Haier

MRV S^{II}

Service Manual

SYJS-11-2016 REV.A Edition: 2016-11

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1. General Information

1.1 Indoor units

4-WAY CASSETTE TYPE/PB-700IB

AB092MCERA
AB122MCERA
AB162MCERA

4-WAY CASSETTE TYPE/PB-950JB

AB182MCERA
AB242MCERA
AB282MCERA

AB302MCERA
AB382MCERA
AB482MCERA

LOW ESP DUCT TYPE

AD072MLERA
AD092MLERA
AD122MLERA

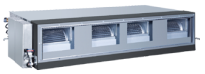
AD162MLERA
AD182MLERA
AD242MLERA

HIGH ESP DUCT TYPE

AD182MHERA
AD242MHERA
AD282MHERA

AD302MHERA
AD382MHERA
AD482MHERA

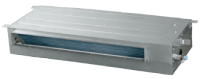
AD722MHERA
AD962MHERA



SLIM LOW ESP DUCT

AD072MSERA
AD092MSERA
AD122MSERA
AD162MSERA

AD182MSERA
AD242MSERA



2-WAY CASSETTE/1055IB

AB072MBERA
AB092MBERA
AB122MBERA
AB162MBERA
AB182MBERA

ROUND-WAY SMART AIR FLOW CASSETTE/ PB-950KC

AB072MRERA
AB092MRERA
AB122MRERA
AB162MRERA
AB182MRERA
AB242MRERA
AB282MRERA
AB302MRERA
AB382MRERA
AB482MRERA
AB602MRERA

HIGH WALL EEV INSIDE

AS072MGERA AS162MGERA
AS092MGERA AS182MGERA
AS122MGERA AS242MGERA

MED ESP DUCT TYPE (80/120Pa)

AD182MZERA
AD242MZERA
AD282MZERA

AD302MNERA
AD382MNERA
AD482MNERA

MED ESP DUCT TYPE (50/96Pa)

AD182MMERA
AD242MMERA
AD282MMERA

AD302MMERA
AD382MMERA
AD482MMERA

CONVERTIBLE TYPE

AC092MCERA
AC122MCERA
AC162MCERA
AC182MCERA
AC242MCERA

AC282MFERA
AC302MFERA
AC382MFERA
AC482MFERA

BUILIT-IN FLOOR STANDING

AE072MLERA
AE092MLERA
AE122MLERA
AE162MLERA
AE182MLERA
AE242MLERA

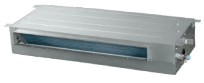
CONSOLE TYPE

AF072MAERA
AF092MAERA
AF122MAERA
AF182MAERA

DC SLIM LOW ESP DUCT

AD072MSERA(D)
AD092MSERA(D)
AD122MSERA(D)
AD162MSERA(D)

AD182MSERA(D)
AD242MSERA(D)



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1.2 Features

Outdoor structure

(8/10/12HP SIDE DISCHARGE)

More Bigger Outdoor Capacity, More Flexible Application

High efficiency DC fan motor

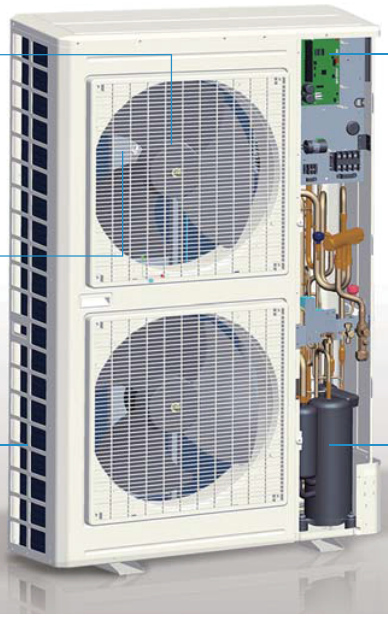
- DC fan motor with stepless inverer control,efficiency increase 45% comparing with AC motor and power input largely decrease

Large diameter fan

- 570mm big diameter axial flow fan
- Zigzag design, reduce airflow disturbance, air volume is bigger, the noise is lower

High efficiency condenser

- New type high efficiency Ø8 inner grooved tube
- New hydrophilic corrugated fissure fin, high efficiency



Vector inverter control

- 180 degrees sine wave vector control, 64-bit operation
- High precision control, to achieve high efficiency and lower noise

Double pressure sensor

- Equipped with high and low voltage Pressure double sensors
- Accurate Pressure control, the system run more smoothly, more energy efficiency

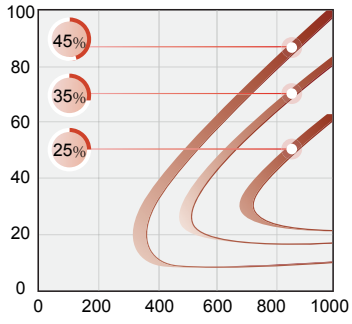
Twin rotary DC Inverter compressor

- High chamber DC INVERTER twin rotary conmpressor
- Small vibration, low noise, high energy effciency

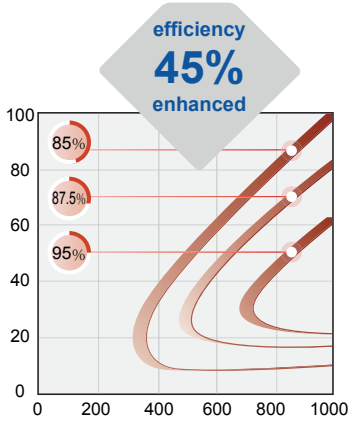
DC fan and fan motor

DC inverter fan motor more higher efficiency in part load running

- 16-stage speed control; high efficiency running especially in low speed
- Efficiency increase 45% comparing with AC motor and power input largely decrease big diameter fan
- 570mm big diameter fan, more big air flow and more higher efficiency



AC motor efficiency



DC motor efficiency

Ø570mm fan

DC motor

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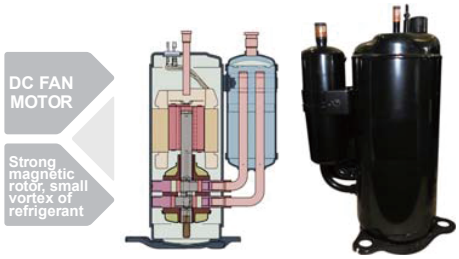
New DC inverter twin rotary compressor

- Small torque change, good dynamic balance, the system runs stably, little vibration, low noise, high efficiency
- More higher efficiency in part load running



Low noise level

Night quiet operation function

Noise can be reduced to 45dB (A)

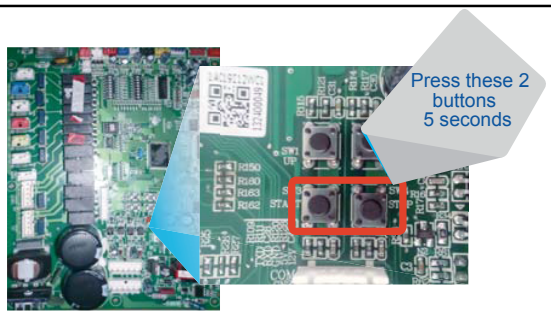
Low noise operation

- DC INVERTER compressor, smooth operation, no need frequent start the compressor, effectively reduce the noise outdoor
- Vector inverter control, more precise control
- DC fan motor, motor bracket used the non-resonance structure, ensure smooth running of the motor, reduce operating noise
- Big diameter fan, design according to aviation quieter principle

High reliability

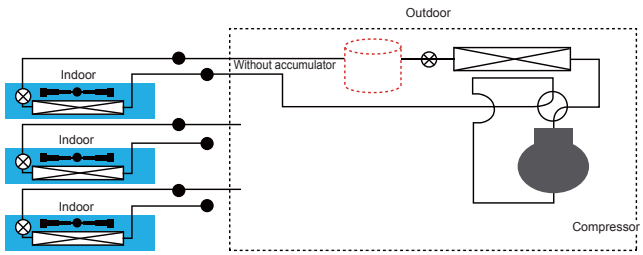
Refrigerant automatically reclaim technology

Set refrigerant automatically reclaim through dip switch, the refrigerant in indoor and pipe can be automatically return to outdoor, convenient in maintenance and reducing waste of refrigerant, reduce customer maintenance cost, improve the efficiency of after-sales maintenance



Refrigerant control technology

Refrigerant control technology without high pressure accumulator, reducing the refrigerant volume and enhancing the running efficiency



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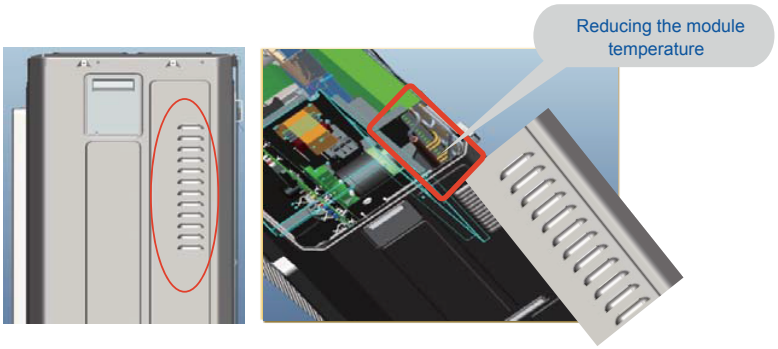
High reliability

Air inlet grill design on right side panel

Air inlet grill design, reducing the module temperature and avoid air dust into air conditioner



High and Low Double Pressure Sensor

Double pressure sensor with PID control technology

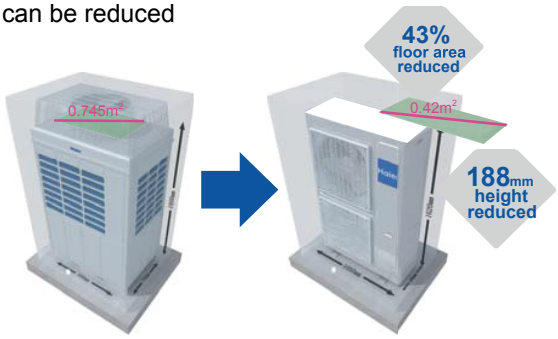
Together with high speed communication to realize the quick start of compressor and more precise control, the temperature can be control ±0.5°C

Easy installation

Compact side discharge design,

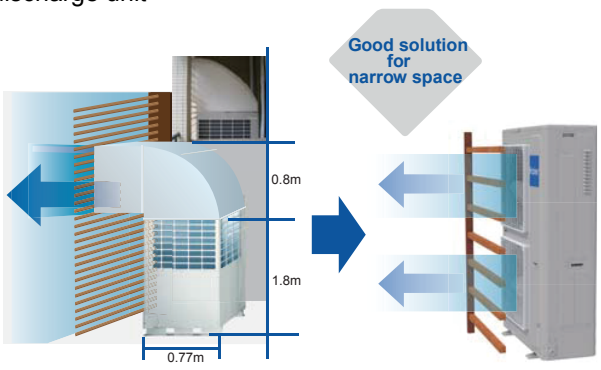
Big capacity, small floor area

Small floor area, only 0.42m², 43% floor area can be reduced



Compact side discharge design

No need additional ventilation hood comparing with top discharge unit



4 Way pipe connection

Front, rear, right, down 4 way pipe connection, flexible installation

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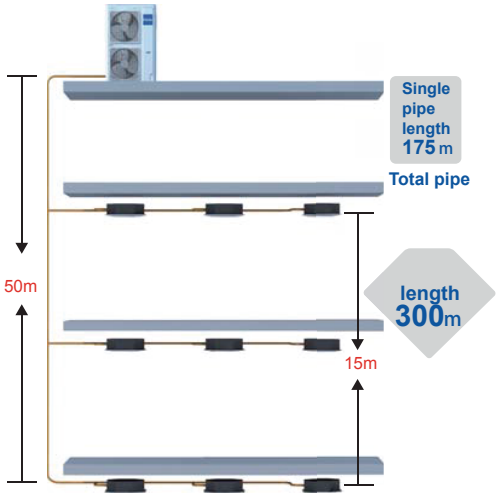
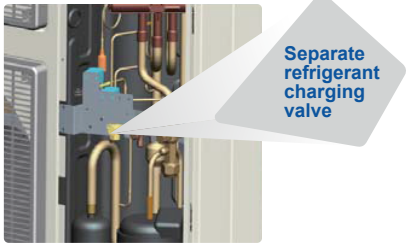
Long pipe length, high height drop

- Total pipe length: 300m
- Single pipe length: Max. 175m
- From outdoor to the first branch pipe: 135m
- From the first branch to the farthest indoor door unit: 40m Height drop: 50m (outdoor above)/40m (outdoor below)
- Height drop between indoor units: 15m



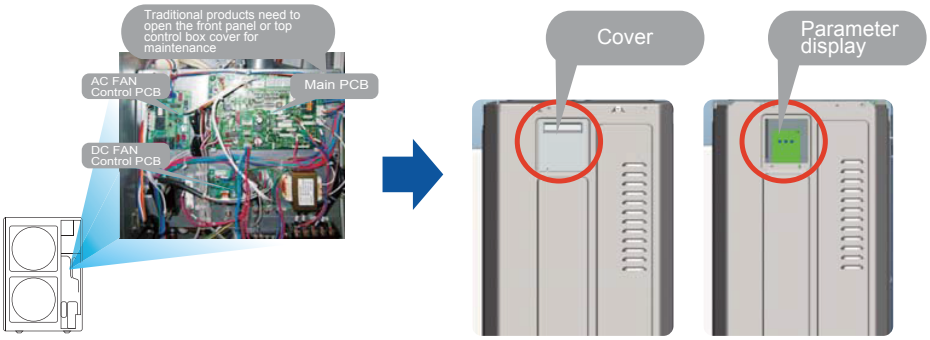
- Separate Refrigerant Charging Valve
- Easy for refrigerant charging



Easy service

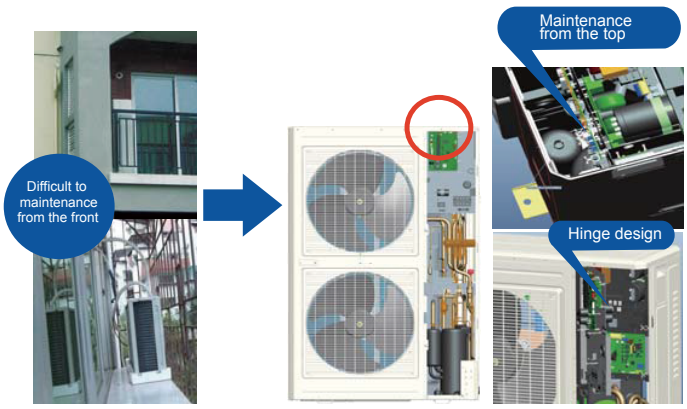
Parameter display panel

- The first original parameter display panel on the side
- The parameter can be observed directly by opening the protective cover in case of maintenance, to avoid removing the repair board



Easy maintenance for control

- The control box is in front, reserving space 108mm between control box and toppanel, easy maintenance from the top Control box is with hinge design, easy to open for maintenance



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2. Specification

Model			AV08NMSETA
Power supply		Ph/V/Hz	3/380~400/50/60
Cooling	Rated capacity	kW	22.6
	Rated capacity	kBtu/h	77.1
	Rated power input	kW	5.79
	Max. power input	kW	10.42
	EER		3.90
	Rated current	A	9.6
	Max. current	A	17.2
Heating	Rated capacity	kW	25
	Rated capacity	kBtu/h	85.3
	Rated power input	kW	5.43
	Max. power input	kW	9.78
	COP		4.60
	Rated current	A	9
	Max. current	A	16.2
Compressor	Brand		MITSUBISHI ELECTRIC
	Model		LNB53FCAMC
	Type		Rotary
	Compressor quantity		1 INV
	Capacity	W	16860
	Power Input	W	5200
	Rated current (RLA)	A	15.4
	Speed	rps	60.0
	Crankcase Heater	W	60.0
	Refrigerant oil brand		IDEMITSUKOSAN CO.,LTD
	Refrigerant oil type		FV50S
	Refrigerant oil charge	ml	1700.0
Outdoor fan motor	Brand		NIDEC TECHNO
	Model		SIC-81FW-F1145-1
	Voltage		310.0
	IP Class		IP42
	Type		DC
	Insulation class		E
	Safe class		I
	Power Input	W	145.0
	Output	W	200.0
	Rated current	A	0.6
	Capacitor	μF	/
	Speed	rpm	147-770
Outdoor fan	Brand		SHUNWEI
	Model		/
	Material		Plastic
	Type		Axial
	Diameter	mm	570
	Height	mm	202

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Model			AV08NMSETA
Outdoor coil	Number of rows		2
	Tube pitch (a)×row pitch (b)	mm	19.05×22
	Fin spacing	mm	1.4
	Fin type (code)		HYDROPHILIC ALUMINIUM
	Fin coating type	Optional	Clear lacquer
	Salt spray test duration	Hour	168
	Tube outside dia.and type		INNERGROOVE TUBE
		mm	Φ8
	Coil length × height	mm	1122×1584
	Number of circuits		14
Cabinet coating	Coating type		Powder coating
	Salt spray test duration	Hour	72
	Sheet metal material		Hot zinc plate
	Sheet metal thickness	mm	1.0
Control panel enclosure IP class		Standard	IP24
Outdoor air flow		m^3/h	10000
Outdoor sound level (sound pressure level)		dB (A)	55
Outdoor sound level (sound power level)		dB (A)	66
Outdoor unit	Dimension (W*H*D)	mm	1050×400×1636
	Packing (W*H*D)	mm	1150×510×1790
	Net weight	kg	168
	Gross weight	kg	183
Refrigerant	Type		R410A
	Charged volume	kg	7.4
Throttle type			EXV
Design pressure		MPa	4.15
Refrigerant piping	Liquid pipe	mm	9.52
	Gas pipe	mm	19.05
	Total pipe lenth	m	300
	Max. pipe length (Equivalent/ Actual)	m	175/150
	Max.Diff. indoor/ outdoor unit	m	50 (Outdoor higher than indoor) 40 (Indoor higher than outdoor)
	Max.Diff. indoor/indoor unit	m	15
Connectable indoor unit ratio		%	50%~130%
Maximum indoor units		Piece	13
Connection wiring	Power wiring	mm^2	6.0
	Signal wiring	mm^2	Shield wire: (0.75-2)*2
Operation Range		°C	Cooling: -15~43 Heating: -15~21

■ Norminal condition: indoor temperature (cooling): 27DB (°C)/19WB (°C), indoor temperature (heating): 20DB (°C)/14.5 WB(°C) Outdoor temperature (cooling): 35DB (°C)/24WB (°C), outdoor temperature (heating): 7DB (°C)/6WB (°C)

The noise level will be measured in the third octave band limited values in the semi-anechoic chamber, using a Real Time Analyser calibrated sound intensity meter. It is a sound pressure noise level.

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Model			AV10NMSETA
Power supply		Ph/V/Hz	3/380~400/50/60
Cooling	Rated capacity	kW	28
	Rated capacity	kBtu/h	95.5
	Rated power input	kW	8
	Max. power input	kW	14.4
	EER		3.50
	Rated current	A	13.2
	Max. current	A	23.8
Heating	Rated capacity	kW	31.5
	Rated capacity	kBtu/h	107.5
	Rated power input	kW	7.5
	Max. power input	kW	12.4
	COP		4.20
	Rated current	A	12.4
	Max. current	A	22.3
Compressor	Brand		MITSUBISHI ELECTRIC
	Model		LNB53FCAMC
	Type		Rotary
	Compressor quantity		1 INV
	Capacity	W	16860
	Power Input	W	5200
	Rated current (RLA)	A	15.4
	Speed	rps	60.0
	Crankcase Heater	W	60.0
	Refrigerant oil brand		IDEMITSUKOSAN CO.,LTD
	Refrigerant oil type		FV50S
	Refrigerant oil charge	ml	1700.0
Outdoor fan motor	Brand		NIDEC TECHNO
	Model		SIC-81FW-F1145-1
	Voltage		310.0
	IP Class		IP42
	Type		DC
	Insulation class		E
	Safe class		I
	Power Input	W	145.0
	Output	W	200.0
	Rated current	A	0.6
	Capacitor	μF	/
	Speed	rpm	147-770
Outdoor fan	Brand		SHUNWEI
	Model		/
	Material		Plastic
	Type		Axial
	Diameter	mm	570
	Height	mm	202

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Model			AV10NMSETA
Outdoor coil	Number of rows		2
	Tube pitch (a)× row pitch (b)	mm	19.05×22
	Fin spacing	mm	1.4
	Fin type (code)		HYDROPHILIC ALUMINIUM
	Fin coating type	Optional	Clear lacquer
	Salt spray test duration	Hour	168
	Tube outside dia.and type		INNERGROOVE TUBE
		mm	Φ8
	Coil length × height	mm	1122×1584
	Number of circuits		14
Cabinet coating	Coating type		Powder coating
	Salt spray test duration	Hour	72
	Sheet metal material		Hot zinc plate
	Sheet metal thickness	mm	1.0
Control panel enclosure IP class		Standard	IP24
Outdoor air flow		m^3/h	10000
Outdoor sound level (sound pressure level)		dB (A)	58
Outdoor sound level (sound power level)		dB (A)	69
Outdoor unit	Dimension (W*H*D)	mm	1050×400×1636
	Packing (W*H*D)	mm	1150×510×1790
	Net weight	kg	168
	Gross weight	kg	183
Refrigerant	Type		R410A
	Charged volume	kg	7.4
Throttle type			EXV
Design pressure		MPa	4.15
Refrigerant piping	Liquid pipe	mm	9.52
	Gas pipe	mm	22.22
	Total pipe lenth	m	300
	Max. pipe length (Equivalent/ Actual)	m	175/150
	Max.Diff. indoor/ outdoor unit	m	50 (Outdoor higher than indoor) 40 (Indoor higher than outdoor)
	Max.Diff. indoor/indoor unit	m	15
Connectable indoor unit ratio		%	50%~130%
Maximum indoor units		Piece	16
Connection wiring	Power wiring	mm^2	10.0
	Signal wiring	mm^2	Shield wire:(0.75-2)*2
Operation Range		°C	Cooling: -15~43 Heating: -15~21

■ Norminal condition: indoor temperature (cooling): 27DB (°C)/19WB (°C), indoor temperature (heating): 20DB (°C)/14.5 WB(°C) Outdoor temperature (cooling): 35DB (°C)/24WB (°C), outdoor temperature (heating): 7DB (°C)/6WB (°C)

The noise level will be measured in the third octave band limited values in the semi-anechoic chamber, using a Real Time Analyser calibrated sound intensity meter. It is a sound pressure noise level.

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Model			AV12NMSETA
Power supply		Ph/V/Hz	3/380~400/50/60
Cooling	Rated capacity	kW	33.5
	Rated capacity	kBtu/h	114.3
	Rated power input	kW	9.75
	Max. power input	kW	15.4
	EER		3.44
	Rated current	A	16.4
	Max. current	A	26
Heating	Rated capacity	kW	37.5
	Rated capacity	kBtu/h	128
	Rated power input	kW	9.62
	Max. power input	kW	15
	COP		3.90
	Rated current	A	16.2
	Max. current	A	25.3
Compressor	Brand		MITSUBISHI ELECTRIC
	Model		LNB53FCAMC
	Type		Rotary
	Compressor quantity		1 INV
	Capacity	W	16860
	Power input	W	5200
	Rated current (RLA)	A	15.4
	Speed	rps	60.0
	Crankcase heater	W	60.0
	Refrigerant oil brand		IDEMITSUKOSAN CO.,LTD
	Refrigerant oil type		FV50S
	Refrigerant oil charge	ml	1700.0
Outdoor fan motor	Brand		NIDEC TECHNO
	Model		SIC-81FW-F1145-1
	Voltage		310.0
	IP class		IP42
	Type		DC
	Insulation class		E
	Safe class		I
	Power input	W	145.0
	Output	W	200.0
	Rated current	A	0.6
	Capacitor	μF	/
	Speed	rpm	147-770
Outdoor fan	Brand		SHUNWEI
	Model		/
	Material		Plastic
	Type		Axial
	Diameter	mm	570
	Height	mm	202

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Model			AV12NMSETA
Outdoor coil	Number of rows		2
	Tube pitch (a)× row pitch (b)	mm	19.05×22
	Fin spacing	mm	1.4
	Fin type (code)		HYDROPHILIC ALUMINIUM
	Fin coating type	Optional	Clear lacquer
	Salt spray test duration	Hour	168
	Tube outside dia.and type		INNERGROOVE TUBE
		mm	Φ8
	Coil length × height	mm	1122×1584
	Number of circuits		14
Cabinet coating	Coating type		Powder coating
	Salt spray test duration	Hour	72
	Sheet metal material		Hot zinc plate
	Sheet metal thickness	mm	1.0
Outdoor air flow		m^3/h	10000
Outdoor sound level (sound pressure level)		dB (A)	60
Outdoor sound level (sound power level)		dB (A)	71
Outdoor unit	Dimension (W*H*D)	mm	1050×400×1636
	Packing (W*H*D)	mm	1150×510×1790
	Net weight	kg	168
	Gross weight	kg	183
Refrigerant	Type		R410A
	Charged volume	kg	7.4
Throttle type			EXV
Design pressure		MPa	4.15
Refrigerant piping	Liquid pipe	mm	12.7
	Gas pipe	mm	25.4
	Total pipe lenth	m	300
	Max. pipe length (Equivalent/ Actual)	m	175/150
	Max.Diff. indoor/outdoor unit	m	50 (Outdoor higher than indoor) 40 (Indoor higher than outdoor)
	Max.Diff. indoor/indoor unit	m	15
Connectable indoor unit ratio		%	50%~130%
Maximum indoor units		Piece	16
Connection wiring	Power wiring	mm^2	16.0
	Signal wiring	mm^2	Shield wire:(0.75-2)*2
Operation range		°C	Cooling: -15~43 Heating: -15~21

■ Norminal condition: indoor temperature (cooling): 27DB (°C)/19WB (°C), indoor temperature (heating): 20DB (°C)/14.5 WB(°C) Outdoor temperature (cooling): 35DB (°C)/24WB (°C), outdoor temperature (heating): 7DB (°C)/6WB (°C)

The noise level will be measured in the third octave band limited values in the semi-anechoic chamber, using a Real Time Analyser calibrated sound intensity meter. It is a sound pressure noise level.

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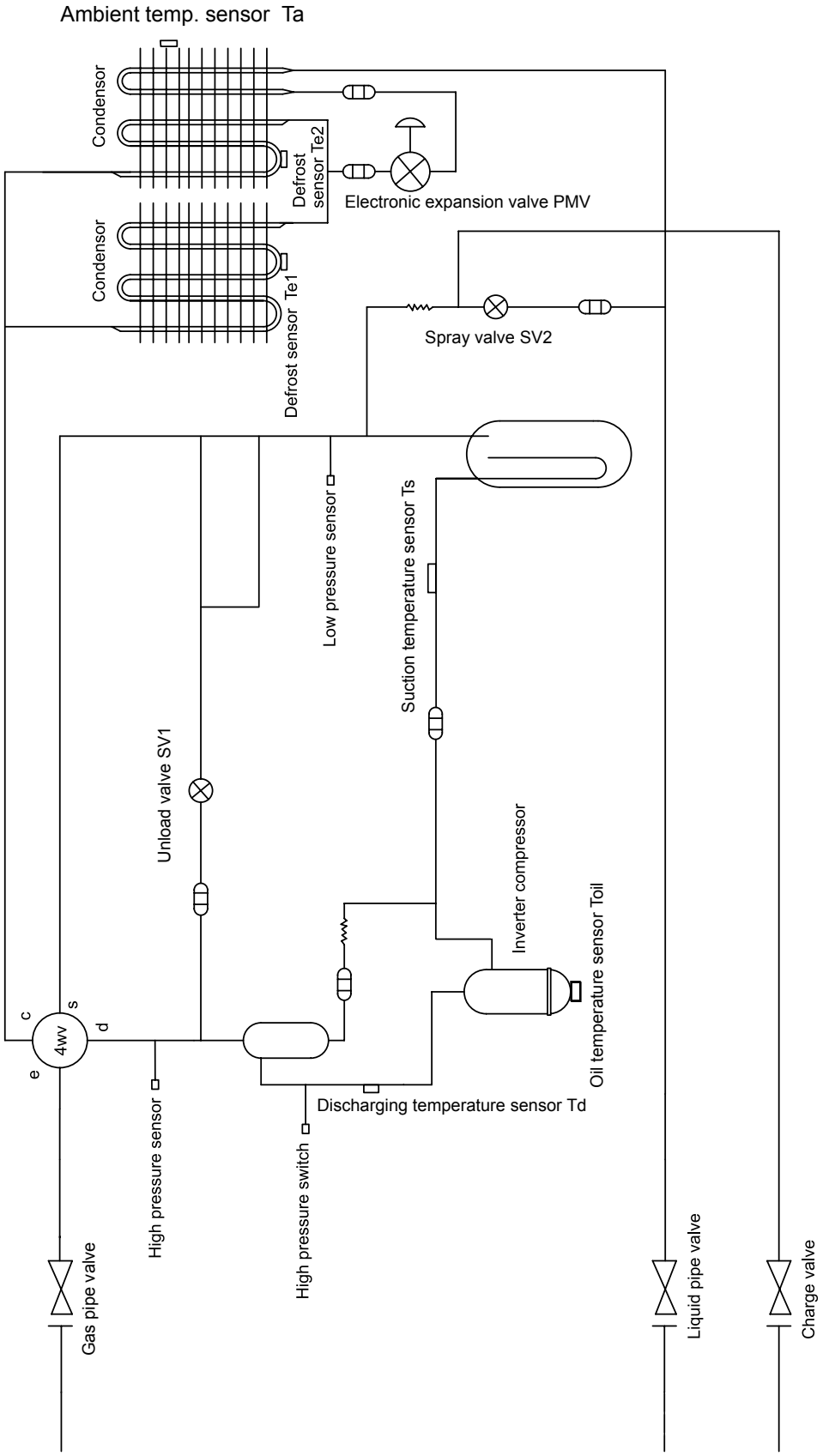
3. Refrigerant Circuit



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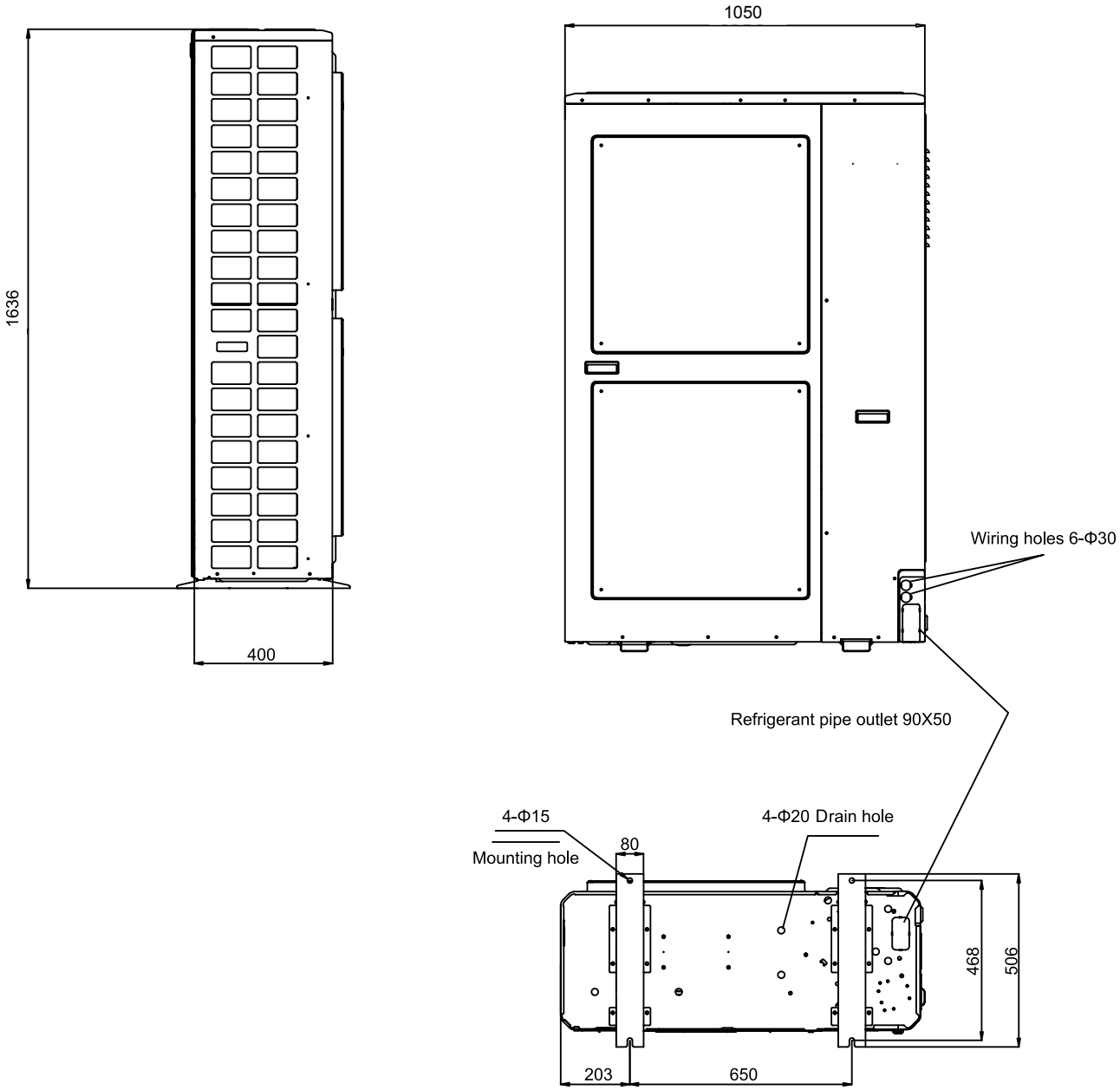
4. Dimension



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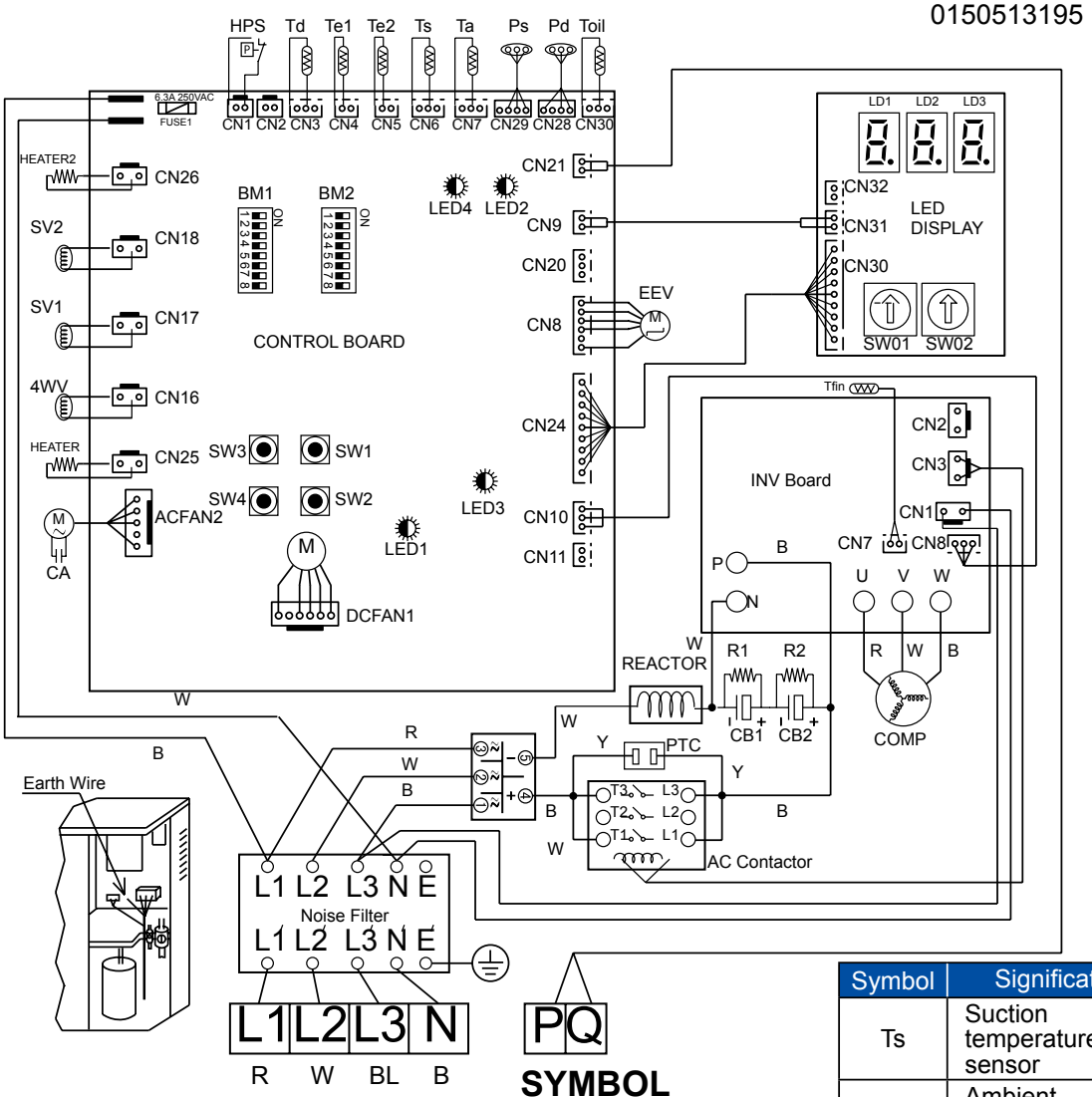
5. Wiring Diagram

0150513195



⚠ WARNING

Please power off firstly for about 10 minutes before checking control box, and make sure the voltage between P and N below 20V.

Notes

*• Please check the power firstly before test, and make sure the crankcase heater powering on for 12 hours at least to protecting compressor.The switch BM1-1 is used for locking the indoor units number, the initial situation is "OFF". After power on, the display board will display【U**】,"**"indicates the number of indoor units that the outdoor unit can communicate with. If it can match the actual number of indoor units, please change "OFF" to "ON", or else fix the communication problem firstly. Forbid connecting the power wire to the "P" and "Q", otherwise the control board will be damaged.Please make sure the earth wire connecting the grounding hole on the electric box firmly.*

SYMBOL

Symbol	Signification
HEATER, 2	Crankcase heater
SV1	Unloading valve
SV2	Spray valve
4WV	4-way valve
CA	Capacitor
ACFAN2	AC fan motor
DCFAN1	DC fan motor
HPS	High pressure switch
Td	Discharging temp. sensor
Te1, 2	Defrost temperature sensor

Symbol	Signification
Ts	Suction temperature sensor
Ta	Ambient temperature sensor
Pd	High pressure sensor
Ps	Low pressure sensor
Toil	Oil temperature sensor
EEV	Electronic expansion valve
Tfin	IPM temperature sensor
CB1, 2	Electrolytic capacitor
R	Red
W	White
BL	Blue
B	Black
Y	Yellow

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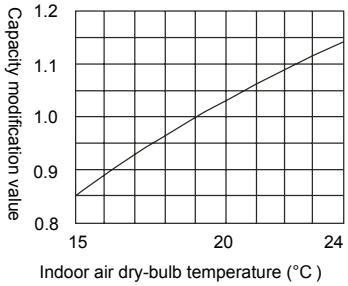
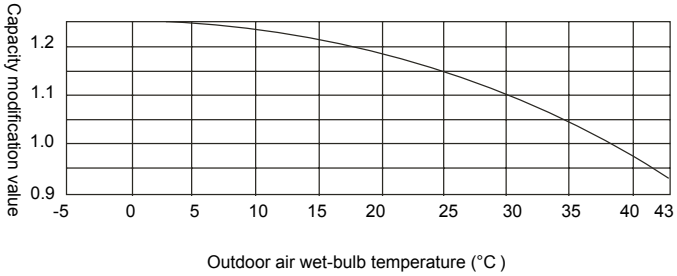
6. Performance Curves

(1) Calculation methed of refrigerating capacity----refrigerating capacity to be known=refrigerating capacity*(A*B*C*D*E)W

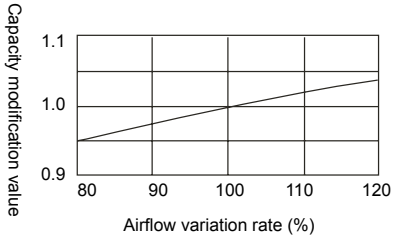
A. Capacity compensation value of indoor air wet-bulb temperature condition



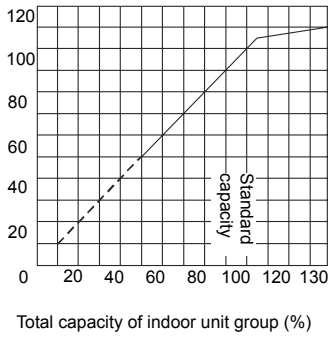
B. Capacity compensation value of outdoor air dry-bulb temperature condition



C. Capacity modification value under airflow variation rate of indoor unit group (only fro duct unit)

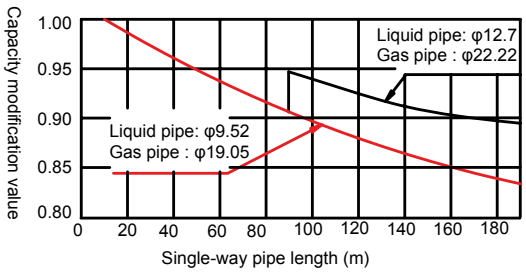


D. Capacity compensation suitable for total capability of indoor unit group

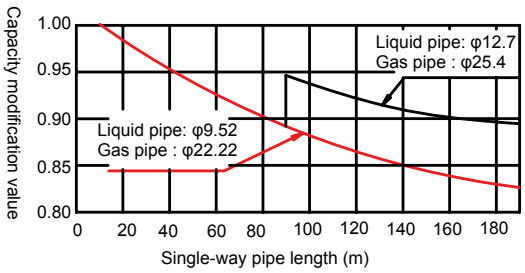


E. Fall of refrigerant pipe of indoor and outdoor unit, capacity compensation value of pipe length

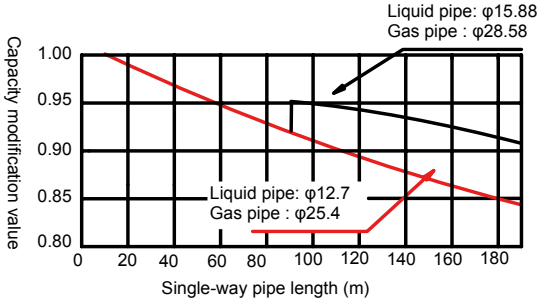
AV08NMSETA



AV10NMSETA



AV12NMSETA



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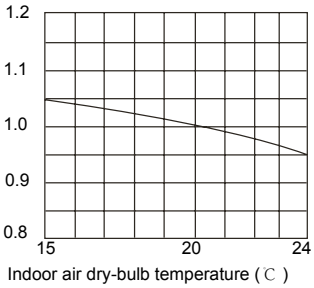
Notes:

- *The refrigerant pipe should be thickened when the single way length is over 90m.*
- *When in cooling mode, outdoor is lower than indoor; or when in heating mode, outdoor is higher than indoor, the compensation factor should be decreased the below value from the above figure.*

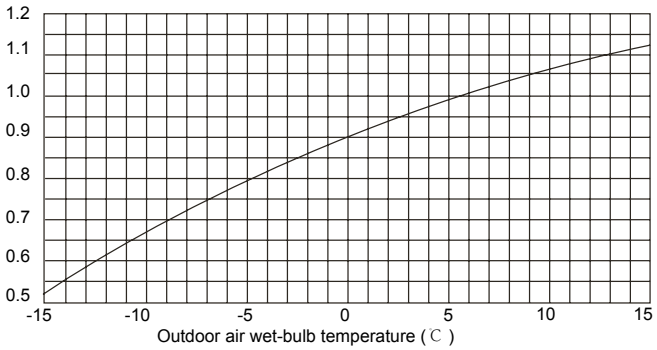
Vertical height drop between indoor and outdoor	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m
Adjustment factor	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	0.027	0.030

(2) Calculation method of refrigerating capacity----heating capacity to be known=refrigerating capacity*(A*B*C*D*E*F)W

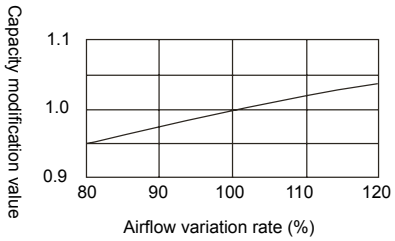
A. Capacity compensation value of indoor air dry-bulb temperature condition



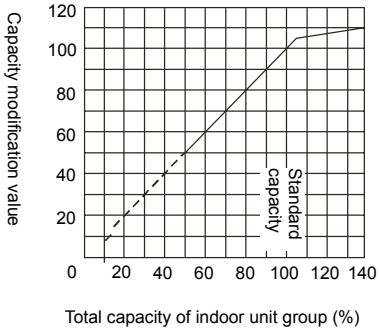
B. Capacity compensation value of outdoor air wet-bulb temperature condition



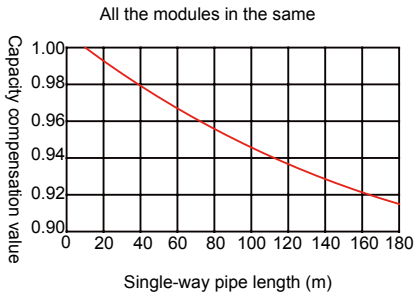
C. Capacity modification value under airflow variation rate of indoor unit group (only fro duct unit)



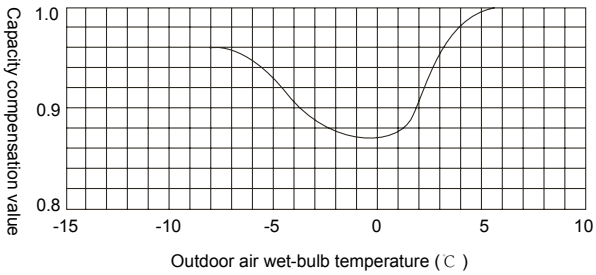
D. Capacity compensation suitable for total capability of indoor unit group



E. Capacity compensation value of pipe length between outdoors



F. Capacity compensation value for defrost capability of outdoor heat exchanger



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7. Noise Level

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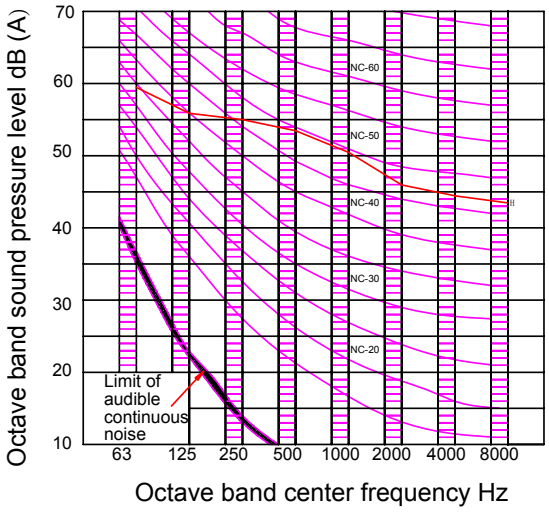
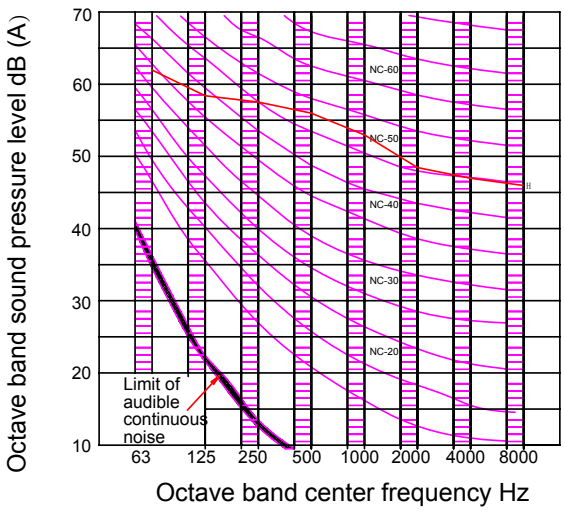
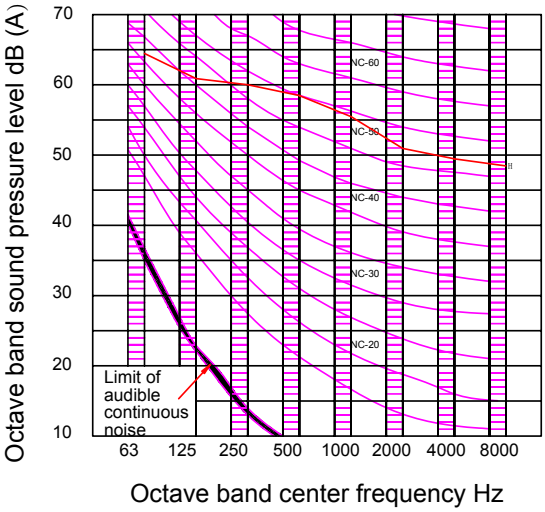


AV10NMSETA



AV12NMSETA



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8. Outdoor Installation

- This manual should always be accessible and close to this air condition equipment.
- There are two types of indications, "WARNING" and "CAUTION". The indication preventing from death or heavy injury is listed as "WARNING". Even the indication listed as "CAUTION " may also cause serious accident. Both of them are related to safety, and should be strictly followed.
- After installation and start-up commissioning, please handover the manual to the user. The manual should be well kept in safe place and close to the unit.

⚠ WARNING

- The installation or the maintenance should be performed by an authorized agency. The wrong operation of this air condition equipment may cause water leakage, electric shock or fire.
- Please install the unit on the top of a solid foundation or structure which is strong enough to support the unit.
- The installation of this air condition equipment should follow local construction codes.
- Use the right cable size, secure the terminal firmly, organize the cables well and make sure no tension is added on cables. Cable insulation should not be damaged. The incorrect installation may lead to overheat or fire.
- When installing or moving the unit, the refrigerant system should be vacuumed and recharged with R410A refrigerant. If any other gas enters the system, it may lead to abnormal high pressure which may cause damage or injury.
- Please use the proper manifolds or branches during the system installation. The wrong parts may cause refrigerant leakage.
- Keep the drain pipe away from toxic gas vents to prevent possible pollution of indoor environment.
- During or after the installation, please check whether there is refrigerant leakage. If any leakage, please take any measures for ventilation. The refrigerant may be toxic at some concentration levels.
- The unit is not explosion-proof. Please keep it away from flammable gases.
- The drain pipe should be installed per this manual to ensure proper drainage. The pipe should be well insulated to avoid condensation. Wrong installation may lead to water leakage.
  Both liquid pipe and the gas pipe should be also well insulated. Not enough insulation may lead to system performance deterioration or humidity formation.
- This air condition equipment is not intended to be operated by persons with lack of experience and training, unless they have supervision or instruction concerning use of this air condition equipment.
- Please keep children away from this air condition equipment.

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⚠ CAUTION

- Grounding wire should be connected with the grounding bar. The grounding wire can not be connected to the gas pipe, water pipe, lightening rod or the telephone grounding wire. Improper grounding may cause electric shock.
- Units installed on roof should have appropriate access and handrail.
- Use the wrench to fasten the nut and flare at proper torque. Excessive torque may cause flared section to broke leading to refrigerant leakage.
- After refrigerant pipe installation, please take nitrogen leakage test to avoid refrigerant leakage.
- R410A is the only permitted refrigerant.
- To avoid mischarging wrong refrigerant, the check valve diameter is changed for R410A. To strengthen the pipe, the flared pipe dimension is also changed. Please use R410A specified tools as shown below.

	R410A specified tools	Remarks
1	Gauge manifold	Range: HP >4.5MPa, LP >2MPa
2	Charge hose	Pressure: HP:5.3MPa, LP:3.5MPa
3	Electronic weight for charging R410A	No other means permitted
4	Torque wrench	
5	Flare tool	
6	Copper pipe gauge for adjusting projecting margin	
7	Vacuum pump fitting	Vacuum pump must be equipped with check valve
8	Leakage detector	Only Helium detector permitted

When charging refrigerant, the refrigerant must be in liquid state from the tank.

- To prevent EMC interference on other appliances, please keep indoor unit, outdoor unit, power cable and connecting wire at least 1m away from those appliances .
- Fluorescent lamp (reverse phase or rapid start type) may interfere the remote controller's signal. Please install indoor unit away from fluorescent lamp. The farther the better.

For installation, please review the items below:

- Is the connected units quantity and the total capacity in the allowable range?
- Is the refrigerant pipe length in the limited range?
- Is the pipe size proper? And if the pipe installed horizontally?
- Is the branch pipe installed horizontally or vertically?
- Is the additional refrigerant counted correctly and weighed by the standard balance?
- Is there refrigerant leakage?
- Is all the indoor power supplies can be on/off simultaneously?
- Is the power voltage in compliance with the data marked on the rating label?
- Is the address of indoors has been set?

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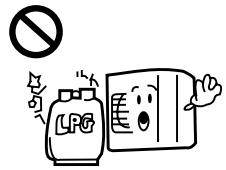
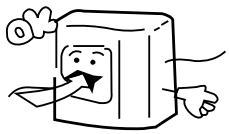
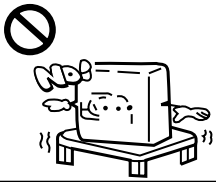
(1) Before installation

1) Before installation, check if the model, power supply, pipe, wires and parts purchased respectively are correct.

2) Check if the indoors and outdoors can be combined as the following.

Outdoor	Indoor	
Capacity (X 100W)	Indoor Qty	Total indoor capacity (X 100W)
AV08NMSETA	13	113~293
AV10NMSETA	16	140~364
AV12NMSETA	16	167~436

(2) Installation place selection

	Air-conditioner can't be installed in the place with inflammable gas. Or it will cause fire hazard.
	The unit should be installed at the place where the cold/hot air or noise will not interfere the neighbours.
	The unit should be installed at the place with good ventilation. No obstacle at the air inlet/outlet. And no strong wind blows the unit. The installation space refers to the latter info.
	The unit should be installed at the strong enough place. Or it will cause vibration and noise.

- The place where the water can flow fluently.
- The place where no other heat source will affect the unit.
- Pay attention to the snow against clogging the outdoor.
- In installation, install the anti-vibration rubber between the unit and the bracket.

- The unit is better not be installed at the below places, or it will cause damage.
- The place where there is corrosive gas (spa area etc).
- The place blowing salty air (seaside etc).
- Exists the strong coal smoke.
- The place with high humidity.
- The place where there is device emitting Hertzian waves.
- The place where voltage changes greatly.

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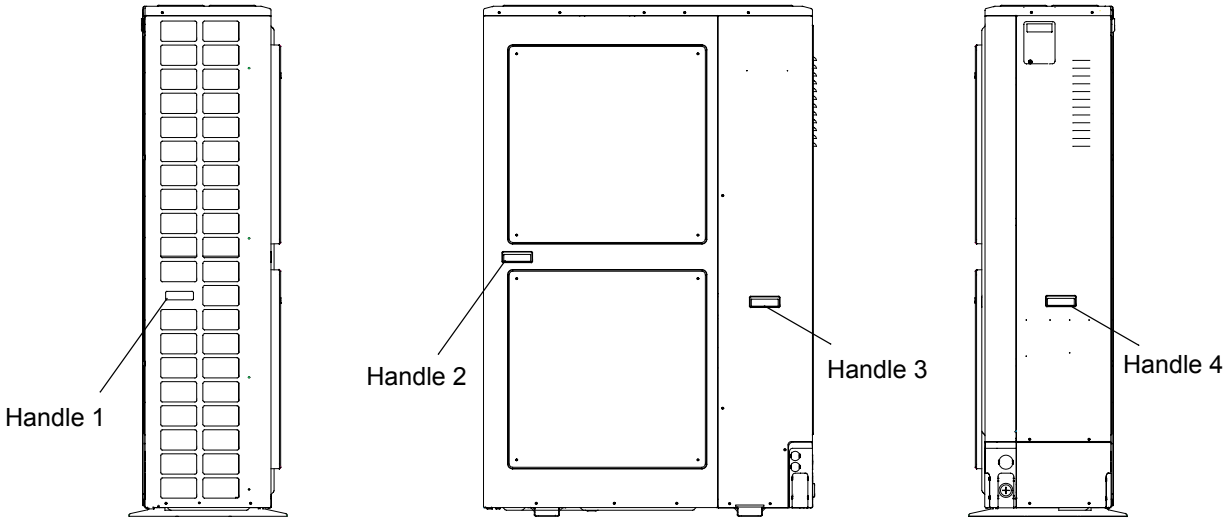
(3) Transportation and hoisting

Hoisting

- Please remove the outdoor unit to the installation location as far as possible near place befor open the packaging.
- Forbid on the equipments to place anything, need to use 2 ropes while promoting outdoor.
- Please according to following way hoisting outdoor:
- Ensure that the outdoor unit when hosting the level to rise slowly.
- Do not remove the packaging.
- When hoisting do not have to tie up the elevator to the unit hits on the packaging and the outside wrapping.
- When hoisting exterior must use the suitable protection.

Handling

Before the installation, outdoor do not deposit any material, otherwise likely has the fire or the accident.
When handling unit, please operate as shown in the following figure and note the following points
1. Forbids to demolish the wooden foundation.
2. Prevent the outdoor to incline.
3. Should be handling more than two.



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Outdoor installation

Installation location

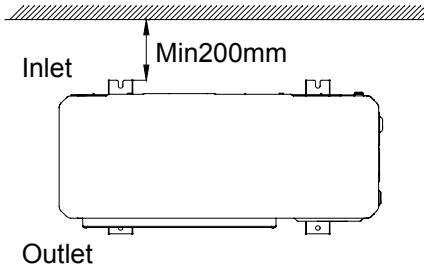
- Outdoor unit should be placed in well ventilated and dry place.
- Outdoor noise and exhaust should not affect neighbors and around the ventilation.
- Ensure the ground steadily reliable.
- Do not install the outdoor unit on high oil, salt spray or harmful gases.
- Don't being installed to electromagnetic wave can directly radiate an electricity box and keep off electromagnetic wave radiation possibly, at least more than 3 meters.
- When ice snow overlay area installs outdoor unit, please add to defend snow cover.
- Outdoor unit installed in the shade, avoiding direct sunlight or high temperature heat sources of radiation.
- Do not install in dusty or polluted place to prevent outdoor unit heat exchanger jam.
- The outdoor unit should install in the public unapproachable place.

Installation and maintenance space

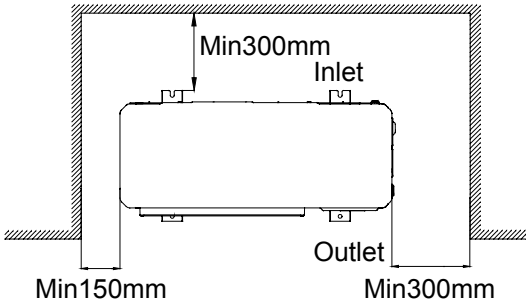
As shown below, install the outdoor unit should allow sufficient space for handing and maintenance.

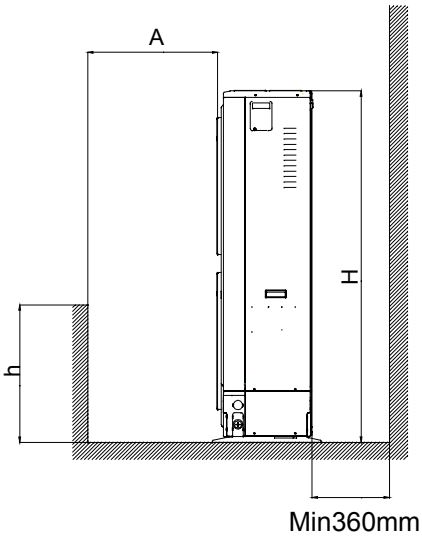
Case 1: Stumbling block on the inlet , also upside opens.

Single installation around the opening



Single installation around the closed





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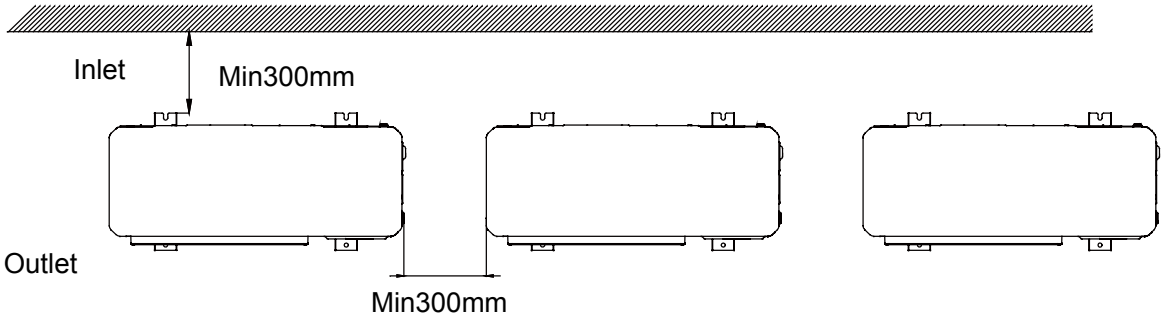
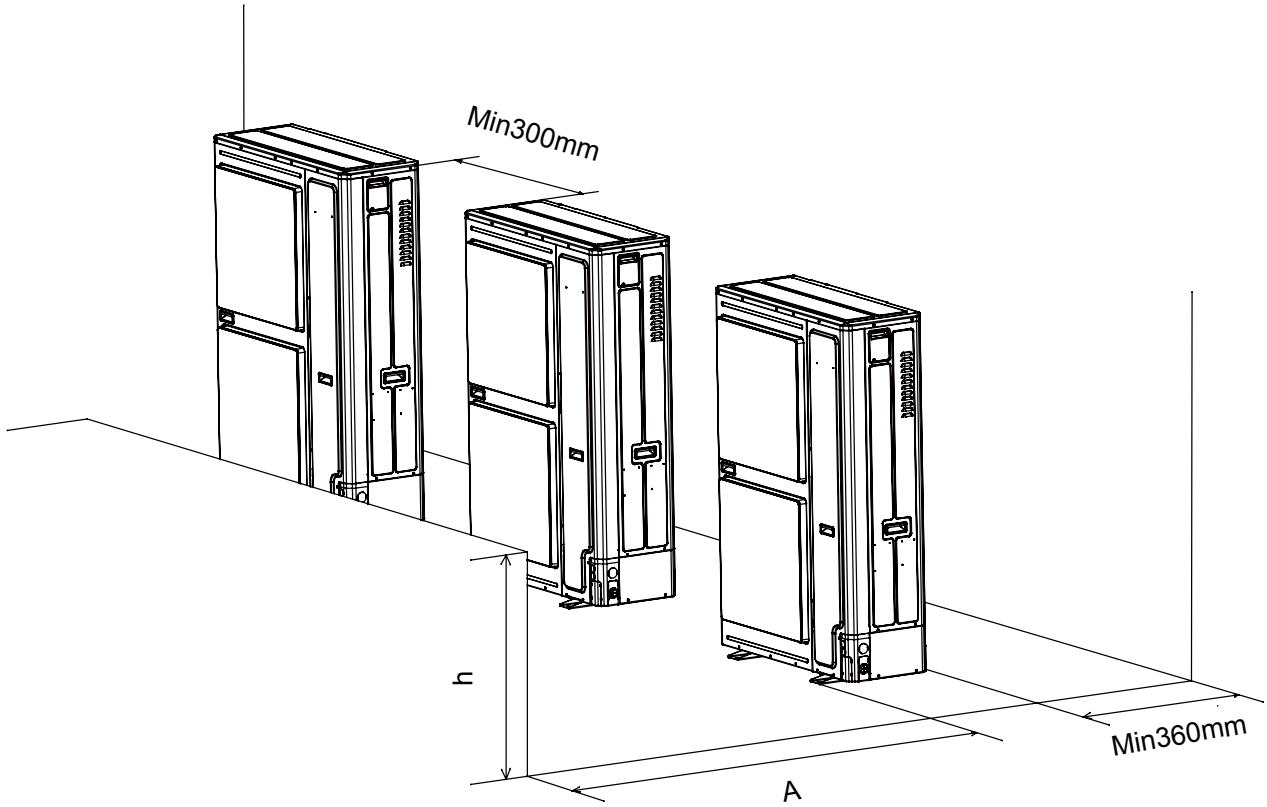
Multi Outdoor





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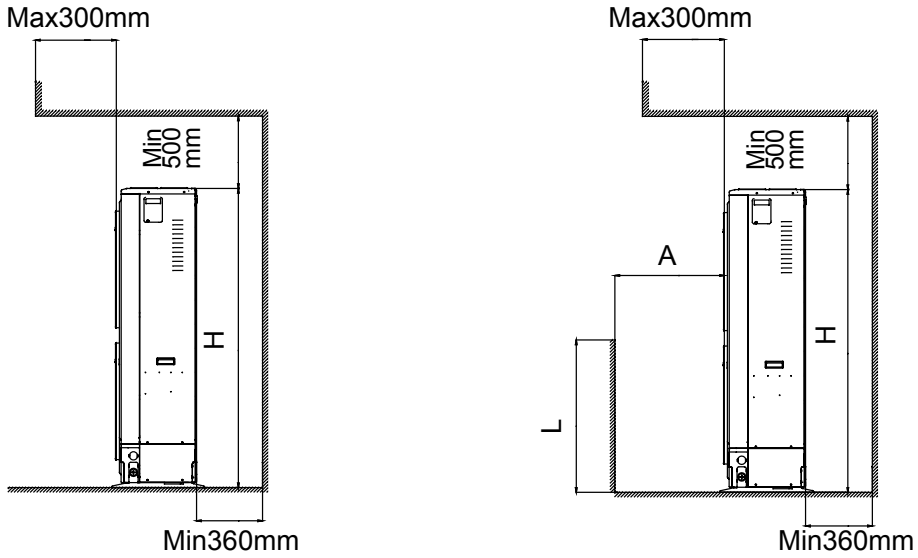
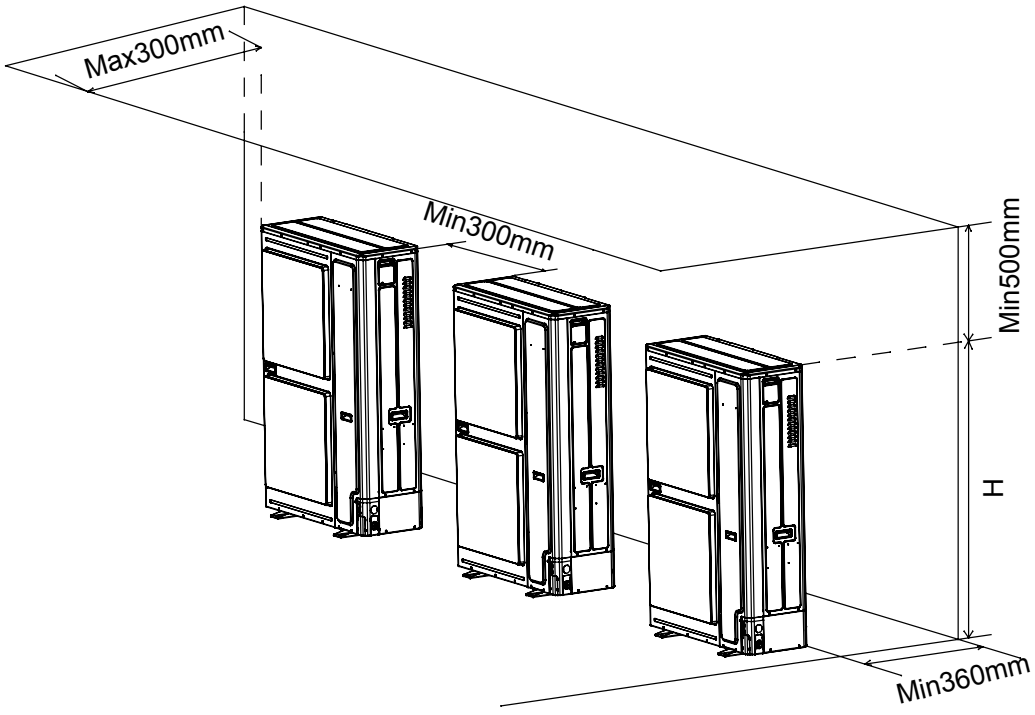
Case 2: Stumbling block on the inlet and top side

Single Outdoor



Multi Outdoor



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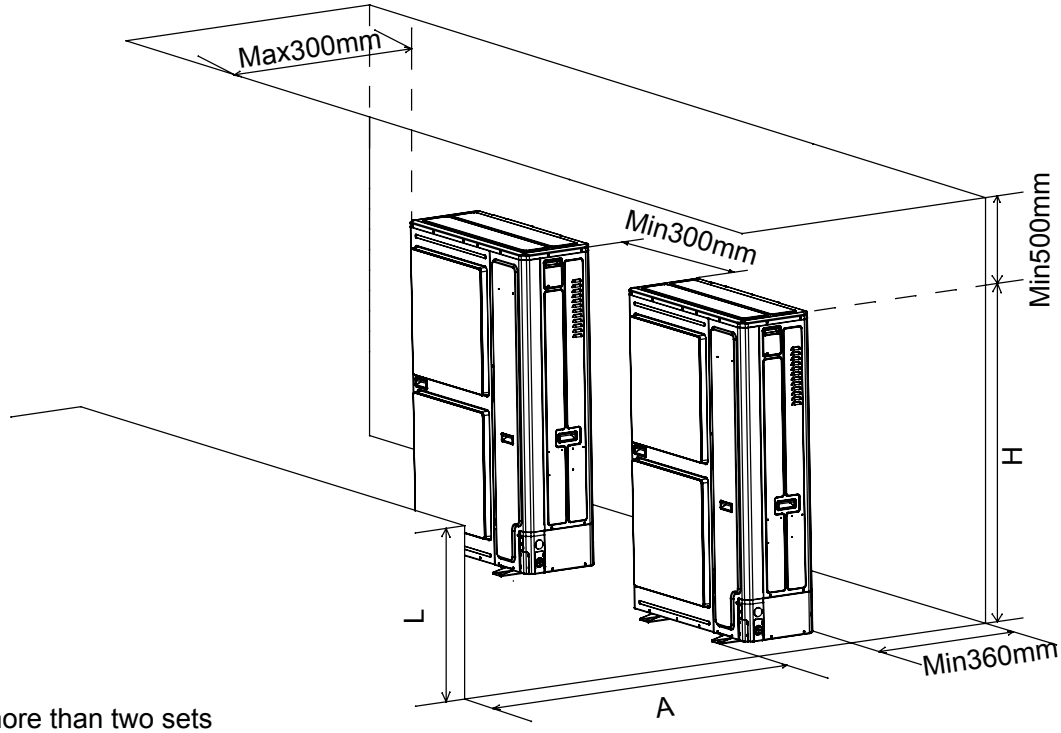
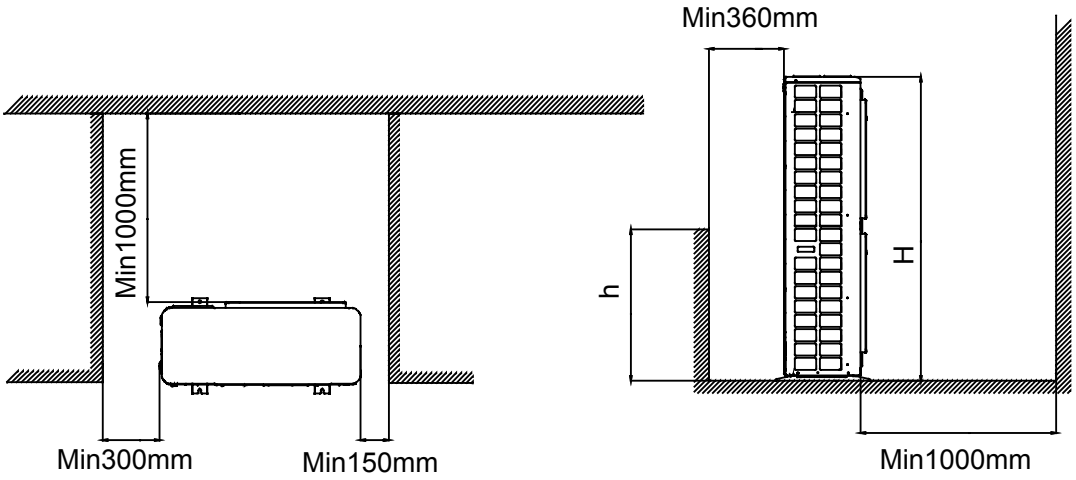


Not more than two sets

Case 3:Stumbling block on the outlet, both right and left side

Single Outdoor



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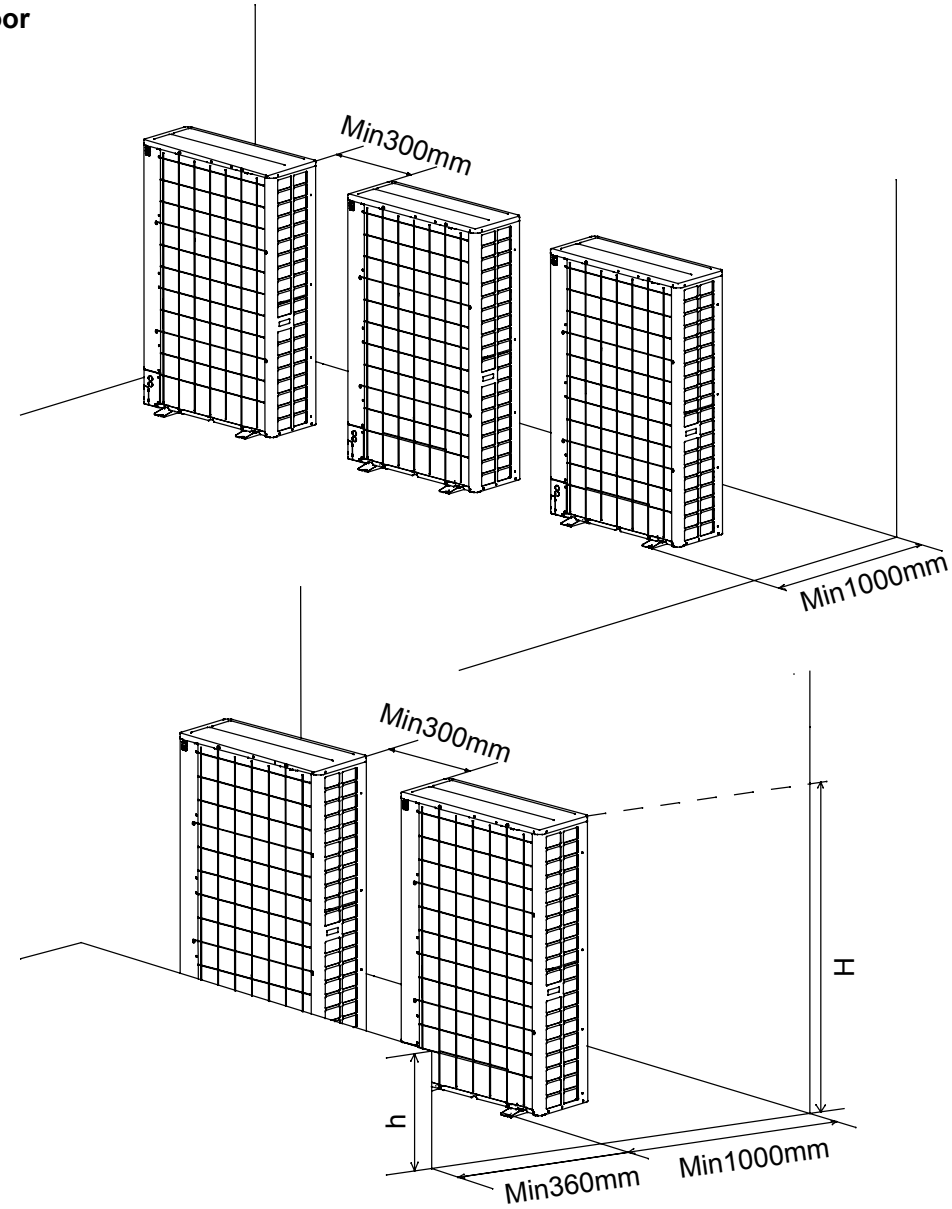
Multi Outdoor



If h>H, please set the outdoor on the foundation to make sure H≥h.
H=The height of outdoor and foundation

h	A
0<h≤1/2H	Over 600
1/2H<h≤H	Over 1400

Note:

• *Avoid making air short cycle in any case.*

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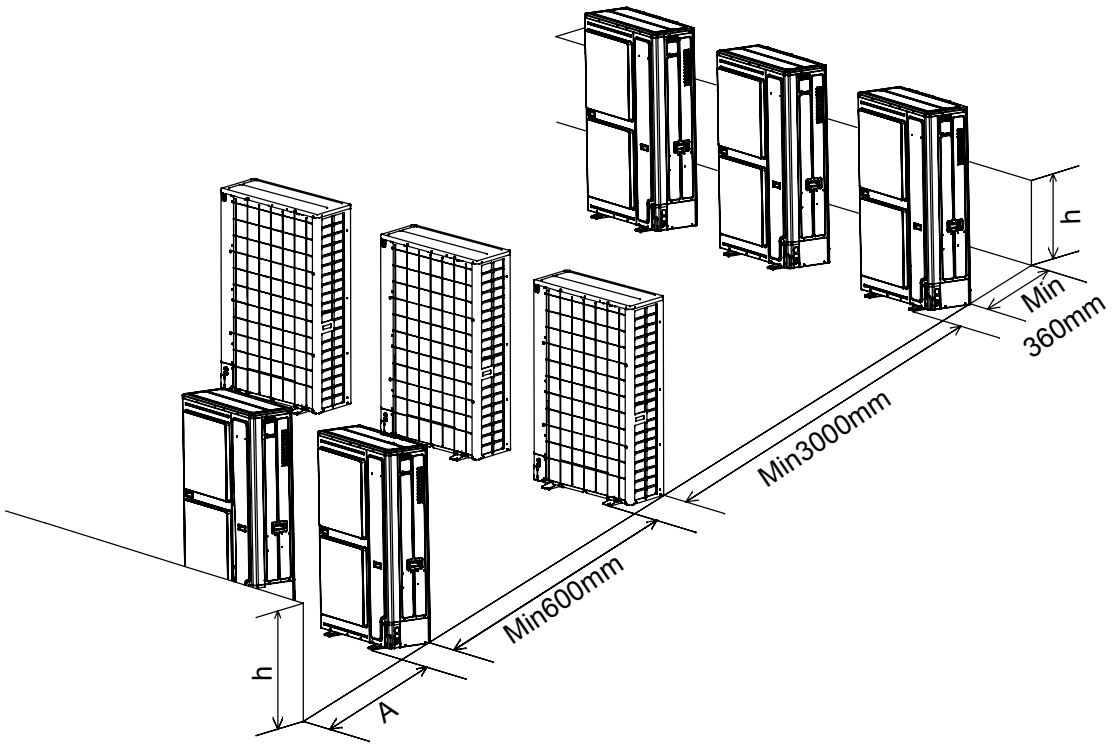
Multi Row Outdoor



Note:

• Make sure the distance at least 300mm between two neighbor units and no stumbling block.

h	A
0<h≤1/2H	Over 600
1/2H<h≤H	Over 1400

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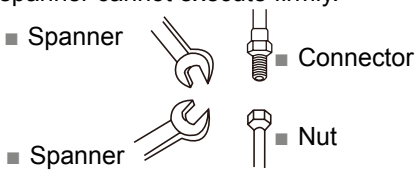
A. Refrigerant pipe connection

Pipe connection method

- To ensure the efficiency, the pipe should be as short as possible.
- Daub the refrigerant oil on the connector and the flare nut.
- When bending the pipe, the bending semi-diameter should be as large as possible against the pipe being broken or bent.
- When connecting the pipe, aim at the center to thread the nut by hand and tighten it with the double spanners.
- Fastening torque please refers to "pipe specs and fastening torque" on page 15.
- Don't let the impurity such as sand, water etc into the pipe. Antifouling measures refer to page 13.

- When fastening and loosing the nut, operate with double spanners, because only one spanner cannot execute firmly.



- If threading the nut as not aiming at the center, the screw thread will be damaged, further it will cause leakage.

Cautions in piping installation:

- When welding the pipe with hard solder, charge nitrogen into the pipe against oxidation. The pressure gauge should be set at 0.02 MPa. Perform the procedure with nitrogen circulation. Otherwise, the oxide film in the pipe may clog the capillary and expansion valve resulting in accident.
- The refrigerant pipe should be clean. If the water and the other impurity enter the pipe, charge the nitrogen to clean the pipe. The nitrogen should flow under the pressure of about 0.5Mpa and when charging the nitrogen, stop up the end of the pipe by hand to enhance the pressure in the pipe, then loose the hand (meanwhile stop up the other end).
- The piping installation should be executed after the stop valves are closed.
- When welding the valve and the pipe, cool down the valve with wet towel.
- When the connection pipe and the branch pipe need to be cut down, please use the special shears and cannot use the saw.
- When welding copper pipe, use the phosphor copper welding rod without any welding flux.
- (welding flux will damage the piping system. The welding flux containing chlorine will corrode pipe, especially, the welding flux with fluorin will damage refrigeration oil.)

Pipe material and specs selection

- Please select the refrigerant pipe of the below material.
- Material: the phosphoric oxidize seamless copper pipe, model: C1220T-1/2H (diameter is over 19.05); C1220T-0 (diameter is below 15.88).
- Thickness and specs:
- Confirm the pipe thickness and specs according to the pipe selection method (the unit is with R410A, if the pipe over 19.05 is 0-type, the pressure preservation will be bad, thus it must be 1/2H type and over the min. thickness.)
- The branch pipe and the gather pipe must be from Haier.
- When installing the stop valve, refer to the relative operation instruction.
- The pipe installation should be in the allowable range.
- The installation of branch pipe and gather pipe should be performed according to the relative manual.

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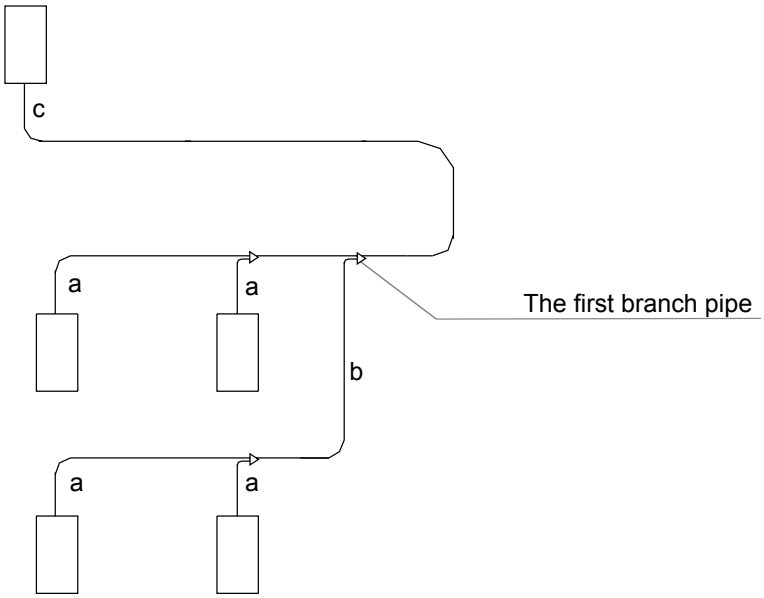
Anti-fouling measures

First, clean the pipe.

Position	Installation period	Measures
Outdoor	More than 1 month	Flat the pipe end
	Less than 1 month	Flat the pipe end or seal with adhesive tape
Indoor	Nothing to do with period	

Pipe specification



1. Pipe a (indoor-branch pipe) diameter: decided by connected indoor capacity			
Indoor rated capacity (x100w)	Gas pipe	Liquid pipe	Note
22~28	9.52	6.35	AS07/092MGERA gas pipe should be 12.7 AS182MGERA gas / liquid pipe should be 15.88 / 9.52
36~56	12.7	6.35	
71~140	15.88	9.52	
226~300	25.4	9.52	
450~600	28.58	12.7	
(1) When pipe length between indoor & nearest branch pipe ≥15m, adjust in accordance with following criteria: ① If indoor rated capacity≤5.6kW, change gas / liquid pipe diameter to 15.88 / 9.52 ② If 16.8kW≥ indoor rated capacity>5.6kW, change gas / liquid pipe diameter to 19.05 / 9.52 ③ If indoor rated capacity>16.8kW, change liquid pipe diameter to 12.7			

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2. Pipe b (between branch pipes) diameter:			
Total capacity of connected indoors	Gas pipe	Liquid pipe	(1) Select in accordance with total capacity connected (2) Pipe b diameter should not be bigger than main pipe c If pipe b diameter is larger than main pipe c, please correct diameter according to either of the following rules: ① Reduce b diameter to be the same as pipe c ② Enlarge main pipe c diameter to be the same as pipe b. (3) If pipe b diameter smaller than pipe a, the pipe b diameter must be enlarged.
x<16.8kw	15.88	9.52	
16.8kw≤x<22.4kw	19.05	9.52	
22.4kw≤x<33kw	22.22	9.52	
33kw≤x<47kw	28.58	12.7	
47kw≤x<71kw	28.58	15.88	
71kw≤x<104kw	31.8	19.05	
104kw≤x<154kw	38.1	19.05	
154kw≤x<182kw	41.3	19.05	
x≥182kw	44.5	22.22	

3. Main pipe c (between outdoor gather pipe & the first branch pipe) diameter:				
Outdoor horse power	Main pipe		Enlarged main pipe	
	Gas pipe	Liquid pipe	Gas pipe	Liquid pipe
8HP	19.05	9.52	22.22	12.7
10HP	22.22	9.52	25.4	12.7
12HP	25.4	12.7	28.58	15.88
When the farthest length (between outdoor & the farthest indoor) is over 90m (equivalent length), the main pipe must be enlarged one size.				

Copper pipe selection:

Material	O type pipe: Soft pipe			
Pipe diameter (mm)	Ø6.35	Ø9.52	Ø12.7	Ø15.88
Thickness (mm)	0.8	0.8	1.0	1.0

Material	Hard pipe				
Pipe diameter (mm)	Ø19.05	Ø22.22	Ø25.4	Ø28.58	Ø31.8
Thickness (mm)	1.0	1.0	1.0	1.0	1.1

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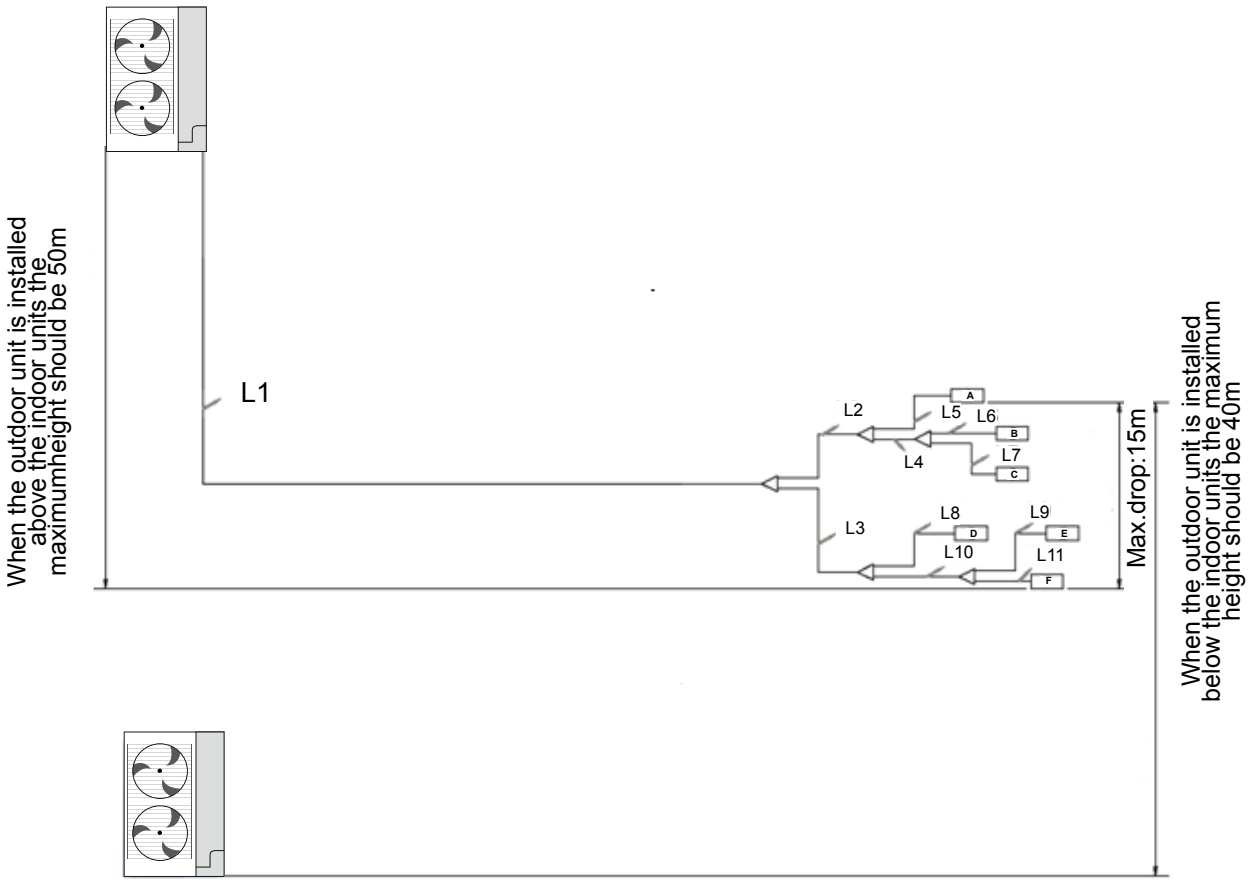
Long pipe and high drop



	Max. length	Pipe in above figure
Single way total pipe length (=total liquid pipe length)	300m	L1+L2+L3+L4+L5+L6+L7+L8+L9+L10+L11
Single way max. pipe length (max. length between outdoor & indoor) actual / equivalent length	150m / 175m	L1+L3+L10+L11
Pipe length after first branch pipe (length between first branch & farthest indoor)	40m	L1+L10+L11
Main pipe actual length (length between first gather pipe & first branch pipe)	110m	L1
Height difference between indoor units	15m	--
Pipe length between indoor unit and the nearest branch	30m	--

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Unit pipe spec and connection method (unit: mm)

A. Outdoor Unit

Mobel	Gas pipe side		Liquid pipe side	
	Diameter (mm)	Connecting method	Diameter (mm)	Connecting method
AV08NMSETA	Ø19.05	Flared joint	Ø9.52	Flared joint and Brazing (here including two connecting methods because of using a reduser pipe)
AV10NMSETA	Ø22.22	Flared joint and Brazing (here including two connecting methods because of using a reduser pipe)	Ø9.52	
AV12NMSETA	Ø25.4		Ø12.7	Flared joint

B. Indoor Unit

Model Capacity	Gas pipe side		Liquid pipe side	
	Diameter (mm)	Connecting method	Diameter (mm)	Connecting method
07	Ø9.52	Flared	Ø6.35	Flared
09	Ø9.52		Ø6.35	
12	Ø12.7		Ø6.35	
16	Ø12.7		Ø6.35	
18	Ø12.7		Ø6.35	
24	Ø15.88		Ø9.52	
28	Ø15.88		Ø9.52	
30	Ø15.88		Ø9.52	
38	Ø15.88		Ø9.52	
48	Ø15.88		Ø9.52	
72	Ø25.4	Braze	Ø9.52	
96	Ø25.4		Ø9.52	

Note:

• *AS072, AS092 gas pipe: Ø12.7mm; AS182 gas pipe/liquid pipe: Ø15.88/9.52mm*

C. Pipe spec and the torque

Diameter (mm)	Torque (N.m)
Ø6.35	14~18
Ø9.52	34~42
Ø12.7	49~61
Ø15.88	68~82
Ø19.05	84~98

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Branch pipe

Branch pipe selection:

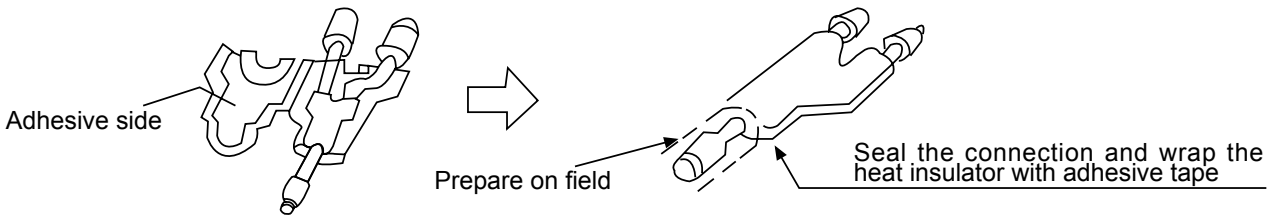
Total indoor capacity (100W)	Model (optional)
Less than 335	FQG-B335A
More than 335, less than 506	FQG-B506A

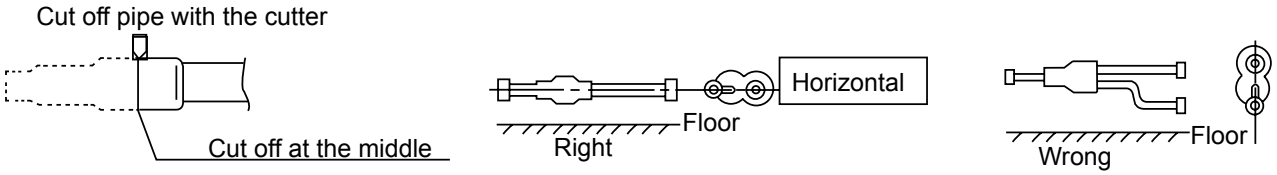
Outdoor unit type

The master unit will choose the closest one to the 1st branch pipe.

Note:

- *When connecting the outdoor branch pipe and the outdoor, please pay attention to the outdoor pipe dimension.*
- *When adjusting the diameter among outdoor branch pipe and among the units, please must execute at the branch pipe side.*
- *Please install the outdoor branch pipe (gas/liquid side) in horizontal or vertical direction.*
- *When welding with hard solder, please must blow nitrogen. If not, a number of oxide will be produced and cause heavy damage. Besides, to prevent water and dust into the pipe, please make the brim as outer roll.*





Pipe installation

When doing the piping connection, please do the following:

- Please don't let the pipe and the parts in the unit collide each other.
- When connecting the pipes, close the valves fully.
- Protect the pipe end against the water, impurity into the pipes (welding after being flat, or being sealed with adhesive tape).
- Bend the pipe as large semi-diameter as possible (over 4 times of the pipe diameter).
- The connection between outdoor liquid pipe and the distributing pipe is flared type. Please expand the pipe with the special tool for R410A after installing the expanding nut. But if the projecting pipe length has been adjusted with the copper pipe gauge, you can use the original tool to expand the pipe.
- Since the unit is with R410A, the expanding oil is ester oil, not the mineral oil.
- When doing the flare connection, please do the following: When connecting the expanding pipe, fasten the pipes vwith double-spanner. The torque refers to the former info.

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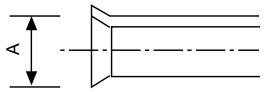
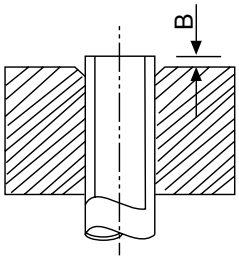
■ Expanding pipe: A (mm)



Pipe outer diameter (mm)	A 0 -0.4
Ø6.35	9.1
Ø9.52	13.2
Ø12.7	16.6
Ø15.88	19.7

■ Projecting length of pipe to be expanded: B (mm)



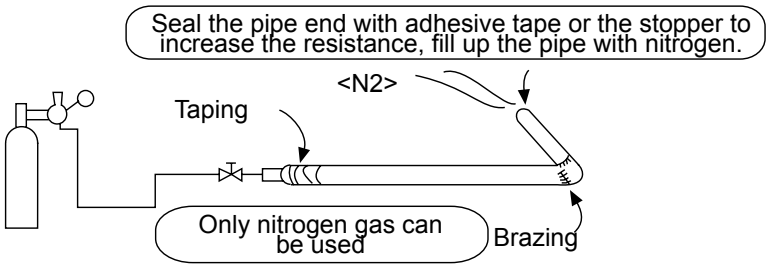
Pipe outer diameter (mm)	When it is hard pipe	
	Special tool for R410A	The former tool
Ø6.35	0-0.5	1.0-1.5
Ø9.52		
Ø12.7		
Ø15.88		

■ The outdoor gas pipe and the refrigerant distributing pipe, as well the refrigerant distributing pipe and the branch pipe should be welded with hard solder.

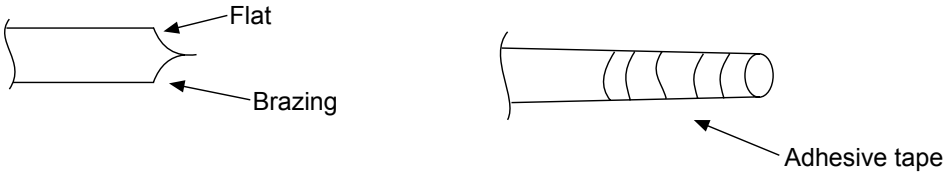
■ When doing the braze connection, please do the following: Brazing the pipe at the same time charge the nitrogen. Or it will cause a number of impurity (a film of oxidation) to clog the capillary and the expansion valve, further cause the deadly failure.

Operation procedure

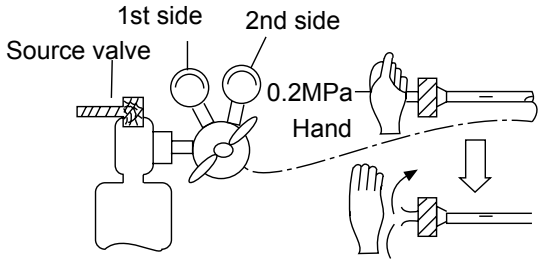
■ Brazing the pipe at the same time charge the nitrogen. Or it will cause a number of impurity (a film of oxidation) to clog the capillary and the expansion valve, further cause the deadly failure.



■ Protect the pipe end against the water, impurity into the pipes (welding after being flat, or being sealed with adhesive tape).



■ The refrigerant pipe should be clean. The nitrogen should flow under the pressure of about 0.5Mpa and when charging the nitrogen, stop up the end of the pipe by hand to enhance the pressure in the pipe, then loose the hand (meanwhile stop up the other end).



■ When connecting the pipes, close the valves fully.

■ When welding the valve and the pipes, use the wet cloth to cool down the valve and the pipes.

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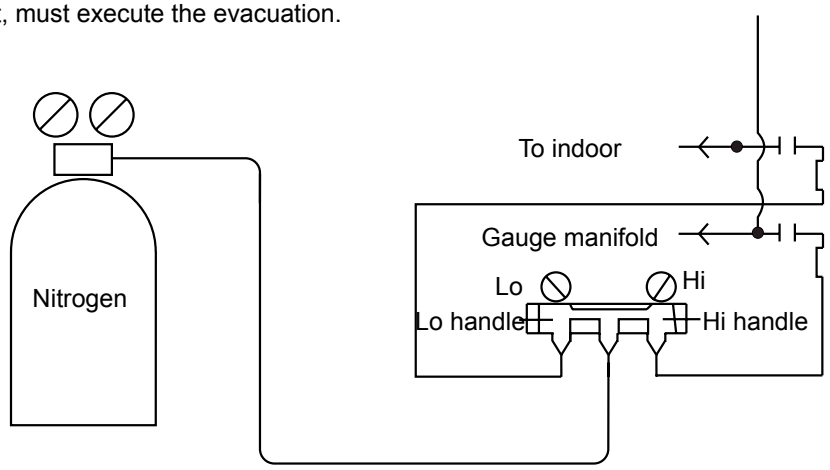
B. Leakage test

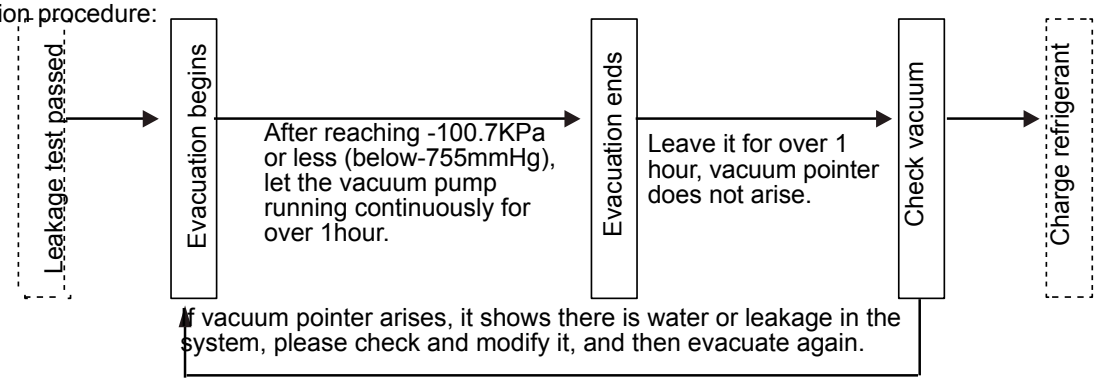
- The outdoor unit has been executed the leakage test in the factory. The pipe should be executed leakage test individually and forbidden to test after connecting with stop valve.
- Refer to the below figure to charge the nitrogen into the unit to take a test. Never use the chlorin, oxygen, flammable gas in the leakage test. Apply pressure both on the gas pipe and the liquid pipe.
- Apply the pressure step by step to the target pressure.
- a. Apply the pressure to 0.5MPa for more than 5 minutes, confirm if pressure goes down.
- b. Apply the pressure to 1.5MPa for more than 5 minutes, confirm if pressure goes down.
- c. Apply the pressure to the target pressure (4.15MPa), record the temp. and the pressure.
- d. Leave it at 4.15MPa for over 1 day, if pressure does not go down, the test is passed.
- Meanwhile, when the temp. changes for 1degree, pressure will change 0.01MPa as well.
- Correct the pressure.
- e. After confirmation of a~d, if pressure goes down, there is leakage. Check the brazing position, flared position by laying on the soap. Modify the leakage point and take another leakage test.
- After leakage test, must execute the evacuation.



C. Evacuation

Evacuate at the check valve of liquid stop valve and both sides of the gas stop valve. The oil equalization pipe also must be vacuum (executed at the oil equalization pipe check valve respectively).

Operation procedure:



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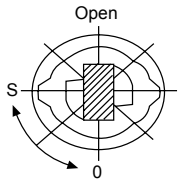
Because the unit is with refrigerant R410A, the below issues should be paid attention:

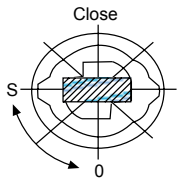
- To prevent the different oil into the pipe, please use the special tool for R410A, especially for gauge manifold and charging hose.
- To prevent the compressor oil into the refrigerant cycle, please use the anti-counter-flow adapter.

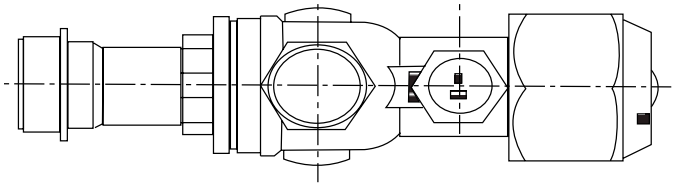
D. Check valve operation

Open/close method:

- Take down the valve cap, gas pipe turns to "open" state as right figure.
- Turn the liquid pipe with hexangular spanner until it stops. If opening the valve strongly, the valve will be damaged.
- Tighten the valve cap.







Tighten torque as the table below:

Tighten torque N·m			
	Shaft (valve body)	Cap (cover)	T-shape nut (check joint)
For gas pipe	8~9	22~27	8~10
For liquid pipe	5~6	13~16	8~10

E. Additional refrigerant charging

Charge the additional refrigerant as liquid state with the gauge.
If the additional refrigerant can not be charged totally when the outdoor stops, charge it at the trial mode.
If the unit runs for a long period in the state of lack of refrigerant, compressor will occur failure.
(the charging must be finished within 30 minutes especially when the unit is running, meanwhile charging the refrigerant).

The unit is charged only part of the refrigerant at the factory, also need additional refrigerant at the installation site.
W1: Refrigerant charging volume to outdoor unit at factory.
W2: Refrigerant charging volume to outdoor unit on site.
W3: Refrigerant charging volume to liquid pipe base on different piping length calculation.
W3=actual length of liquid pipe×additional amount per meter liquid pipe
=L1×0.35+L2×0.25+L3×0.17+L4×0.11+L5×0.054+L6×0.022

L1: Total length of 22.22 liquid pipe;
L2: Total length of 19.05 liquid pipe;
L3: Total length of 15.88 liquid pipe;
L4: Total length of 12.7 liquid pipe;
L5: Total length of 9.52 liquid pipe;
L6: Total length of 6.35 liquid pipe;
Total refrigerant volume charging on site during installation=W2+W3
W: Total refrigerant volume charging on site for maintenance.

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Refrigerant record form						
Model	W1: Refrigerant charging volume to outdoor unit at factory	W2: Refrigerant charging volume to outdoor unit on site	W3: Refrigerant charging volume to liquid pipe base on different piping length calculation		Total refrigerant volume charging on site during installation	W: Total refrigerant volume charging on site for maintenance
			Liquid pipe diameter (mm)	Additional refrigerant amount (kg)		
AV08NMSETA	7.4kg	0kg	Ø6.35	0.022kg/m×__m=__ kg	W2+W3= ___ kg	W1+W2+W3=___ kg
AV10NMSETA		0kg	Ø9.52	0.054kg/m×__m=__ kg		
AV12NMSETA		0kg	Ø12.7	0.11kg/m×__m=__ kg		
			Ø15.88	0.17kg/m×__m=__ kg		
			Ø19.05	0.25kg/m×__m=__ kg		
			Ø22.22	0.35kg/m×__m=__ kg		
			W3=___kg			

Note:

• To prevent the different oil into the pipe, please use the special tool for R410A, especially for gauge manifold and charging hose.

• Mark the refrigerant type in different colour on the tank. R410A is pink.

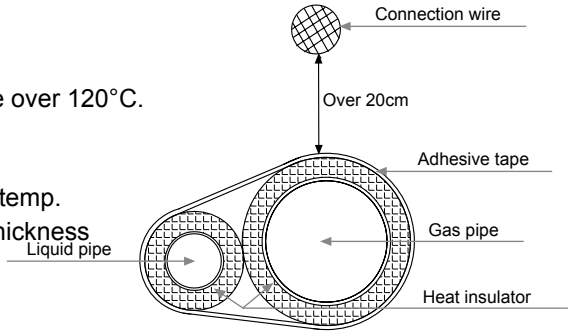
• Must not use the charging cylinder, because the R410A will change when transferring to the cylinder.

• When charging refrigerant, the refrigerant should be taken out from the tank as liquid state.

• Mark the counted refrigerant volume due to the distributing pipe length on the label.

Heat insulation

- Gas pipe and liquid pipe should be heat insulated separately.
- The material for gas pipe should endure the high temperature over 120°C.
- That for liquid pipe should be over 70°C.
- The material thickness should be over 10mm, when ambient temp. is 30°C, and the relative humidity is over 80%, the material thickness should be over 20mm.
- The material should cling the pipe closely without gap, then be wrapped with adhesive tape. The connection wire can not be put together with the heat insulation material and should be far at least 20cm.



Fix the refrigerant pipe

- In operation, the pipe will vibrate and expand or shrink. If not being fixed, the refrigerant will focus on one part to cause the broken pipe.
- To prevent the central stress, fix the pipe for every 2-3m.

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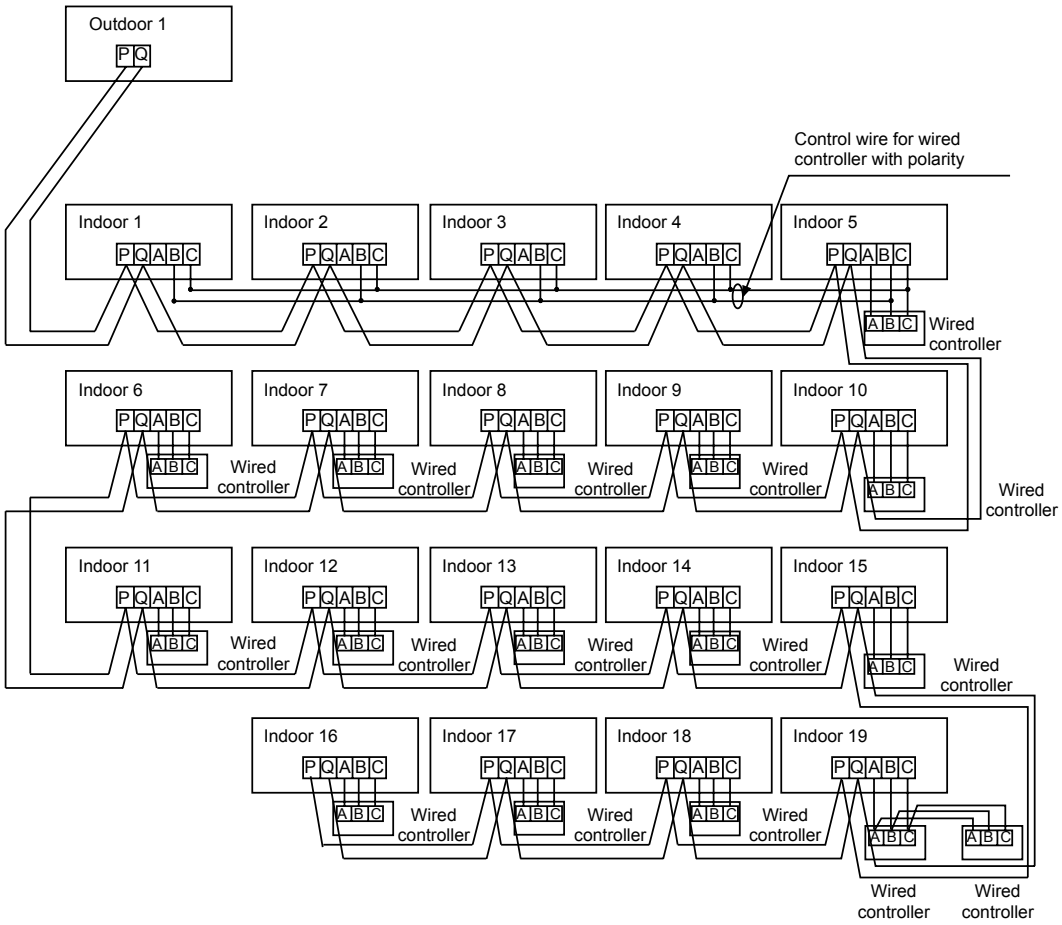
9. Electric Installation

Communication wiring figure



The outdoor and all indoor units are in parallel through 2 non-polar wires.

Three wiring methods between wired controller and indoor unit:

A. 1 to multi (group control) : one wired controller controls 2~16 indoors, as shown in above figure, indoor 1~indoor 5: indoor 5 is wired control master unit, the others are wired control slave units.
Wired controller and the master indoor (directly connected to wired controller) is connected by 3 polar wires; the other indoors and the master indoors are connected by 2 polar wires.

B. 1 to 1 (one wired controller controls one indoor) : as shown in above figure, indoor 6~ indoor 19, indoor and wired controller are connected by 3 polar wires.

C. 2 to 1 (two wired controller controls one indoor) : as shown in above figure, indoor 19. Either of wired controllers can be set as master wired controller, and the other is slave wired controller.
Master/slave wired controller, and master/indoor are connected by 3 polar wires.
When indoor is controlled by remote controller, refer to the "wired control master unit/wired control slave unit/remote control unit table". A, B, C on signal terminal block need not wires and not connect the wired controller.

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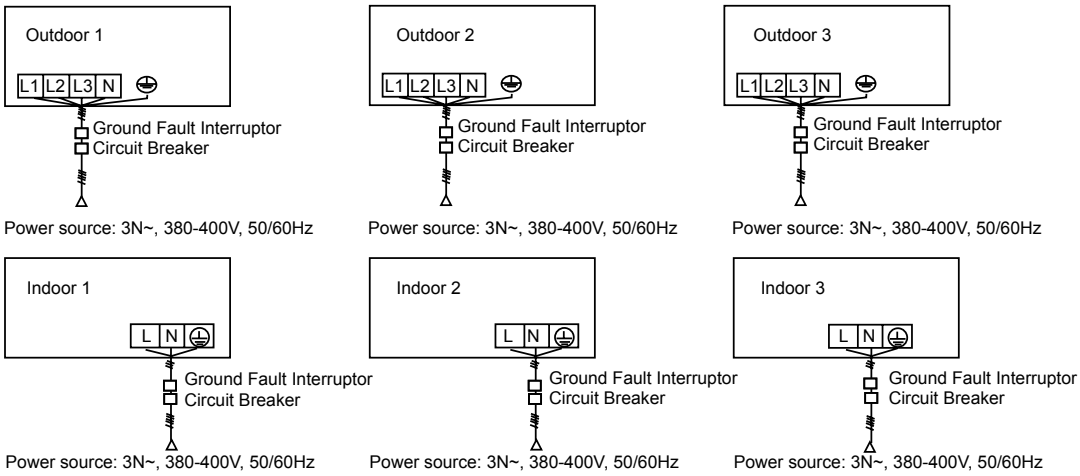
Power wiring figure

- Please make sure that when the unit is running, the input voltage is no less than 380V; if it is lower than 380V, the unit may run abnormal.



- Indoor and outdoor use their individual power source.
- All indoors use one power source.
- Must install the leakage breaker and the over current breaker, or electric shock will occur.

Outdoor power source and power cable

	Item / Model	Power source	Power cable section (mm²)	Wire length (m)	Circuit breaker (A)	Rated current of residual circuit breaker (A) Ground fault interruptor (mA) Response time (S)	Ground wire	
							Section (mm²)	Screw
Individual power	AV08NMSETA	3N~, 380-400V, 50/60 Hz	6	60	40	40A 30mA below 0.1S	3.5	M5
	AV10NMSETA		10	60	40	40A 30mA below 0.1S	3.5	M5
	AV12NMSETA		10	60	40	40A 30mA below 0.1S	3.5	M5

- Power cable must be fixed firmly.
- Each outdoor must be earthed well.
- When power cable exceeds the range, thicken it appropriately.

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Indoor power source and communication wiring

Item Indoor total current (A)	Power cable section (mm²)	Wire length (m)	Rated current of overcurrent breaker (A)	Rated current of residual circuit breaker (A) Ground fault interruptor (mA) Response time (S)	Communication wire section	
					Outdoor/ indoor (mm²)	Indoor/ indoor (mm²)
<10	2	20	20	20A, 30mA, below 0.1s	2-core×(0.75-2.0mm²) shielded wire	
≥10 and <15	3.5	25	30	30A, 30mA, below 0.1s		
≥15 and <22	5.5	30	40	40A, 30mA, below 0.1s		
≥22 and <27	10	40	50	50A, 30mA, below 0.1s		

- Power cable and communication wire must be fixed firmly.
- Each indoor must be grounded well.
- When power cable exceeds the range, increase the gauge appropriately.
- Shielded layer of communication wires must be connected together and be earthed at single point.
- Communication wire total length cannot exceed 1000m.

Communication wire for wired controller

	Wire spec	Wire length (m)	Wire spec
<100	0.3mm²×(3-core) shielded wire	≥300 and <400	1.25mm²×(3-core) shielded wire
≥100 and <200	0.5mm²×(3-core) shielded wire	≥400 and <600	2mm²×(3-core) shielded wire
≥200 and <300	0.75mm²×(3-core) shielded wire		

- Shielded layer of communication wire must be grounded at one end.
- The total length cannot exceed 600m.

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10. Trial Operation

5-minute delay function

- If starting up the unit after being powered off, the compressor will run about 5 minutes later against being damaged.

Cooling/heating operation

- Indoor units can be controlled individually, but cannot run in cool and heat mode at the same time. If the cool mode and the heat mode are existing simultaneously, the unit set latter will be standby, and the unit set earlier will run normally.
- If the A/C manager sets the unit at cooling or heating mode fixedly, the unit can not run at the other modes.

Heating mode characteristic

- In operation if outdoor temp. arises, indoor fan motor will turn to low speed or stop.

Defrosting in heating mode

- In heating mode, outdoor defrosting will affect the heating efficiency. The unit will defrost for about 2~10 minutes automatically, at this time, the condensate will flow from outdoor, also in defrosting, the vapour will appear at outdoor, which is normal. Indoor motor will run at low speed or stop, and outdoor motor will stop.

The unit operation condition

- To use the unit properly, please operate the unit under the allowed condition range. If operating beyond the range, the protection device will act.
- The relative humidity should be lower than 80%. If the unit runs at the humidity over 80% for a long period, the dew on the unit will drop down and the vapour will be blowed from air outlet.

Protection device (such as high pressure switch)

- High pressure switch is the device which can stop the unit automatically when the unit runs abnormally.
  When the high pressure switch acts, the cooling/heating mode will stop but the running LED on wired controller will be light still. The wired controller will display failure code.
- When the following cases occur, the protection device will act:
  In cooling mode, air outlet and air inlet of outdoor are clogged.
  In heating mode, indoor filter is sticked with duct; indoor air outlet is clogged.
  When protection device acts, please cut off the power source and re-start up after eliminating the trouble.

When power failure

- When power is failure in running, all the operations will stop.
- After being electrified again, if with re-start up function, the unit can resume to the state before power off automatically; if without re-start up function, the unit needs to be switched on again.
- When abnormal occurs in running because of the thunder, the lightning, the interference of car or radio, etc, please cut off the power source, after eliminating the failure, press "ON/OFF" button to start up the unit.

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Heating capacity

- The heating mode adopts the heat pump type that absorbs outdoor heat energy and releases into indoor. So if outdoor temperature goes down, the heating capacity will decrease.

Trial operation

- Before trial operation:

  Before being energized, measure the resistor between power terminal block (live wire and neutral wire) and the grounded point with a multimeter, and check if it is over 1M * . If not, the unit can not operate.

  To protect compressor, energize the outdoor unit for at least 12 hours before the unit runs.If the crankcase heater is not energized for 6 hours, the compressor will not work.

  Confirm the compressor bottom getting hot.

  Except for the condition that there is only one master unit connected (no slave unit), under the other conditions, open fully the outdoor operating valves (gas side, liquid side, oil equalization pipe). If operating the unit without opening the valves, compressor failure will occur.

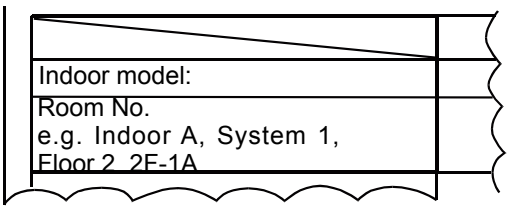
  Confirm all indoor units being electrified. If not, water leakage will occur.Measure the system pressure with pressure gauge, at the same time, operate the unit.

- Trial operation

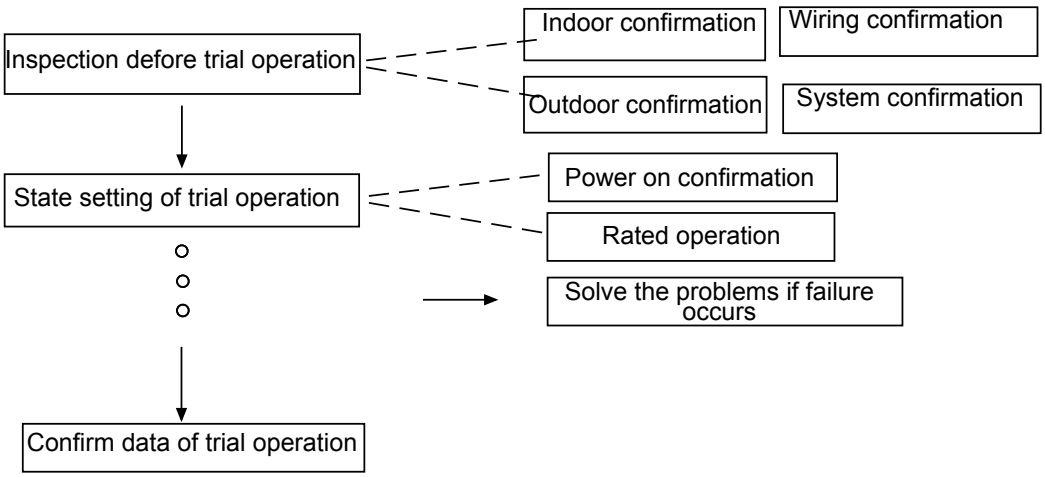
  In trial operation, refer to the information of performance section.When the unit can not start up at the room temperature, make trial operation for outdoor.

1. System marks

On the condition that multi MRV II system are installed, in order to confirm the relationship between outdoor and indoor, please make marks on outdoor electric control box cover to indicate the connected indoor unit. As the below figure:



2. Trial operation sequence



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3. Inspection before trial operation

Before inspection, confirm the state of indoor and outdoor to avoid the trial failure because of the incorrect installation.

3.1 Indoor unit confirmation

NO.	Inspection Items	Results
1	If indoor unit is in good condition, and if the electric box position is in accordance with state when out of factory, also if it is fixed firmly.	
2	If indoor wiring is correct.If the connecting terminal of the fan motor, swing motor and water pump is connected well. If the sensor is in good condition and it is at the proper place.	
3	If the dip switch of indoor unit is set correctly. If the indoor address, central controller address, wired controller address and its other selection are correct.	
4	If the wire sequence of wired controller is correct.	
5	Before being electrified, measure the resistors among live wire, neutral wire and earthing point on the terminal block with the 500V ohmmeter. The resistor must be over 1 M Ohm.	

3.2 Outdoor unit confirmation

NO.	Inspection items	Results
1	If outdoor unit is in good condition, and if the electric box is fixed firmly.	
2	If outdoor wiring is correct. If the wires are broken.	
3	If the dip switch of outdoor unit is set correctly. If the outdoor address is correct. The master unit No. must be No.1, and the other units can be No.2, No.3. If there are multiple outdoors, before being electrified, the master unit SW4-5 is set as "searching outdoor".	

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3.3 Wiring confirmation

NO.	Inspection Items	Results
1	If outdoor power cable is fixed at correct position. And if the power cable is in compliance with the requirement.	
2	If indoor power cable is fixed at correct position. And if the power cable is in compliance with the requirement.	
3	Check the indoor power wiring to prevent that one of indoors has already powered down, all the other indoors and outdoors in one system ate normally running. Indoors in one system should adopt one power supply.	
4	If the communication wire between outdoors complies with requirement, and A, B, C must be corresponding, or the PCB will be damaged.	
5	If the communication wire between indoor and outdoor complies with requirement, and the communication wires do not care the phase sequence, but the shielded wire is needed. The shielded layer among indoors must be continuous. The communication wire of the whole system must be earthed at the farthest shielded wires of indoor and outdoor.	
6	If the communication wire between indoor and wired controller complies with requirement, and A, B, C must be corresponding, or the wired controller will be abnormal.	
7	The distance between high voltage and low voltage of the power cable and the communication wire must be over 50mm. Or communication failure will occur.	

3.4 System confirmation

Liquid pipe diameter	Standard additional charging amount (kg/m)	Total length of liquid pipe (mm)	Every liquid pipe additional charging amount (kg)
φ6.35	0.022	=	
φ9.52	0.054	=	
φ12.7	0.11	=	
φ15.88	0.17	=	
φ19.05	0.25	=	
φ22.22	0.35	=	
		total additional charging amount	

Note:

• *Check if outdoor stop valve has been open fully. When there is only master unit, please confirm if the oil pipe stop valve has been close fully.*

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4. State setting of trial operation

Confirm being electrified

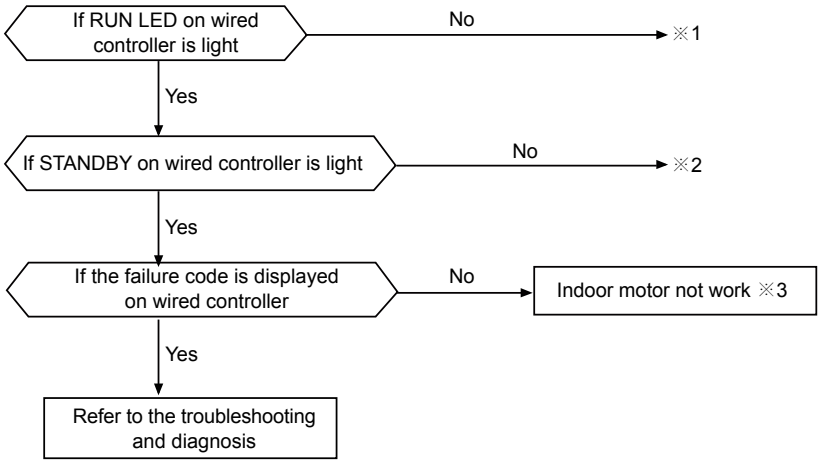
Indoor and outdoor are electrified respectively and then check as the following table:

NO.	Inspection items	Results
1	If outdoor PCB is electrified; if the communication indicator flashes.	
2	If indoor communication indicator flashes.	
3	Check the indoor running parameters are correct after outdoor is connected the testing board and the testing software, such as the sensor characteristic, the EEV open angle, etc.	

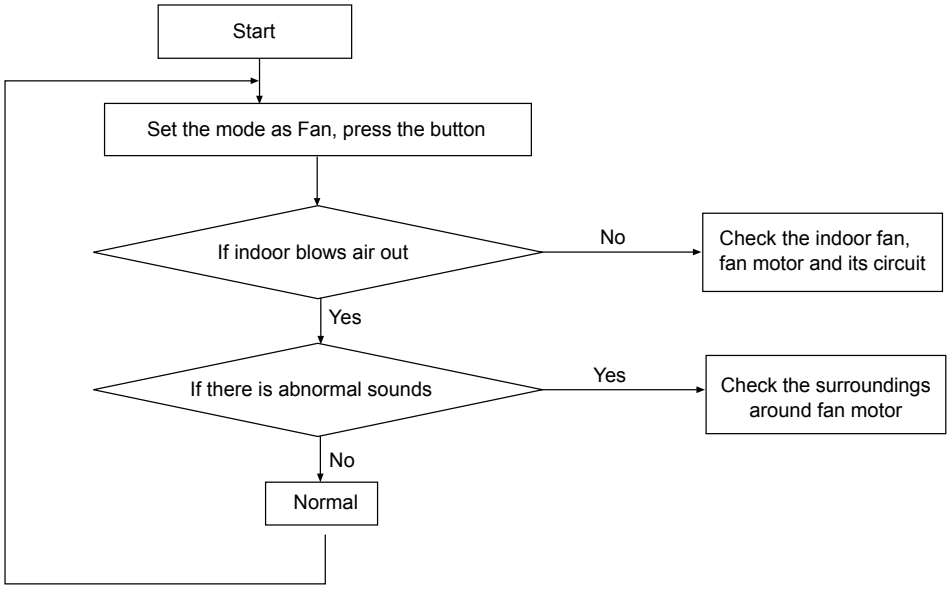
5. Trial operation

Generally, confirm all the indoors one by one. Please set the other indoors at STOP state.

(1) Main power supply and preliminary confirmation



(2) Motor operation confirmation



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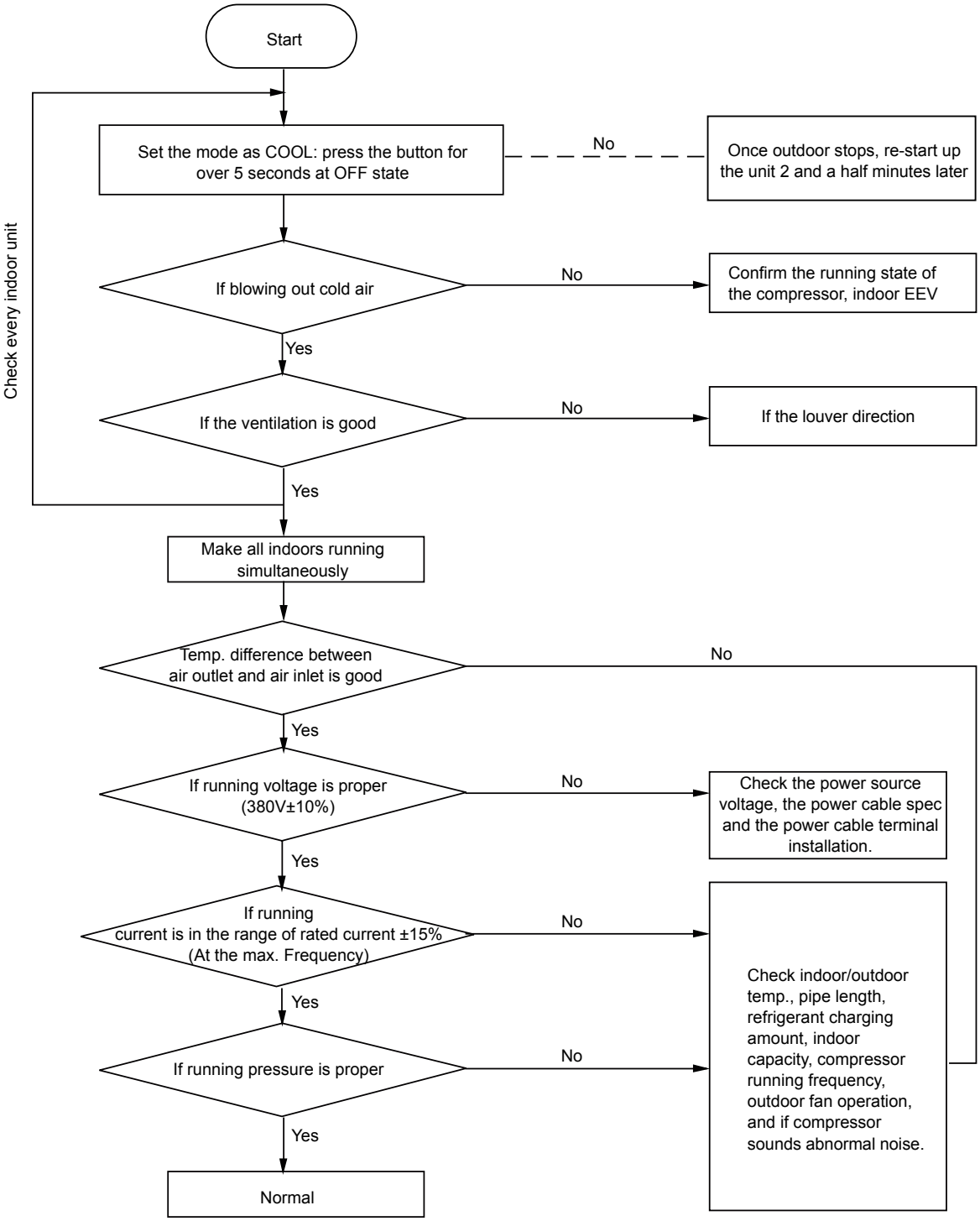
(3) Cooling operation confirmation



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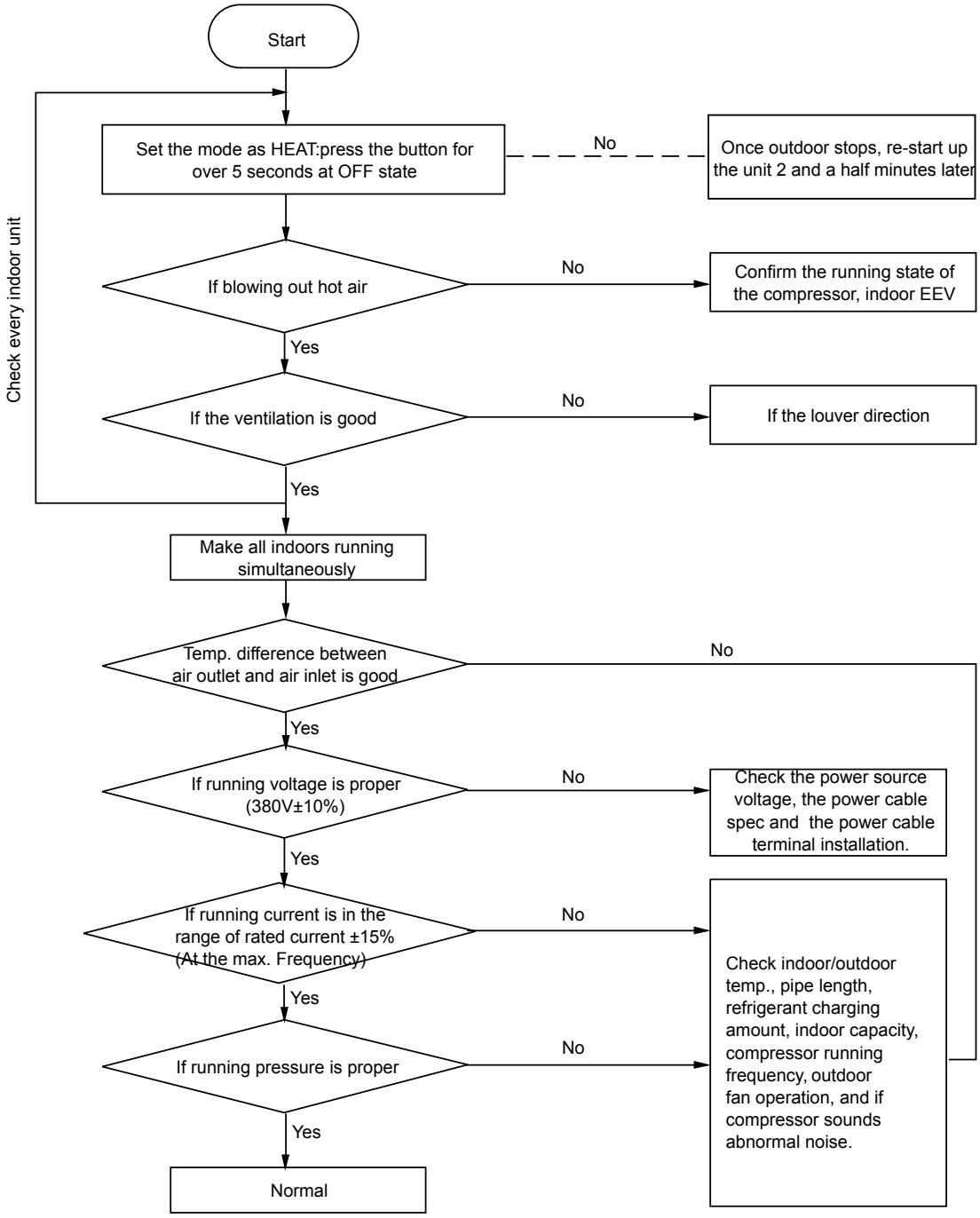
(4) Heating operation confirmation



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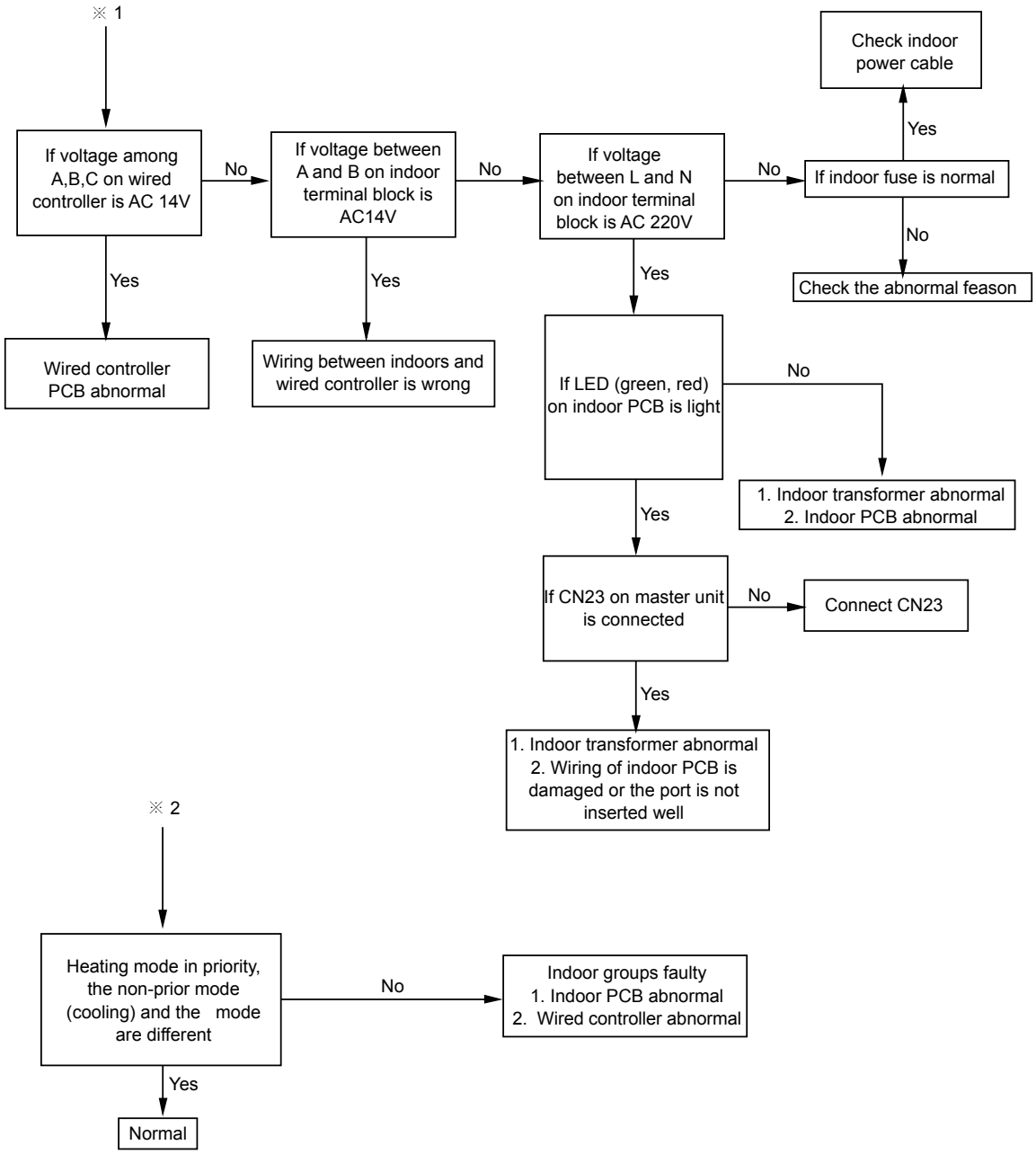

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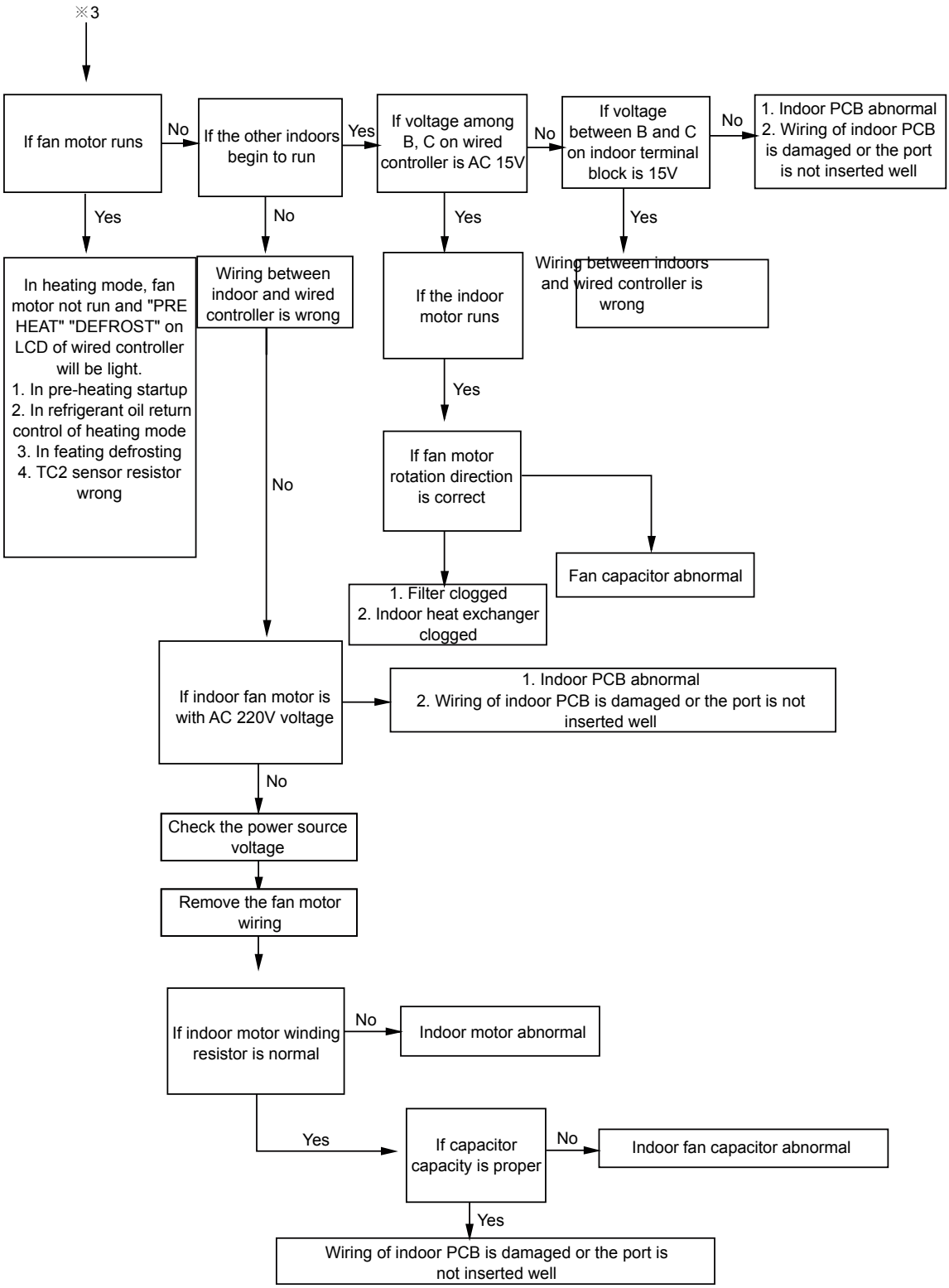

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Note 1: *Temp. difference between air inlet and air outlet Standard*

- *A. In cooling mode, after running for at least 30 minutes, it is normal that the temp. difference between air inlet and air outlet is over 10°C, (at max. frequency)*
- *B. In heating mode, after running for at least 30 minutes, it is normal that the temp. difference between air inlet and air outlet is over 14°C, (at max. frequency).*

Note 2: *Running current standard*

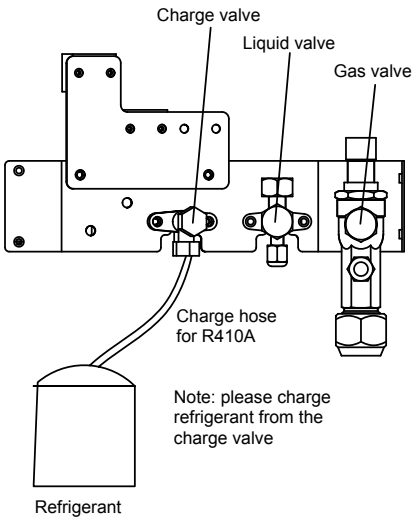
- *It is normal that the running current is in the range of rated current 15±% (at max. frequency) . The current will be different for the below condition:*
- *If more than the rated current: high indoor/outdoor temp. ; outdoor bad ventilation (cooling mode), indoor bad ventilation (heating mode).*
- *If lower than rated current: low indoor/outdoor temp. ; refrigerant leakage (lack of refrigerant).*

Note 3: *Running pressure standard*

Cooling (at max. frequency)	High pressure 2.0~3.5MPa	Indoor 18~32°C Outdoor 25~35°C
	Low pressure 0.6~1.0MPa	
Heating (at max. frequency)	High pressure 2.2~2.8MPa	Indoor 15~25°C Outdoor 5~10°C
	Low pressure 0.3~0.8MPa	

The above value is measured after running for 15 minutes (ambient temp. is DB(°C))
High/low pressure changing trend due to the running condition:
Cooling/heating:
Indoor temp. goes up---high/low pressure goes up
Indoor temp. goes down---high/low pressure goes down
Outdoor temp. goes up---high/low pressure goes up
Outdoor temp. goes down---high/low pressure goes down

6. Refrigerant automatic recall operating instructions



Please according to as follows the operation
1. Press"start+stop" at the same time on the PCB 5 ses,
2. When the digital tube shows C1 alternately gleam with low-pressure pressure, please close liquid valve; When the digital tube shows C2, please close gas valve; The system automatically shuts down after the 5 ses, the digital tube shows C3, please cut the power.

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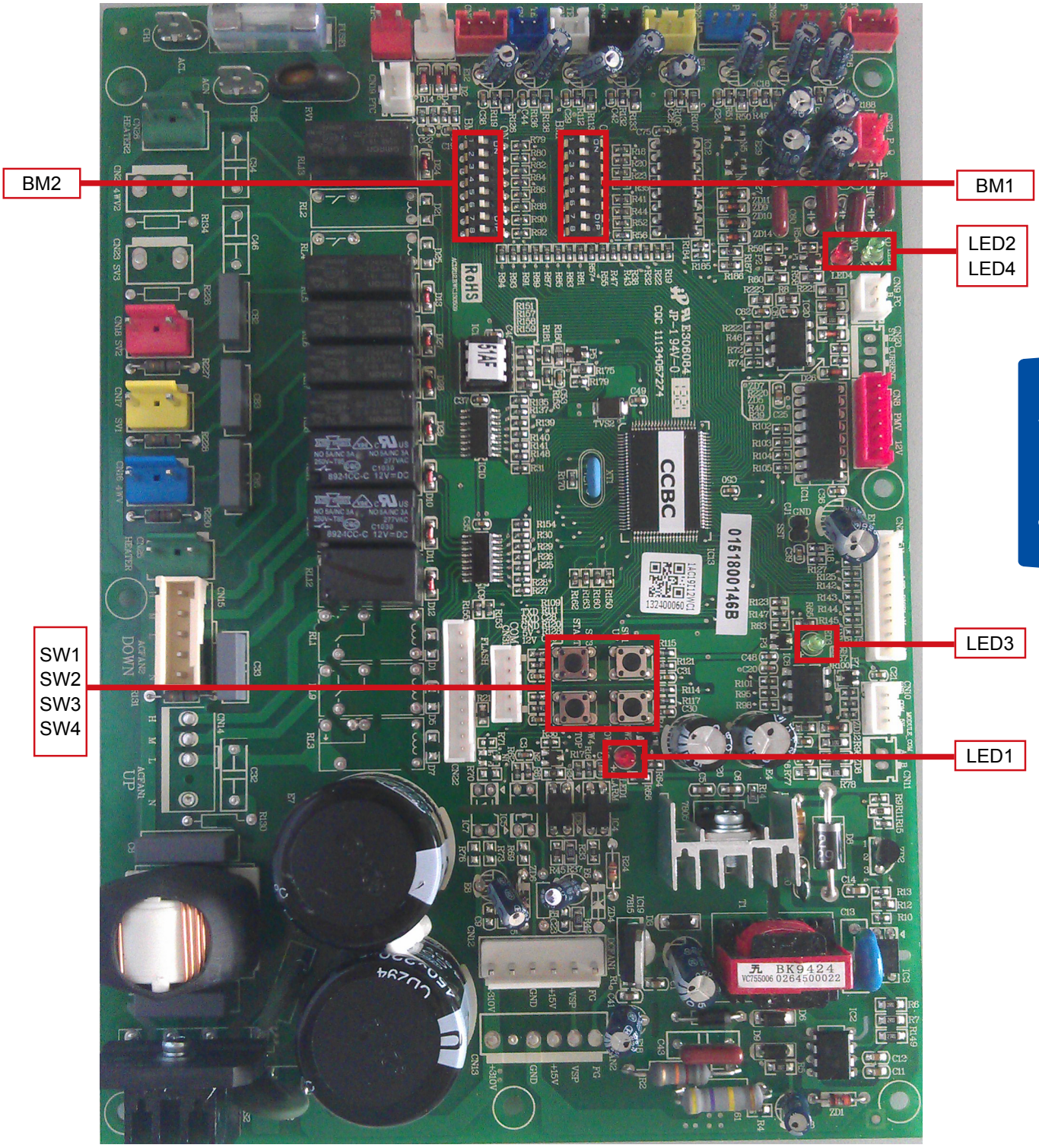
11. Dip Switch Setting

Outdoor PCB photo



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LED light introduction

• LED1: malfunction lamp of indoor unit.
This lamp not light under normal condition; once indoor unit occurs malfunction this lamp will flicker, flicker times indicate the corresponding failure code.
• LED2, LED4: communication lamp between indoor units and outdoor units.
These two lamps flicker alternately under normal condition; once occurs the communication faulty, these two lamps will light or not light at the same time.
• LED3: communication lamp between outdoor PCB and module.
The lamp flicker frequency is 0.5s/time under normal condition; once occurs the communication faulty, the lamp flicker frequency is 1s/time.

Dip switch introduction

BM1 is usually set by the personnel on site; BM2 is usually used in the factory.

BM1 Introduction

<table>
<tr><th>BM1</th><th>Definition</th><th colspan="3">Introduction</th></tr>
<tr><td rowspan="2">BM1_1</td><td rowspan="2">Indoor unit Qty. lock</td><td>OFF</td><td colspan="2">Searching indoor unit</td></tr>
<tr><td>ON</td><td colspan="2">Lock indoor unit Qty.</td></tr>
<tr><td rowspan="2">BM1_2</td><td rowspan="2">Start up after preheat 2 hours</td><td>OFF</td><td colspan="2">Unit shall startup after 2 hours preheat or oil temp. reaches the target value</td></tr>
<tr><td>Power on, then OFF→ON</td><td colspan="2">Unit shall startup after 2 hours preheat or oil temp. reaches the target value (note: here the target value is lower than the target value when the BM1-2 on "OFF" position).</td></tr>
<tr><td>BM1_3</td><td>Compressor brand</td><td>OFF</td><td colspan="2">Default (MHI compressor)</td></tr>
<tr><td rowspan="5">BM1_4
BM1_5</td><td rowspan="5">Piping length selection
(Single way total pipe length)</td><td>[4]</td><td>[5]</td><td>Piping length selection</td></tr>
<tr><td>OFF</td><td>OFF</td><td>Medium piping length:100m ＜ L ≤200m (default)</td></tr>
<tr><td>OFF</td><td>ON</td><td>Long piping length: L > 200m</td></tr>
<tr><td>ON</td><td>OFF</td><td>Short piping length: L ≤ 100m</td></tr>
<tr><td>ON</td><td>ON</td><td>Medium piping length:100m ＜ L ≤200m</td></tr>
<tr><td rowspan="5">BM1_6
BM1_7</td><td rowspan="5">Defrosting judge condition</td><td>[6]</td><td>[7]</td><td>Defrosting judge condition</td></tr>
<tr><td>OFF</td><td>OFF</td><td>Default setting (Normal installation condition)</td></tr>
<tr><td>OFF</td><td>ON</td><td>Low humidification in winter condition</td></tr>
<tr><td>ON</td><td>OFF</td><td>High humidification in winter condition (when outdoor unit defrosting is not clear, can set the dip switch on this position)</td></tr>
<tr><td rowspan="2">BM1_8</td><td rowspan="2">Quiet running function</td><td>OFF</td><td colspan="2">Quiet running function is unavailable (default)</td></tr>
<tr><td>ON</td><td colspan="2">Quiet running function is available</td></tr>
</table>

Note:

• The number of indoor units must be locked by the BM1_1 (OFF to ON), otherwise the outdoor unit cannot be started.

• The outdoor unit cannot be started if the locked indoor unit Qty. is not same as Qty. of real indoor units.

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BM2 Introduction

BM2	Definition	Introduction		
BM2_1	Cooling only or heat pump selection	**OFF**	Heat pump (default)	
		ON	Cooling only	
BM2_2 BM2_3	Outdoor capacity selection	[2]	[3]	Outdoor capacity selection
		OFF	OFF	8HP (AV08NMSETA)
		ON	OFF	10HP (AV10NMSETA)
		ON	ON	12HP (AV12NMSETA)
BM2_4	Heat reservation module selection	**OFF**	Default (no heat reservation module) note: forbid changing	
BM2_5	Indoor and outdoor high drop selection	**OFF**	No high drop (default)	
		ON	High drop	
BM2_6	Communication protocol selection	**OFF**	New communication protocol (default)	
		ON	Old communication protocol	
BM2_7 BM2_8	Start mode selection	[7]	[8]	Start mode selection
		OFF	**OFF**	First open priority
		OFF	ON	After open priority
		ON	OFF	Cooling priority, any one indoor unit runs in cooling mode, the outdoor unit will run in cooling mode, the indoor units running in heating mode will stop.
		ON	ON	Heating priority, any one indoor unit runs in heating mode, the outdoor unit will run in heating mode, the indoor units running in cooling mode will stop.

Note: communication protocol between indoor and outdoor units
The new communication protocol is faster than the old communication and its control content is more than the old one.
The indoor PCB 151800113, 151800161, 0151800161B, 0151800227, 0151800244, 0010451751AF, 0151800141A, 0010451751AE and 151800141 are new communiction protocol.
The indoor PCB 151800086 and 0010451181A are old communiction protocol.
Old communication protocol indoor PCB can't connect with new communiction protocol outdoor, so if this outdoor unit connect with old communication protocol indoor, need set the dip switch BM2-6 to ON position.

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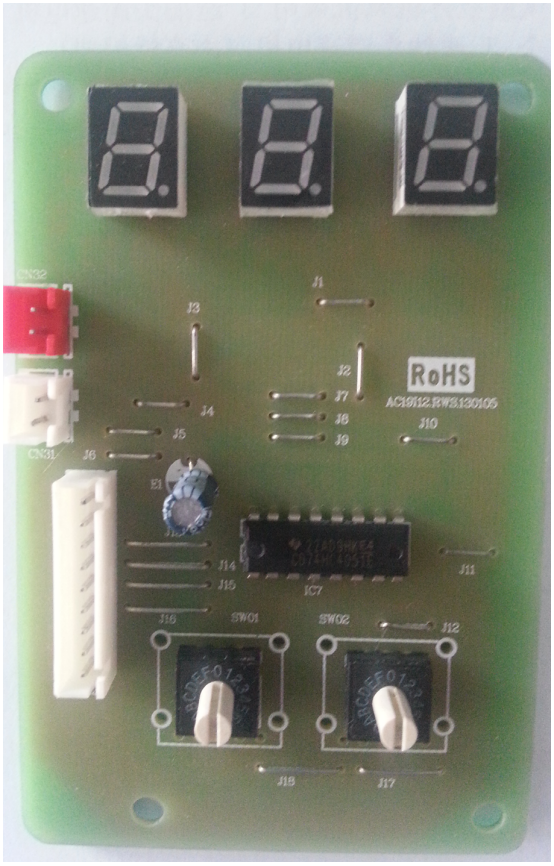
12. Digital Tube Display



Main function instruction:
By setting the rotary switch, the digital tube will display the outdoor and indoor unit parameters, the data is inform of decimal integer. During the process of installation, adjustion and maintenance, the whole system's operating parameters can be tested conveniently which can help to check and solve problems quickly and correctly.

SW01	SW02	Digital tube display
0	0	Display outdoor failure code
	1	Display operation mode
	4	Target frequency of inverter compressor
	5	Current frequency of inverter compressor
	6	Indoor quantity
	7	Running indoor quantity
1	0	Td discharging temperature
	1	Ta ambient temperature
	2	Ts suction temperature
	3	Te defrosting temperature 1
	4	Toil oil temperature
	5	Pd pressure
	6	Ps pressure
	7	Outdoor PMV valve open range
	A	Tfin temperature
	B	Compressor current
	C	Te defrosting temperature 2
	E	Forced cooling (Press start for 5sec, all the indoor units are in cooling state, and press stop for 5sec to stop cooling) display "CCC", otherwise "---"
	F	Forced heating (Press start for 5sec, all the indoor units are in heating state, and press stop for 5sec to stop heating) display "HHH", otherwise "---"
4	0-F	Display indoor failure code
5	0-F	Indoor capacity
7	0-F	Indoor PMV valve open range
9	0-F	Indoor Ta ambient temperature
A	0-F	Indoor TC1 gas temperature
B	0-F	Indoor TC2 liquid temperature
C	0-F	Indoor units: fan speed of indoor units(0-OFF, 1-Low, 2-med, 3-high)
E	0-F	Forced cooling (press "start" for 5sec for cooling operation of indoor units and press "stop" for 5sec to quit)display "CCC", otherwise "---"
F	0-F	Forced heating (press "start" for 5sec for heating operation of indoor units and press "stop" for 5sec to quit)display "CCC", otherwise "---"

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13. Failure Code

Digital tube indication on master unit	Indication on wired controller (hex)	Failure code definition	Failure description	Remarks
20	20-0	Defrosting temp. sensor TE1 failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 60seconds, in cooling mode, if the sensor is abnormal, the unit does not deal with it, besides, in defrosting and within 3 minutes after defrosting, no alarm.	Resumable
20	20-1	Defrosting temp. sensor TE2 failure		
21	21	Ambient temp. sensor Ta failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 60seconds, in defrosting and within 3 minutes after defrosting, no alarm.	Resumable
22	22	Suction temp. sensor Ts failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 60seconds, in defrosting and within 3 minutes after defrosting, no alarm.	Resumable
23	23	Discharging temp. sensor Td failure	After compressor is running for 5 minutes, AD value is below 11 (open circuit) or over 1012 (short circuit) for 60seconds, in course of startup, defrosting and within 3 minutes after defrosting, no alarm.	Resumable
24	24	Oil temp. sensor Toil failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 60seconds, if Ta<=-10degree or ET<=-10degree, within 5 minutes, no alarm.	Resumable
26	26-0	Indoor communication failurel	For continuous 200 cycles, can not find connected indoors.	Resumable
26-1	26-1		For continuous 300seconds, the searched indoor quantity is less than the set quantity.	
26-2	26-2		For continuous 300seconds, the searched indoor quantity is more than the set quantity.	
27	27	Oil temp.too high protection (Toil)	Toil≥110degree at interval of 25msec for twice continuously, and over the set value, then stop and alarm; 3 minutes later, resume automatically. If it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
28	28	High pressure sensor Pd failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 30seconds, in defrosting and within 3 minutes after defrosting, no alarm.	Resumable

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LD indication on master unit	Indication on wired controller (hex)	Failure code definition	Failure description	Remarks
29	1D	Low pressure sensor Ps failure	AD value is below 11 (open circuit) or over 1012 (short circuit) for 30seconds, in defrosting and within 3 minutes after defrosting, no alarm.	Resumable
30	30	High pressure switch HPSi failure	If disconnect for 50ms continuously, alarm. If alarm 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
33	33	EEPROM failure	EEPROM failure.	Once confirmation, un-resumable
34	34	Discharging temp. too high protection (Td)	Td≥115degree at interval of 25msec for twice continuously, and over the set value, then stop and alarm; 3 minutes later, resume automatically. If it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
35	35	4-way valve reversing failure	After 4-way valve is electrified for 3 minutes, if the below conditions can be met for continuous 10 seconds, that is conversing successfully: 1. this outdoor compressor is running normally 2. Pd-Ps≥0.6MPa, Otherwise, the system alarms reversing failure.	Once confirmation, un-resumable
36	36	Oil temp. too low protection (Toil)	In normal operation, if Td<CT+6°Cfor continuous 5 minutes, the unit stops and alarms. 2 minutes and 50 seconds later, resume automatically. If it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
39-0	39-0	Low pressure sensor Ps too low protection	After compressor is running (except for residual operation), if in cooling, Ps<0.05Mpa; in heating, Ps<0.03Mpa; in oil return, Ps<0.03Mpa for continuous 5 minutes, alarm and stop. 2 minutes and 50 seconds later, resume automatically, if it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
39-1	39-1	Compression ratio too high protection	After compressor is running, compression ratio ε<8. for continuous 5 minutes stop and alarm. 2 minutes and 50 seconds later, resume automatically, if it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable

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LD indication on master unit	Indication on wired controller (hex)	Failure code definition	Failure description	Remarks
39-2	39-2	Compression ratio too low protection	In normal operation, compression ratio ε <1.8 for continuous 5 minutes stop and alarm.2 minutes and 1 seconds later, resume automatically, if it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
40	40	High pressure sensor Pd too high protection	In normal operation, Pd>=4.15Mpa for continuous 50ms, alarm and stop. 2 minutes and 50 seconds later, resume automatically, if it occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
43	43	Discharging temp. sensor Td too low protection	In normal operation, if Td<CT+10°C for continuous 5 minutes, the unit stops and alarms. 2 minutes and 50 seconds later, resume automatically. If it occurs 3 times in an hour, confirm the failure. After fixed frequency compressor alarms, inverter compressor will continue to run. If fixed frequency compressor has been locked for 3 times, the unit will stop and alarm.	Once confirmation, un-resumable
46	46	Communication with inverter board failure	No communication within 30 seconds continuously.	Resumable
71	71	DC motor blocked	Running at speed below 20rpm for 30s, or at speed of 70% lower than the target for 2 minutes, 2 minutes and 50 seconds later after stop, resume automatically. It occurs 3 times in an hour, confirm the failure.	Once confirmation, un-resumable
75	75	No pressure drop between high pressure and low one	In 5 minutes after inverter compressor starts up, Pd-Ps<=0.2MPa. 2 minutes and 50 seconds later after unit stops, resume automatically, if it occurs twice continuously, confirm the failure.	Once confirmation, un-resumable
78	78	Lack of refrigerant	Compressor running in cooling mode, Ps<0.2MPa for 30 minutes; compressor running in heating mode, Tsi-ET>20; LEV will fully open for 60 minutes, the unit will output lack of refrigerant alarm, unit will not stop.	--

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LD indication on master unit	Indication on wired controller (hex)	Failure code definition	Failure description	Remarks
110	110	IPM modular protection (F0)	IPM modular over current, in short circuit, over heat, voltage too low of control circuit.	3 times in an hour, confirm failure; once confirmation, un-resumable
111	111	Compressor out of control	In the course of compressor startup or running, the unit can not detect the rotor position, or not connecting compressor.	
112	112	Radiator of transducer temp.too high	Radiator temp. too high.	
113	113	Transducer overload	Output current of transducer is too high.	
114	114	Voltage too low of DC bus line of transducer	Voltage of power source is too low.	
115	115	Voltage too high of DC bus line of transducer	Voltage of power source is too high.	
116	116	Communication abnormal between transducer and control PCB	Communication is disconnected.	Resumable
117	117	Transducer over current (software)	Compressor startup fails for 5 times continuously, or compressor is running down till stops caused by over current or over heat.	3 times in an hour, confirm failure; once confirmation, un-resumable
118	118	Compressor startup failure	The sensor used for current detecting of transducer is abnormal, disconnected or incorrectly connection.	
120	120	Power supply of transducer abnormal	Power supply of transducer is broken down instantly.	
121	121	Power supply of inverter board is abnormal	Power supply of inverter board is broken down instantly.	3 times in an hour, confirm failure; once confirmation, un-resumable
122	122	Radiator temp. sensor of transducer abnormal	Resistor of temp.sensor abnormal or temp.sensor disconnected.	

When there is no failure, if the starting condition can not be met, digital tube on master unit will display stand-by code:

Code	Standby code description
555.0	When capacity is over 130% or low-er than 50%, the system is standby.
555.1	When it is in heating mode with ambient temp. over 27°C the system standby
555.3	When it is in cooling mode with ambient temp. over 54°C or lower -10°C, the system is standby.
555.4	Oil temperature is too low, the system is standby. heater in heating compressor up to 2 hours
U**	BM1-1 is OFF, the outdoor is searching indoor unit. U** is the number of indoor. E.g. U16 represents 16 indoor units within system. If the number of indoor units is correct, please set BM1-1 to ON.

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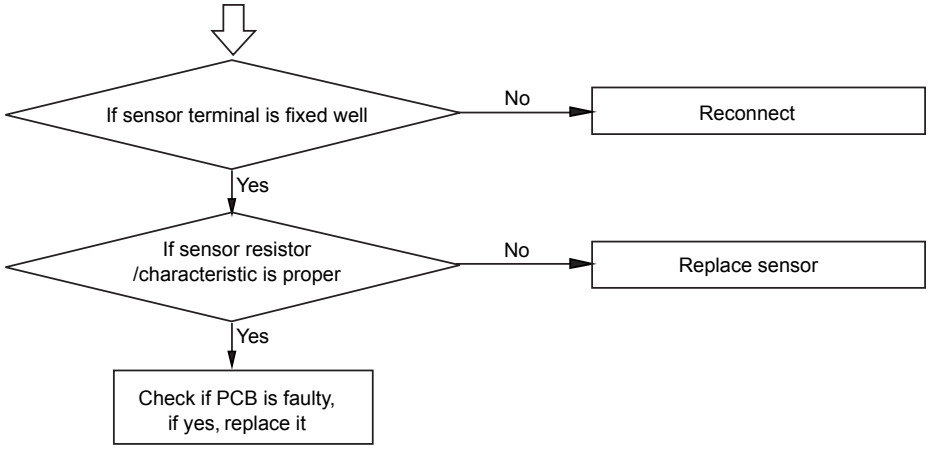
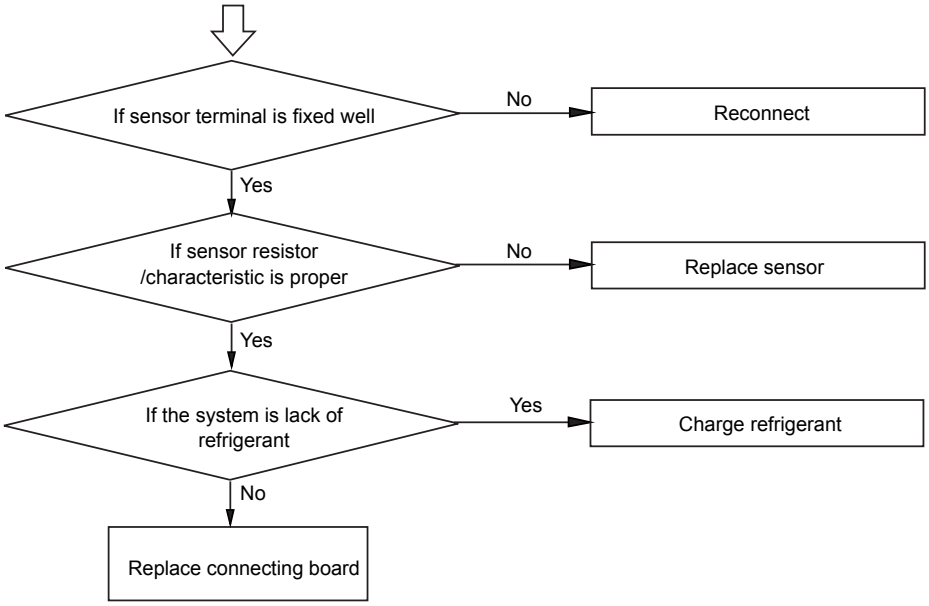
14. Troubleshooting

[20~24] Temperature sensor failure



[27] Protection of oil temperature too high



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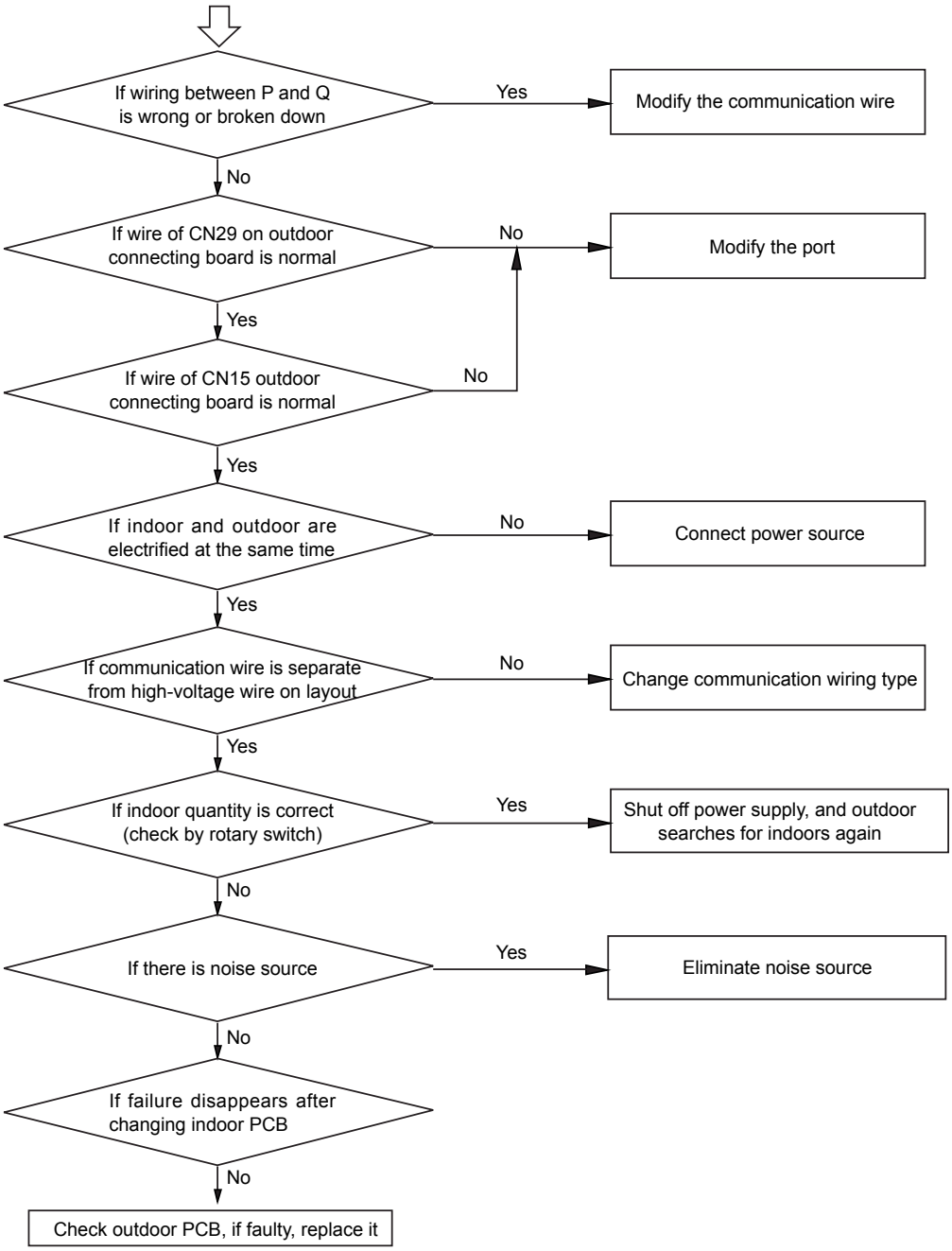
[26-0, 26-1, 26-2] Communication circuit between indoor and outdoor



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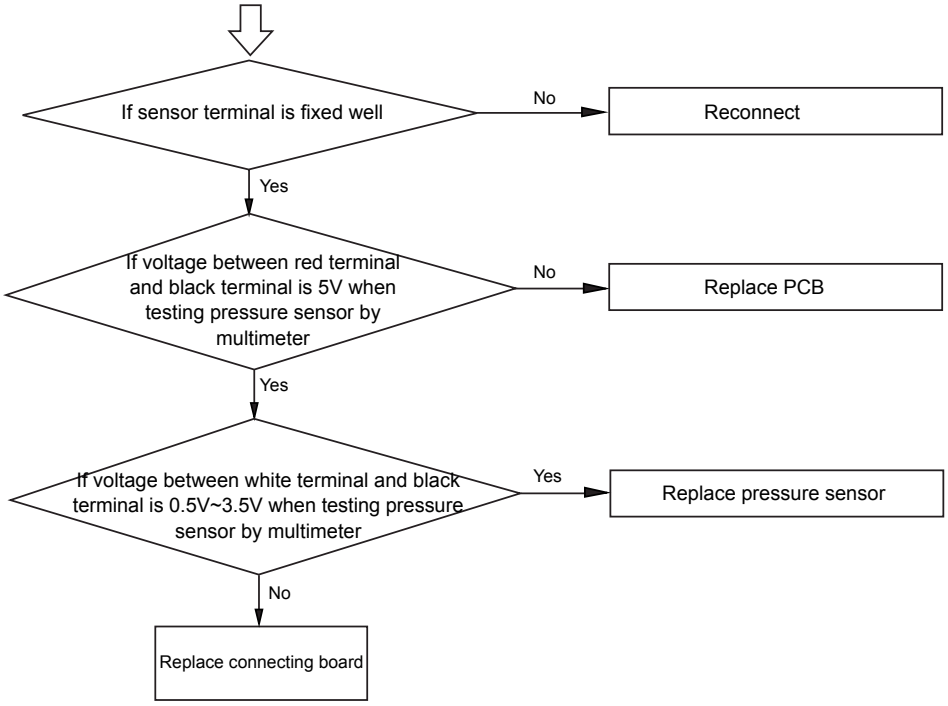
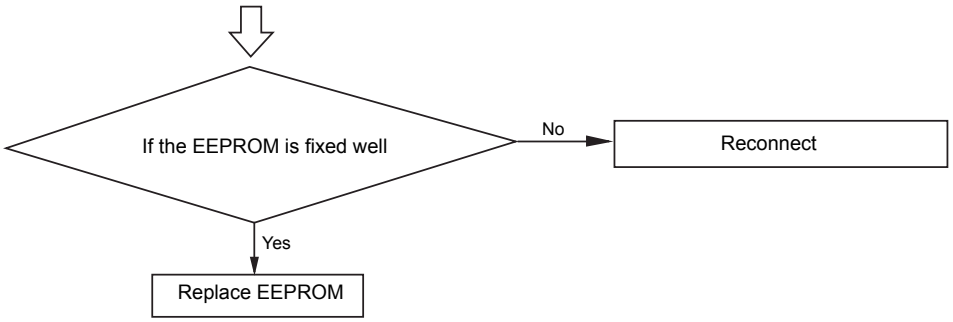
[28, 29] High/low pressure sensor failure



[33] Outdoor EEPROM failure



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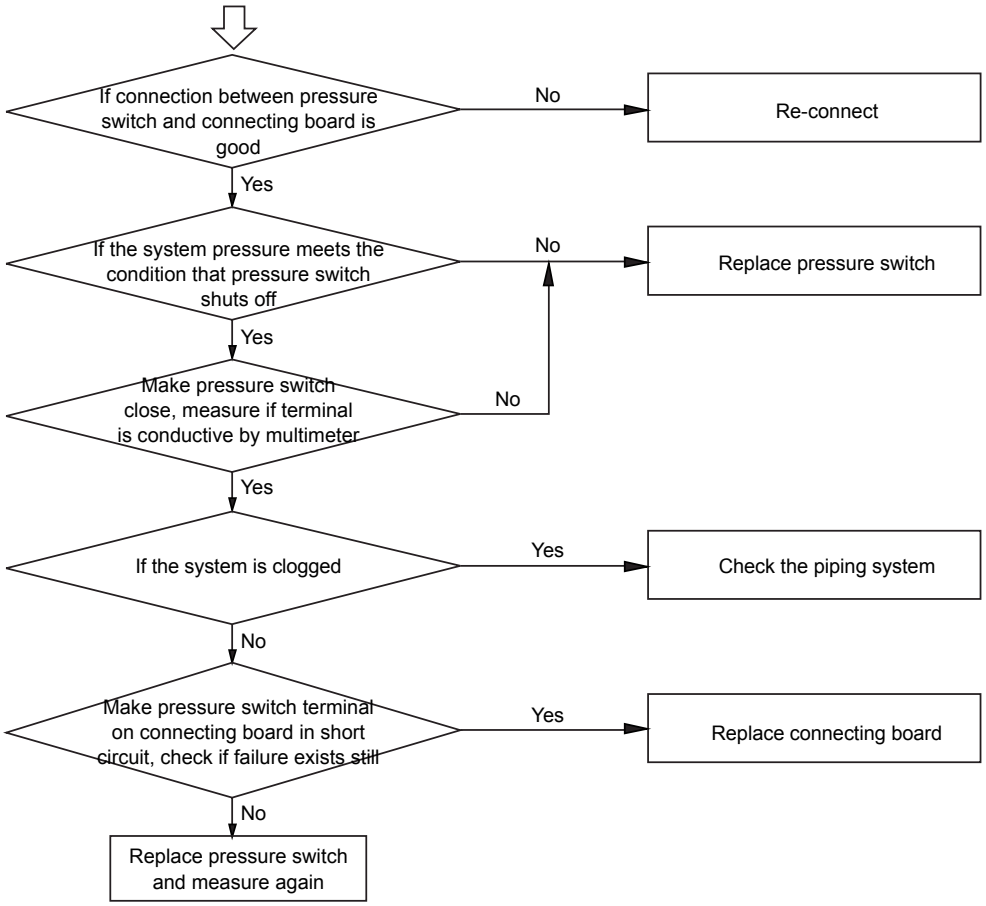
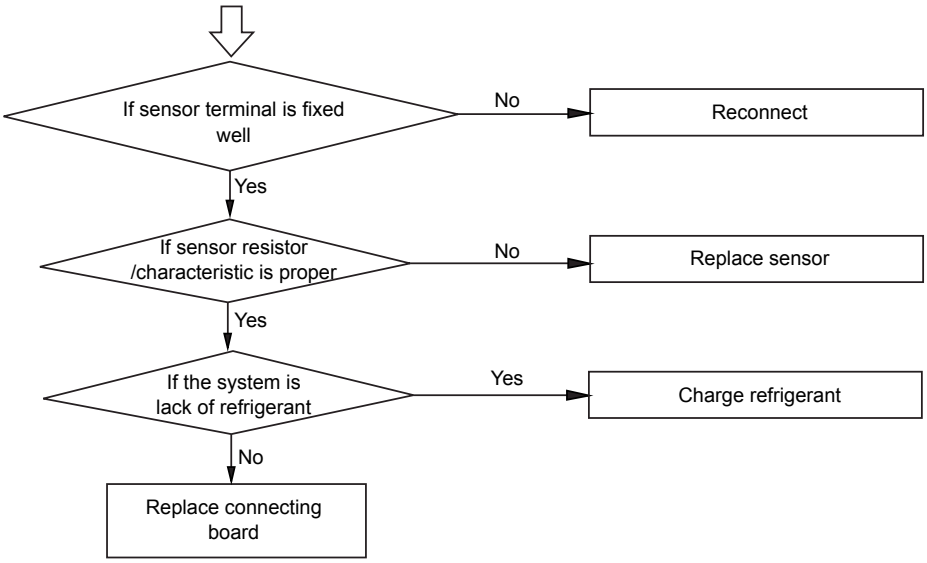
[30] High pressure switch shutoff failure



[34] Protection of discharging temp.too high



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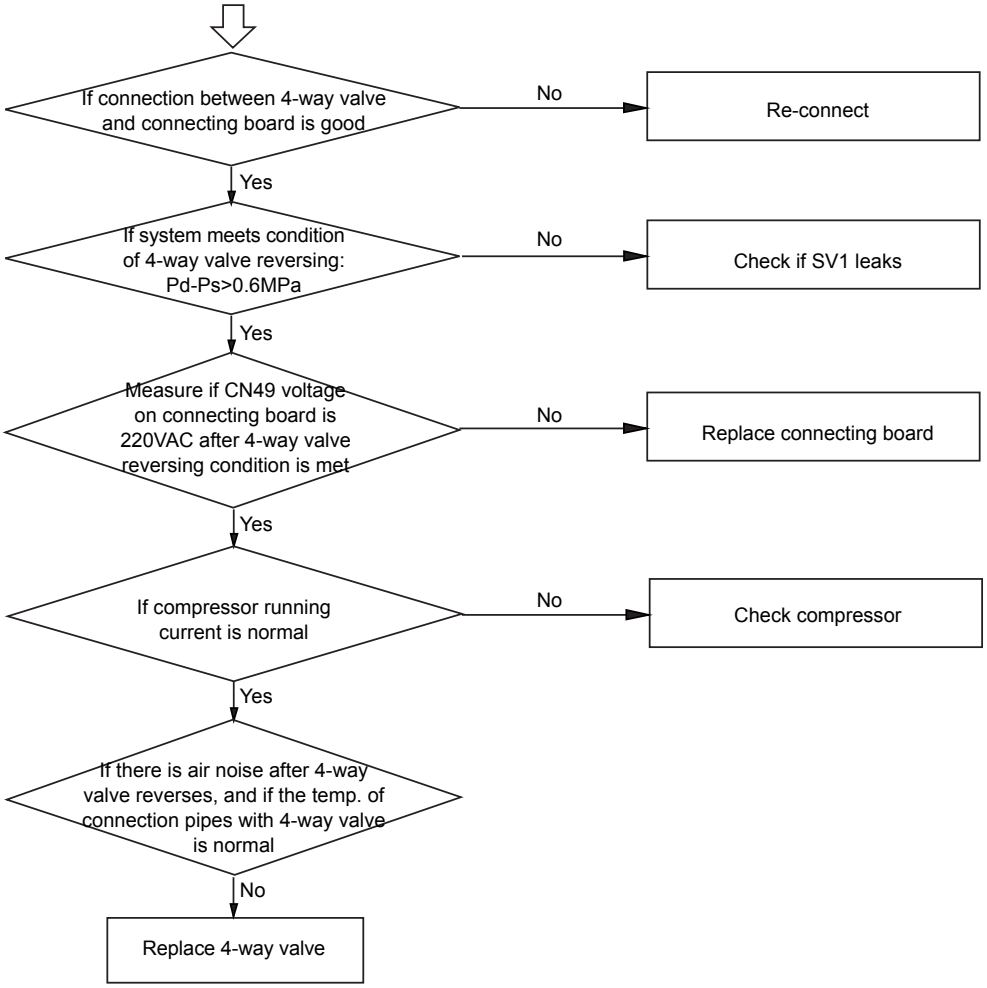
[35] 4-way valve reversing failure



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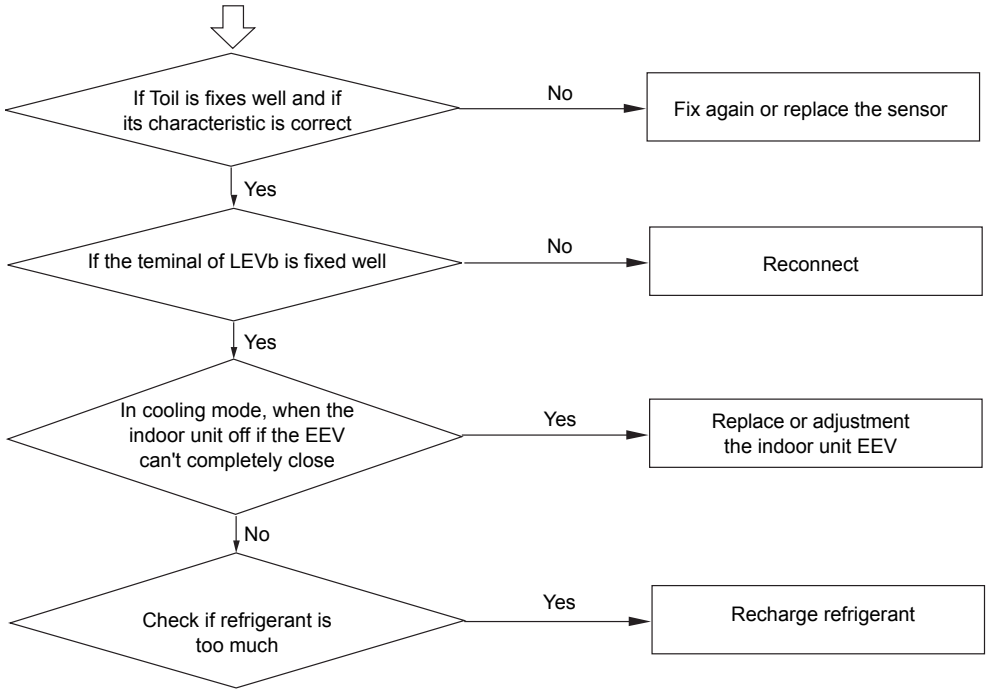
[36] Protection of oil temperature too low



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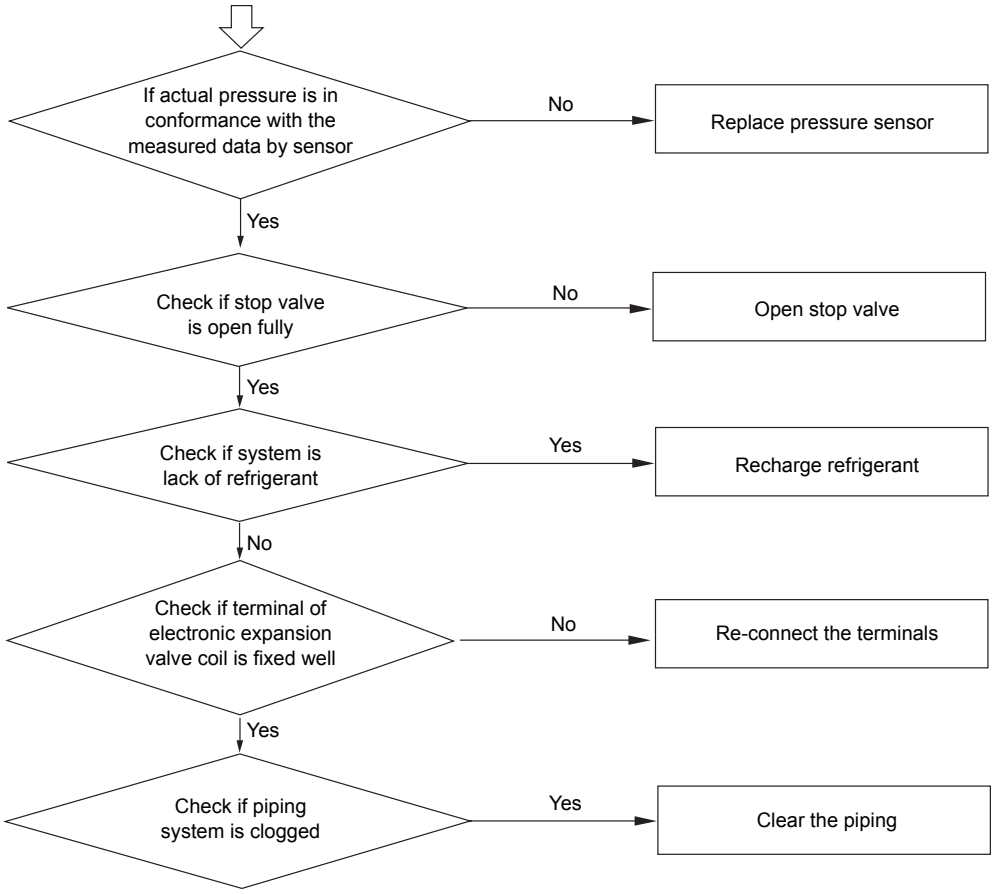
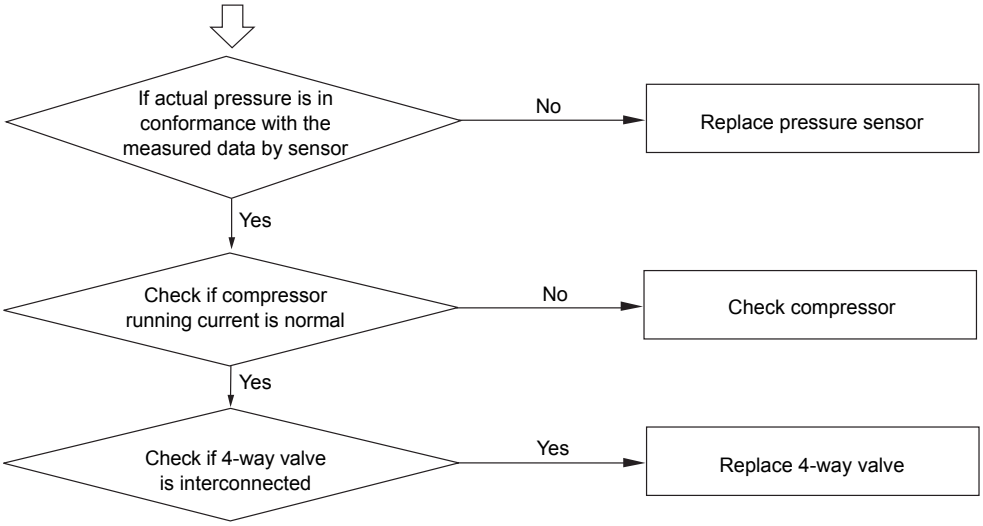
[39-0, 39-1] Low pressure too low and compression ratio too high



[39-2] Compression ratio too low



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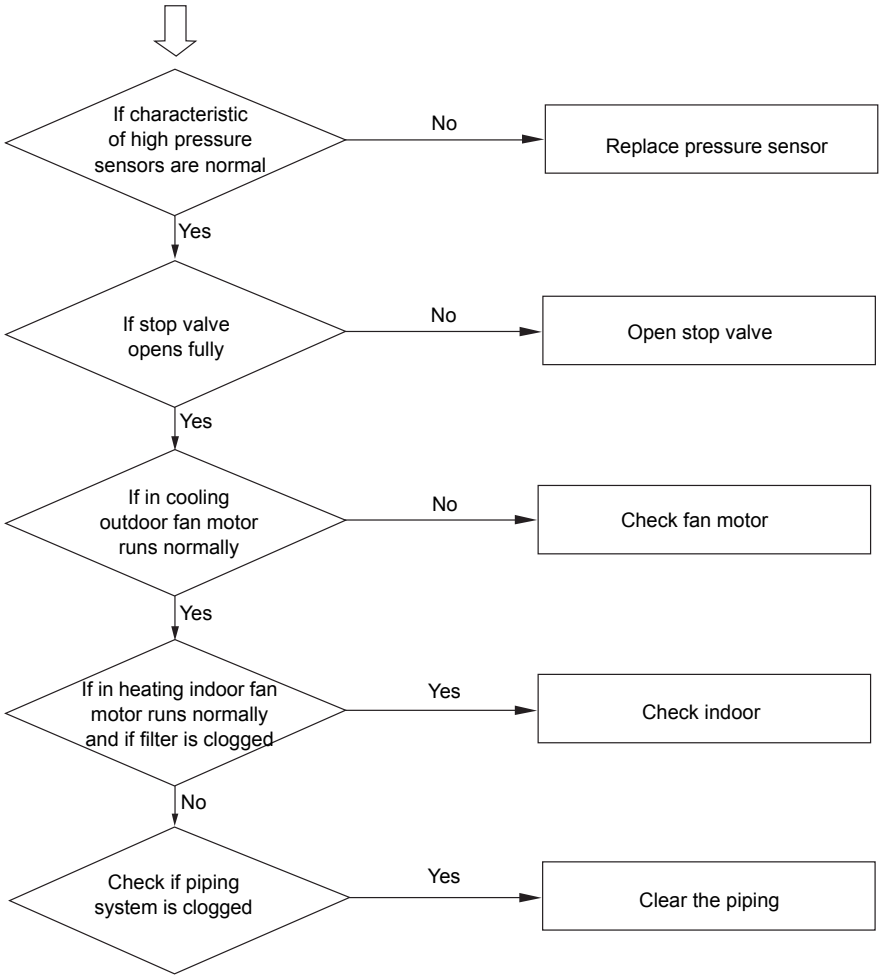
[40] High pressure protection



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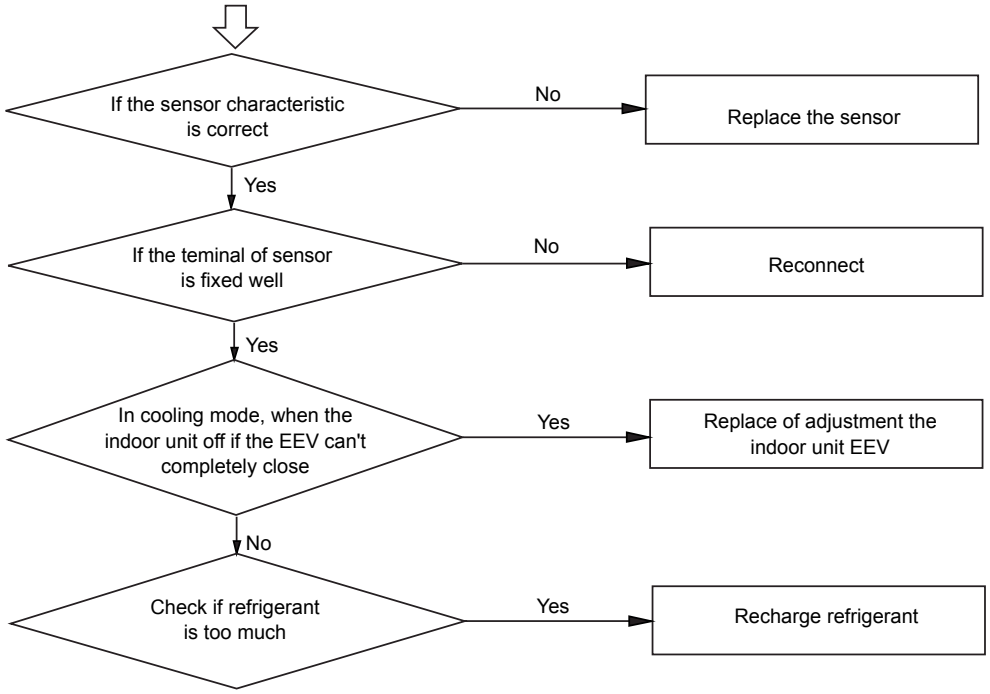
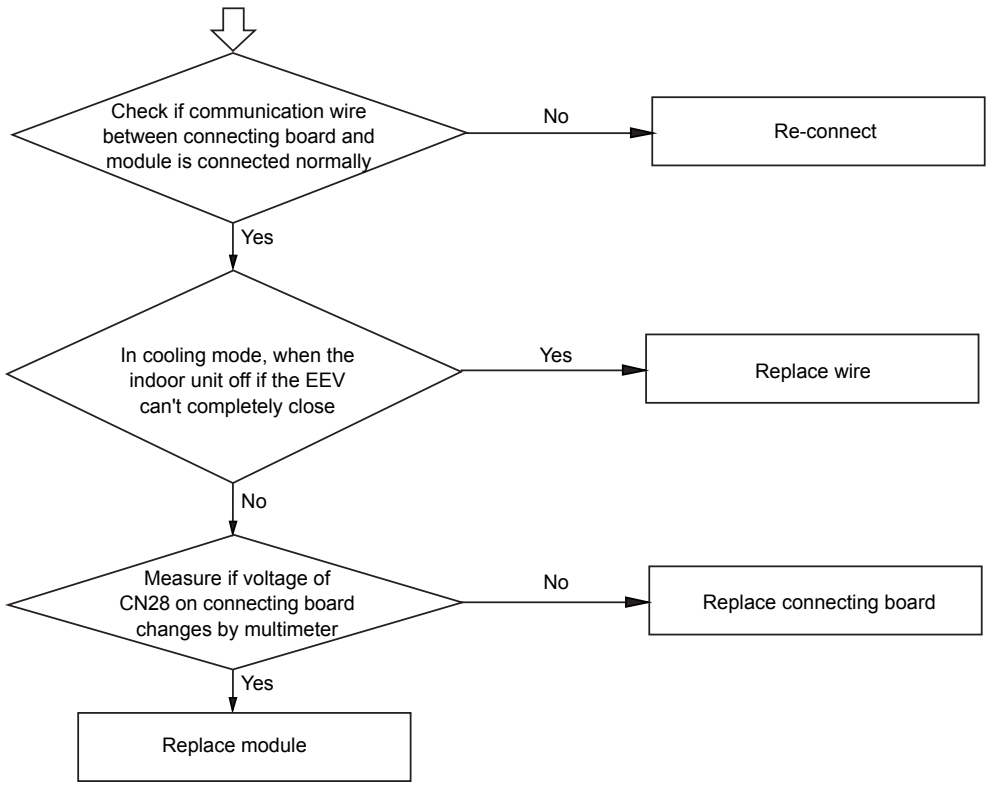
[43] Discharging temp.sensor Td too low protection



[46] Communication with inverter module failure



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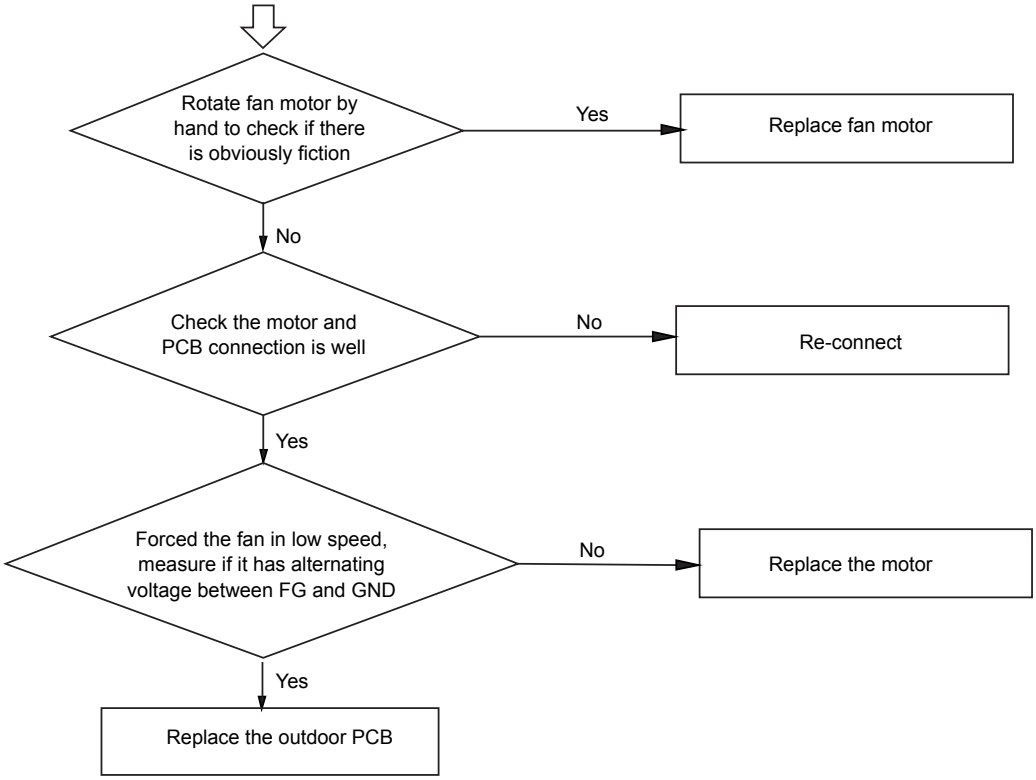
[71] DC motor blocked



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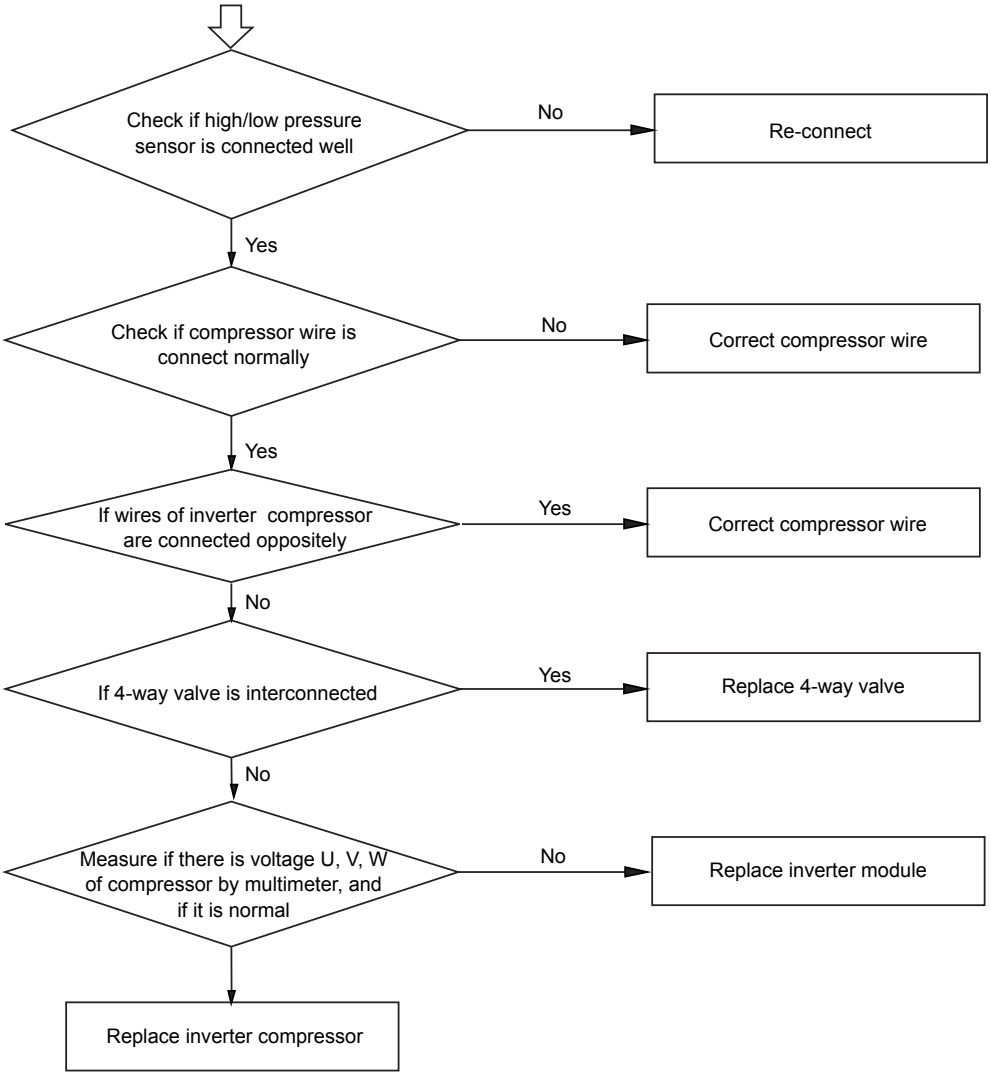
[75] No pressure drop between high pressure and low one



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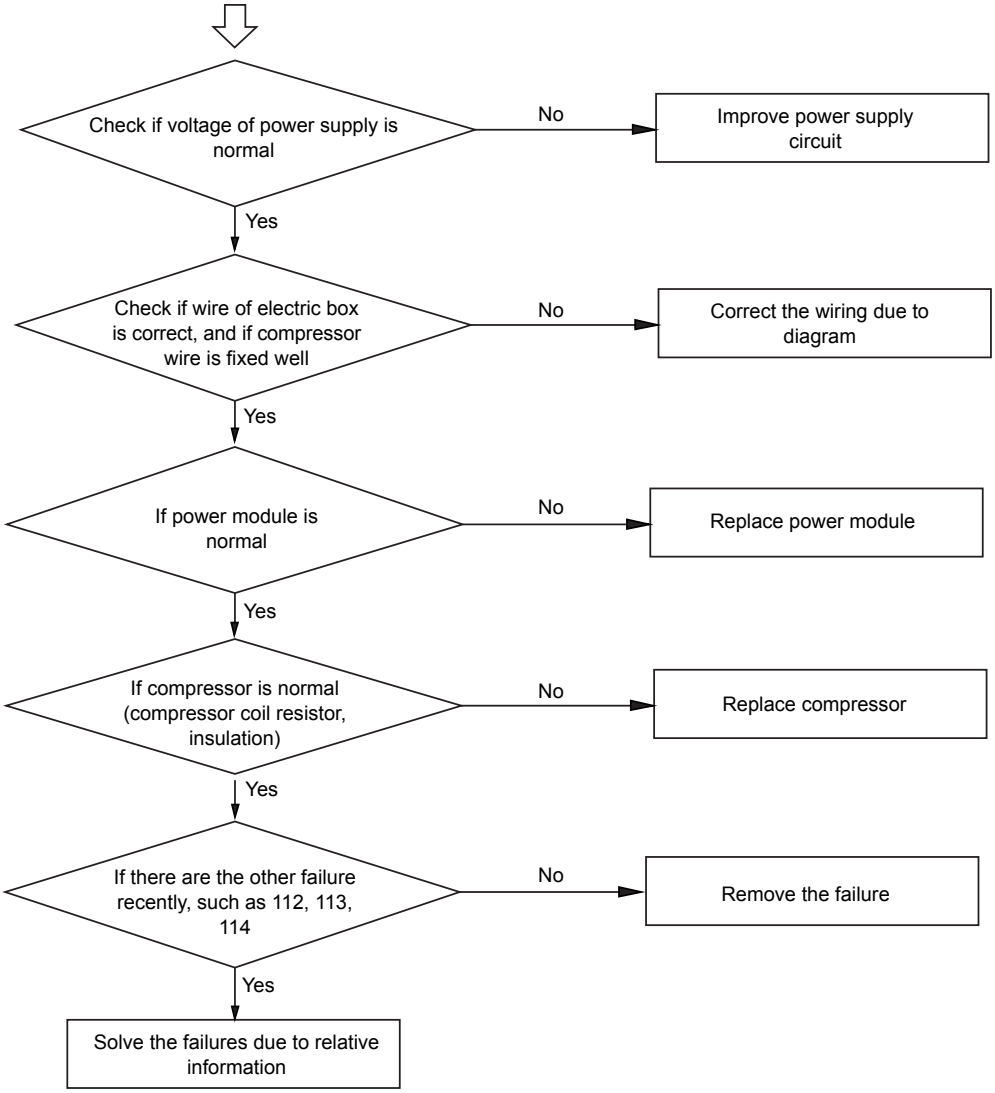
[110] Power module overcurrent



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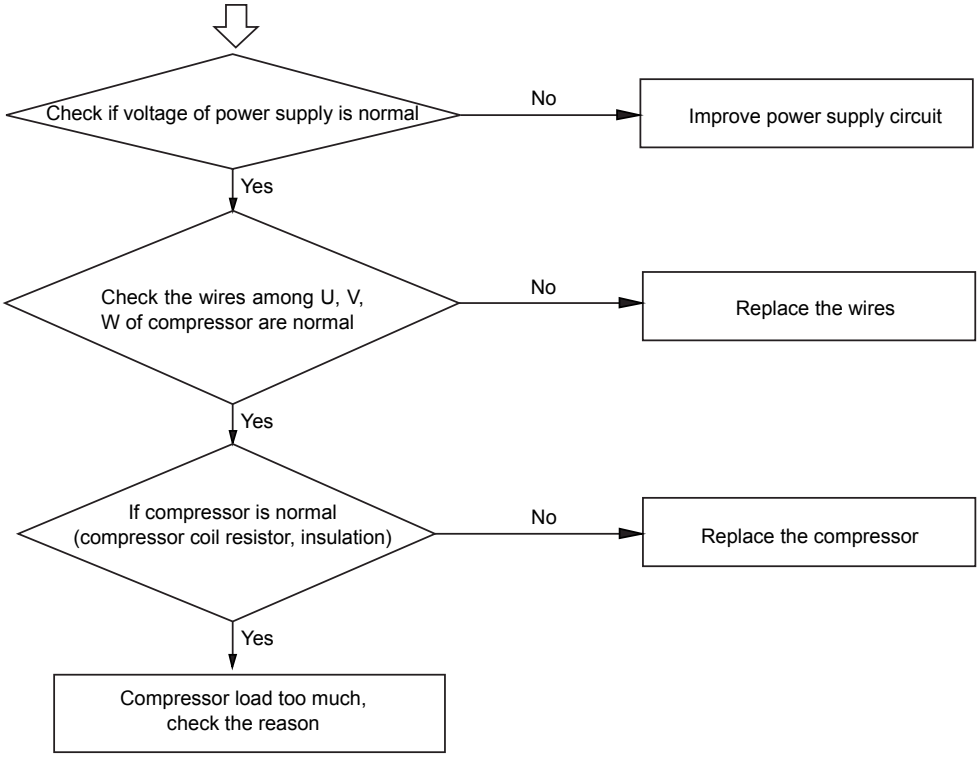
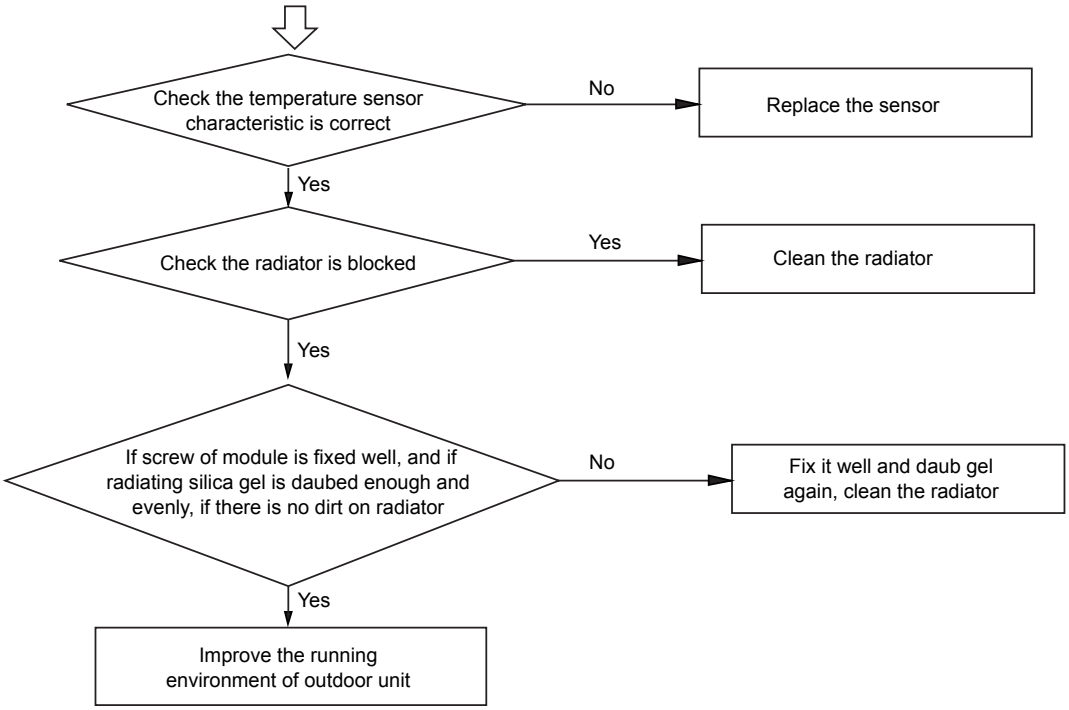
[111] Compressor out of control



[112] Radiator of transducer temp. too high



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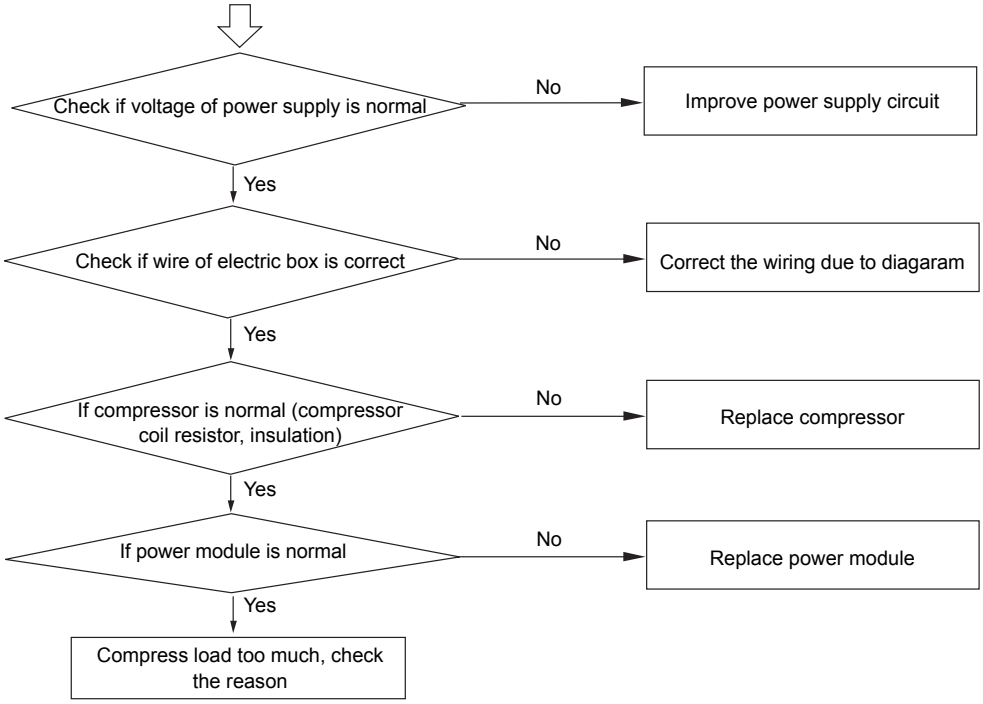
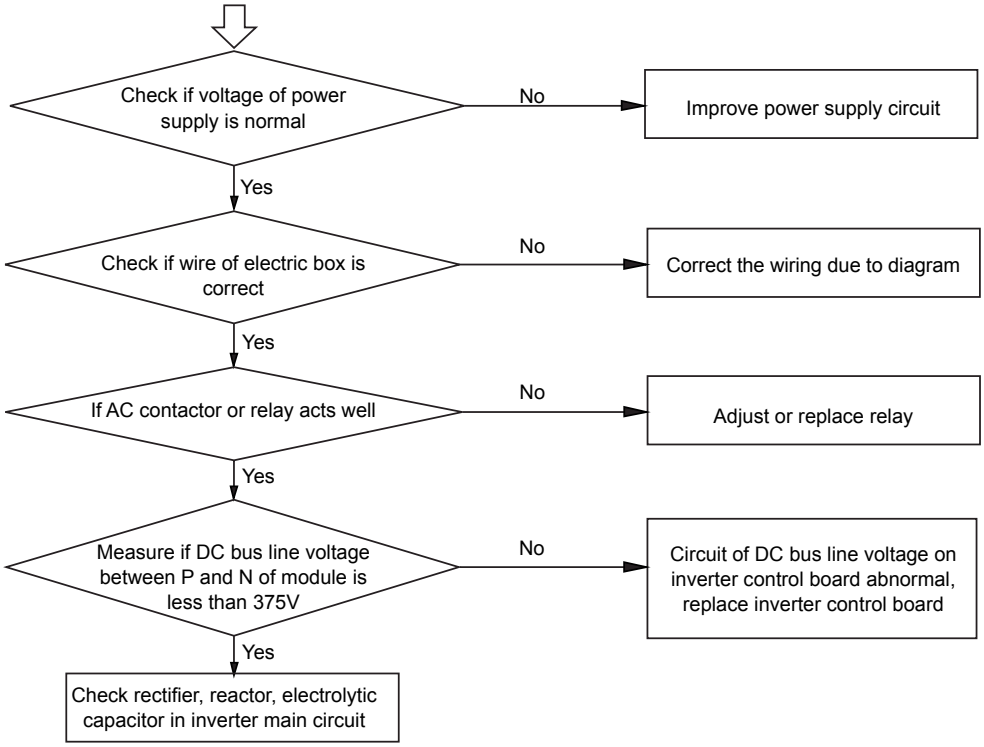
[113] Protection of overload



[114] Voltage too low of DC bus line of transducer



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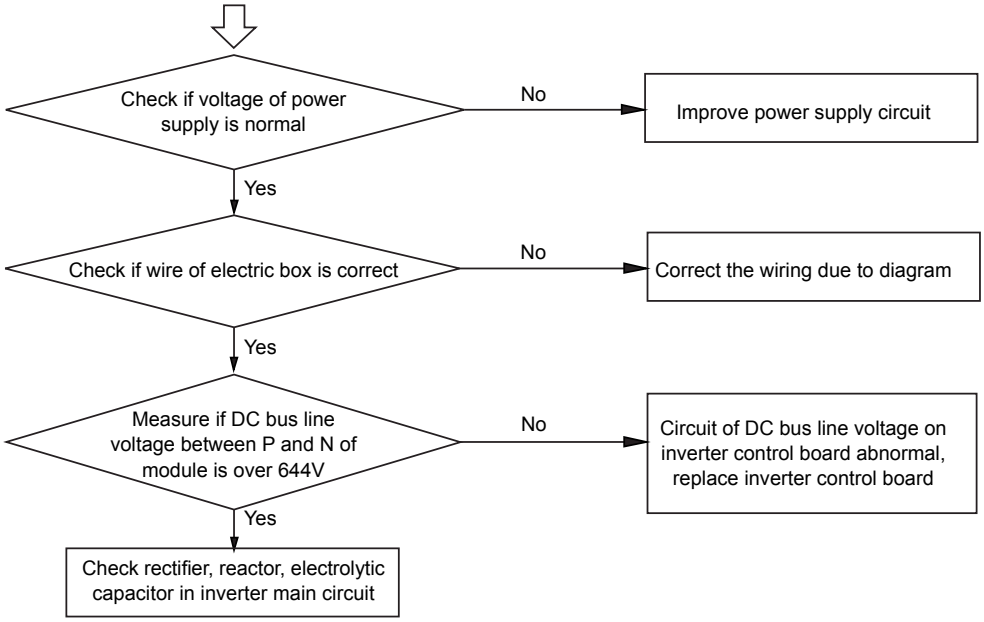
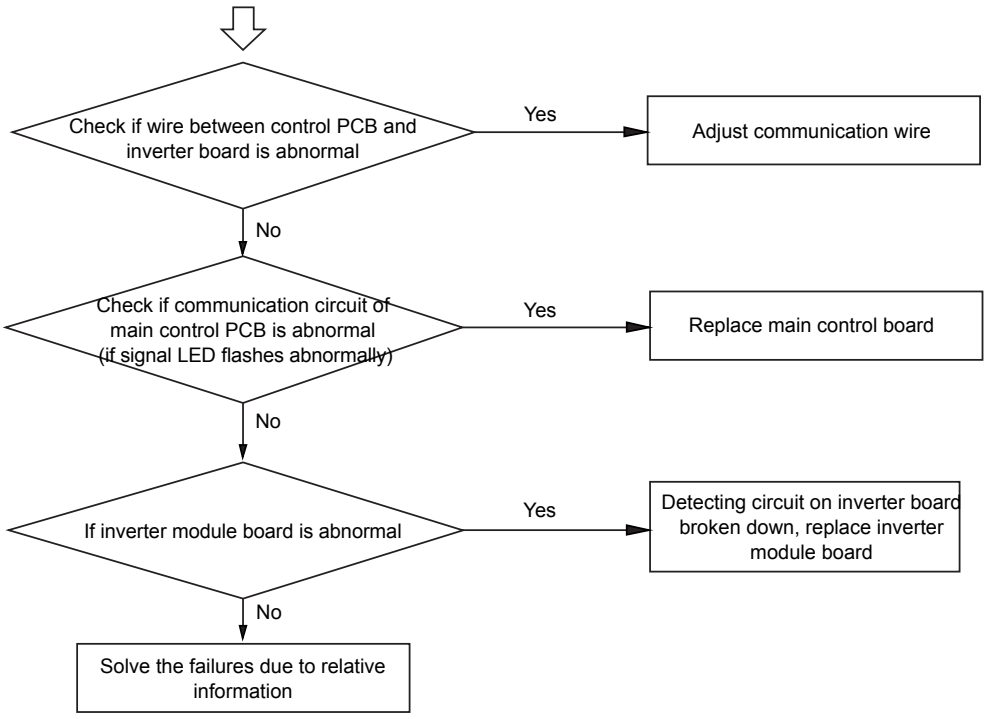
[115] Voltage too high of DC bus line of transducer



[116] Communication abnormal between transducer (inverter module board) and control PCB



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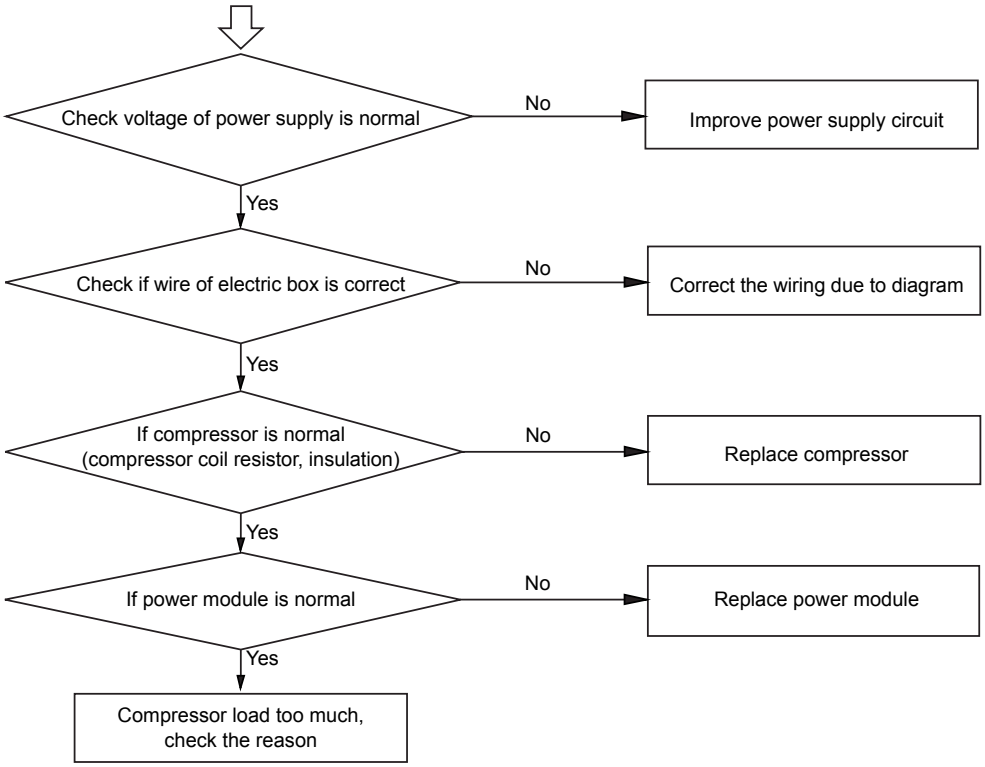
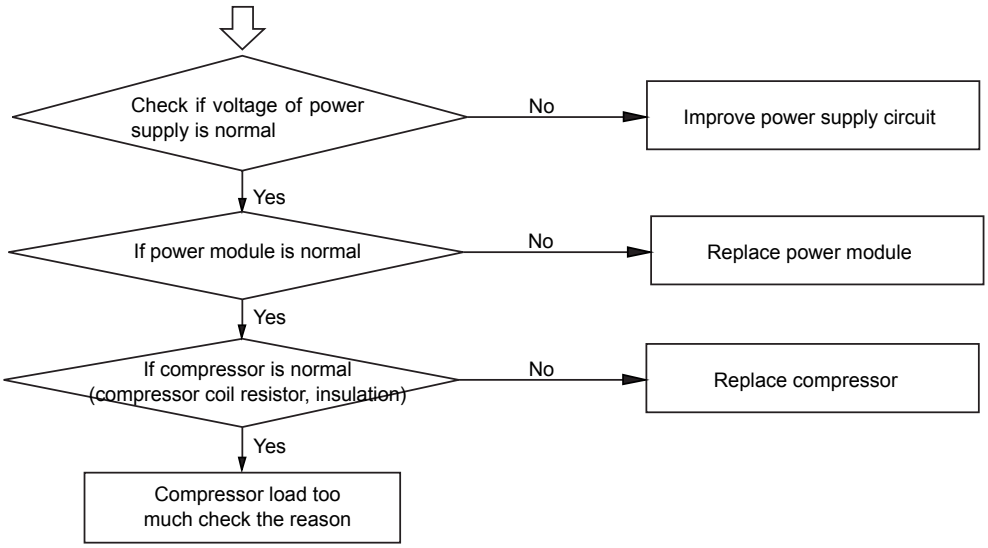
[117] Transducer over current (software protection)



[118] Compressor startup failure



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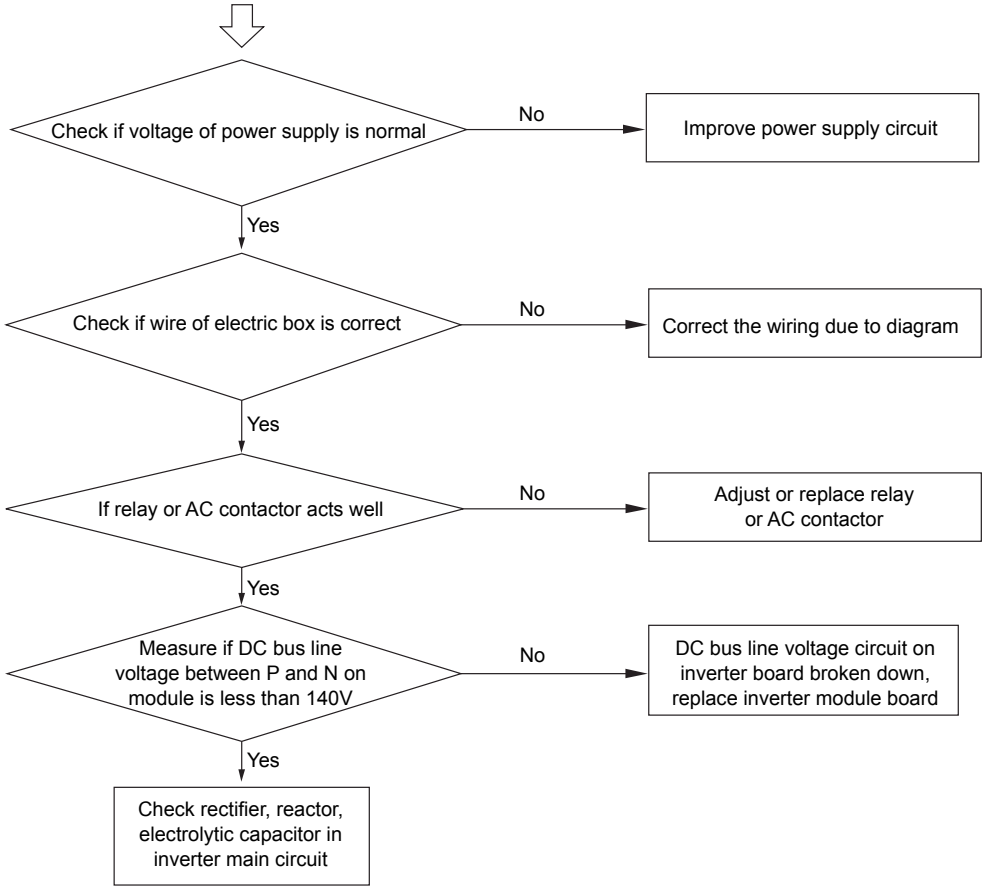
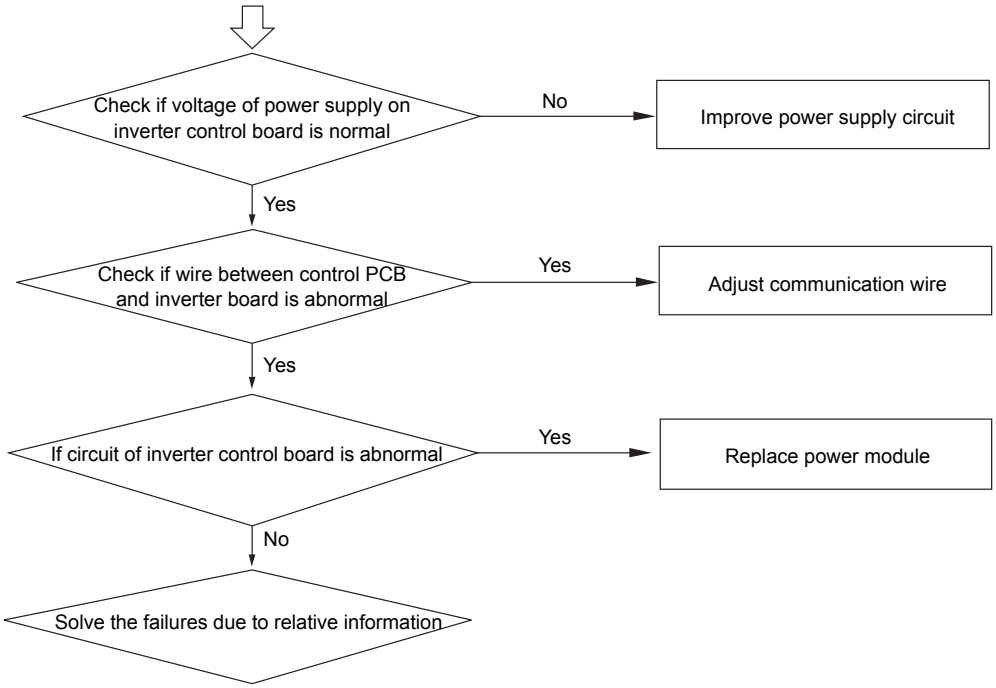
[120] Power supply of transducer abnormal



[121] Power supply of inverter board is abnormal



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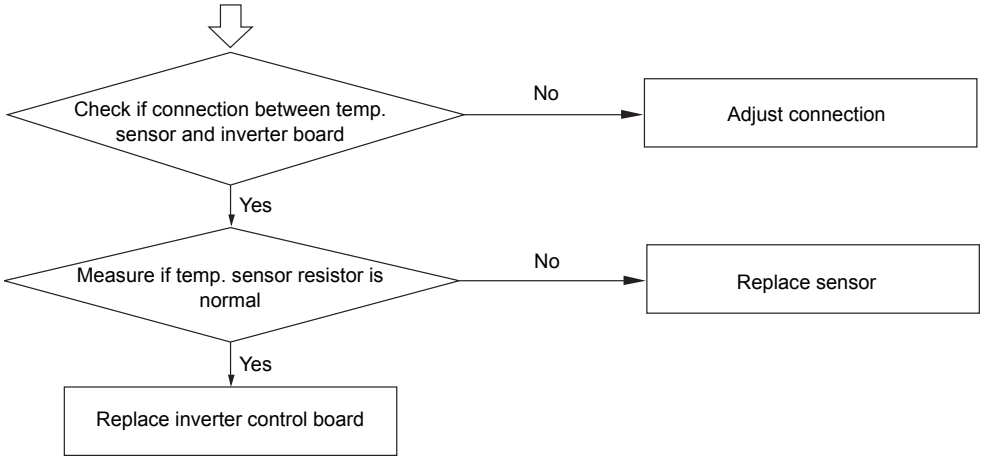
[122] Radiator temp.sensor of transducer abnormal



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APPENDIX

1. Sensor characteristic

Temp. sensor characteristic

No.	Sensor type	Characteristic
1	Indoor coil/outdoor Ta Te1, Te2 , Ts	R (25°C)=10kΩ B (25°C/50°C)=3700K
2	Indoor ambient temp.sensor	R (25°C)=23 kΩ B (25°C/50°C)=4200K
3	Outdoor Td , Toil	R (80°C)=50 kΩ B (25°C/80°C)=4450K
4	Outdoor Tfin	R (50°C)=17kΩ B (25°C/50°C)=4170K

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2. Saturated R410A thermodynamic characteristic

R50=17KΩ±2% B25/50=4170K±3%							
Temp (°C)	Rmin	R (t) Normal	Rmax	Temp (°C)	Rmin	R (t) Normal	Rmax
0	164.73	176.38	187.00	53.00	14.73	15.07	15.41
1	156.21	167.10	177.02	54.00	14.14	14.48	14.82
2	148.19	158.36	167.64	55.00	13.58	13.93	14.26
3	140.63	150.13	158.81	56.00	13.05	13.39	13.72
4	133.50	142.38	150.49	57.00	12.53	12.88	13.20
5	126.77	135.07	142.66	58.00	12.04	12.38	12.71
6	120.42	128.18	135.28	59.00	11.58	11.91	12.24
7	114.43	121.68	128.32	60.00	11.13	11.46	11.79
8	108.77	115.55	121.76	61.00	10.70	11.03	11.35
9	103.42	109.76	115.58	62.00	10.29	10.62	10.94
10	98.37	104.30	109.74	63.00	9.90	10.23	10.54
11	93.59	99.14	104.23	64.00	9.52	9.85	10.16
12	89.07	94.26	99.02	65.00	9.16	9.49	9.79
13	84.80	89.65	94.11	66.00	8.82	9.14	9.44
14	80.76	85.29	89.47	67.00	8.49	8.81	9.10
15	76.93	81.17	85.08	68.00	8.18	8.49	8.78
16	73.31	77.27	80.93	69.00	7.87	8.18	8.47
17	69.87	73.58	77.01	70.00	7.58	7.89	8.17
18	66.62	70.09	73.30	71.00	7.31	7.61	7.89
19	63.54	66.78	69.78	72.00	7.04	7.33	7.61
20	60.62	63.65	66.46	73.00	6.78	7.08	7.35
21	57.84	60.68	63.31	74.00	6.54	6.83	7.10
22	55.22	57.87	60.33	75.00	6.30	6.59	6.85
23	52.72	55.20	57.50	76.00	6.08	6.36	6.62
24	50.35	52.67	54.82	77.00	5.86	6.14	6.39
25	48.10	50.27	52.28	78.00	5.65	5.93	6.18
26	45.97	47.99	49.87	79.00	5.45	5.72	5.97
27	43.94	45.83	47.59	80.00	5.26	5.53	5.77
28	42.01	43.77	45.42	81.00	5.08	5.34	5.58
29	40.18	41.82	43.37	82.00	4.90	5.16	5.39
30	38.43	39.97	41.41	83.00	4.73	4.98	5.22
31	36.78	38.21	39.56	84.00	4.57	4.82	5.04
32	35.20	36.53	37.79	85.00	4.41	4.66	4.88
33	33.70	34.94	36.12	86.00	4.26	4.50	4.72
34	32.27	33.43	34.53	87.00	4.12	4.35	4.57
35	30.91	31.99	33.01	88.00	3.98	4.21	4.42
36	29.61	30.62	31.57	89.00	3.84	4.07	4.28
37	28.38	29.31	30.21	90.00	3.71	3.94	4.14
38	27.20	28.07	28.90	91.00	3.59	3.81	4.01
39	26.08	26.89	27.66	92.00	3.47	3.69	3.88
40	25.01	25.76	26.48	93.00	3.36	3.57	3.76
41	23.99	24.69	25.36	94.00	3.24	3.45	3.64
42	23.01	23.66	24.29	95.00	3.14	3.34	3.53
43	22.09	22.69	23.27	96.00	3.04	3.24	3.42
44	21.20	21.76	22.30	97.00	2.94	3.14	3.32
45	20.35	20.87	21.37	98.00	2.84	3.04	3.21
46	19.55	20.02	20.49	99.00	2.75	2.94	3.12
47	18.78	19.21	19.64	100.00	2.66	2.85	3.02
48	18.04	18.44	18.84	101.00	2.58	2.76	2.93
49	17.33	17.70	18.07	102.00	2.50	2.68	2.84
50	16.66	17.00	17.34	103.00	2.42	2.60	2.76
51	15.99	16.33	16.67	104.00	2.34	2.52	2.68
52	15.34	15.68	16.02	105.00	2.27	2.44	2.60

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R80=50KΩ±3% B25/80=4450K±3%					
Temp	Resistance (KΩ)			% (resist.tol)	
(℃)	Rmax	R (t) Normal	Rmin	MAX (+)	MIN (-)
0	1749.01	1921.99	2094.97	9.00	9.00
1	1651.43	1813.27	1975.10	8.93	8.93
2	1560.17	1711.65	1863.13	8.85	8.85
3	1474.74	1616.59	1758.45	8.78	8.78
4	1394.71	1527.61	1660.51	8.70	8.70
5	1319.68	1444.25	1568.82	8.63	8.63
6	1249.30	1366.10	1482.90	8.55	8.55
7	1183.21	1292.77	1402.34	8.48	8.48
8	1121.12	1223.94	1326.75	8.40	8.40
9	1062.76	1159.27	1255.77	8.33	8.33
10	1007.85	1098.47	1189.10	8.25	8.25
11	956.17	1041.29	1126.42	8.18	8.18
12	907.49	987.48	1067.46	8.10	8.10
13	861.62	936.80	1011.98	8.03	8.03
14	818.37	889.05	959.73	7.95	7.95
15	777.57	844.04	910.51	7.88	7.88
16	739.07	801.59	864.11	7.80	7.80
17	702.71	761.53	820.36	7.73	7.73
18	668.35	723.72	779.08	7.65	7.65
19	635.89	688.00	740.12	7.58	7.58
20	605.19	654.25	703.32	7.50	7.50
21	576.15	622.36	668.57	7.43	7.43
22	548.66	592.19	635.72	7.35	7.35
23	522.65	563.65	604.66	7.28	7.28
24	498.01	536.64	575.28	7.20	7.20
25	474.66	511.08	547.49	7.13	7.13
26	452.54	486.86	521.19	7.05	7.05
27	431.56	463.92	496.28	6.98	6.98
28	411.67	442.18	472.69	6.90	6.90
29	392.80	421.57	450.34	6.83	6.83
30	374.89	402.03	429.17	6.75	6.75
31	357.89	383.49	409.09	6.68	6.68
32	341.75	365.90	390.05	6.60	6.60
33	326.42	349.20	371.99	6.53	6.53
34	311.85	333.35	354.85	6.45	6.45
35	298.00	318.30	338.59	6.38	6.38
36	284.84	304.00	323.15	6.30	6.30
37	272.33	290.41	308.49	6.23	6.23
38	260.43	277.49	294.56	6.15	6.15
39	249.10	265.22	281.33	6.08	6.08
40	238.33	253.54	268.75	6.00	6.00
41	228.07	242.44	256.80	5.93	5.93
42	218.31	231.87	245.44	5.85	5.85
43	209.01	221.82	234.63	5.78	5.78
44	200.15	212.25	224.35	5.70	5.70
45	191.72	203.14	214.57	5.63	5.63
46	183.67	194.47	205.26	5.55	5.55
47	176.01	186.20	196.40	5.48	5.48
48	168.70	178.33	187.96	5.40	5.40
49	161.74	170.83	179.93	5.33	5.33
50	155.09	163.68	172.28	5.25	5.25
51	148.75	156.87	164.98	5.18	5.18
52	142.70	150.37	158.04	5.10	5.10
53	136.92	144.17	151.41	5.03	5.03
54	131.41	138.26	145.10	4.95	4.95
55	126.15	132.61	139.08	4.88	4.88
56	121.12	127.23	133.34	4.80	4.80
57	116.32	122.09	127.86	4.73	4.73
58	111.73	117.18	122.63	4.65	4.65
59	107.35	112.49	117.64	4.58	4.58
60	103.16	108.02	112.88	4.50	4.50
61	99.15	103.74	108.33	4.43	4.43
62	95.32	99.65	103.99	4.35	4.35

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3% B25/80=4450K±3%					
	Resistance (KΩ)			% (resist.tol)	
(C)	Rmax	R (t) Normal	Rmin	MAX (+)	MIN (-)
63	91.66	95.75	99.84	4.28	4.28
64	88.15	92.01	95.88	4.20	4.20
65	84.80	88.44	92.09	4.13	4.13
66	81.58	85.03	88.47	4.05	4.05
67	78.51	81.76	85.01	3.98	3.98
68	75.57	78.64	81.70	3.90	3.90
69	72.75	75.65	78.54	3.83	3.83
70	70.05	72.78	75.51	3.75	3.75
71	67.47	70.04	72.61	3.68	3.68
72	64.99	67.42	69.84	3.60	3.60
73	62.61	64.90	67.19	3.53	3.53
74	60.34	62.49	64.65	3.45	3.45
75	58.15	60.19	62.22	3.38	3.38
76	56.06	57.97	59.89	3.30	3.30
77	54.05	55.85	57.65	3.23	3.23
78	52.13	53.82	55.52	3.15	3.15
79	50.28	51.87	53.47	3.08	3.08
80	48.50	50.00	51.50	3.00	3.00
81	46.73	48.21	49.68	3.07	3.07
82	45.03	46.48	47.94	3.13	3.13
83	43.40	44.83	46.27	3.20	3.20
84	41.83	43.25	44.66	3.27	3.27
85	40.33	41.72	43.11	3.33	3.33
86	38.89	40.26	41.63	3.40	3.40
87	37.51	38.86	40.20	3.47	3.47
88	36.18	37.51	38.83	3.53	3.53
89	34.91	36.21	37.51	3.60	3.60
90	33.68	34.96	36.24	3.67	3.67
91	32.50	33.76	35.03	3.73	3.73
92	31.37	32.61	33.85	3.80	3.80
93	30.29	31.50	32.72	3.87	3.87
94	29.24	30.44	31.64	3.93	3.93
95	28.24	29.41	30.59	4.00	4.00
96	27.27	28.43	29.58	4.07	4.07
97	26.34	27.48	28.61	4.13	4.13
98	25.45	26.56	27.68	4.20	4.20
99	24.59	25.69	26.78	4.27	4.27
100	23.76	24.84	25.91	4.33	4.33
101	22.97	24.02	25.08	4.40	4.40
102	22.20	23.24	24.28	4.47	4.47
103	21.46	22.48	23.50	4.53	4.53
104	20.75	21.75	22.75	4.60	4.60
105	20.07	21.05	22.03	4.67	4.67
106	19.41	20.37	21.34	4.73	4.73
107	18.77	19.72	20.67	4.80	4.80
108	18.16	19.09	20.02	4.87	4.87
109	17.57	18.49	19.40	4.93	4.93
110	17.01	17.90	18.80	5.00	5.00
111	16.46	17.34	18.22	5.07	5.07
112	15.93	16.79	17.66	5.13	5.13
113	15.42	16.27	17.11	5.20	5.20
114	14.93	15.76	16.59	5.27	5.27
115	14.46	15.28	16.09	5.33	5.33
116	14.01	14.80	15.60	5.40	5.40
117	13.57	14.35	15.13	5.47	5.47
118	13.14	13.91	14.68	5.53	5.53
119	12.73	13.49	14.24	5.60	5.60
120	12.34	13.08	13.82	5.67	5.67
121	11.96	12.69	13.41	5.73	5.73
122	11.59	12.31	13.02	5.80	5.80
123	11.24	11.94	12.64	5.87	5.87
124	10.90	11.58	12.27	5.93	5.93
125	10.57	11.24	11.92	6.00	6.00
126	10.25	10.91	11.57	6.07	6.07
127	9.94	10.59	11.24	6.13	6.13
128	9.65	10.29	10.92	6.20	6.20
129	9.36	9.99	10.61	6.27	6.27
130	9.09	9.70	10.32	6.33	6.33
131	8.82	9.43	10.03	6.40	6.40
132	8.57	9.16	9.75	6.47	6.47
133	8.32	8.90	9.48	6.53	6.53
134	8.08	8.65	9.22	6.60	6.60
135	7.85	8.41	8.97	6.67	6.67
136	7.63	8.18	8.73	6.73	6.73
137	7.42	7.96	8.50	6.80	6.80
138	7.21	7.74	8.27	6.87	6.87
139	7.01	7.53	8.06	6.93	6.93
140	6.82	7.33	7.85	7.00	7.00

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R25=10KΩ±3% B25/50=3700K±3%					
Temp	Resistance（KΩ）			% (resist.tol)	
(℃)	Rmax	R（t）Normal	Rmin	MAX (+)	MIN (-)
-30	145.82	135.02	124.22	7.00	7.00
-29	138.07	129.13	120.18	6.93	6.93
-28	131.79	123.34	114.89	6.85	6.85
-27	125.67	117.68	109.70	6.78	6.78
-26	119.71	112.18	104.65	6.71	6.71
-25	113.93	106.84	99.75	6.64	6.64
-24	108.36	101.69	95.01	6.56	6.56
-23	103.00	96.72	90.44	6.49	6.49
-22	97.85	91.95	86.05	6.42	6.42
-21	92.92	87.37	81.83	6.35	6.35
-20	88.20	82.99	77.79	6.27	6.27
-19	83.70	78.82	73.93	6.20	6.20
-18	79.42	74.83	70.25	6.13	6.13
-17	75.34	71.04	66.74	6.05	6.05
-16	71.47	67.44	63.40	5.98	5.98
-15	67.80	64.02	60.23	5.91	5.91
-14	64.32	60.77	57.22	5.84	5.84
-13	61.02	57.69	54.37	5.76	5.76
-12	57.90	54.78	51.66	5.69	5.69
-11	54.94	52.02	49.10	5.62	5.62
-10	52.15	49.41	46.67	5.55	5.55
-9	49.51	46.94	44.37	5.47	5.47
-8	47.02	44.61	42.20	5.40	5.40
-7	44.66	42.40	40.14	5.33	5.33
-6	42.43	40.32	38.20	5.25	5.25
-5	40.33	38.35	36.36	5.18	5.18
-4	38.35	36.48	34.62	5.11	5.11
-3	36.47	34.72	32.97	5.04	5.04
-2	34.70	33.06	31.42	4.96	4.96
-1	33.03	31.49	29.95	4.89	4.89
0	31.45	30.00	28.56	4.82	4.82
1	29.95	28.59	27.24	4.75	4.75
2	28.54	27.26	25.99	4.67	4.67
3	27.20	26.01	24.81	4.60	4.60
4	25.94	24.82	23.69	4.53	4.53
5	24.74	23.69	22.63	4.45	4.45
6	23.61	22.62	21.63	4.38	4.38
7	22.54	21.61	20.68	4.31	4.31
8	21.52	20.65	19.77	4.24	4.24
9	20.56	19.74	18.92	4.16	4.16
10	19.65	18.87	18.10	4.09	4.09
11	18.78	18.05	17.33	4.02	4.02
12	17.96	17.28	16.59	3.95	3.95
13	17.18	16.54	15.90	3.87	3.87
14	16.44	15.83	15.23	3.80	3.80
15	15.73	15.17	14.60	3.73	3.73
16	15.06	14.53	14.00	3.65	3.65
17	14.42	13.93	13.43	3.58	3.58
18	13.82	13.35	12.88	3.51	3.51
19	13.24	12.80	12.36	3.44	3.44
20	12.69	12.28	11.86	3.36	3.36
21	12.17	11.78	11.39	3.29	3.29
22	11.67	11.30	10.94	3.22	3.22
23	11.19	10.85	10.51	3.15	3.15
24	10.73	10.41	10.09	3.07	3.07
25	10.30	10.00	9.70	3.00	3.00
26	9.90	9.60	9.31	3.06	3.06
27	9.51	9.23	8.94	3.13	3.13
28	9.15	8.86	8.58	3.19	3.19
29	8.80	8.52	8.24	3.25	3.25
30	8.46	8.19	7.92	3.31	3.31
31	8.14	7.87	7.61	3.38	3.38
32	7.83	7.57	7.31	3.44	3.44
33	7.53	7.28	7.02	3.50	3.50
34	7.25	7.00	6.75	3.56	3.56
35	6.98	6.73	6.49	3.63	3.63
36	6.72	6.48	6.24	3.69	3.69
37	6.47	6.23	6.00	3.75	3.75

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R25=10KΩ±3% B25/50=3700K±3%					
Temp	Resistance（KΩ）			% (resist.tol)	
（℃）	Rmax	R（t）Normal	Rmin	MAX (+)	MIN (-)
38	6.23	6.00	5.77	3.81	3.81
39	6.00	5.77	5.55	3.88	3.88
40	5.78	5.56	5.34	3.94	3.94
41	5.56	5.35	5.14	4.00	4.00
42	5.36	5.15	4.94	4.06	4.06
43	5.17	4.96	4.76	4.13	4.13
44	4.98	4.78	4.58	4.19	4.19
45	4.80	4.60	4.41	4.25	4.25
46	4.63	4.43	4.24	4.31	4.31
47	4.46	4.27	4.09	4.38	4.38
48	4.30	4.12	3.94	4.44	4.44
49	4.15	3.97	3.79	4.50	4.50
50	4.00	3.83	3.65	4.56	4.56
51	3.86	3.69	3.52	4.63	4.63
52	3.72	3.56	3.39	4.69	4.69
53	3.59	3.43	3.27	4.75	4.75
54	3.47	3.31	3.15	4.81	4.81
55	3.35	3.19	3.04	4.88	4.88
56	3.23	3.08	2.93	4.94	4.94
57	3.12	2.97	2.83	5.00	5.00
58	3.02	2.87	2.73	5.06	5.06
59	2.91	2.77	2.63	5.13	5.13
60	2.82	2.68	2.54	5.19	5.19
61	2.72	2.59	2.45	5.25	5.25
62	2.63	2.50	2.36	5.31	5.31
63	2.54	2.41	2.28	5.38	5.38
64	2.46	2.33	2.21	5.44	5.44
65	2.38	2.26	2.13	5.50	5.50
66	2.30	2.18	2.06	5.56	5.56
67	2.23	2.11	1.99	5.63	5.63
68	2.16	2.04	1.92	5.69	5.69
69	2.09	1.97	1.86	5.75	5.75
70	2.02	1.91	1.80	5.81	5.81
71	1.96	1.85	1.74	5.88	5.88
72	1.90	1.79	1.69	5.94	5.94
73	1.84	1.74	1.63	6.00	6.00
74	1.78	1.68	1.58	6.06	6.06
75	1.73	1.63	1.53	6.13	6.13
76	1.68	1.58	1.48	6.19	6.19
77	1.63	1.53	1.43	6.25	6.25
78	1.58	1.48	1.39	6.31	6.31
79	1.53	1.44	1.35	6.38	6.38
80	1.49	1.40	1.31	6.44	6.44
81	1.44	1.36	1.27	6.50	6.50
82	1.40	1.32	1.23	6.56	6.56
83	1.36	1.28	1.19	6.63	6.63
84	1.32	1.24	1.16	6.69	6.69
85	1.29	1.20	1.12	6.75	6.75
86	1.25	1.17	1.09	6.81	6.81
87	1.21	1.14	1.06	6.88	6.88
88	1.18	1.10	1.03	6.94	6.94
89	1.15	1.07	1.00	7.00	7.00
90	1.12	1.04	0.97	7.06	7.06
91	1.09	1.01	0.94	7.13	7.13
92	1.06	0.99	0.91	7.19	7.19
93	1.03	0.96	0.89	7.25	7.25
94	1.00	0.93	0.86	7.31	7.31
95	0.97	0.90	0.84	7.38	7.38
96	0.94	0.88	0.81	7.44	7.44
97	0.92	0.85	0.79	7.50	7.50
98	0.89	0.83	0.77	7.56	7.56
99	0.87	0.81	0.75	7.63	7.63
100	0.84	0.78	0.72	7.69	7.69
101	0.82	0.76	0.70	7.75	7.75
102	0.80	0.74	0.68	7.81	7.81
103	0.77	0.72	0.66	7.88	7.88
104	0.75	0.69	0.64	7.94	7.94
105	0.73	0.67	0.62	8.00	8.00

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R25=23KΩ±3% B25/50=4200K±3%					
Temp	Resistance（KΩ）			% (resist.tol)	
（℃）	Rmax	R（t）Normal	Rmin	MAX (+)	MIN (-)
-30	538.77	513.12	487.46	5.00	5.00
-29	502.58	478.89	455.21	4.95	4.95
-28	469.29	447.41	425.53	4.89	4.89
-27	438.61	418.38	398.15	4.84	4.84
-26	410.29	391.56	372.84	4.78	4.78
-25	384.09	366.75	349.41	4.73	4.73
-24	359.82	343.75	327.69	4.67	4.67
-23	337.30	322.41	307.52	4.62	4.62
-22	316.38	302.57	288.76	4.56	4.56
-21	296.92	284.11	271.29	4.51	4.51
-20	278.79	266.91	255.02	4.45	4.45
-19	261.90	250.87	239.83	4.40	4.40
-18	246.15	235.90	225.64	4.35	4.35
-17	231.43	221.91	212.39	4.29	4.29
-16	217.69	208.84	199.99	4.24	4.24
-15	204.83	196.61	188.39	4.18	4.18
-14	192.81	185.16	177.52	4.13	4.13
-13	181.55	174.44	167.34	4.07	4.07
-12	171.01	164.40	157.79	4.02	4.02
-11	161.13	154.98	148.84	3.96	3.96
-10	151.87	146.15	140.44	3.91	3.91
-9	143.18	137.87	132.56	3.85	3.85
-8	135.04	130.10	125.15	3.80	3.80
-7	127.40	122.80	118.20	3.75	3.75
-6	120.23	115.95	111.67	3.69	3.69
-5	113.49	109.51	105.53	3.64	3.64
-4	107.17	103.46	99.76	3.58	3.58
-3	101.23	97.78	94.33	3.53	3.53
-2	95.65	92.44	89.23	3.47	3.47
-1	90.40	87.42	84.43	3.42	3.42
0	85.47	82.69	79.91	3.36	3.36
1	80.84	78.25	75.66	3.31	3.31
2	76.48	74.07	71.66	3.25	3.25
3	72.38	70.13	67.89	3.20	3.20
4	68.52	66.43	64.34	3.15	3.15
5	64.89	62.94	61.00	3.09	3.09
6	61.47	59.66	57.85	3.04	3.04
7	58.25	56.57	54.88	2.98	2.98
8	55.22	53.65	52.08	2.93	2.93
9	52.37	50.90	49.44	2.87	2.87
10	49.68	48.31	46.95	2.82	2.82
11	47.14	45.87	44.60	2.76	2.76
12	44.75	43.57	42.39	2.71	2.71
13	42.49	41.40	40.30	2.65	2.65
14	40.37	39.34	38.32	2.60	2.60
15	38.36	37.41	36.45	2.55	2.55
16	36.46	35.58	34.69	2.49	2.49
17	34.67	33.85	33.02	2.44	2.44
18	32.98	32.22	31.45	2.38	2.38
19	31.39	30.67	29.96	2.33	2.33
20	29.87	29.21	28.55	2.27	2.27
21	28.45	27.83	27.21	2.22	2.22
22	27.10	26.52	25.95	2.16	2.16
23	25.82	25.28	24.75	2.11	2.11
24	24.61	24.11	23.62	2.05	2.05
25	23.46	23.00	22.54	2.00	2.00
26	22.40	21.95	21.50	2.04	2.04
27	21.39	20.95	20.51	2.09	2.09
28	20.43	20.00	19.58	2.13	2.13
29	19.52	19.10	18.69	2.18	2.18
30	18.66	18.25	17.85	2.22	2.22
31	17.84	17.44	17.05	2.26	2.26
32	17.06	16.67	16.29	2.31	2.31
33	16.32	15.94	15.57	2.35	2.35
34	15.61	15.25	14.88	2.39	2.39
35	14.94	14.59	14.23	2.44	2.44
36	14.31	13.96	13.61	2.48	2.48
37	13.70	13.36	13.03	2.53	2.53

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R25=23KΩ±3%　B25/50=4200K±3%					
Temp	Resistance（KΩ）			% (resist.tol)	
（℃）	Rmax	R（t）Normal	Rmin	MAX (+)	MIN (-)
38	13.12	12.79	12.47	2.57	2.57
39	12.57	12.25	11.93	2.61	2.61
40	12.05	11.74	11.42	2.66	2.66
41	11.55	11.24	10.94	2.70	2.70
42	11.07	10.78	10.48	2.74	2.74
43	10.62	10.33	10.04	2.79	2.79
44	10.18	9.90	9.62	2.83	2.83
45	9.77	9.50	9.22	2.88	2.88
46	9.38	9.11	8.84	2.92	2.92
47	9.00	8.74	8.48	2.96	2.96
48	8.64	8.39	8.14	3.01	3.01
49	8.30	8.05	7.80	3.05	3.05
50	7.97	7.73	7.49	3.09	3.09
51	7.65	7.42	7.19	3.14	3.14
52	7.35	7.13	6.90	3.18	3.18
53	7.07	6.85	6.63	3.23	3.23
54	6.79	6.58	6.36	3.27	3.27
55	6.53	6.32	6.11	3.31	3.31
56	6.28	6.08	5.87	3.36	3.36
57	6.04	5.84	5.64	3.40	3.40
58	5.81	5.62	5.43	3.44	3.44
59	5.59	5.40	5.22	3.49	3.49
60	5.38	5.20	5.02	3.53	3.53
61	5.18	5.00	4.82	3.58	3.58
62	4.99	4.82	4.64	3.62	3.62
63	4.81	4.64	4.47	3.66	3.66
64	4.63	4.46	4.30	3.71	3.71
65	4.46	4.30	4.14	3.75	3.75
66	4.30	4.14	3.99	3.79	3.79
67	4.15	3.99	3.84	3.84	3.84
68	4.00	3.85	3.70	3.88	3.88
69	3.86	3.71	3.56	3.93	3.93
70	3.72	3.58	3.44	3.97	3.97
71	3.59	3.45	3.31	4.01	4.01
72	3.47	3.33	3.20	4.06	4.06
73	3.35	3.22	3.08	4.10	4.10
74	3.23	3.10	2.98	4.14	4.14
75	3.12	3.00	2.87	4.19	4.19
76	3.02	2.90	2.77	4.23	4.23
77	2.92	2.80	2.68	4.28	4.28
78	2.82	2.70	2.59	4.32	4.32
79	2.73	2.61	2.50	4.36	4.36
80	2.64	2.53	2.42	4.41	4.41
81	2.56	2.45	2.34	4.45	4.45
82	2.47	2.37	2.26	4.49	4.49
83	2.39	2.29	2.19	4.54	4.54
84	2.32	2.22	2.12	4.58	4.58
85	2.25	2.15	2.05	4.63	4.63
86	2.18	2.08	1.98	4.67	4.67
87	2.11	2.02	1.92	4.71	4.71
88	2.05	1.95	1.86	4.76	4.76
89	1.98	1.89	1.80	4.80	4.80
90	1.92	1.83	1.75	4.84	4.84
91	1.87	1.78	1.69	4.89	4.89
92	1.81	1.72	1.64	4.93	4.93
93	1.76	1.67	1.59	4.98	4.98
94	1.70	1.62	1.54	5.02	5.02
95	1.65	1.57	1.49	5.06	5.06
96	1.60	1.52	1.45	5.11	5.11
97	1.55	1.48	1.40	5.15	5.15
98	1.51	1.43	1.36	5.19	5.19
99	1.46	1.39	1.32	5.24	5.24
100	1.42	1.35	1.28	5.28	5.28
101	1.37	1.31	1.24	5.33	5.33
102	1.33	1.26	1.20	5.37	5.37
103	1.29	1.22	1.16	5.41	5.41
104	1.25	1.18	1.12	5.46	5.46
105	1.21	1.15	1.08	5.50	5.50

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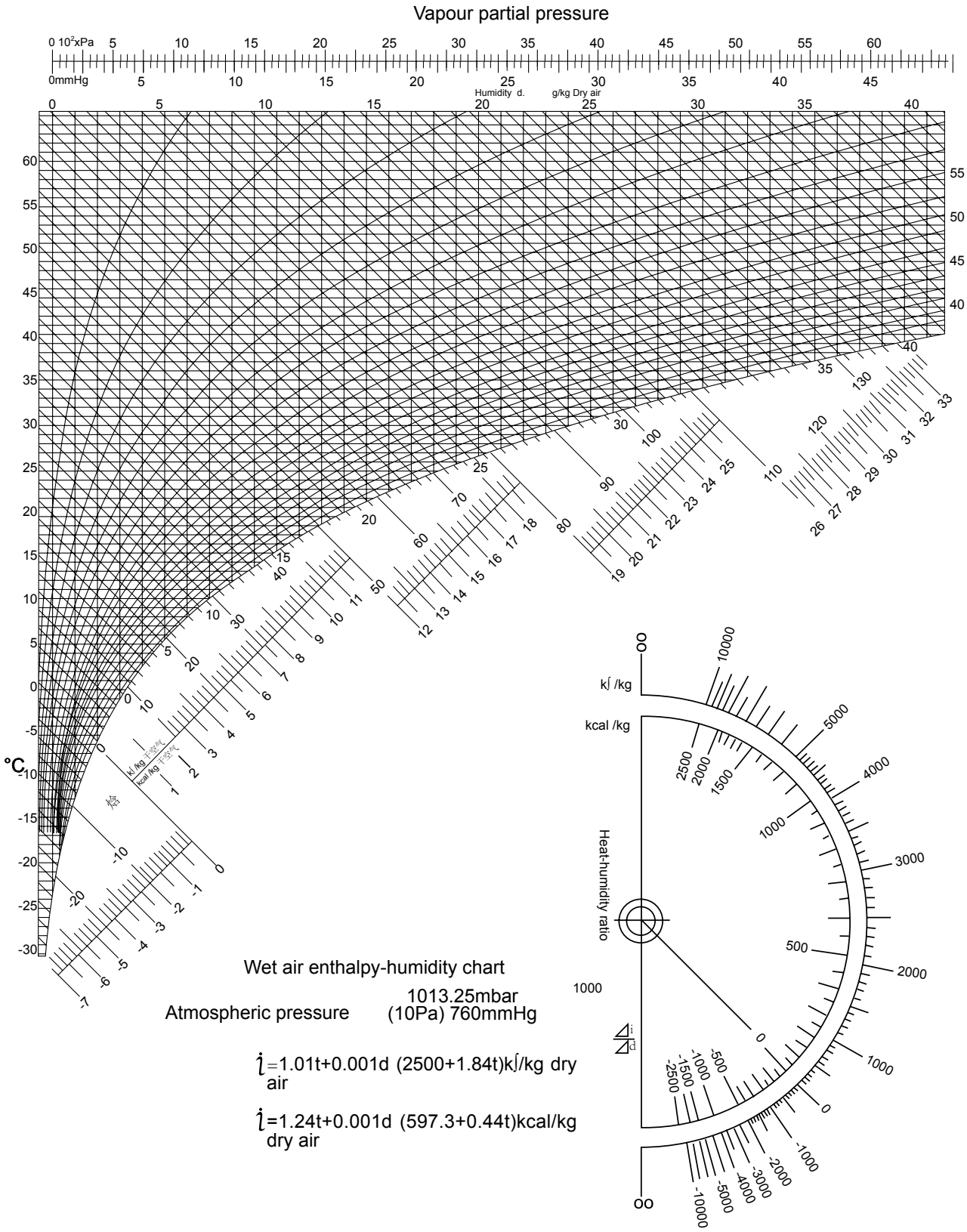
3. Enthalpy-humidity chart



Wet air enthalpy-humidity chart

Atmospheric pressure 1013.25mbar (10Pa) 760mmHg

i=1.01t+0.001d (2500+1.84t)kJ/kg dry air

i=1.24t+0.001d (597.3+0.44t)kcal/kg dry air

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