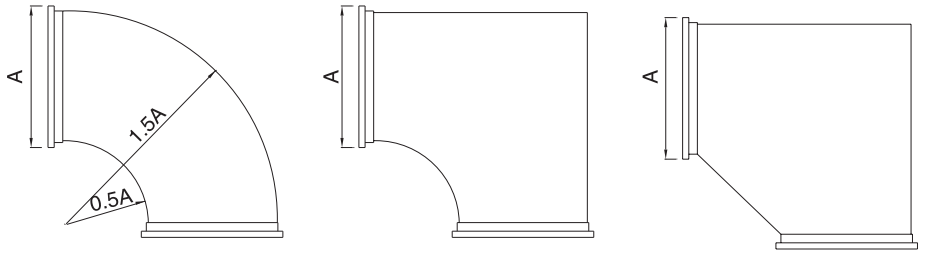
The wall thickness directly relates to the effect and life of the pipe.Too thin wall will cause unstable installation, and thus the pipe will heavily with noise increased. Even worse, the friction might compound the problem, shortening the service life of the air pipe or even the entire air conditioning system.

Recommended thickness of steel air pipes and accessories Unit: mm

Diameter of round air pipe or length of the longest side of rectangular air pipe		⩽ 320	340 ~ 450	480 ~ 630	670 ~ 1000	1120 ~ 1250	1320 ~ 2000
Rectangular air pipe	Low-speed air pipe	0.5	0.6		0.8	1.0	1.2
	High-speed air pipe	0.8	0.8		0.8	1.0	1.2
Round air pipe		0.5	0.6	0.8		1.0	1.2
Connection mode		Insertion			Flange		

■ Elbow

The rectangular air pipe can be inner-arc or inner-slanting, as shown in Figure. When the longest side A is 500 mm or longer, a flow deflector must be used.



(a) inner and outer-arc elbow (b) inner-arc elbow (c) Inner-slanting elbow

Air pipe elbow

■ Reinforcement of the air pipe

Generally, the air pipe is reinforced through using the ridge web and ridge lines, or adding flanges or reinforcing frames. Strictly follow the newest national standard Ventilation and Air Conditioning Engineering and Acceptance Standard when making and installing the pipes.

■ Accessories of the air system

The air system has following accessories: air outlet/return air inlet, outside rainproof shutter, air flow adjusting valve, smoke discharge & fireproof valve, and air deflector. The smoke discharge & fireproof valve must be tested before installed. The surface of the air outlet and the return air inlet must be smooth and even. The size of the neck part must be within the allowed deviation range so that it can engage with the air pipe tightly. The entire air conditioning system, including all the accessories, should be firm and tight, and, after installed, it should be pass the light leakage or air leakage acceptance check for a low-pressure air pipe system.

■ Heat insulation of the air system

The heat insulating layer of the air pipe system should also be non-flammable. Generally, it is 25 mm thick if it is PE materials, or at least 35 mm when consisting of common glass cotton. This layer should be even, dense, closely attached to the air pipe and its accessories, and without cold bridges. It should also be well protected against scratch.

■ Design and calculation of fresh air flow

The fresh air volume mainly depends on the health requirements, the supplementary local air exhaust volume, and therequirement to guarantee the air conditioned room in “positive pressure”.

■ Health requirements

Generally, in both the country and the city, the content of carbon dioxide outdoor is 0.5-0.75g/kg. According to the allowed density of this gas (see the following table), you can use the overall ventilation volume defined in the Industrial Ventilation to calculate the volume of fresh air needed to eliminate it.

Acceptable (CO_2) density

Room type	Acceptable CO_2 density	
	L/m³	g/kg
Place where people stay for a long time	1	1.5
Place where children and patients stay	0.7	1.0
Place where people stay regularly (government agency)	1.25	1.75
Place where people stay for a short time	2	3.0

In actual practice, the fresh air volume is generally 30m²/h person or more, no matter how much room space a person occupies.

For densely populated buildings, such as air conditioned gymnasiums and meeting rooms, as the room space per capita is less and every one stays shorter, the fresh air volume can be calculated on a basis of 7-15m²/h.person. However, as the fresh air volume got by this way will count for 30% to 40% of the total air volume and it will greatly affect the cooling capacity, you must be careful in deciding it.

- Supplementary of air discharge
  When the air conditioned room has an exhaust system, the air conditioning system must have corresponding fresh air volume to complement the exhaust volume. Generally, it is recommended to use an exhaust volume that is 80% of the fresh air volume for comfortable air conditioning.
- Keeping the air conditioned room in "positive pressure"
  To prevent outside air (those from outdoor and adjacent rooms with less strict air conditioning requirements) from penetrating the room and affecting the temperature/humidity or the cleanness of the air conditioned room, the air conditioning system needs to use a certain volume of fresh air to keep the room in "positive pressure", that is, the atmospheric pressure of the room is higher than that of outside). Generally, the indoor positive pressure is 5□0 Pa. Too high positive pressure not only is a waste, but also makes the system run less cost-effectively. In actual engineering design, the fresh air flow should count for 10% or more of the total inlet to guarantee the air is healthy and comfortable.

■ Introduction of fresh air

- The inlet of fresh air should be at a clean place outdoor. It should be away from the air discharge outlet and leeward to smoke, dust, and other harmful and toxic sources.
- To avoid dust, the fresh air inlet should be at least 2m above the ground, or 1m above the ground if it is placed in a green belt.
- To introduce less hot air from outdoor in the summer, the inlet should be placed at the shade side of the building.Generally, it is placed on the northern wall, not at the roof or on the west wall.
- Configure waterproof shutters, metal web, and air flow adjustment valves to fresh air inlet if necessary.
- To guarantee the quality of the introduced fresh air and the ambient temperature, do not place the fresh air inlet near to the outdoor unit which has a condenser or put it near to the exhaust outlet.
- Generally, the size of the fresh air inlet depends on the air volume and air speed. For the air speed, refer to Annex 4.

【Note】

For heat pump unit, you should consider the effects of layer height to the air conditioning effects. When the layer height is 3m or more, you should select an appropriate air inlet to improve the air flow pattern and the blown-in air flow.

3.5 Slection of Refnet Joint

3.5.1 Copper Pipe Selection (MDS100BR)

■ Diameter of the main pipe and that of the remotest pipe(equivalent length<90m)

Main pipe: ϕ 12.7/ ϕ 28.6(the same as the outdoor unit）

The remotest pipe: the same as the indoor unit

■ Refer to the refrigerant pipe to calculate the cooling capacity of downstream A

A-B-C: 17.4 kW

A-D-E: 11.8 kW

■ Select the pipe diameter of downstream A

Diameter of A-B: ϕ 12.7/ ϕ 25.4

Diameter of A-D: ϕ 9.52/ ϕ 19.05

■ We can use the same method to select the pipe diameter of downstream B and D.

Diameter of B-C: ϕ 9.52/ ϕ 19.05

Diameter of D-E: ϕ 9.52/ ϕ 15.88

3.5.2 Refnet Joint Selection

■ Refer to the refnet joint specification to select the refnet joint for Point A.

A: Refnet joint to liquid pipe: MDS-Y2

A: Refnet joint to gas pipe: MDS-Y1

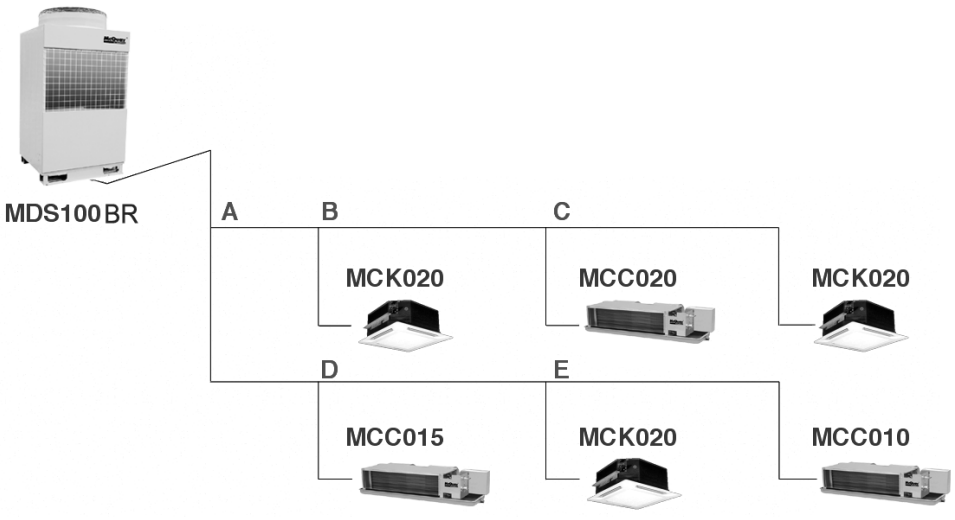
■ We can adopt the same method to select the refnet joint for point B to D.

B: Refnet joint to liquid pipe: MDS-Y2 B: Refnet joint to gas pipe: MDS-Y1

C: Refnet joint to liquid pipe: MDS-Y2 C: Refnet joint to gas pipe: MDS-Y4

D: Refnet joint to liquid pipe: MDS-Y2 D: Refnet joint to gas pipe: MDS-Y4

E: Refnet joint to liquid pipe: MDS-Y2 E: Refnet joint to gas pipe: MDS-Y2



The following tables show the refrigerant copper pipe dimension specifications.

For MDS-A series

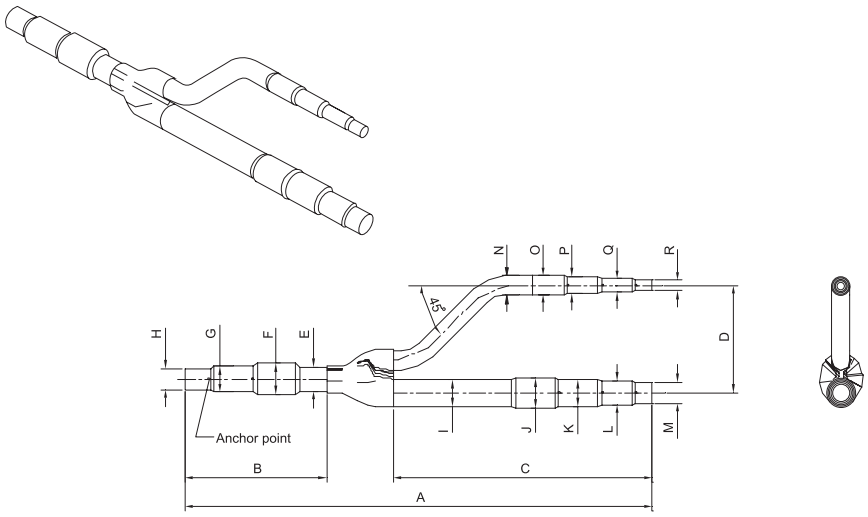
Specification \ Outdoor unit capacit			3.0HP	4.0HP/5.0HP	6.0HP
			Between the outdoor unit and the first tap joint		
Liquid pipe			Φ 9.52mmxt0.8	Φ 9.52mmxt0.8	Φ 9.52mmxt0.8
Gas pipe			Φ 15.88mmxt1.2	Φ 19.05mmxt1.2	Φ 19.05mmxt1.2
			Between the tap joints		
Liquid pipe	Total capacity of the indoor unit to which the pipe is connected.	<16kW	Φ 9.52mm x t0.8		
		16kW ~ 22.5kW	–	–	–
		>22.5kW	–	–	–
Gas pipe	Total capacity of the indoor unit to which the pipe is connected.	<9.0kW	Φ 15.88mm x t1.0		
		9.0kW ~ 16kW	Φ 19.05mm x t1.2		
		16kW ~ 21kW	–	–	–
		>21kW	–	–	–
			Between the tap joint and the indoor unit		
Liquid pipe	Total capacity of the indoor unit to which the pipe is connected.	<4kW	Φ 6.35mm x t0.7		
		⩾ 4kW	Φ 9.52mm x t0.8		
Gas pipe	Total capacity of the indoor unit to which the pipe is connected.	<2.8kW	Φ 9.52mm x t0.8		
		2.8kW ~ 4.5kW	Φ 12.70mm x t1.0		
		4.5kW ~ 8kW	Φ 15.88mm x t1.2		
		>8kW	Φ 19.05mm x t1.2		

For MDS-B series

Specification \ Outdoor unit capacit			8.0HP 10.0HP	12.0HP	15.0HP/18.0HP 20.0HP	22.0HP 24.0HP	26.0HP/28.0HP 30.0HP
			Between the outdoor unit and the first tap joint				
Liquid pipe			Φ 12.7mmxt1.0	Φ 15.88mmxt1.2	Φ 15.88mmxt1.2	Φ 19.05mmxt1.2	Φ 19.05mmxt1.2
Gas pipe			Φ 28.6mmxt1.2	Φ 28.6mmxt1.2	Φ 34.9mmxt1.4	Φ 38.1mm xt1.6	Φ 41.3mmxt1.6
			Between the tap joints				
Liquid pipe	Total capacity of the indoor unit to which the pipe is connected.	<15kW	Φ 9.52mm x t0.8				
		15kW ~ 22.5kW	Φ 12.70mm x t1.0				
		22.5kW ~ 50kW	Φ 12.77mm x t1.0	Φ 15.88mm x t1.2			
		50kW ~ 85kW	–	–	–	Φ 19.05mm x t1.2	
Gas pipe	Total capacity of the indoor unit to which the pipe is connected.	<9.0kW	Φ 15.88mm x t1.2				
		9.0kW ~ 15kW	Φ 19.05mm x t1.2				
		15kW ~ 21kW	Φ 25.40mm x t1.2				
		21kW ~ 31kW	Φ 28.06mm x t1.2				
		31kW ~ 39kW	–	–	Φ 31.75mm x t1.4		
		39kW ~ 50kW	–	–	Φ 34.9mm x t1.4		
		50kW ~ 69kW	–	–	–	Φ 38.1mm x t1.6	
		69kW ~ 85kW	–	–	–	–	Φ 41.3mm x t1.6
			Between the tap joint and the indoor unit				
Liquid pipe	The indoor unit to which the pipe is connected.		Consistent to the indoor unit port				
Gas pipe	The indoor unit to which the pipe is connected.		Consistent to the indoor unit port				

Refnet joint type selection

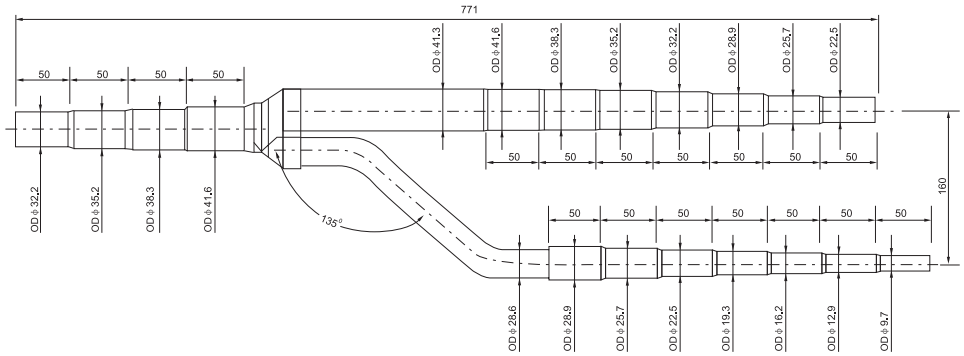
"Y" type



Unit: mm

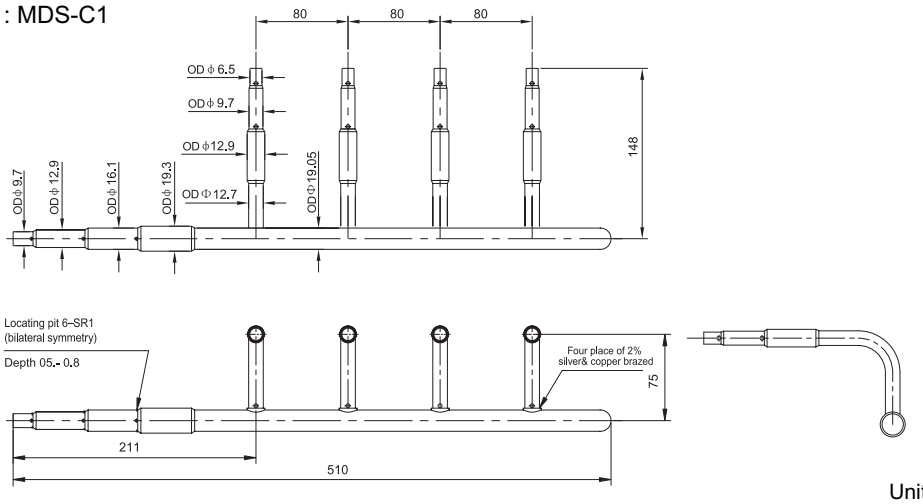
Refnet joint type	Length (mm)				Diameter Φ(mm)				Diameter Φ(mm)					Diameter Φ(mm)				
	A	B	C	D	E(outer diameter)	F	G	H	I(outer diameter)	J	K	L	M	N(outer diameter)	O	P	Q	R
MDS-Y1	553	172	293	120	28.6	28.9	25.7	22.5	28.6	28.9	25.7	22.5	19.3	22.2	19.3	16.1	12.9	9.7
MDS-Y2	420	142	223	80	15.88	16.1	12.9	9.7	12.7	12.9	9.7	6.5		12.7	12.9	9.7	6.5	
MDS-Y3	420	142	223	80	15.88	16.1	12.9	9.7	12.7	12.9	9.7	6.5		15.88	16.1	12.9	9.7	
MDS-Y4	493	142	223	80	22.2	22.5	19.3	16.1	19.1	19.3	16.1	12.9	9.7	19.1	19.3	16.1	12.9	

Type: MDS-Y5



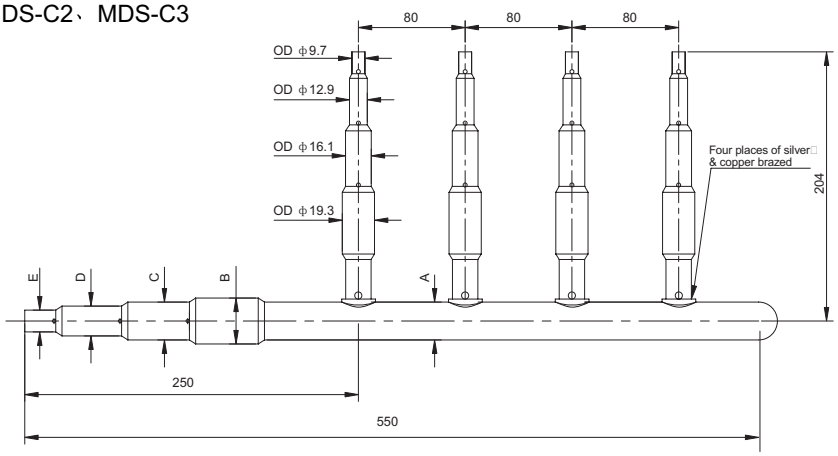
Unit: mm

Type : MDS-C1



Unit: mm

Type：MDS-C2、MDS-C3



Refnet joint type	Refnet joint type ϕ(mm)				
	A(outer diameter)	B	C	D	E
MDS-C2	28.6	28.9	25.7	22.5	19.5
MDS-C3	25.4	25.7	22.5	19.3	16.1

Unit: mm

3.6 Selection of E-EXV Box

To reduce the noise of indoor unit, MDS system is using external EXV Box. For different EXV Box model, please refer to the table below :

Indoor Unit	EXV Box Model
MWM008/010/015	MEX-14-2SA-A
MCC008/010/015	
MCK010/015	
MWM020	MEX-18-2SA-A
MWM025	MEX-18-3SA-A
MCC018/020/025	
MCK018/020/025	
MCM020	
MCC030/040/050/060	MEX-24-3SA-A
MCK030/040	
MCK030	
MCK050	MEX-30-3SA-A
MCM050	

CHAPTER 4

Installation

4.1 Outdoor Unit Installation

■ To choose location of installation

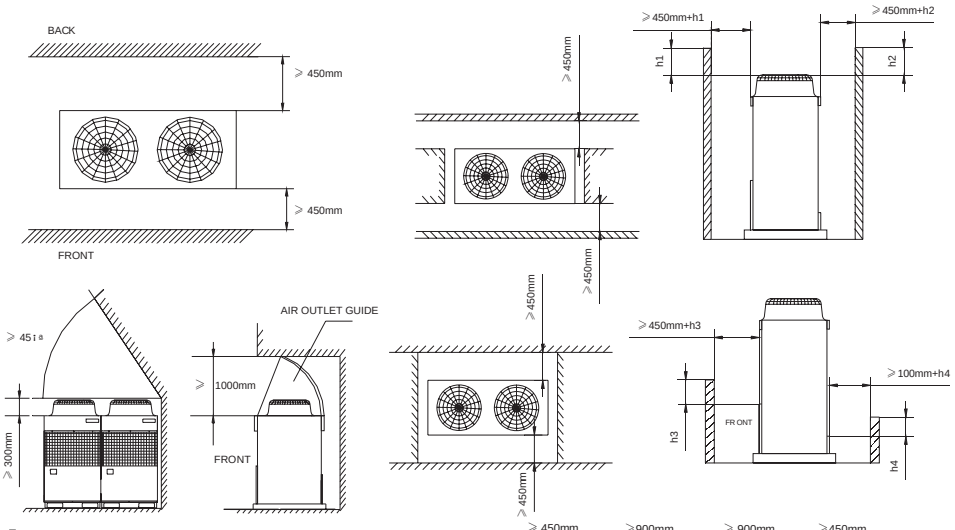
To ensure good cooling and heating performance of the units, follow up the below to pick up right place to install units:

- To avoid discharged air returns to the air inlet, to avoid hot air discharged by other units; ensure enough space for maintenance.
- To remove any barrier of air ventilation both air supply and air discharge.
- Maintain good ventilation for better heat exchange efficiency.
- Installation base shall be strong enough to support the units and prevent vibration.
- To avoid installing units at dirty and salty place.
- Do not install units at easy burning gas leakage place. Accumulated burning gas leakage may result in an explosion.
- Do not install units to the place where the units are inclined to be damaged by typhoon and strong wind. If possible, install rainproof, snow-shield, and lightproof equipment.

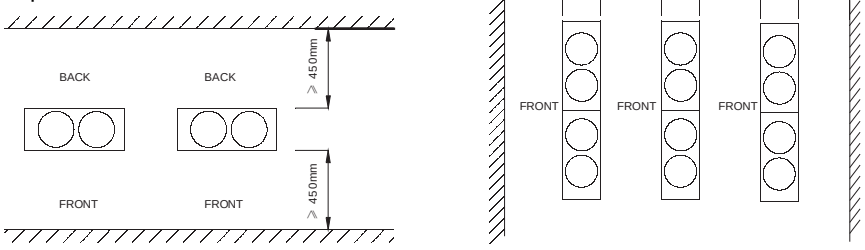
■ Space for installation of outdoor units

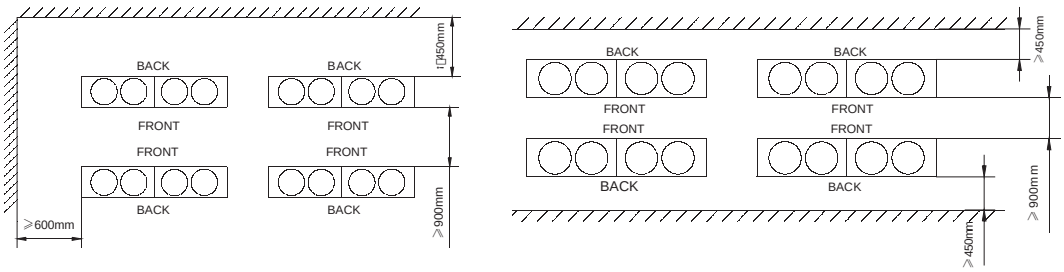
One single outdoor unit can be installed in one place, multiple outdoors can be installed in one big place in order. For details, see the following:

- Space for single outdoor unit



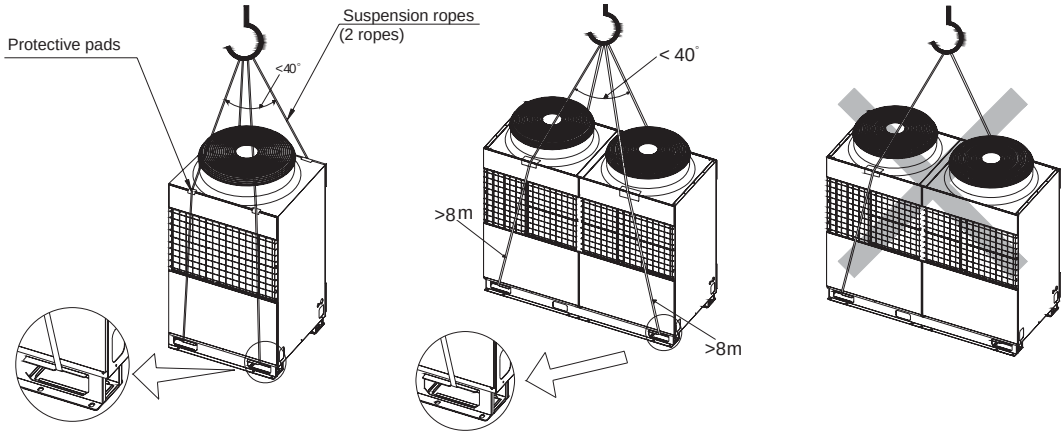
- Space for more than one units



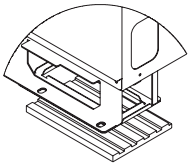


■ Handling outdoor units

Please refer to the followings to move units; To use 4 supporting points to move units instead of 3 points, to avoid unstable move and units drop off.



■ Notes:



- Be careful in the moving of outdoor units.
- Do not lift or move units with the package rope, as it is easy to break and bring danger.
- Do not directly touch the fins of units to avoid hurt of hand.
- Do keep the plastic bag from the child.

■ Outdoor unit installation

- To use concrete or supporter to build a base. Fully consider the floor strength, drainage (discharge from the unit in operation), and pipes and cables layout. If the strength cannot satisfy the requirement, the unit may fall off to damage the unit and injure people.
- To fix the outdoor unit with screw bolt to avoid falling off by earthquake or strong wind. Properly install the unit to defend against strong wind and earthquake better.
- To take some shock resistance measures (such as using cushion and bumper bracket) to avoid vibration passing to the installation part. The bottom panel and wall may cause vibration and noise, depending on the installation condition.
- To place the edge to the right position. Otherwise, the unstable unit may cause the installation foot bent. Any improper installation may cause the unit falling off and injuring people.

■ Warning:

- The unit must be installed to the place which is strong enough to bear the unit weight and vibration.
- For lower pipes and cables layout, make sure the base not block the hole at the bottom. When laying out the lower pipes, the basic height shall not be less 100 mm to ensure the pipe to get through the unit bottom.

Installation of the Combined Outdoor Units (Suitable for Model of MDS260/280/300)

Two outdoor units can be grouped as one outdoor unit, to connect with indoor units. The installation of combined units is more complicated than that of the single outdoor unit; please read the below notes carefully before installation, and strictly follow the installation instructions.

■ Select the position of the installation for outdoor unit

Select one unit as the master unit, the other one as the slave unit; and these two units shall be positioned in the same level side by side.

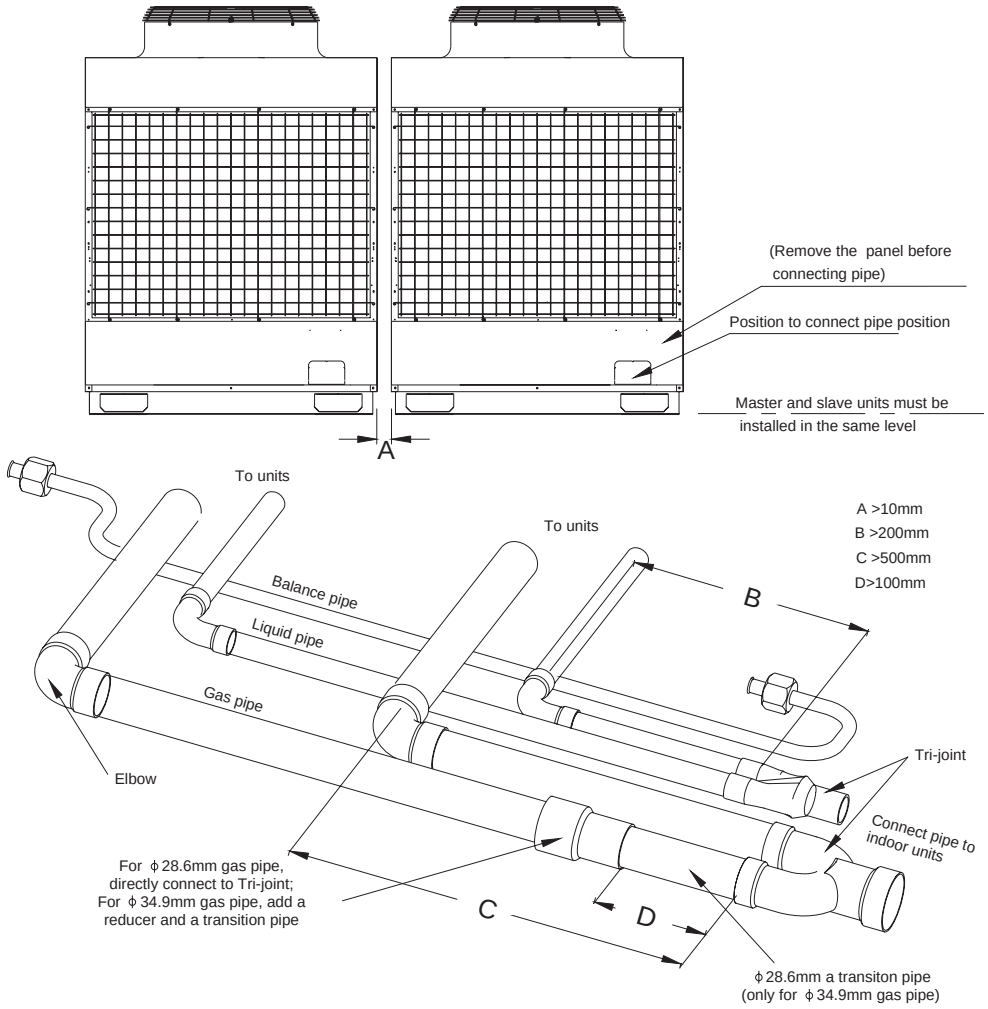
- Master unit and slave unit shall be installed in the same level.
- The distance between the master and slave unit shall be more than 10mm.

■ Connecting pipe of the outdoor units

- Accessory copper parts are packed with the outdoor units; pipe connection includes gas, liquid and balance piping connection between the master and slave units. All pipes shall be with insulation material and avoid any damage of this insulation material.

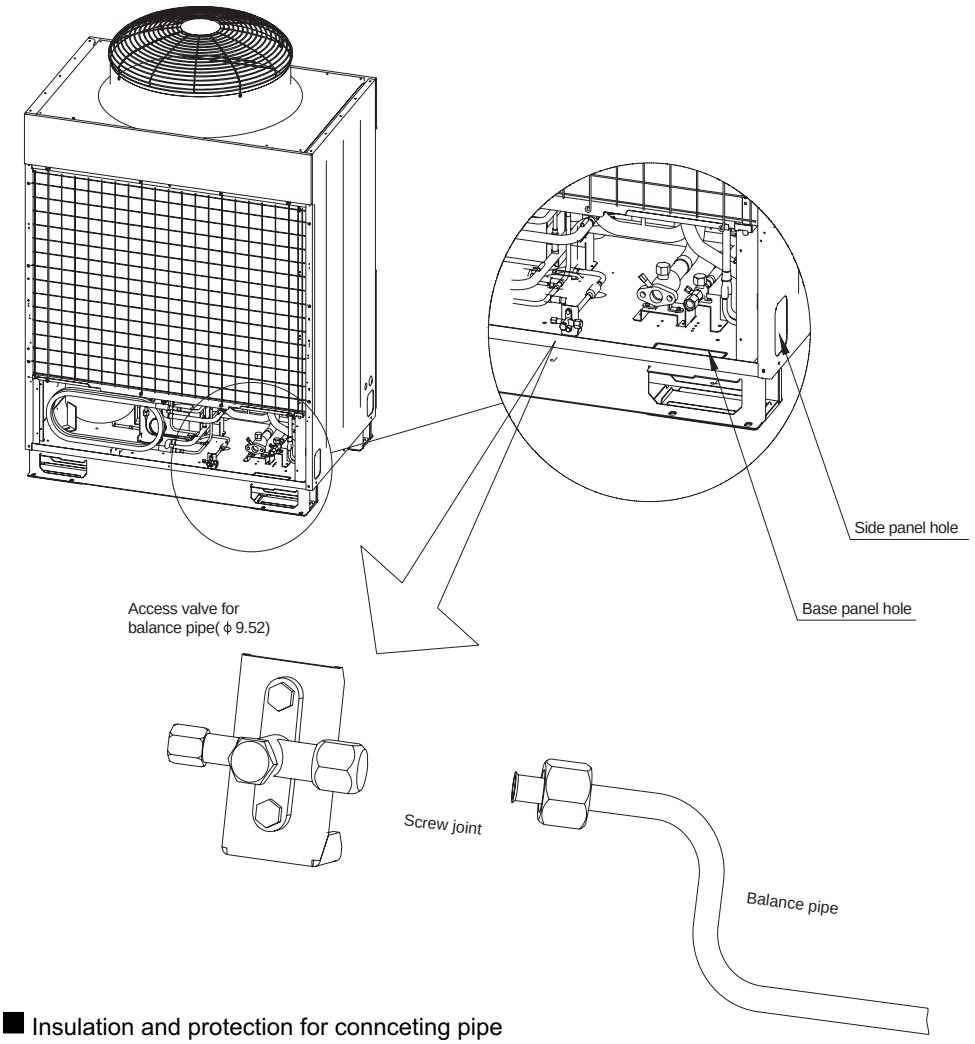
■ Gas and liquid pipe connection

- Gas and liquid pipe connection with the units, please refer to the concerned chapter of "installation of refrigeration pipe".
- Gas and liquid pipe shall be connected paralleled, shown as below. The dimensions of the straight pipe connected to the Tri-joint must meet the requirements below.



■ Balance pipe connection

- Balance pipe must be installed. Balance pipe shall be connected through the hole of side panel or base panel or the position with the other outdoor unit.
- Balance pipe shall be installed horizontally and orderly, and shall be lower than the access valve for balance pipe.
- Protect the balance pipe carefully and avoid touching any other parts, especially need to keep the pipe from touching the wall of hole.
- Balance pipe connection with the unit is shown in below drawing.



■ Insulation and protection for connceting pipe

- All connceting pipe shall be well insulated.
- All piping shall be well protected to avoid any bumping, trampling and rubbing with the surround when vibrating. Otherwise the piping may be damaged, and affect the unit performance and safety, further more other safety problems may occur.

4.2 Indoor Unit Installation

■ To choose the position of installation

Improper installation position will affect the cooling and heating performance, or even cause malfunction or accident. Follow the below instructions:

- Ensure air flow everywhere of room.
- No barrier for air flow.
- Ensure enough maintenance space for installation. Otherwise, it will cause difficulties to maintain the unit in future.

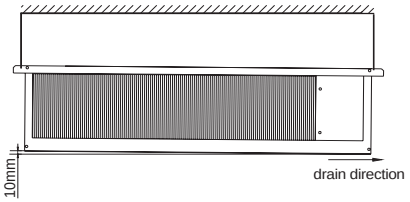
- Wall or ceiling shall be strong enough to support indoor units. Otherwise, it may cause the unit falling off.
- Do not expose to sunshine.
- Do not install units to the place where steam or oil smoke exists.
- Do not install units to the place where burning gas leakage may happen.
- Do not install around the high frequency equipment (such as high frequency electric welding machine).
- Do not install units in the place where acid liquid exists.
- Do not install units in the place usually using sulfide or other sprayer.

■ Installation of MCC-T series indoor units

This type indoor units shall couple with duct working of air supply and air return; also can add the heating coil and heater.

■ Indoor unit

- To check the accessories are ready.
- To install the hooker and ensure it strong enough to support unit.
- Install the unit and check it installed horizontally; ensure the slope of the drainage piping , as shown in below figure.



■ Notes:

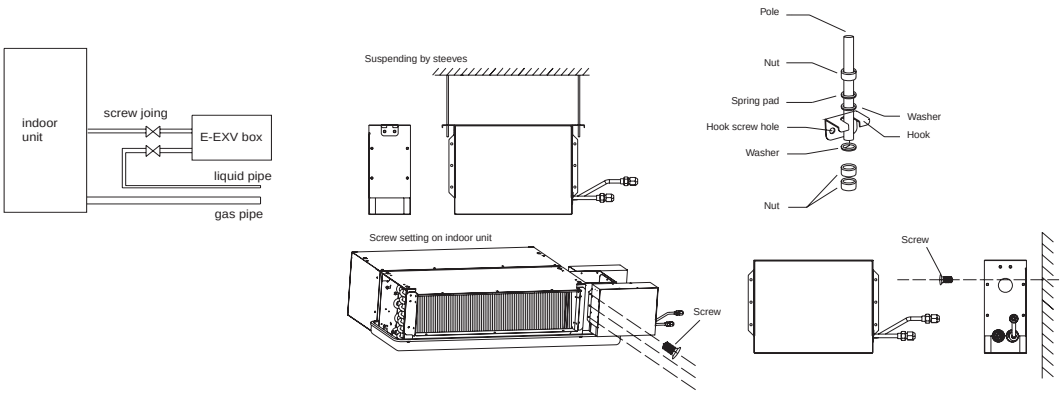
a. Ensure piping and air duct working are most efficent length and units shall be installed in the middle position of the room.

b. When installation of the indoor units, to ensure the distance shall be larger than 3m between return air inlet and heat exchanger.

- To install the refrigerant pipe drainage pipe. Specification for the refrigerant pipe and drainage pipe, see the section "technical parameters" of Usage Instruction. Use the torque spanner to install the pipe to avoid damaging the copper tube and its joint.
- Do not use the damaged copper tube or dirty copper tube. To avoid long time expose to the air. Only get the concerned preparation ready, and do not open valves, connector, copper cap and cushion before installation.
- To install refrigerant pipe, all models of this series product should be connected with a E-EXV box out of the machine, as shown in below figure.

  Note: The E-EXV box contains electronic expansion valves, which needs to be mounted in proper place on the liquid piping. When installing the E-EXV box, make sure the box vertical. The E-EXV box and the indoor unit could not exceed the length-limit of the electric expansion valve cable, as shown in the figure below.

  There are some manners to install the E-EXV (the mounting must be fixed and safe, and the direction must be vertical).



Duct Working Installation

■ Air supply duct working installation

Two types of air supply duct working: round and rectangle. Round air duct working can be connected up to the air supply inlet directly; while the rectangle one needs to be connected with a transition air duct to air supply inlet, and separate to the air diffuser. Pick up the selected air distributor or diffuser to meet the application requirements.

■ Air return duct working installation

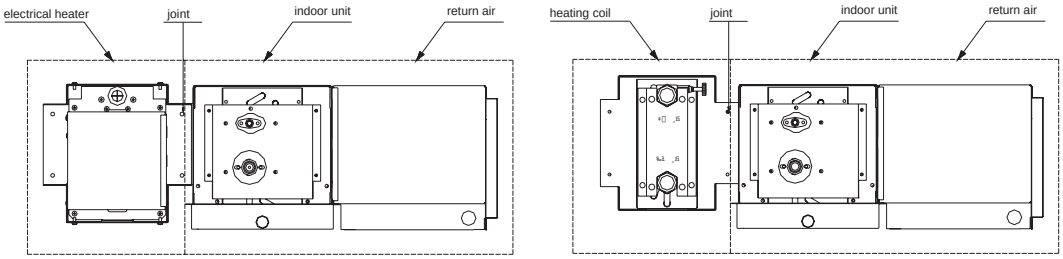
To connect with return air inlet of indoor units, the other end connecting with return air inlet of ceiling. Make a sailcloth foldaway air duct, and strengthen it with 8# iron rope, in this way, the unit can be adjusted freely depending on ceiling height.

■ Insulation of duct working

Both air supply and return duct working shall be equipped insulation material with aluminum foil.

■ Electrical heater and heating coil installation

The way to install electrical heater and heating coil is almost the same, both need to connect to air outlet of indoor units as shown as followings:



■ Install MCK-T series indoor unit

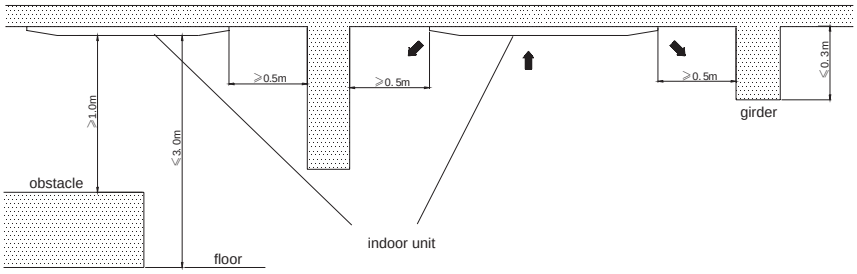
■ Notes:

a. Ensure the space for installation.

b. Ensure no barrier, and good ventilation is a must.

Please refer to the below fixed:

To refer to the above installation dimension to ensure the performance of units as much as possible. The supports shall carry weight 4 times larger than the indoor units to avoid unnecessary vibration and reduce the noise. The unit must be installed horizontally, and ensure enough ceiling height and space for installation.



■ Installation instruction

a. To keep indoor units from the source of heat and vapor (do not install in the entrance).

b. To measure the position of fixing and drill hole in the ceiling and fix the units tightly.

c. The paper template may change with the temperature and humidity, so please measure the dimension before usage.

d. Ensure the paper temperate is the same dimension as hole dimension in the ceiling.

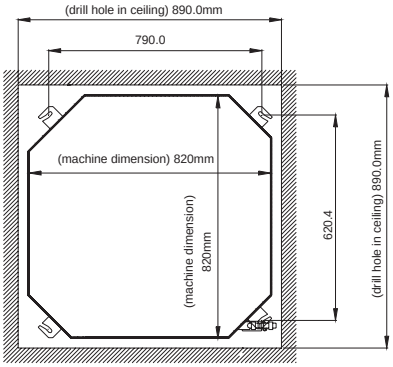
e. Before the completion of ceiling decoration, leave the paper template with the indoor unit.

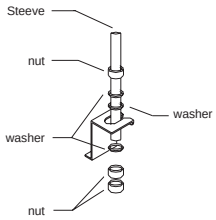
f. Ensure the distance between the hang poles is 620.4mm × 790.0mm.

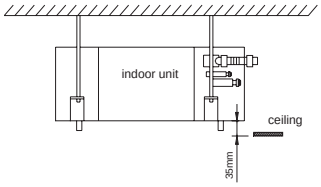
g. To use screw to fix the indoor units tightly.

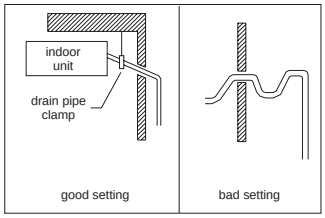
h. To adjust distance between the bottom panel and ceiling to 35.0mm.

i. To check whether the installation is horizontal, and indoor units are fixed tightly without dropping off and vibration.





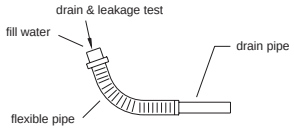




j. To cut the same shape of paper template in ceiling.

k. Drainage shall be smooth piping and slope installed.

l. To avoid drainage piping bent, shall be straight.



m. To install the drainage piping, do not exert too strong force.

n. It shall be installed diameter 20 mm host to connect outside part of drainage piping.

o. Drainage piping shall be covered with insulation material (thickness: 8.0mm polyphone plastic material), to avoid the dropping off of the condensing water.

p. To connect the drainage host and flexible host.

q. To fill water to piping from the host connector to test the leakage.

r. After testing, to connect the other end of host to indoor units.

■ Note:

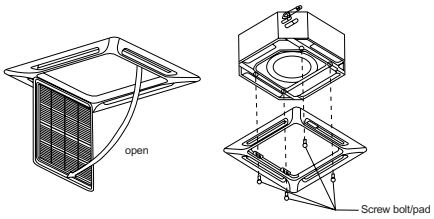
In this type of indoor units, a water pump is used to help to drain the condensing water, to install unit horizontally to avoid leakage of water and condensing water dropping off.

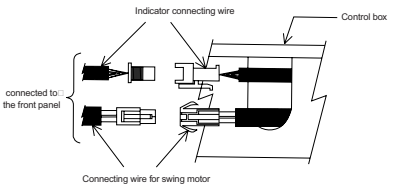
■ Installation of front panel

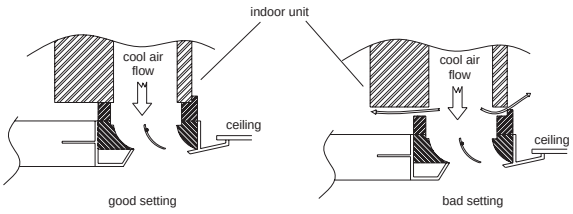
- ● To install the front panel, please check the piping connecting direction first. (Follow the direction of connecting pipe shown in the front pane.)
- ● To remove the paper template.
- ● To remove the air filter and grill of front panel.
- ● To use 4 screw bolts to fix the frame of front panel tightly.
- ● To connect the indicator light with indoor unit and fan swing motor with indoor units respectively.

■ Note:

Ensure the frame of the front panel is fixed tightly to avoid the leakage of cool and dropping of condensing water.

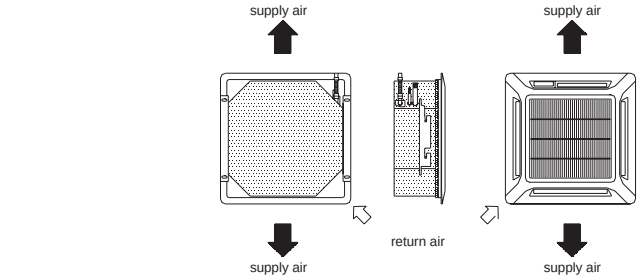




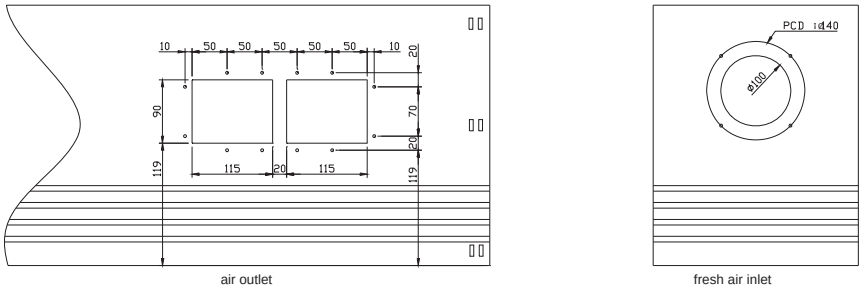


There are also the hole for fresh air and exhaust air for connection with outside in indoor unit, but as for air piping, and only be the other side of refrigerant piping connector. If the indoor unit is installed to the place with a barrier (such as a head lamp) or a small space, the connecting pipe can improve air supply to two rooms at one time.

Return Air and Supply Air Direction



Drawings for piping connector and its dimension (unit: mm):



■ Notes:

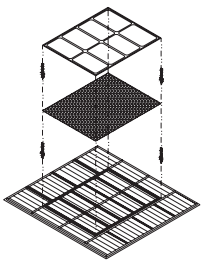
- ●Do not close all air outlets of indoor unit in the using of the unit to avoid the frost of evaporator.
- ● To ensure the thickness of insulation material and no leakage allowed.
- ● Fresh air shall be less than or equal to 20%.

■ Air tightness of outlet of supply air

- ●Total 4 air outlets can be sealed by insulation material but more than 2 air outlets closed will cause abnormal operation of units.
- ● Open the front panel, to seal the air outlet in front panel.
- ● To ensure the length of insulation material is the same length of the air outlet.
- ●To extend the insulation material to cover the gas about 10mm but not touch the air grill; there is no need to extend insulation material far more than 10 mm.

■ Installation of air inlet grill

- ● Before installation of air inlet grill, to install the air filter.
- ● To ensure the right side to face the grill.
- ● Be careful to install the air filter in the frame of air filter supporter.
- ● To fix the filter with the front panel.
- ●The air inlet grill can be installed in any direction, depending on the ceiling design.
- ● To fix the grill and consider the service friendly to open the grill.

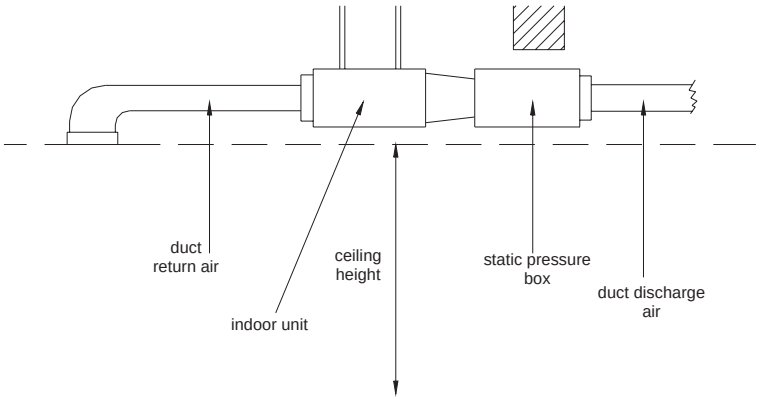


■ Installation of drainage

a. Slope is required as 1/100, and try to drain in a positive slope.
b. To use suspending bolt to fix the long drainage piping.
c. After installation, to run the leakage test is necessary to ensure it works.
d. Only in cooling mode, there is a need to detect the status of drainage.

■ Installation of MDB-T series indoor unit

To mount the MDS050~060T in ceiling. As the air outlet flange is close to the unit bottom, when the unit is mounted in ceiling, the pipe can be laid out easier, effectively reducing the requirement for room height. After the installation, only the air inlet/outlet is exposed, as shown below.



- To check the accessories are ready
- To choose the location for installation

  Make sure it is easy to connect cables and pipes. Select a place where needs shorter air pipe and fewer connecting pipe work and ensure the building is with enough strength, ascertain the pole location and adjust it to keep the unit horizontally, and examine safety of the suspending.
- To install the hook

  Make sure to fix the hook, and the top suspending part is strong enough to bear the unit weight.
- To install the indoor unit

  To fix the pole location, examine if it is in the same level with the unit, and check if the suspending panel is stable; make sure there is a slope oriented to the drainage direction. Pay attention that the distance between the return air outlet and the heat exchanger inlet shall not be less than 3m.
- To install the refrigerant piping

  If units expose to air more than 15s, units shall be vacuumed firstly. If the connecting pipe is not prepared for indoor unit, do not open sealed parts (valves, joints, rubber, plastic gasket and copper cap).
- Duct working design

  Well designed duct working can reduce noise level effectively. When doing this, please consider the internal air pressure drop shall be equal to ESP, otherwise, air flow may be too big or too small, and cause the unit failure. It can be solved by adjusting the fan speed to make them in balance (such as adjusting the air speed of the diffuser).
- Installation of drainage piping

  a. Slope is required as 1/100, and try to drain in a positive slope.

  b. To use suspending bolt to fix the long drainage piping.

  c. After installation, to run the leakage test is necessary to ensure it works.

  d. Only in cooling mode, there is a need to detect the status of drainage.

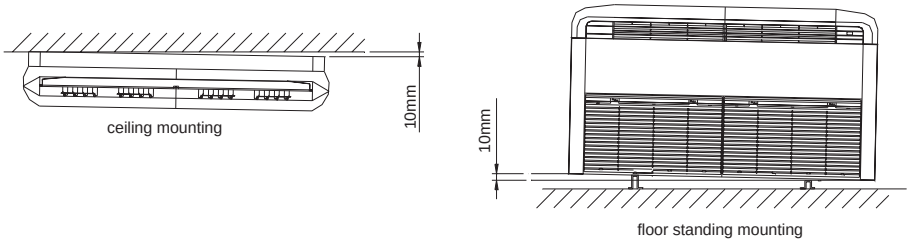
Installation of MCM-T Series Indoor Unit

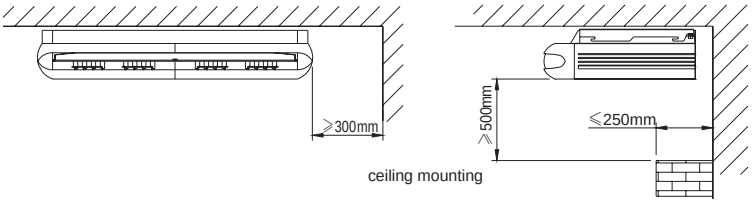
To Check the Accessories are Ready

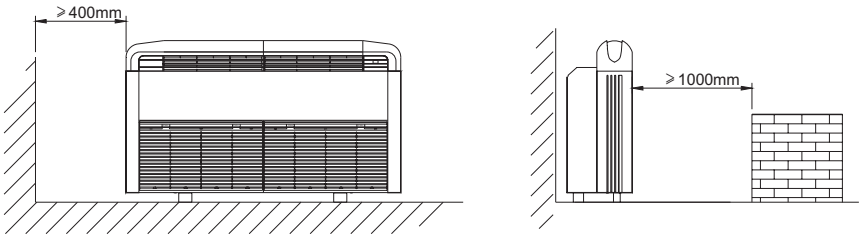
■ To install the indoor unit

There are two types of installation. Make sure the hook can bear the unit weight in ceiling mounting; a slope for the drainage direction is a must both for ceiling/floor standing mounting; ensure there is enough space for maintenance around the unit.

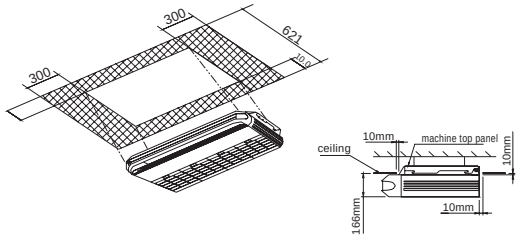
There are two type of installation: vertical floor standing or horizontal ceiling mounting:





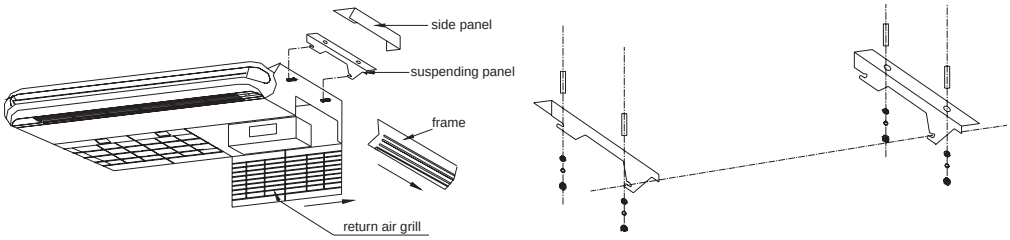


If the indoor unit is semi-concealed mounted in ceiling, reserve holes in ceiling to ensure enough space for mounting and maintenance, as shown below:

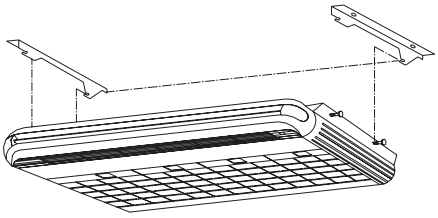


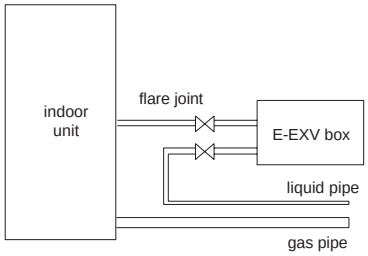
■ Horizontal ceiling mounted

1. To remove the return air grill, frame, side panel and suspending panel as shown as below:



2. To fix the suspending panel with screw bolt as shown as above right figure.
3. To hang the unit to the suspending panel and fix screw bolts, after installation of refrigerant pipe and drainage pipe, install the return air grill and frame, as shown below left figure: return air grill



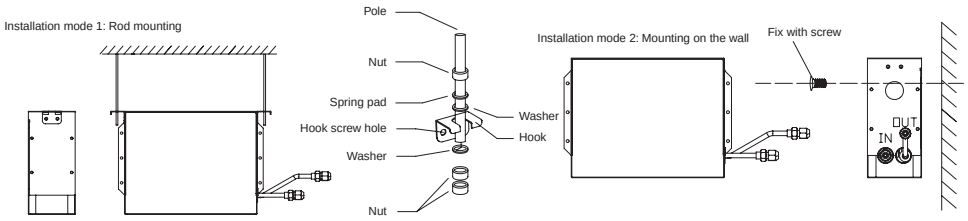


● Install the E-EXV box: All models of this series product need connect a E-EXV box to finish the piping installation, as shown on right figure:

■ Notes:

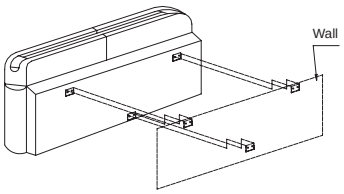
●The E-EXV box contains electronic expansion valves, which needs to be mounted in proper place on the liquid piping. When installing the E-EXV box, make sure the box vertical. The E-EXV box and the indoor unit could not exceed the length-limit of the electric expansion valve cable, as shown above right figure.

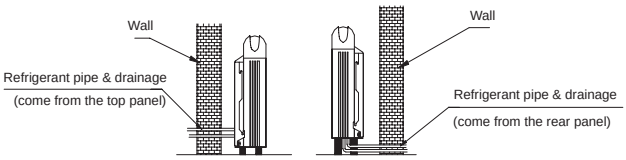
●There are some manners to install the E-EXV box (the mounting must be fixed and safe, and the direction must be vertical).



■ Vertical floor standing

1. To remove the air return grill, frame, side panel and suspending panel as shown below:
2. To install the unit supporter and wall suspending panel, as shown below left figure:





3. To install the refrigerant and drainage piping as shown above right figure;
4. To install the electrical expansion valve as same as the horizontal installation;

■ Installation of drain piping

a. Slope is required as 1/100, and try to drain in a positive slope.
b. To use suspending bolt to fix the long drainage piping.
c. After installation, to run the leakage test is necessary to ensure it works.
d. Only in cooling mode, there is a need to detect the status of drainage.

4.3 Refrigerant Piping Design and Installation

4.3.1 Refrigerant Piping Design (Including Selection of Refnet Joint)

■ Capacity combination

The indoor units & outdoor units should have a relationship as follows:

$$50\% \leqslant \frac{\Sigma \text{ indoor units' cap}}{\Sigma \text{ outdoor units' cap}} \leqslant 130\%$$

Note:We strongly recommend that the capacity modulation equals to 100%.

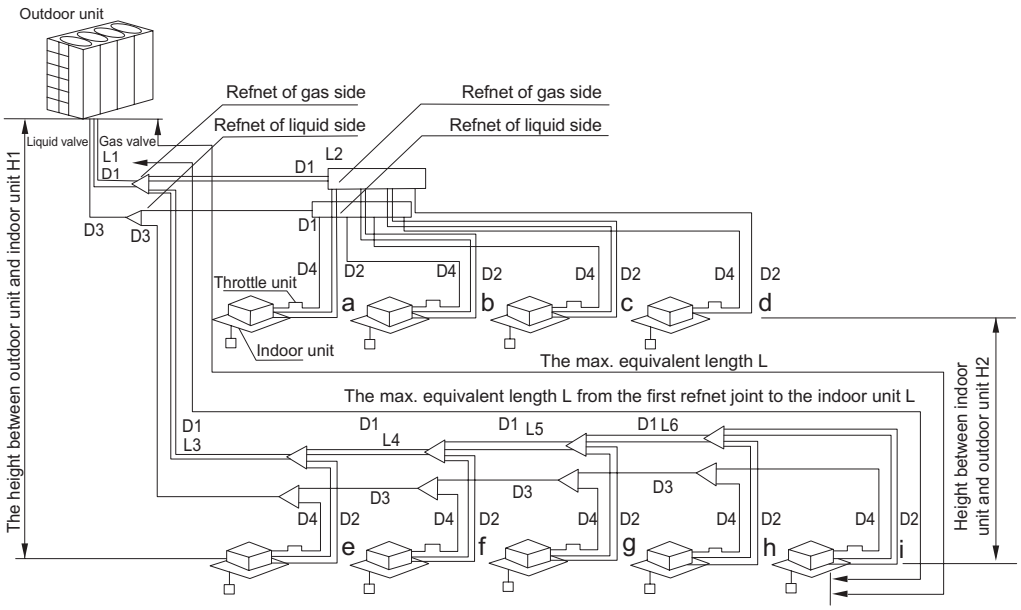
■ Refrigerant piping limit

			Allowable value	piping section
Piping	Actual length		⩽ 250m	$L_1+L_2+\cdots\cdots L_i$
	Max. length(m)	Actual length	⩽ 125m	$L_1+L_2+\cdots\cdots L_i$
		Equivalent length	⩽ 150m	
	The length from the first branch to the remotest unit L(m)		⩽ 40m	$L_2+L_3+\cdots\cdots L_i$
Height	Height between indoor unit and outdoor unit	Outdoor unit is above	⩽ 50m	-
		Indoor unit is above	⩽ 40m	-
	Height between indoor unit and outdoor unit		⩽ 15m	-

Note: the equivalent length is calculated as follows:

One refnet joint equals to 0.5m, one distributor kit equals to 1.0m.

The above table is based on the 8/10HP unit.



■ Equivalent length

● Equivalent length = actual pipe length + number of elbows X equivalent length of each elbow + number of oil traps X equivalent length of each oil trap.

Item / Diameter	elbow(m)	oil trap(m)
9.52	0.18	1.3
12.70	0.20	1.5
15.88	0.25	2.0
19.02	0.35	2.4
22.02	0.40	3.0
25.40	0.45	3.4
28.58	0.50	3.7
31.80-41.30	0.55	4.0

● For example: when 10HP outdoor unit's actual length is 80m, the piping diameter is 25.4mm, ten elbows and three oil traps are used, then the equivalent length is calculated as follows:

Equivalent length = 80+0.45x10+3.4x3=94.7(m).

■ Application of equivalent length

● When the equivalent length is more than 90% of the actually allowable maximum piping length (more than 63m in 6HP, 90m in 8/10HP), the gas pipe diameter of the main piping (piping from the outdoor unit to the first branch) should be expanded to a higher level. For instance, when the equivalent length of 10HP outdoor unit is more than 100m, the gas pipe diameter is changed from 28.6mm to 31.8mm.

● When the diameter of gas pipes is expanded to a higher level, the equivalent length should be recalculated as follows:

Expanded equivalent length = equivalent length of main piping X 0.5 + equivalent length of the branch pipe

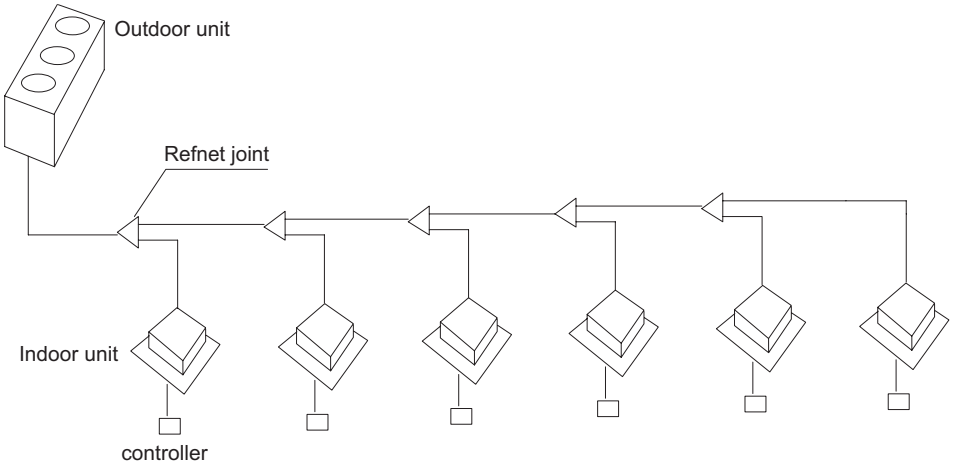
■ For example: when the actual length of 10HP outdoor unit is 80m, branch pipe length is 20m, the diameter of the main gas pipe is 25.4mm, ten elbows and three oil traps are used (elbows and traps are used only in main piping).

● Equivalent length = 80+0.45X10+3.4X3=94.7(m)

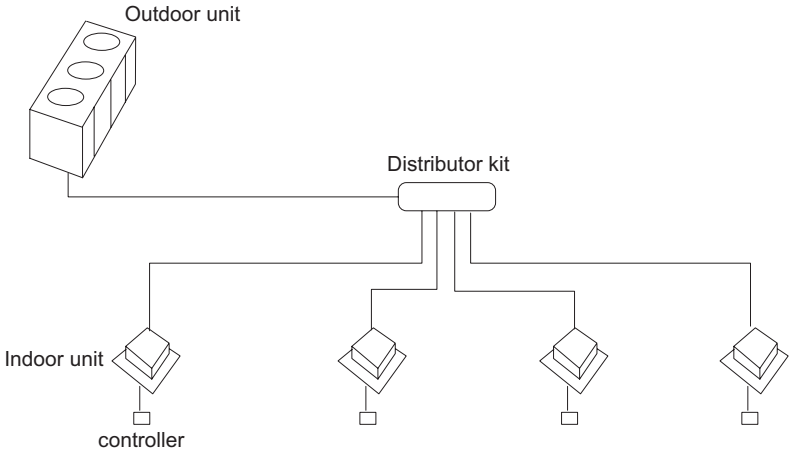
● As the equivalent length is more than 90m, the diameter of gas pipe in the main piping is expanded to a higher level.

● Expanded equivalent length =(60+0.45X10+3.4X3) X0.5+20=59.1(m).

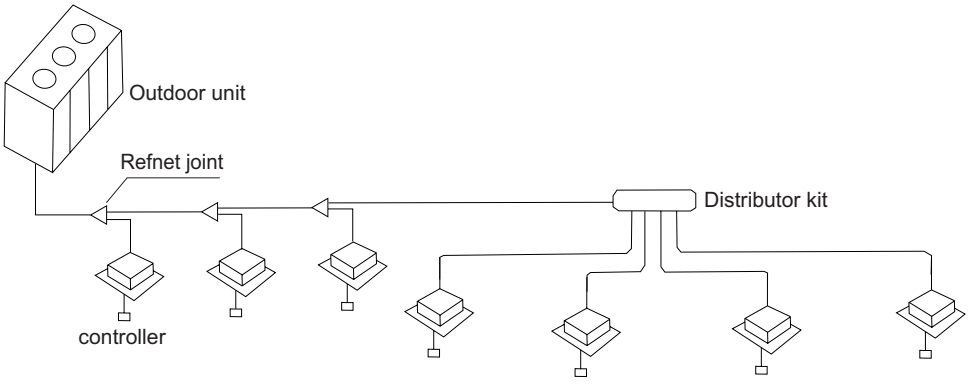
■ Connection of refnet joint and distributor kit



Only connected by the refnet joint



Only connected by the distributor kit

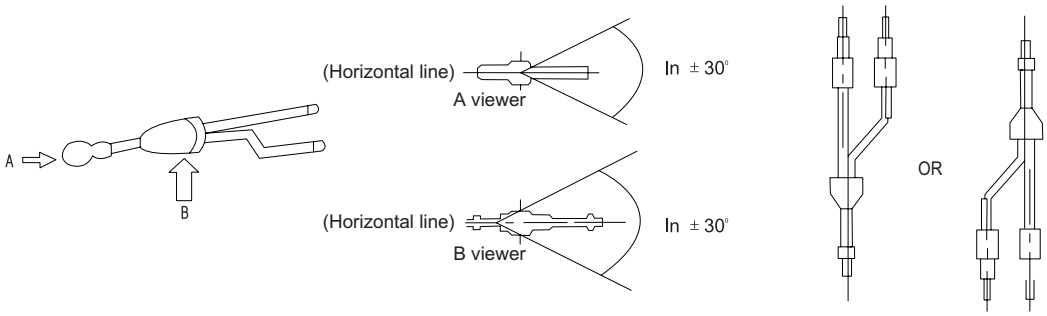


Connected by the refnet joint and the distributor kit

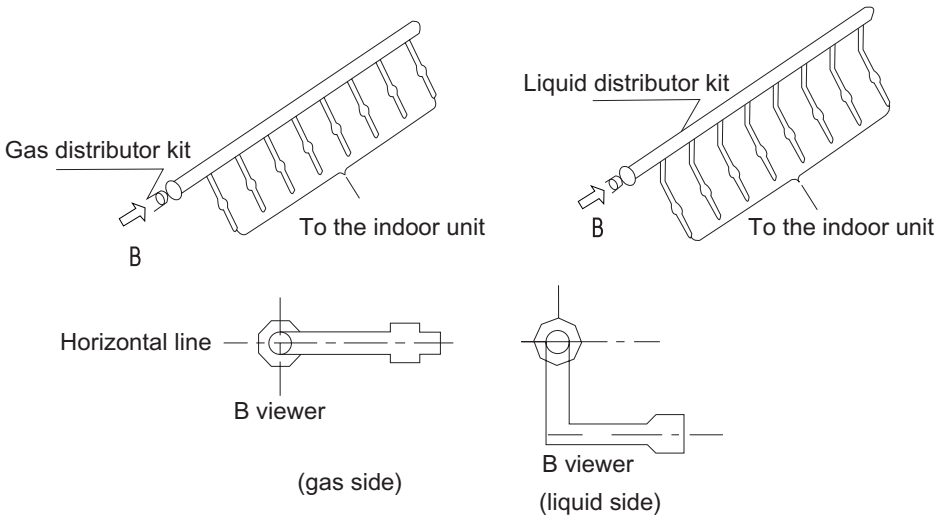
■ Refrigerant Piping Installation:

● Refrigerant piping should use the appointed diameter pipe;

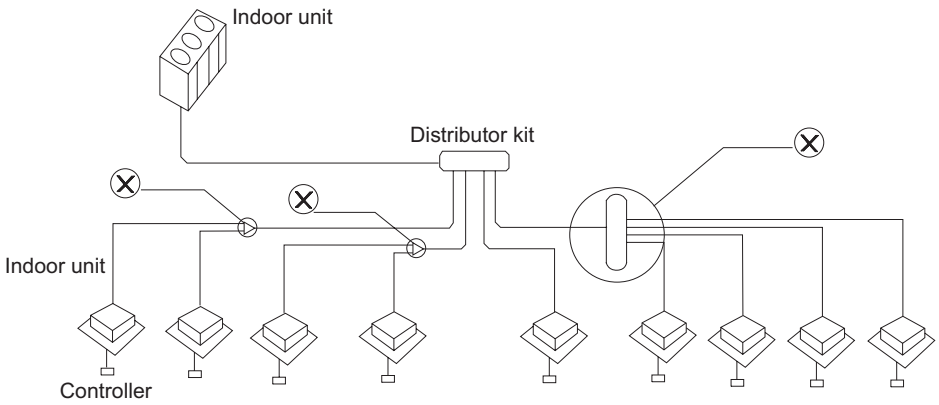
● Refnet joint must be installed horizontally or vertically.



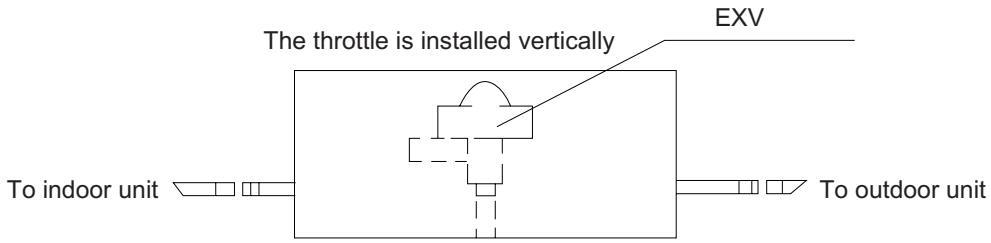
● Distributor kit must be installed horizontally.



● Distributor kit should be connected to indoor unit directly, it is not allowed to connected to the distributor kit or refnet joint.



● The EXV must be installed vertically



4.3.2 Refrigerant Piping Assembly Process

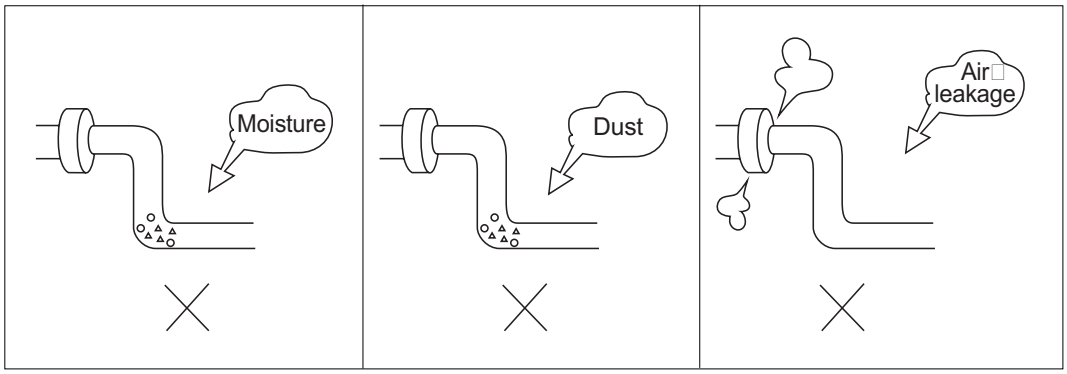
Sequence	install the indoor unit → cut the piping required → install the pipe → nitrogen charging welding blow → air leakage test → dry

Three principle of the refrigerant piping assembly

	Processing method
Dry	Piping assembly → air blow → dry
Clean	Nitrogen charging Piping assembly → air blow
No air leakage	Use the right material such as copper and welding rod Abide by the welding process Abide by the flare fitting process → air leakage test

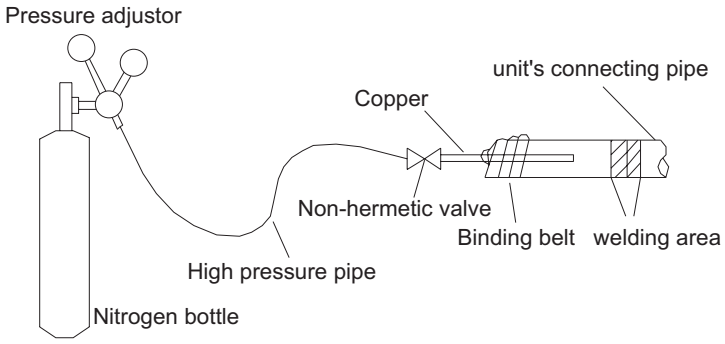
Three principle of the refrigerant pipe

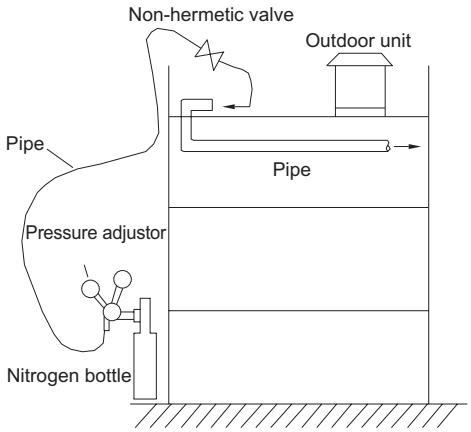
Dry	Clean	No air leakage
no moisture	no dust	No refrigerant leakage



4.3.3 Exchange Way of Nitrogen Gas (When Welding Copper Tube)

Suppose no nitrogen gas is injected into refrigerant pipe when welding, the oxide air bubble will come into being in the internal surface of tube. This will result in some damage to the system. In order to avoid these, nitrogen gas should be injected into refrigerant pipe when welding, this process is called nitrogen gas exchange method. This is the standard operation process of welding.





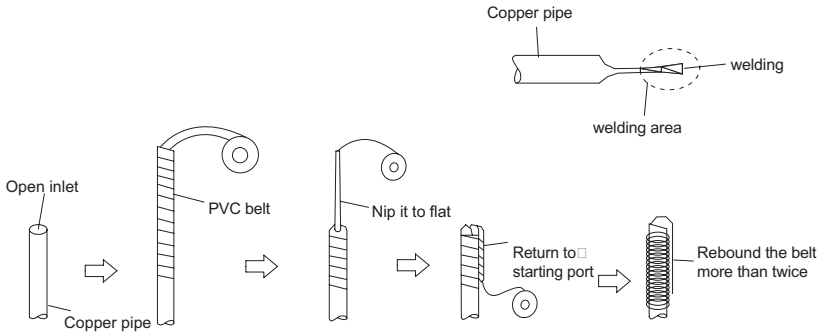
Note:

The gas must be Nitrogen.

Pressure adjustor must be used.

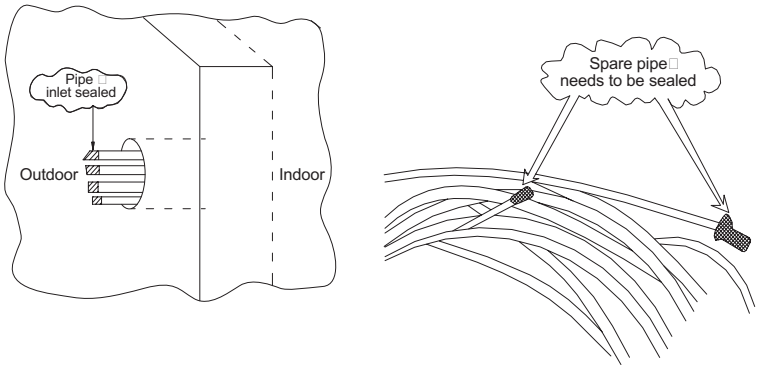
4.3.4 Transportation and Conservation of Copper Tube

■ When transport the connecting pipe, please be careful to keep it in shape. Copper cap should be used to prevent the dirt and water from entering it. When store it, the side of the connecting pipe should be sealed as follows:



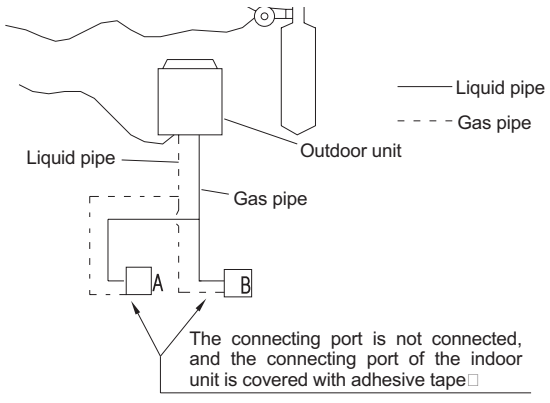
■ Be careful when there are some operation as follows:

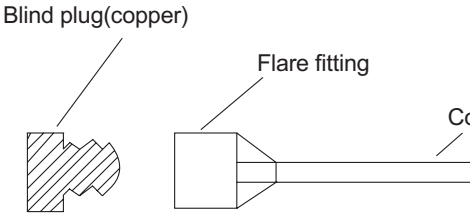
- ● Put the copper pipe through a hole (The dirt is easy to enter it).
- ● The copper pipe is extended to outside door (rainwater is easy to enter it, especially when copper tube is vertical outside door)



4.3.5 Blow of refrigerant pipe

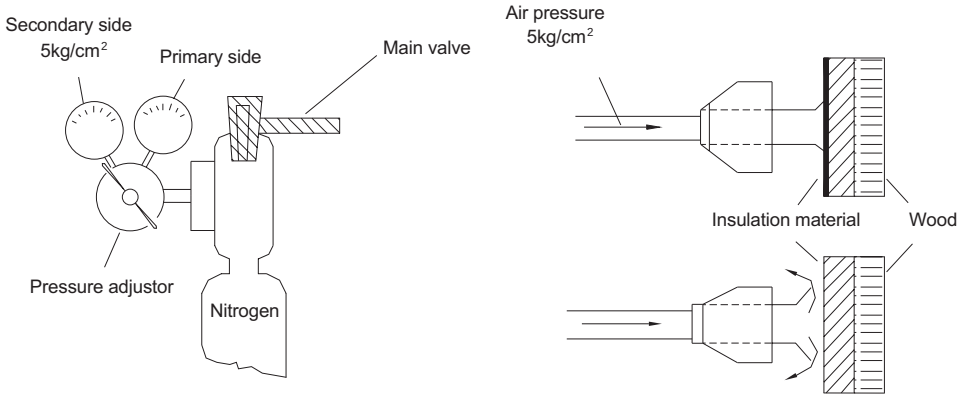
Using pressurized air to blow pipe is a kind of way to clean the pipe.





■ Steps:

- ● Put the pressure adjustor on the nitrogen bottle
- ● Connect the pressure adjustor with the liquid pipe of the outdoor unit
- ● Seal any other connecting port,
- ● Open the valve of the nitrogen and adjust it which the pressure is 5kg/cm^2.
- ● Check to see if the nitrogen go through the liquid pipe of point A.
- ● Air blow
  - ◆ Hold a insulation material in your hand and try to seal the side of the copper pipe.
  - ◆ When the pressure is too strong to hold, release the insulation material quickly.
  - ◆ Seal the port of the copper pipe with the insulation material and put a piece of cloth near it, when you feel that there are some moisture in it, it is time to dry it. And the following steps are as follows:
  - ◆ Blow the copper pipe with nitrogen,
  - ◆ Process vacuum dry.
- ● Close the valve of gitrogen bottle;
- ● Repeat the above operation of unit B;
- ● When the operation on the liquid pipe is finished, please do the same thing on the gas pipe.



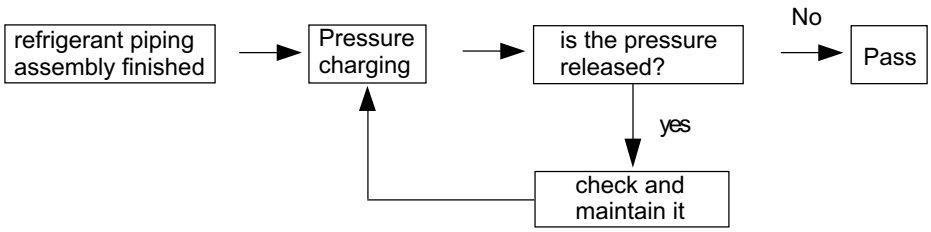
Avoid wielding too often

4.3.6 Selection of Refrigerant Pipe Material

■ Refrigerant pipe

- ● Use the long straight copper pipe to reduce the welding times,
- ● All the pipe must comply with the JIS requirement such as size, material and thickness.

4.3.7 Process Sequence of Air Leakage Test



■ Main points of testing

Please test as follows:

- The Pressure charging must be tested both in liquid pipe and gas pipe.
  - ◆ First step, keep 3.0kg/cm^2 pressure gas for more than 3 minutes---may be can find big gap;
  - ◆ Second step, keep 15.0kg/cm^2 pressure gas for more than 3 minutes---may be can find big gap;
  - ◆ Third step, keep 28.0kg/cm^2 pressure gas for more than 24 hours.

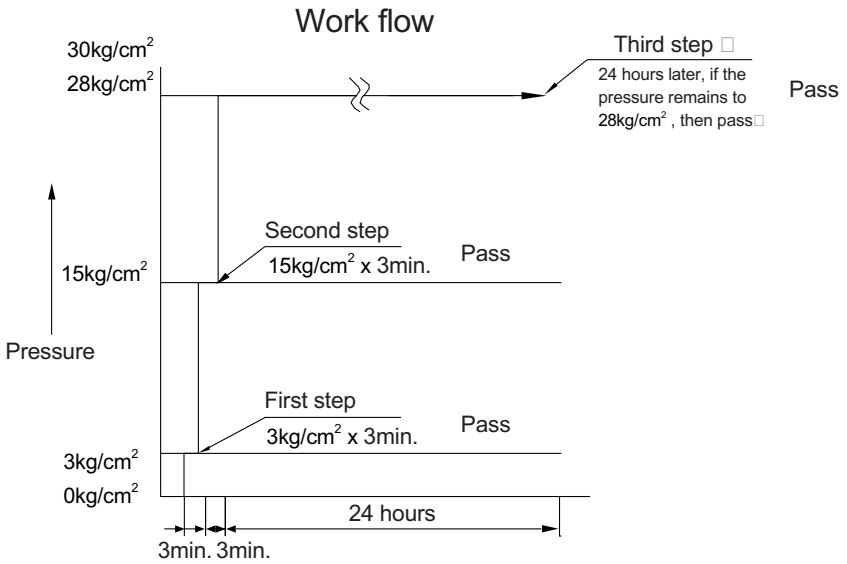
Notes:

Keep the 28.0kg/cm^2 pressure gas must more than 24 hours.

The pressure can not be more than 28.0kg/cm^2!

- Check the pressure decrease or not
  - ◆ If the pressure remain the same, then it is OK;
  - ◆ If the pressure decrease, then we should find out the leak gap.
  - ◆ If the ambient temperature when pressure is charged is different from the temperature when observing, the pressure need to be modified as follows:

    Modified value = (temperature when pressure is charged- temperature when observing)x 0.1; e.g.: when pressure is charged to 28.0kg/cm^2 and the ambient temperature is 25℃; after 24 hours, the pressure is 27.5kg/cm^2 and the temperature is 20℃, then you can have a conclusion that it is OK.



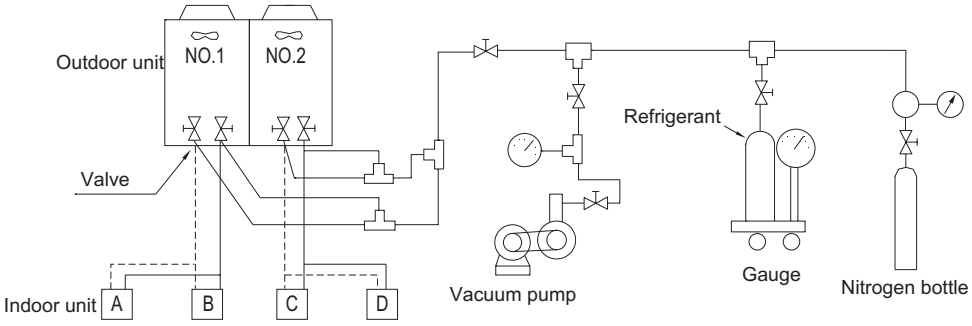
4.3.8 Air Leak Gap Checking

■ Test 1 (when the pressure reduces)

- ● Hearing — use your ear to find it out.
- ● Touching — use your hand to find it out.
- ● Soap water — use soap water to find it out.

■ Test 2 (when step 1 can not find out , then the following should be adopted)

- ● Reduce nitrogen pressure to 3.0kg/cm^2;
- ● Charge the nitrogen with R22 to 5.0kg/cm^2;
- ● Use haloid lamp, alkyl detector or electric controller to check;
- ● If still can not find the air leak gap, then the pressure should be charged to 28.0kg/cm^2 and check it again;
  (The pressure can not be more than 28.0kg/cm^2).



Notes:

If the pipe is too long, it should be divided to sections to test as follows:

- ● Indoor side
- ● Indoor side + vertical pipes
- ● Indoor side + vertical pipes + outdoor piping assembly

4.3.9 Copper Pipe Insulation

Refrigerant piping assembly → pipe insulation → air leak test → pipe insulation

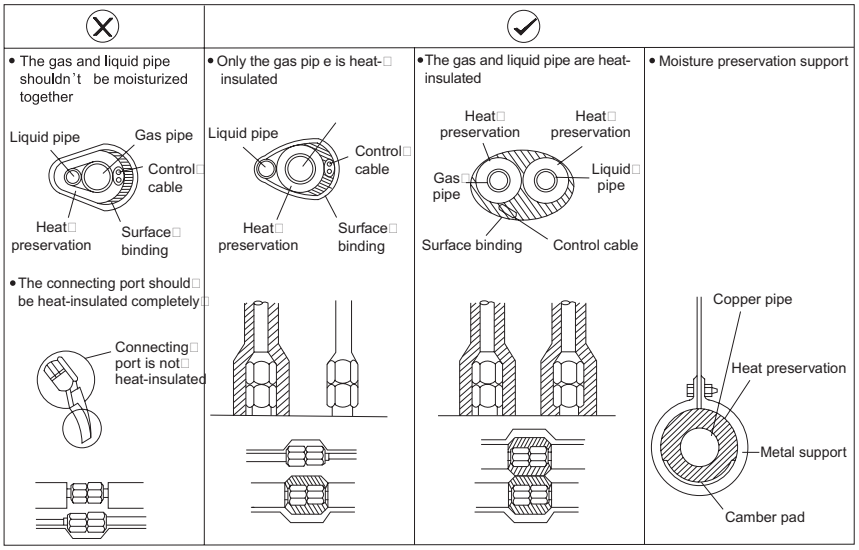
■ Material

All the insulation material should be strong enough to insulate the pipe.

For example, polyethylene is a good insulation material.

■ key points

Some areas such as welding area, enlarged port area and flange area can be insulated only after the air leak test. Pay attention to the unit model and the running condition, for some gas pipe and liquid pipe are all needed to be insulated.



The thickness of insulation materials depends on the pipe size.

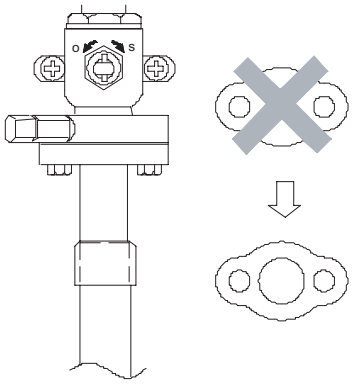
Pipe size	Thickness of the insulation material
6.4mm~25.4mm	10mm or more
28.6mm~38.1mm	15mm or more

- In case the environment is hot and damp, increase the recommended thickness (1 inch for the main pipe, and half inch for the refnet joint) in the table above.
- For the cooling only unit, if it is predicted that the system might run in the ambient temperature of less than 10℃degrees Celsius, the liquid pipe should also be insulated.

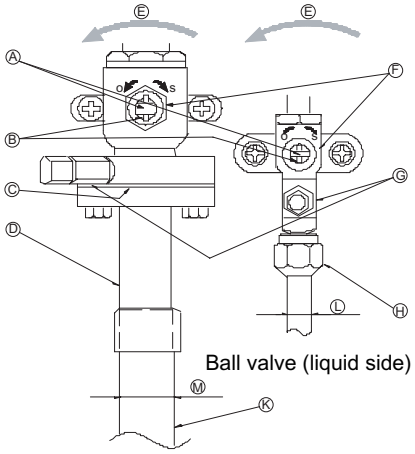
4.3.10 Ball Valve Operation

■ Ball valve operation procedures

Make sure the pipes are connected and the valves are operated correctly. Please install and operate the valves as follows:



- Gas side ball valve operation
  1) Remove the connection pipe with flange: Remove the connection pipe with flange from the gas side ball valve and braze it to the outside of the unit.
  2) Stick the sealing material: When removing the connection pipe and flange, remove the sealing material on the ball valve label and stick it on the flange of the ball valve to prevent dusts into the ball valve.
  3) Replace the hollow gasket: Before delivery, seal the refrigerant circulation loop with a round solid sealing plate to avoid gas leakage between flanges. In such status, the system cannot run. So, please replace with the hollow gasket on the ball valve. Before installing the hollow gasket, clean the flange surface and the sealing plate.
  4) Fix the connection pipe welded with gas pipe, hollow gasket and gas ball valve with screws.
- Connection of the liquid side stop valve: Expand the flare fitting of the copper pipe. Then, connect it with the threaded stop valve.
- After pumping vacuum and fill refrigerant, make sure the valve is fully open. If the system runs when the valve is closed, the unit pressure will be abnormal, damaging the compressor and four-way valve.
- Calculate the refrigerant amount to be added with the formula (refer to Section 9.3), and fill the amount through the access opening when the pipe connection work is complete.
- After the work is finished, firmly fix the access opening and cap to avoid gas leakage.



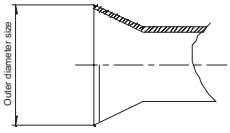
Ball valve (liquid side)

Ball valve (gas side)

A Valve handle
(Before pipe connection, vacuum pumping and additional refrigerant filling for delivery, make sure this valve is closed completely. After the above operations, please fully open it.)
B Stop pin (prevent the valve handle from turning over 90 degrees)
C Sealing plate (annex)
D Connection pipe (annex)
Install the pipe firmly to the valve flange with the sealing plate to avoid gas leakage.
E Open (slow operation)
F Cap and copper spacer
Remove the cap and operate the handle. After the operation, reinstall the cap. The moment to tighten the valve handle cap is 23 Nm to 72 Nm.
G Access opening
Pump vacuum for the refrigerant pipe through this access opening, and fill additional refrigerant on the site. Open and close the access opening with a double-end wrench. After the operation, reinstall the cap. The moment to tighten the access opening cap is 12 N · m to 15 N · m.
H Flare fitting
For the tightening moment, refer to the figure in next page. Loosen and screw up the screw with a double-end wrench. Coat refrigerant oil on the contact surface of the flare fitting (Type R22 mineral oil is applicable).
K Field connection pipe
Braze to the connection pipe. (Please use non-oxidative brazing materials)

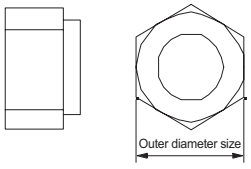
■ The following table shows the dimension of the copper flare fitting. （Unit: mm）

Outer diameter		Outer diameter
Metric system	British measurement	
Φ 6.35	1/4 〃	9.0
Φ 9.52	3/8 〃	13.0
Φ 12.7	1/2 〃	16.2
Φ 15.88	5/8 〃	19.4
Φ 19.05	3/4 〃	23.3



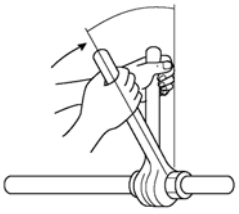
The following table shows the dimension of the nut of the flare fitting nut. （Unit: mm）

Outer diameter		Outer diameter
Metric system	British measurement	
Φ 6.35	1/4 〃	17.0
Φ 9.52	3/8 〃	22.0
Φ 12.7	1/2 〃	24.0
Φ 15.88	5/8 〃	27.0
Φ 19.05	3/4 〃	36.0

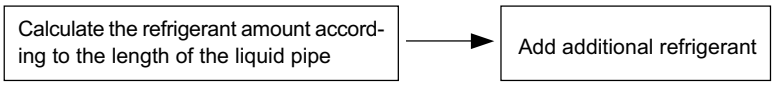


■ When connecting the liquid pipe and liquid stop valve, align the center of the flare fitting of the liquid pipe to that of the stop valve, and then tighten with a moment wrench. Whether tightened with the wrench depends on the setting of the wrench range and the tightening angle. The following table shows the external pipe diameter, the corresponding tightening moment and the tightening angle.

Outer diameter (mm)	Tightening moment (N·m)	Tightening angle(°)
Φ 6.35	14 ~ 18	60 ~ 90
Φ 9.52	35 ~ 42	60 ~ 90
Φ 12.7	50 ~ 57.5	30 ~ 60
Φ 15.88	75 ~ 80	30 ~ 60
Φ 19.05	100 ~ 140	20 ~ 35



4.3.11 Refrigerant charging



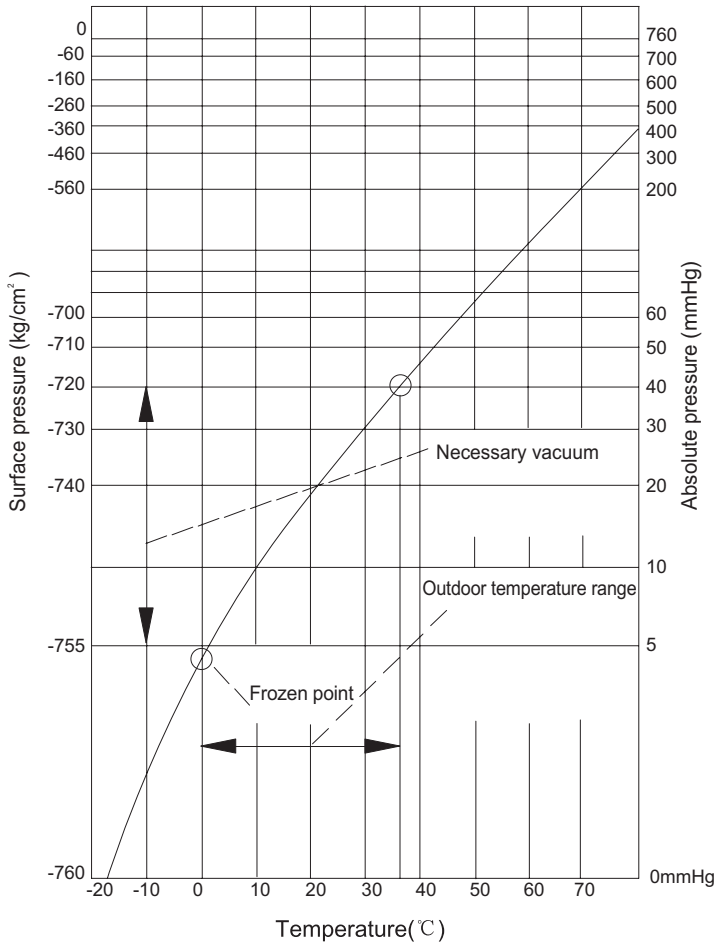
- The refrigerant amount of fill of the outdoor unit before delivery (excluding the refrigerant to be filled in the site pipe)
- The additional amount of the refrigerant depends on the liquid pipe diameter and length (based on the liquid pipe).

Diameter of the liquid pipe (mm)	6.35	9.52	12.7	15.88	19.05
Amount of the additional refrigerant (g/m)	50	80	120	180	290

- Calculation of the additional amount of the refrigerant
  Additional amount= (ϕ 15.88 liquid pipe length x180g/m) + (ϕ 12.7 liquid length x120g/m) + (ϕ 9.52 liquid lengthx80g/m) + (ϕ 6.35 liquid length x50g/m).

4.3.12 Vacuum Pumping

- Vacuum drying of the refrigerant pipe
  - Vacuum drying
    Vacuum drying is to dry the pipe by vaporizing the water (liquid) in the pipe with a vacuum pump and discharge it. Under one atmospheric pressure, the water boiling point (steam temperature) is 100 degrees Celsius. When the pressure in the pipe is reduced to nearly vacuum by using a vacuum pump, the boiling point reduces. When the boiling point goes under the outdoor temperature, the water in the pipe vaporizes.
    Before vacuum drying, make sure you know how to select a vacuum pump and how to maintain.



● Selection of vacuum pump

When selecting a vacuum pump, please pay attention to the follows:

◆ The range of vacuum must be up to -755 mmHg

◆ The vacuum pump should have a large exhaust volume(more than 40 litres/min).

Water boiling point(c)	Pressure(mmHg)	Vacuity(mmHg)
40	55	-705
30	36	-724
26.7	25	-735
24.4	23	-737
22.2	20	-740
20.6	18	-742
17.8	15	-745
15.0	13	-747
11.7	10	-750
7.2	8	-752
0	5	-755

Type of vacuum pump and the vacuity

Type	Max. exhaust volume	Application	
		Vacuum drying	Air discharge
Vacuum pump with lubricant	0.02mmHg 100L/min	Suitable	Suitable
Vacuum pump without lubricant	10mmHg 40L/min	Unsuitable	Suitable
	0.02mmHg 50L/min	Unsuitable	Suitable

● Sequence of vacuum drying

According to the different ambient, vacuum drying has two ways:

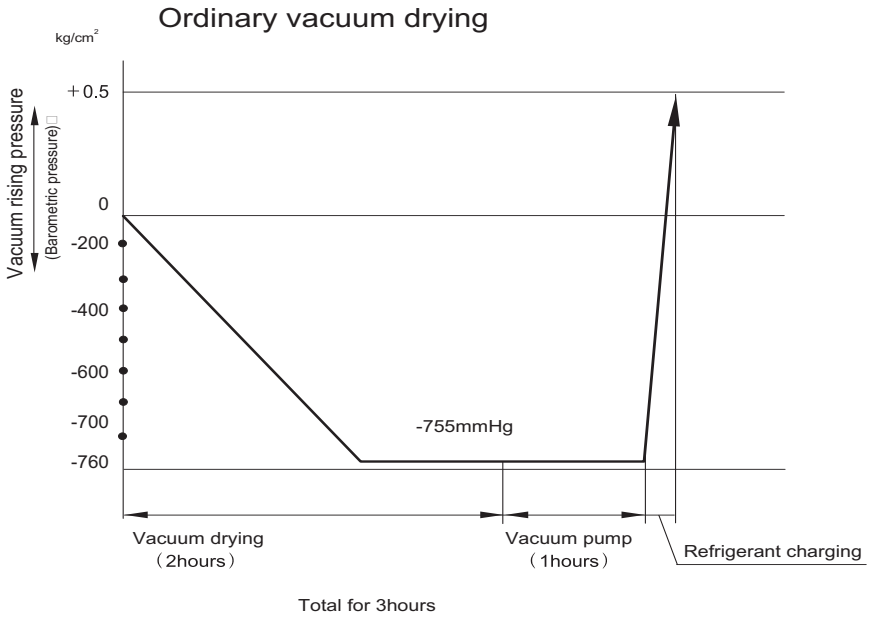
■ Ordinary vacuum drying

Operating sequence:

- ● Connect the pressure gauge with the liquid pipe and gas pipe, then run the vacuum pump for more than 2 hours to reach the vacuity of -755 mmHg.
- ● After pumping for 2 hours, if the pressure is higher than -755 mmHg, or there is some moisture, then pump it for 1 more hour.
- ● After 3 hours pumping, if the pressure is still higher than -755 mmHg, please check to see if there are some air leak gap.
- ● When the pressure is -755mmHg, stop pumping and wait for 1 hour to see if the pressure change. If the pressure change, that means there are some air leak gaps or there is some moisture in the pipe.

Notes

Vacuum should be held both in the liquid pipe and the gas pipe at the same time.



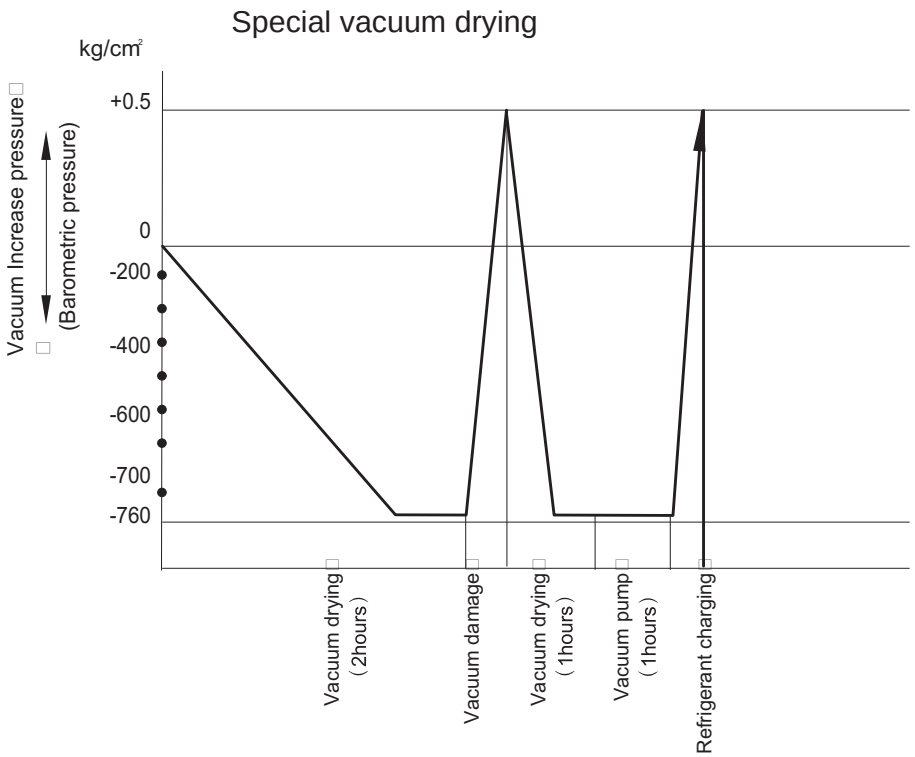
■ Special vacuum drying

This vacuum drying way is used when there are some moisture in the copper pipe.

Operating sequence:

- Vacuum drying: pumping the system for 2 hours;
- Nitrogen charging: Charge the nitrogen to the pressure of 0.5kg/cm^2;
  As Nitrogen is a dried gas, so it can dry the system; but if the moisture is too much, maybe it can not dry the system thoroughly. So when install the refrigerant piping, please be careful enough to prevent the water coming into the pipe or the condensated water.
- Vacuum drying one more time: pumping the system for 1 hours;if the pressure is less than -75 mmHg, then it is OK; if it can not reach -75 mmHg, then it should go back to item 2, then item 3;
- Stop vacuum pumping and wait for 1 hour;
- Additional refrigerant charging;
- Open the vale to charge.

Please note that the gas must be nitrogen, if oxygen is used by mistake, it can result in explosion



4.4 Design, Processing and Installation of Condensated Drain Pipe

4.4.1 Design of Condensated Piping

■ Size selection of main pipe and vertical pipe of condensated water

Choose the pipe size according to the condensated water flow from the main pipe of indoor unit and the following table;

Suppose the condensated water flow of 1 HP is 2L/h, then the condensated water flow of 3# 2HP and 2# 3HP is calculated as follows:

2（L/h）x 2(HP) x 3(sets) +2L/h x 3(HP) x 2(sets) = 24L/h.

Main horizontal pipe Vs condensated water flow rate

JIS	Polyethylene pipe diameter（mm）	allowable flow rate（L/h）		Remark
		slope ⩾ 1/50	slope ⩾ 1/100	
VP20	20	39	27	unsuitable for the header pipe
VP25	25	70	50	
VP32	31	125	88	Suitable for the header pipe
VP40	40	247	175	
VP50	51	473	334	

Note:

Suppose the moisture is 10% in the pipe.

After the header pipe, the pipe should be larger or equal to VP30.

Vertical pipe Vs condensated water flow rate

JIS	Polyethylene pipe diameter（mm）	allowable flow rate（L/h）	Remark
VP20	20	220	unsuitable for the header pipe
VP25	25	410	
VP30	31	730	
VP40	40	1，440	Suitable for the header pipe
VP50	51	2，760	
VP65	67	5，710	
VP75	77	8，280	

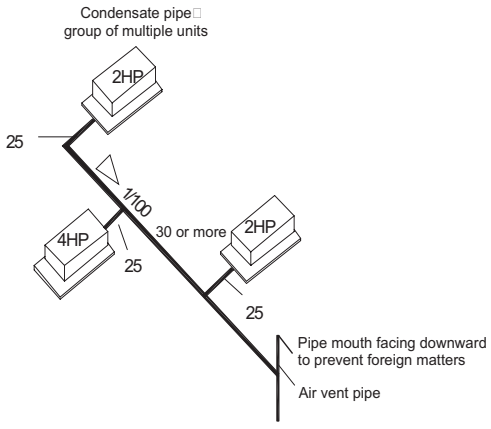
Note:

The vertical pipe should be larger than VP30

For example, The condensate pipe of one 2HP and two 4HP indoor units are connected to a pipe as shown on the right, and its water drainage capacity is:

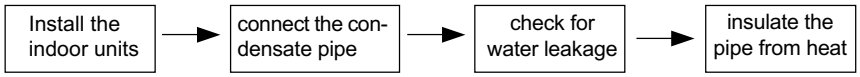
4L/h + 8L/h × 2=20L/h

So the horizontal vertical pipe diameter shall be 30 or more, and the diameter of the vertical diameter shall not be less than that of the horizontal vertical pipe.



4.4.2 Making and Mounting Condensate Pipes

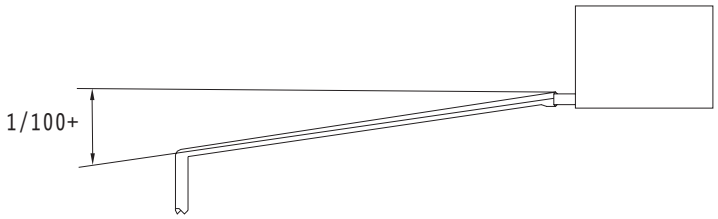
Procedure:



4.4.3 Slope and Supporter of Condensate Pipe

■ The slope condensate pipe should be more than 1/100

● The length of condensate pipe should be as short as possible to discharge the condensate water (no air pocket on the way).



■ For a long condensate pipe, you may use a suspension bolt, to ensure the slope is 1/100 (the PVC pipe cannot be bent)

■ The space of the horizontal pipe support is as follows:

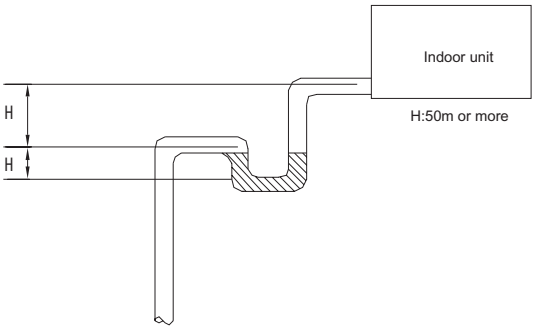
Grade	Nominal diameter	Interval
Hard PVC pipe	25~40mm	Less than 1.0m

■ The length of horizontal pipe should be as short as possible.

4.4.4 Condensate Pipe Trap

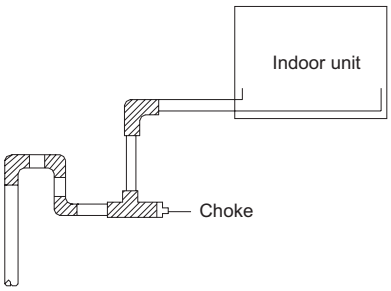
When the unit can generate mins pressure at the condensate water outlet of the unit, the water trap should be installed (to prevent the stench coming into the indoor units)

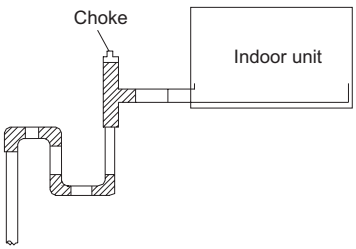
■ The water trap should be installed as shown in the right diagram.



■ Each unit can have only one water trap.

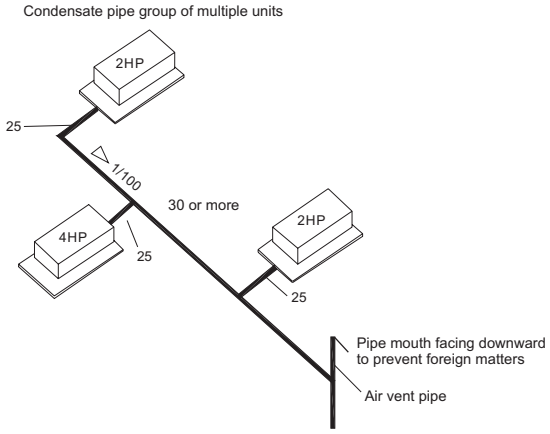
■ The water trap installed should be easy to maintain.





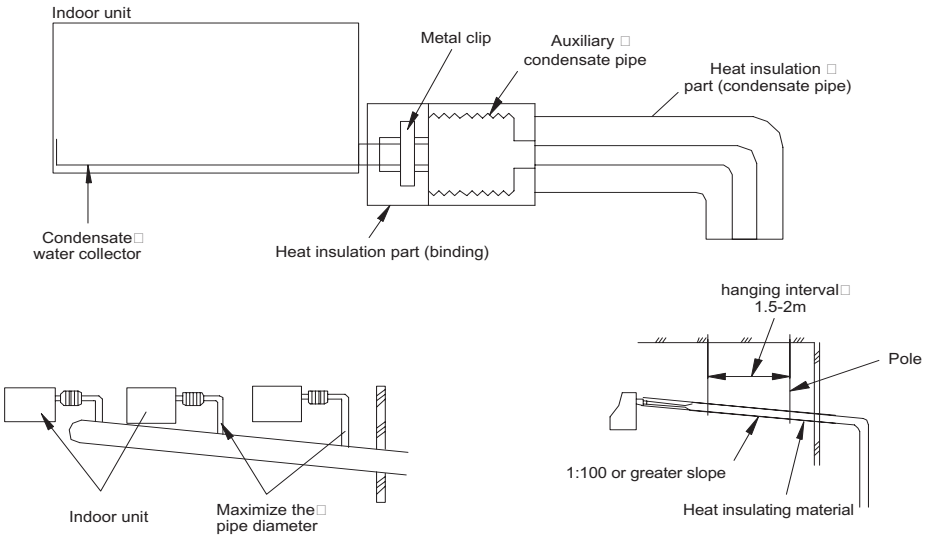
4.4.5 The Main Drainage Pipe of Multiple Indoor Units

- The pipe should be mounted from the upstream, and the diameter of the downstream connecting pipe should be as long as possible.
- The pipe should be as short as possible and the number of the indoor units must be as small as possible.



4.4.6 Accessory Condensate Pipe (Hose)

If the condensate collector is made of polystyrene, it should use the hose. The condensate pipe box can easily connect with the condensate pipe to prevent the condensate coil distorted

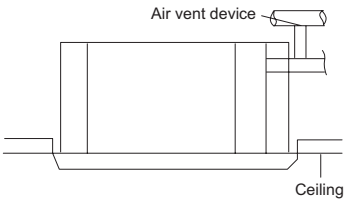


4.4.7 Key Points

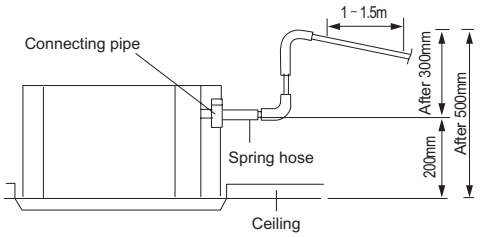
- The diameter of the condensate pipe should be more than or equal to that of the drainage pipe.
- The condensate pipe should be insulated.
- The lift pipe of the condensate pipe should be installed before the indoor unit. When the unit is running, if there is water in the condenser collector, please check whether the condensate pump is working properly.
- All the connecting wiring should be solid (especially the PVC pipe).

4.4.8 Installation of the Drainage Lift Pipe

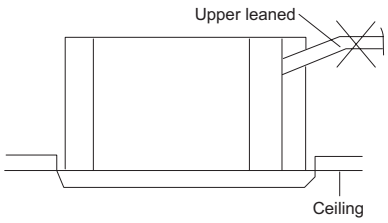
Use the gradienter to check if the indoor unit is parallel to the ceiling,



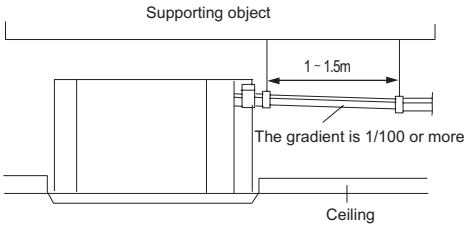
If the drainage pipe needs to be lifted up, it should be less than 300mm. If it is more than 500mm, maybe it will result in the refrigerant leakage.



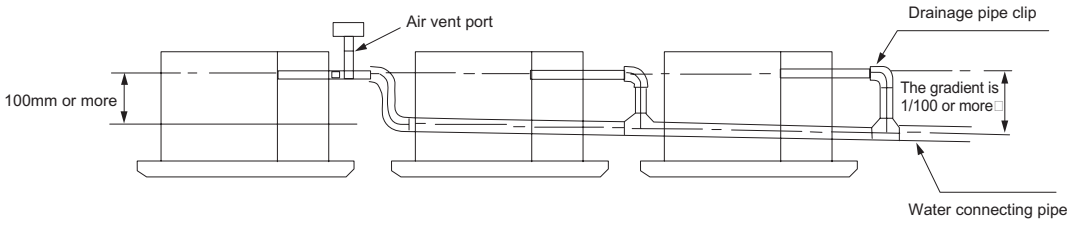
After connecting, the hose should not be higher than the connecting port. This can prevent the water from flowing backwards.



Do not give external force to one side of the unit, and the drainage pipe should not be loose and it should be fixed.



If the water collecting header is installed, please refer to the following:



CHAPTER 5

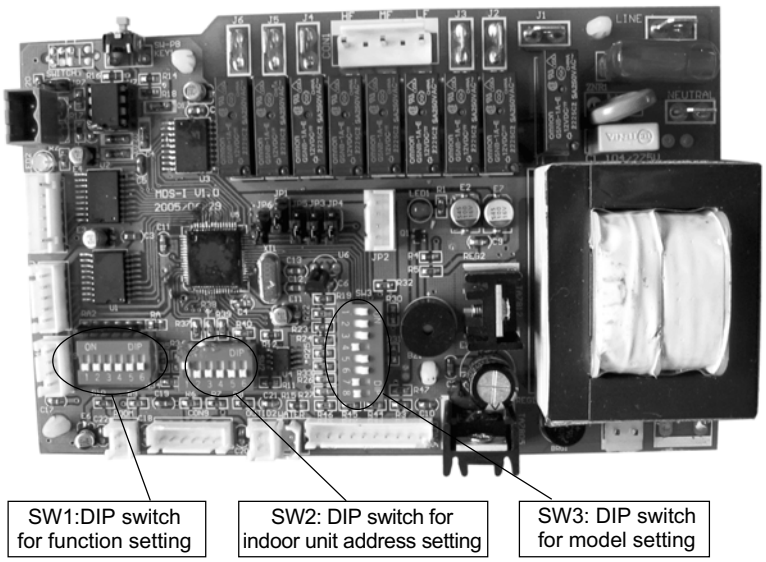
Testing

5.1 Hardware Diagram and Configuration

5.1.1 MDS Series Indoor Units

The indoor unit consists of a three-speed fan and an electronic expansion valve (electric heater and swing function optional). The four temperature sensors respectively serve to measure the temperature of the indoor, inlet coil, midlet coil and outlet coil. The MDS-A system can connect with a remove control or remote receiver and, as a slave unit, communicates with outdoor units via RS485 interface. The DIP switches on the controller determine the electric heater, power, unit model and address number.

MRS485 terminal resistor J2-1: ON/OFF indicate whether resistance is present or not.



Model 1 setting (SW1.1 —— SW1.6)

Model 1	SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6
OFF: No ON: Yes	Electric heater 1	Electric heater 2	Pump	Reserve	Reserve	Reserve

Address settings (SW2.1——SW2.6)

Unit address	SW2.1	SW2.2	SW2.3	SW2.4	SW2.5	SW2.6
0	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1
8	0	0	1	0	0	0
9	0	0	1	0	0	1
10	0	0	0	1	0	1
11	0	0	1	0	1	1
12	0	0	1	1	0	0
13	0	0	1	1	0	1
14	0	0	1	1	1	0
15	0	0	1	1	1	1
16	0	1	0	0	0	0
17	0	1	0	0	0	1
18	0	1	0	0	1	0
19	0	1	0	0	1	1
20	0	1	0	1	0	0
21	0	1	0	1	0	1
22	0	1	0	1	1	0
23	0	1	0	1	1	1
24	0	1	1	0	0	0
25	0	1	1	0	0	1
26	0	1	1	0	1	0
27	0	1	1	0	1	1
28	0	1	1	1	0	0
29	0	1	1	1	0	1
30	0	1	1	1	1	0
31	0	1	1	1	1	1
32	1	0	0	0	0	0
33	1	0	0	0	0	1
34	1	0	0	0	1	0
35	1	0	0	0	1	1
36	1	0	0	1	0	0
37	1	0	0	1	0	1
38	1	0	0	1	1	0
39	1	0	0	1	1	1
40	1	0	1	0	0	0
41	1	0	1	0	0	1
42	1	0	1	0	1	0
43	1	0	1	0	1	1
44	1	0	1	1	0	0
45	1	0	1	1	0	1
46	1	0	1	1	1	0
47	1	0	1	1	1	1

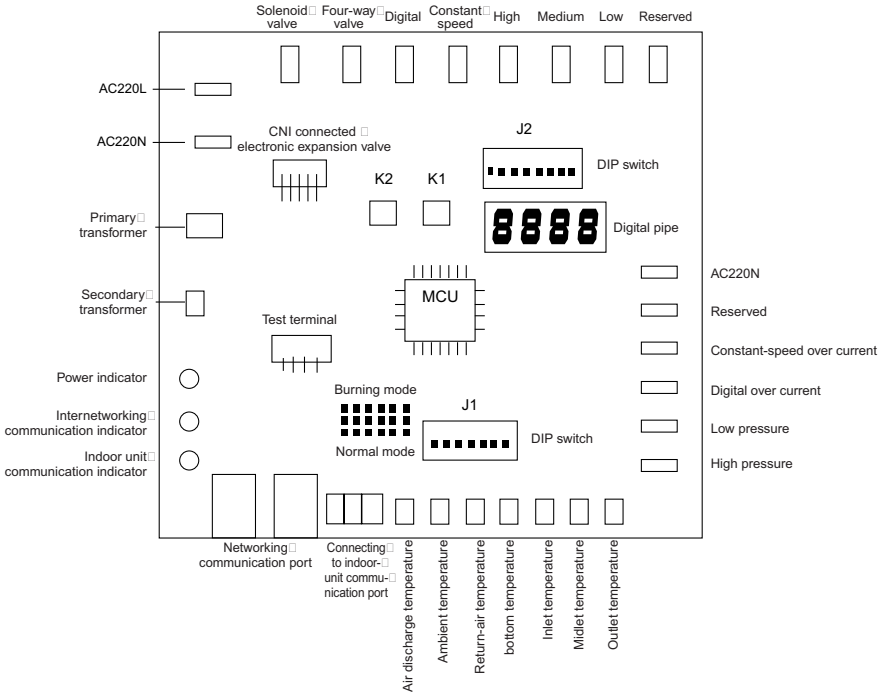
Model 2 setting（SW3.5——SW3.8）

Model 2	SW3.5	SW3.6	SW3.7	SW3.8
MCC	0	0	0	0
MCK	0	0	0	1
MCM	0	0	1	0
MWM	0	0	1	1
MDB	0	1	0	0
MDBX	0	1	0	1
Reserve				

Power setting（SW3.1——SW3.4）

Power	SW3.1	SW3.2	SW3.3	SW3.4
0.8HP	0	0	0	0
1.0HP	0	0	0	1
1.5HP	0	0	1	0
1.8HP	0	0	1	1
2.0HP	0	1	0	0
2.5HP	0	1	0	1
3.0HP	0	1	1	0
4.0HP	0	1	1	1
5.0HP	1	0	0	0
6.0HP	1	0	0	1
7.0HP	1	0	1	0
8.0HP	1	0	1	1
9.0HP	1	1	0	0
10.0HP	1	1	0	1
11.0HP	1	1	1	0
12.0HP	1	1	1	1

5.1.2 MDS-A Series Outdoor Units



Description of controller hardware

■ Input port:

The system contains 5 test ports designed for high/low pressure test, digital compressor overload, constant speed compressor overload 1 and constant speed compressor overload 2 (used when 3 compressors are available)

■ Output port:

The system contains 9 output control ports including PWM valve, 4-way valve, digital compressor/constant-speed compressor main power supply, high/medium/low wind, SI (reserved as the main power supply for the second constant-speed compressor of the 3 compressor systems, if applicable) and riving port for electronic expansion valve.

■ Sensor test port

The system has 7 temperature test ports designed to test the temperature of the digital compressor exhaust, ambient temperature, return-air temperature, the bottom temperature of compressor, inlet temperature, midlet temperature and outlet temperature (Note: The flow direction of the refrigerant inside the coils when the system is running in cooling mode determines the inflow and outflow direction described in this document).

■ Communication port:

The system has two RS485 communication ports. One network with the indoor units and the other is used for internetworking control.

■ DIP switch setting

J1 settings (1:ON: 0:OFF)

J1.1	J1.2	Initial opening extent of the expansion valve	J1.1	J1.2	Initial opening extent of the expansion valve
0	0	300	1	0	400
0	1	350	1	1	450

J1.3 reserved

J1.4: J1.5: J1.6: J1.7 capacity settings

No.	J1.4	J1.5	J1.6	J1.7	Capacity
1	0	0	0	0	10.0kW/4HP
2	0	0	0	1	12.5kW/5HP
3	0	0	1	0	15.0kW/6HP
4	0	0	1	1	22.5kW/8HP
5	0	1	0	0	28.1kW/10HP
6	0	1	0	1	3HP

Note: Other DIP switches are reserved.

J2 settings (1: ON: 0: OFF)

D1 ~ D5 indicate the local address during intercommunication:

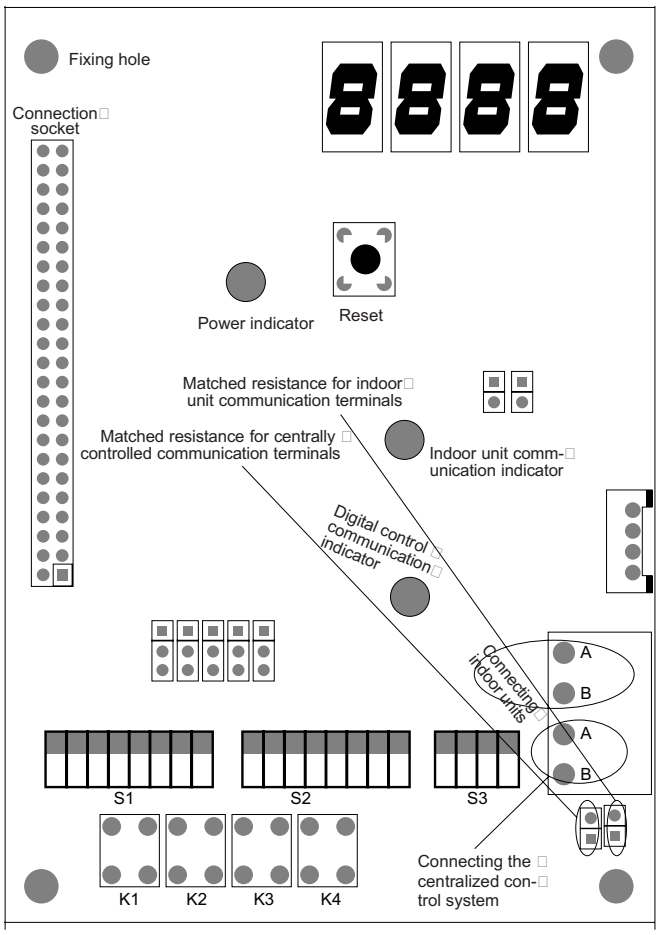
J2.1	J2.2	J2.3	J2.4	J2.5	Address	J2.1	J2.2	J2.3	J2.4	J2.5	Address
0	0	0	0	0	0	0	0	0	0	1	16
1	0	0	0	0	1	1	0	0	0	1	17
0	1	0	0	0	2	0	1	0	0	1	18
1	1	0	0	0	3	1	1	0	0	1	19
0	0	1	0	0	4	0	0	1	0	1	20
1	0	1	0	0	5	1	0	1	0	1	21
0	1	1	0	0	6	0	1	1	0	1	22
1	1	1	0	0	7	1	1	1	0	1	23
0	0	0	1	0	8	0	0	0	1	1	24
1	0	0	1	0	9	1	0	0	1	1	25
0	1	0	1	0	10	0	1	0	1	1	26
1	1	0	1	0	11	1	1	0	1	1	27
0	0	1	1	0	12	0	0	1	1	1	28
1	0	1	1	0	13	1	0	1	1	1	29
0	1	1	1	0	14	0	1	1	1	1	30
1	1	1	1	0	15	1	1	1	1	1	31

J2.6, ON: cooling only OFF: heat pump

J2.7, J2.8 reserved

JP1 and JP2 are used to set matched resistance for communication terminals. The last switch on the manifold must be shorted, while other switches remain in open circuit.

5.1.3 MDS-B Series Outdoor Units



DIP switch setting

Note: 1: 1: ON, 0: OFF

S1 (1~2)

	1	2
1	MDS ~ A	Cooling only
0	MDS ~ B	Heat pump

S1 3~8 indicate the number of connected indoor units

Qty	3	4	5	6	7	8
1	0	0	0	0	0	0
2	0	0	0	0	0	1
3	0	0	0	0	1	0
4	0	0	0	0	1	1
5	0	0	0	1	0	0
6	0	0	0	1	0	1
7	0	0	0	1	1	0
8	0	0	0	1	1	1
9	0	0	1	0	0	0
10	0	0	1	0	0	1
11	0	0	1	0	1	0
12	0	0	1	0	1	1
13	0	0	1	1	0	0
14	0	0	1	1	0	1
15	0	0	1	1	1	0
16	0	0	1	1	1	1
17	0	1	0	0	0	0
18	0	1	0	0	0	1
19	0	1	0	0	1	0
20	0	1	0	0	1	1
21	0	1	0	1	0	0
22	0	1	0	1	0	1
23	0	1	0	1	1	0
24	0	1	0	1	1	1

Qty	3	4	5	6	7	8
25	0	1	1	0	0	0
26	0	1	1	0	0	1
27	0	1	1	0	1	0
28	0	1	1	0	1	1
29	0	1	1	1	0	0
30	0	1	1	1	0	1
31	0	1	1	1	1	0
32	0	1	1	1	1	1
33	1	0	0	0	0	0
34	1	0	0	0	0	1
35	1	0	0	0	1	0
36	1	0	0	0	1	1
37	1	0	0	1	0	0
38	1	0	0	1	0	1
39	1	0	0	1	1	0
40	1	0	0	1	1	1
41	1	0	1	0	0	0
42	1	0	1	0	0	1
43	1	0	1	0	1	0
44	1	0	1	0	1	1
45	1	0	1	1	0	0
46	1	0	1	1	0	1
47	1	0	1	1	1	0
48	1	0	1	1	1	1

S2 (1)

0	Slave module
1	Master module

S2 (2 ~ 3)

2	3	Initial opening extent of the valve
0	0	200
0	1	250
1	0	300
1	1	350

S2 (4~8) addresses of the outdoor unit

Address No.	4	5	6	7	8	Address No.	4	5	6	7	8
0	0	0	0	0	0	16	1	0	0	0	0
1	0	0	0	0	1	17	1	0	0	0	1
2	0	0	0	1	0	18	1	0	0	1	0
3	0	0	0	1	1	19	1	0	0	1	1
4	0	0	1	0	0	20	1	0	1	0	0
5	0	0	1	0	1	21	1	0	1	0	1
6	0	0	1	1	0	22	1	0	1	1	0
7	0	0	1	1	1	23	1	0	1	1	1
8	0	1	0	0	0	24	1	1	0	0	0
9	0	1	0	0	1	25	1	1	0	0	1
10	0	1	0	1	0	26	1	1	0	1	0
11	0	1	0	1	1	27	1	1	0	1	1
12	0	1	1	0	0	28	1	1	1	0	0
13	0	1	1	0	1	29	1	1	1	0	1
14	0	1	1	1	0	30	1	1	1	1	0
15	0	1	1	1	1	31	1	1	1	1	1

S3 (1~4) capacity of the outdoor unit:MDS-A

Address No.	5	6	7	8
3HP	0	0	0	0
4HP	0	0	0	1
5HP	0	0	1	0
6HP	0	0	1	1

S3 (1~4) capacity of the outdoor unit:MDS-B

Address No.	1	2	3	4
8HP	0	0	0	0
10HP	0	0	0	1
12HP	0	0	1	0
15HP	0	0	1	1
18HP	0	1	0	0
20HP	0	1	0	1
22HP	0	1	1	0
26HP	0	1	1	1
28HP	1	0	0	0
32HP	1	0	0	1

5.2 Trial Run

■ Precautions

- ● Power up the system 12 hours while you run it for the first time so that the shaft can be preheated in advance;
- ● After the main power supply is switched off, please don□ start the second trial run until the system is powered for 2.5 hours;
- ● If the heater is not heated, to protect the compressor, don't start the system until it is powered for 2 hours.
  - ◆ Check the power supply between the outdoor units and the distribution unit (it is recommended you use a 3-phase detector).
  - ◆ Check the indoor units.
- ● Check the power cable and the signal cable of each indoor unit are properly connected (the signal cable is marked with A and B);
- ● If the power cable is mixed with the signal cable, the circuit board might go faulty.
- ● Although the signal cable is not marked in color, please note the color, because the signal cable features polarity;
- ● Check if the addresses are correctly set for the indoor units;
- ● Address switches begin with 0;
- ● Each indoor unit must be configured with a different address.

CHAPTER 6

Servicing and Maintenance

6.1 User Guide

6.1.1 Responsibilities and Obligations

This product is covered under MacQuay warranty during the warranty period.

Only MacQuay technicians or experienced professionals designated by MacQuay are allowed to install, test, repair and maintain this product series.

6.1.2 Unpacking Inspection

Upon receipt of the units, please check them against the packing list. Check carefully if the units are damaged during the transportation, and if all the components are complete and in good condition. In case of any damaged unit or missing parts, please inform MacQuay's local branch or dealer in writing immediately.

6.1.3 Using the Units

- The total installed capacity of indoor units can be greater than but not more than 130% of the capacity of outdoor units. However, when the total capacity of indoor units in operation must not exceed that of the outdoor units. Otherwise, the output of each indoor unit can reach their rated value;
- All the indoor units are powered in a centralized manner. Before servicing and maintenance, be sure to turn off the main power between the units;
- After receiving the stop signal, each indoor unit will have its fan and electronic expansion valve running for another 20~60 seconds, to make use of the afterheat or the cool air that remains in the heat exchanger and also to get ready for the next start. This is normal.
- When the running mode of the indoor unit is in conflict with the running mode of the outdoor unit, the hand controller will display a message indicating this indoor unit stops running because of the operation conflict. In this case, you can switch the indoor unit to a running mode not conflicting with the outdoor unit, to restore the system to normal. The cooling mode does not conflict with the dehumidifying mode, while the air supply mode does not agree with any other mode.
- The digital compressor adjusts the volume of refrigerant by opening and closing the PWM solenoid. While the solenoid is operating, it clicks periodically. This is normal.

6.2 Servicing and Maintenance

⚠ Caution:

- Do not use or place inflammable and explosive articles beside the air-conditioning unit;
- Power the indoor units in a centralized way;
- Please check the parts like installing support often to see if they are damaged after longtime service;
- Do not alter or repair the product without authorization. To relocate the air conditioner, please contact your dealer or professional installation personnel;
- Do not install the air conditioner without authorization, to make sure the air-conditioning unit can operate reliably for a long time;
- In case of failure, please turn off the main power switch of the air-conditioning unit immediately;
- Do not remove the blade shield of an outdoor unit. Never put your hand or foreign matters in the air outlet;
- Do not perform a check or repair while the air-conditioning unit is running;
- Do not water the unit or operate the air-conditioning unit with wet hands.

6.2.1 Precautions

- Before installation, please check if the power supply in use is the same as that indicated on the nameplate, and if it is safe;
- Before using the air conditioner, please check and make sure that the power cables are properly connected, to avoid electric shock or fire;
- Keep the air-conditioning unit out of the reach of children;
- Before cleaning the air-conditioning unit or replacing the air filter, please turn off the main power switch;
- If you leave this air-conditioning unit idle for a log time, please be sure to switch it off;
- Do not step on the air-conditioning unit or place anything on it;
- The mains outlet must be securely grounded, to make sure the air-conditioning unit is also properly grounded, and to avoid electric shock. Be sure not to collect a power cable to the gas pipe, tapping pipe, lightning arrester or telephone set;
- Once the air conditioner is switched on, be sure not to turn it off until it remains in operation for over 5 minutes, to avoid affecting the oil return of the compressor;
- Be sure to check the units, once they are installed, for electric leakage.

6.2.2 Servicing and Maintenance

- Daily maintenance

All the units are strictly tested and inspected before they leave factory. To make sure the units remain operational for a long time, users are supposed to maintain and service the units, check and repair them at regular intervals.

- Maintenance and care of indoor units MCC, MDB
  - Air filter

    Depending on the environment to be conditioned, the air filter is usually installed at the air outlet, to effectively filter out the smoke, dust, dirt, pollen and foreign matters in the air. Before the filter is blocked, cleaning makes less sense. The filter should be cleaned at certain intervals depending on where it is mounted and located as well as the amount of foreign matter. The air filter can be made of washable fiber nylon or leno. While cleaning the filter, you can put it on a hard surface and knock it gently, to clear away heavy particles. If necessary, wash it in warm water using neutral detergent. Do not remount the filter until it gets dry.

- Fan motor

  This component requires only a little care. As the motor is lubricated and sealed before the equipment leaves factory, no more lubrication is needed. After the unit remains in service for six months, be sure to check the fan motor is entirely insulated from the ground.
- Heat exchanger

  Clean the dust and foreign matters from the surface of heat exchanger using a cleaner together with a nylon brush. Please note that there is no need to clean the surface if you use an appropriate air filter and take proper care of the heat exchanger.
- Fire damper

  Please check the damper once every three months, to see if the fuse link is broken or has any fallen blade, becomes flexible or even falls off, and if it functions well.
- Drainpipe

  Before the unit is running, check if the drain pipe is blocked, to ensure smooth discharge of condensate water. As the condensate water is prone to bacteria, please check the water collector around the end of each quarter, to see if it smells unusual. If so, put some medicine containing algaecide and penetrant in the collector to prevent bacteria and slime.
- Replacing parts

  You can get parts from nearby dealers. Be sure to indicate the following information about the parts you need: unit model, factory number, name and quantity.
- For a unit equipped with a temperature controller, lease note the following:
  - Make sure the start switch is closed;
  - Press the ON button on the start switch;
  - Set the air-conditioner to your desired temperature;
  - The rotating speed of the fan is usually preset;
  - After the unit stops running, to restart the compressor, please wait at least 3 minutes (except that the unit is equipped with a 3-minute relay) so as to protect the compressor;
  - Sometimes you may install an air output control unit to control the air volume.

■ Maintenance and care of indoor unit MCK

Although the air-conditioner is designed to have a long service life even with minimal care, be sure to check it at regular intervals throughout its service, so that you can use the air-conditioner better.

Part	Procedure	Recommended interval
Air filter (indoor unit)	1. Open the air input grid and take out the air filter and air refresher; 2. Disassemble the air filter and the air refresher; 3. Clear the dust away from the air filter using a cleaner or water below 40℃ containing neutral detergent. Never wash the air refresher; 4. Until the air refresher and the air filter, put them back in the air input grid. At least once a month Caution: Never use gas, dehydrating agent, benzene or any other chemical.	At least once a month
Indoor unit	Wipe the dirt and dust off the grid and panel with a piece of soft cloth soaked in warm water, cold water or neutral washing powder. Caution: Never use gas, dehydrating agent, benzene or any other volatile chemical, to avoid deforming the plastic surface.	At least once a month
Condensate water collector and pipe	1. Check them to see if they are clean. Wash them if necessary. 2. Check for the flow of condensate water.	Once every three months
Indoor fan	Check it to see if there is any unusual noise.	When necessary
Indoor fan, coil pipe of outdoor unit	1. Check and clear the dirt between the blades; 2. Check and clear any foreign matter that blocks the air flow inside the indoor unit and the outdoor unit.	Once a month
Power supply	1. Check the operating current and voltage of the indoor unit and outdoor unit; 2. Check if the electric lines are securely connected.	Once every two months; Once a year
Compressor	Check the weld junctions and joints of the refrigerant pipes to see if they are airtight.	Once every six months
Compressor lube	The lubricating oil is filled by the manufacturer. If the refrigerant circulating pipe is properly airtight, there is no need to refill the pipe.	No need for care
Fan motor lube	All the motors are properly lubricated and sealed before they leave factory.	No need for care

[Note]: Maintenance and care before the first operation in each season when the air-conditioning unit is put into operation

- Thoroughly check and clean the indoor and outdoor units;
- Clean or replace the air filter;
- Clean the drain pipe;
- Clean the coil of the outdoor unit indoors;
- Check the fan for dynamic balance before running;
- Secure all electric connections;
- Check if the refrigerant leaks.

■ Maintenance and care of outdoor units

Normally, for an air-cooled duct unit produced by MacQuay, you only need to check and clean the heat exchanger on a quarterly basis. However, if the unit is operating in an oily, salty, wet or dirty environment over a long period of time, ask professional air-conditioning service personnel to service the unit so that the unit can operate and function well. Otherwise, the service life of the unit might be shortened.

- Care of the compressor

  If the unit gets restarted after staying idle for a long time, do not restart the compressor until you keep the compressor, crankcase and heat exchanger of the outdoor unit powered for at least 24 hours.

- Care of the heat exchanger

  Maintain the heat exchanger once around the end of the running season. If a blade of the heat exchange falls sideways, be sure to put it upright. If any dust or foreign matter is present on the surface of the heat exchanger, use a clean together with a nylon brush to clean it. If compressed air source is available, please use it to blow away the dust from the surface of

the heat exchanger. If the unit is operating in an oily, salty, wet or dirty environment, do clean it with special-purpose detergent. It is not advised to wash it with water. Please use special-purpose detergent to clean a dusty heat exchanger (for example, SF-98 or YD-402).

- Please note the following while using the unit:
  - While the unit is running, please do not point any pole or any other hard material to the equipment through the exhaust hood, to avoid bodily injuries and equipment failures;
  - During the airtight and leakage test, never let inflammable gases like oxygen and acetylene into the cooling loop, to avoid hazards. Do perform tests of this kind using nitrogen or refrigerant.

■ Care at the beginning and end of the running season

- Beginning of the season
  - Check the return air inlet and outlet to see if they are blocked. If so, remove the obstacle;
  - Check that the grounding unit is in good condition to ensure that the air-conditioning unit operates safely.
    - ⊙ Thoroughly check the and clean the indoor and outdoor units;
    - ⊙ Clean or replace the air filter;
    - ⊙ Clean the drain pipe;
    - ⊙ Secure all electric connections;
    - ⊙ Check if the refrigerant leaks. Please ask professionals to troubleshoot the unit and clean the filter.
- End of the season
  - On sunny days, have your air-conditioner running in air supply mode half a day, to keep the inside dry;
  - Turn off the power. Otherwise, the unit still consumes power.
  - Ask professionals to troubleshoot and clean the filter.

■ Important notice for daily operation, maintenance and care

- Set the unit to an appropriate room temperature, preferably within the range of 26□ ~ 28□ for cooling and 18℃ ~ 236℃ for heating;
- Keep the windows and doors in the air-conditioned room closed, to avoid lowering the efficiency of the air-conditioning unit;
- Use a curtain or shutter for the windows to keep out direct sunshine;
- Do not put any floc or anything else around the air outlet and the return air inlet. Otherwise, the unit might work at a lower efficiency or even fail;
- Mechanical wear and dust inside the unit might worsen the performance of the unit. Be sure to clean and maintain the unit in due time;
- If the air-conditioner stays idle for a long time, please switch it off. To protect the air conditioner, switch it on at least 24 hours before you use it again, to heat up the compressor and the heater.

■ Caution

- In case of any exception (say, burning smell), turn off the power immediately, and seek help from the local branch or dealer;
- If you continue using the air-conditioning unit even after the exception takes place, this might damage the unit or even result in electric shock or fire;
- Only professional service personnel are allowed to maintain the air conditioner. Be sure to turn off the power before touching the termination.
- Never clean the air condition before it is switched off. Otherwise, you might suffer an electric shock or a bodily injury.

CHAPTER 7

Fault Codes and Troubleshooting

Fault codes here refer to the codes that appear on the remote control. If a host computer is available, the fault cause is directly displayed.

7.1 Fault Codes for MDS-A/B Series

No.	Fault code	Description
1	E0	System malfunction
2	E1	Sensor broken(TH1 discharge temp)
3	E2	Sensor broken(TH2 inlet coil 1#)
4	E3	Sensor broken(TH3 mid coil 1#)
5	E4	Sensor broken(TH4 inlet coil 2#)
6	E5	Sensor broken(TH5 mid coil 2#)
7	E6	Sensor broken(TH6 inlet coil 3#)
8	E7	Sensor broken(TH7 mid coil 3#)
9	E8	Sensor broken(TH8 ambient temp..)
10	E9	Sensor broken(TH9 outlet coil)
11	EA	Sensor broken(TH10 subcool outlet)
12	EB	Sensor broken(TH11 subcool suction)
13	EC	Sensor broken(suction)
14	EF	Emergency run 36 L0 Super heat too low
15	F0	Outdoor storage malfunction
16	F1	Sensor broken(indoor inlet coil)
17	F2	Sensor broken(indoor mid coil)
18	F3	Sensor broken(indoor outlet coil)
19	F4	Sensor broken(indoor return air)
20	F5	Sensor broken(indoor supply air)
21	F6	Indoor and controller communication malfunction
22	F7	Ambient temp. exceed the limit
23	F8	4wv malfunction
24	F9	Refrigerant leakage
25	FA	Controller storage malfunction
26	FB	Water pump(indoor drain pump)
27	FC	Indoor and outdoor communication malfunction
28	FE	Master and slave communication malfunction
29	H0	Digital comp overload
30	H1	Fixed comp1 overload
31	H2	Fixed comp2 overload
32	H3	Fixed comp3 overload
33	H4	High pressure too high

No.	Fault code	Description
34	H5	Sensor broken, high pressure
35	H6	Discharge temp. too high
36	L0	Protection for too small degree of overheat
37	L1	Low pressure too low
38	L2	Sensor broken, low pressure
39	10	System malfunction
40	11	Sensor broken(slave TH1 discharge temp.)
41	12	Sensor broken(slave TH2 inlet coil 1#)
42	13	Sensor broken(slave TH3 mid coil 1#)
43	14	Sensor broken(slave TH4 inlet coil 2#)
44	15	Sensor broken(slave TH5 mid coil 2#)
45	16	Sensor broken(slave TH6 inlet coil 3#)
46	17	Sensor broken(slave TH7 mid coil 3#)
47	18	Sensor broken(slave TH8 ambient temp.)
48	19	Sensor broken(slave TH9 outlet coil)
49	1A	Sensor broken(slave TH10 subcool outlet)
50	1B	Sensor broken(slave TH11 subcool suction)
51	1C	Sensor broken(slave TH12 suction)
52	1F	Emergency run
53	20	Outdoor storage malfunction
54	27	Ambient temp.. exceed the limit
55	28	4WV malfunction
56	29	Refrigerant leakage
57	30	Digital comp overload
58	31	Fixed comp1 overload
59	32	Fixed comp2 overload
60	33	Fixed comp3 overload
61	34	High pressure too high
62	35	Sensor broken, high pressure
63	36	Discharge temp. too high
64	40	Super heat too low
65	41	Low pressure too low
66	42	Sensor broken, low pressure

7.2 Indoor Unit Malfunction Code

F1	Sensor broken (indoor inlet coil)
F2	Sensor broken (indoor mid coil)
F3	Sensor broken (indoor outlet coil)
F4	Sensor broken (indoor return air)
F5	Sensor broken (indoor supply air)
F6	Indoor and controller communication malfunction
FA	Controller storage malfunction
FB	Water pump(indoor drain pump)
FC	Indoor and outdoor communication malfunction

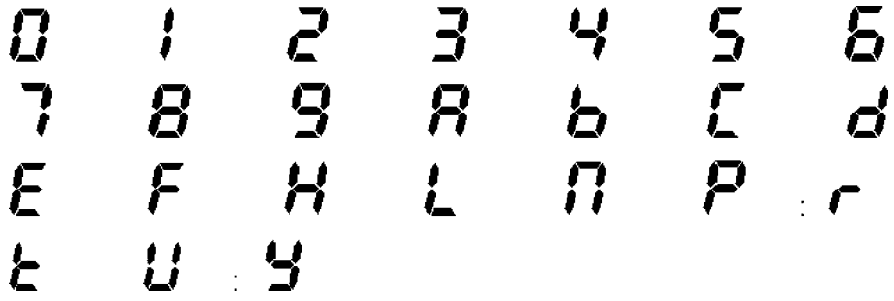
7.3 Indication Light Twinkle Related to Malfunction Code:

Type	Heat	Sleep/Fan	Time/Dry
Sensor broken (indoor temp.)	OFF	OFF	F
Indoor Water pump	OFF	F	OFF
Indoor and outdoor communication malfunction	F	OFF	OFF
Sensor broken (outdoor temp.)	OFF	F	F
Overload, Compressors, Digital/fixed	F	F	OFF
Pressure, Too high/too low	F	OFF	F
Pressure sensor, Outdoor	F	F	ON
System malfunction	F	F	F
Other malfunctions	F	ON	ON

Notes:

1. The mode confliction alarm is canceled, as it is not a malfunction, but a limiting operation. When the mode confliction occurs, the indoor unit stops directly without making alarm.
2. The indoor and outdoor communication malfunction only belongs to this unit.
3. Simplify the light twinkle indication, and the indoor and outdoor malfunction contains master and slave unit.

For example:



7.4 The Following Phenomena Are Not Unit Malfunctions:

Some odorous gas blows from the unit, because the unit sucks cigarette smoke and smell from cosmetic, furniture and electric machine. We always hear fizzle from the unit when starting stopping the unit, as the refrigerant flows in the unit. Sometimes we may hear click noise, because the temperature change causes other parts expanding with heat and contracting with cold. The outdoor unit generates buzz because of loading/unloading the digital scroll compressor.

CHAPTER

Annexes

Annex 1(1) Parameters designed for various kinds of buildings

Building		Cooling load (w/m²)		Occupants	Lighting	Air flow	Max. noise
		Sensible cooling load	Total cooling load	m²/person	W/m²	L/S	dB(A)
Office	Middle	65	95	10	60	5	35 ~ 50
	Far side	110	160	10	60	6	35 ~ 55
	Individual office	160	240	15	60	8	30 ~ 45
	Meeting room	185	270	3	60	9	40 ~ 60
School	Classroom	130	190	2.5	40	9	35 ~ 40
	Library	130	190	6	30	9	35 ~ 40
	Cafeteria	150	260	1.5	30	10	40 ~ 45
Apartment building	High rise, facing south	110	160	10	20	10	35 ~ 40
	High rise,facing north	80	130	10	20	9	35 ~ 40
Theater, auditorium		110	260	1	20	12	40 ~ 45
Laboratory		150	230	10	50	10	35 ~ 45
Library, museum		95	150	10	40	8	35 ~ 40
Hospital	Operation room	110	380	6	20	8	30 ~ 40
	Public area	50	150	10	30	8	35 ~ 40
Clinic, health center		130	200	10	40	10	35 ~ 45
Barbershop, beauty salon		110	200	4	50	10	35 ~ 40
Deparment store	Underground	150	250	1.5	40	12	35 ~ 45
	Middle floors	130	225	2	60	10	35 ~ 45
	Upper floors	110	200	3	40	8	35 ~ 45
Drug store		110	210	3	30	10	35 ~ 40
Retail store		110	160	2.5	40	10	35 ~ 45
Store for choice consumer goods		110	160	5	30	10	35 ~ 40
Computer room		100	200	8	40	5.5	35 ~ 40
Gymnasium		180	320	1	30	6	35 ~ 45
Theater		130	220	1	20	7	30 ~ 35
Single room		90	120	10	60	15	30 ~ 35
Double room		100	150	10	60	15	30 ~ 35
Disco		280	400	1	100	8	30 ~ 35
Bar		130	260	2	15	10	35 ~ 40
Chinese food restaurant		220	400	2	60	10	35 ~ 40
Western food restaurant		160	320	2	60	10	35 ~ 40
Rest-aurant	Room	80	130	10	15	7	30 ~ 40
	Public area	110	160	10	15	8	35 ~ 45
Factory	Assembly shop	150	260	3.5	45	9	45 ~ 55
	Light industry	160	260	15	30	10	40 ~ 50
Playing area	Parlor	160	240	6	20	8	35 ~ 40
	General match	110	220	5	40	12	35 ~ 45
	Open event	110	240	3	80	12	40 ~ 50

[Note]: The above data is for reference only.

Annex 1 (2) Heat load indexes designed for air-conditioning in some of the Chinese buildings

No.	Building type and room name	Heat load index W/m²	No.	Building type and room name	Heat load index W/m²
1	Office building,school	58-80	6	Store	64-87
2	Residential building	46-70	7	Single-floor residential building	85-105
3	Hospital, kindergarten	64-80	8	Dining room	116-140
4	Hotel	58-70	9	Cinema	93-116
5	Library	46-76			

Annex 2 Max. flow velocity at the air outlet (Unit: mm)

Place	Pan outlet	Ceiling outlet	Side outlet
Broadcasting studio	3-3.5	4-4.5	2.5
Hospital ward	4-4.5	4.5-5	2.5-3
Hotel room, parlor	4-5	5-6	2.5-4
Department store, theater	6-7.5	6.2-7.5	5-7
Classroom, library, office building	5-6	6-7.5	3.5-4.5

Annex 3 Table of recommended wind speeds for central air-conditioning

Position	Recommended wind speed (m/s)			Max. wind speed (m/s)		
	Residential building	Public building	Factory	Residential building	Public building	Factory
Air duct inlet	3.5	4.0	5.0	4.5	5.0	7.0
Fan outlet	5 ~ 8	6.5 ~ 10	8 ~ 12	8.5	7.5 ~ 11	8.5 ~ 14
Main air duct	3.5 ~ 4.5	5.0 ~ 6.5	6 ~ 9	4 ~ 6	5.5 ~ 8.0	6.5 ~ 11
Branch air duct	3.0	3.0 ~ 4.5	4.5	3.5 ~ 5.0	4.0 ~ 6.5	5 ~ 9
Fresh air inlet	3.5	4.0	5.0	4.0	5.0	7.0
Air outlet from the branch duct	2.5	3 ~ 3.5	4.0	3.25 ~ 4	4 ~ 6	5 ~ 8

Annex 4 Criteria of environment noise in urban areas

Category	Scope of application	Daytime (dB)	Nighttime (dB)
0	Sanatorium, top-grade villa, top-grade hotel	50	40
1	Areas intended mainly for residence, culture & education,business and industry	55	45
2	Areas intended for residence, business and industry	60	50
3	Industrial estate	65	55
4	On both sides of urban roads and traffic arteries	70	55

Annex 5 Table of recommended diameter for condensate water pipes

Min. slope of pipes	Cooling load (kW)							
0.001	< 18	< 100	< 176	< 598	< 1055	< 1512	< 12462	> 12462
0.003	< 24	< 230	< 400	< 1100	< 2000	< 3500	< 15000	> 15000
Nominal pipe diameter (mm)	DN25	DN32	DN40	DN50	DN80	DN100	DN125	DN150

Annex 6 Confirmation Form

1. Use the Confirmation table to add more secondary refrigerant

■ Calculate the additional amount of secondary refrigerant required according to the diameter and length of the copper pipes.

■ The table below lists the formula used to calculate the additional amount of secondary refrigerant needed for liquid copper pipes of various diameters (The amount of secondary refrigerant required for the pipes that come with the indoor unit is already available).

Diameter of copper pipe	Additional amount of secondary refrigerant (g/m)	Length of piping (m)	Required amount of secondary refrigerant (kg)
ϕ 6.35			
ϕ 9.52			
ϕ 12.7			
ϕ 15.88			
ϕ 19.05			
ϕ 22.23			
		Total	

2. What to be confirmed before the trial run

Power off protection- current	Outdoor unit	A	Indoor unit	A
Power cable model	Outdoor unit	mm^2	Indoor unit	mm^2
If the addresses of the indoor unit are properly set				
If the indoor unit is powered				
If the communication line is properly connected				
If the manifolds are mounted as required				
If the condensate water pipe of the indoor unit is clear				
If the equipment is properly grounded				
If the equipment is properly insulated(⩾ 10M Ω)				
If the input voltage is correct (220V ± 10% or 380V ± 10%)				
Check that the piping is airtight and vacuum before they are refilled				
If the number of indoor units is preset using the outdoor unit controller				
If the valve of the outdoor unit is opened				

3. Test and maintenance record

Below are the operating parameters that must be recorded during the test.

Recorded by: Date of recording:

Suction pressure (bar)	Exhaust pressure (bar)	Voltage（V）	Current(A)	Transient heat of the entire equipment（℃）	Environment temperature（℃）

Record of unit maintenance

Recorded by: Date of recording:

	Suction pressure (bar)	Exhaust pressure (bar)	Voltage (V)	Current（A）	Transient heat of the entire equipment（℃）	Environment temperature（℃）	Remarks
1st time							
2st time							
3st time							
4st time							
5st time							
6st time							

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