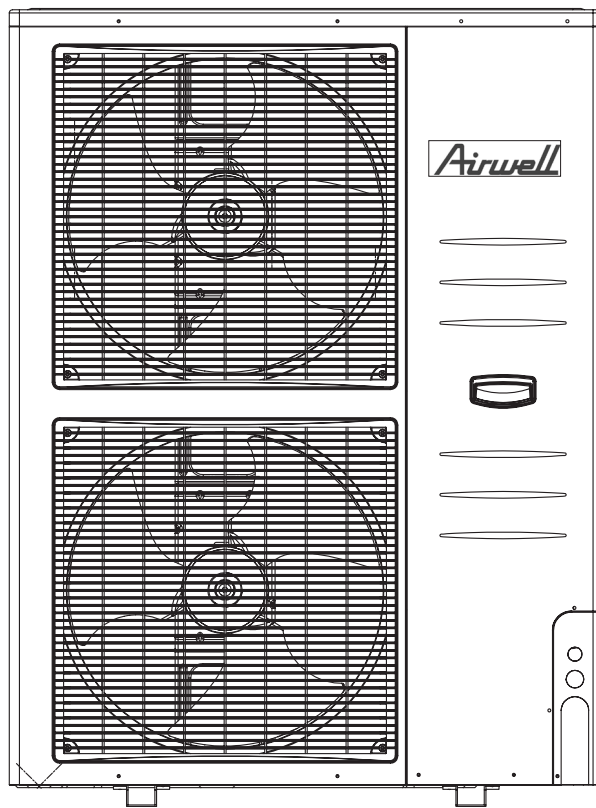


“MVi” Series

DC-inverter air-conditioners



Outdoor unit

- YAV112
- YAV140
- YAV160

Before installing your air-conditioner, please read this installation instruction carefully and keep it for future reference.

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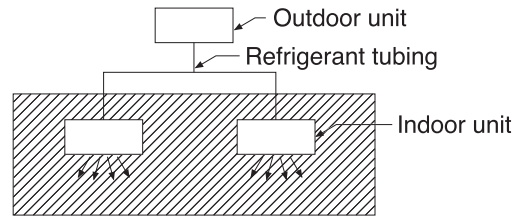
1 CHECK OF DENSITY LIMIT

The room in which the air conditioner is to be installed requires a design that in the event of refrigerant gas leaking out, its density will not exceed a set limit.

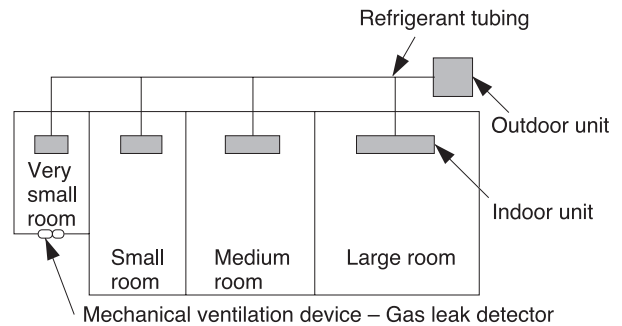
The refrigerant (R410A), which is used in the air conditioner, is safe, without the toxicity or combustibility of ammonia, and is not restricted by laws imposed to protect the ozone layer. However, since it contains more than air, it poses the risk of suffocation if its density should rise excessively. Suffocation from leakage of refrigerant is almost non-existent. With the recent increase in the number of high density buildings, however, the installation of multi air conditioner systems is on the increase because of the need for effective use of floor space, individual control, energy conservation by curtailing heat and carrying power, etc.

Most importantly, the multi air conditioner system is able to replenish a large amount of refrigerant compared to conventional individual air conditioners. If a single unit of the multi air conditioner system is to be installed in a small room, select a suitable model and installation procedure so that if the refrigerant accidentally leaks out, its density does not reach the limit (and in the event of an emergency, measures can be made before injury can occur).

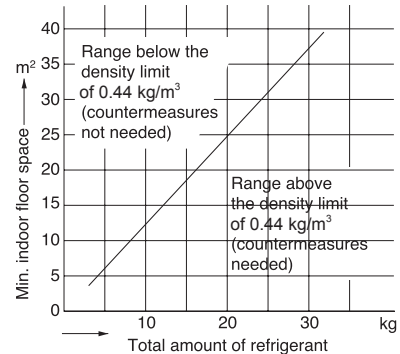
In a room where the density may exceed the limit, create an opening with adjacent rooms, or install mechanical ventilation combined with a gas leak detection device.



- (3) If an indoor unit is installed in each partitioned room and the refrigerant tubing is interconnected, the smallest room of course becomes the object. But when mechanical ventilation is installed interlocked with a gas leakage detector in the smallest room where the density limit is exceeded, the volume of the next smallest room becomes the object.



2. The minimum indoor floor space compared with the amount of refrigerant is roughly as follows (when the ceiling is 2.7 m high):



Total amount of refrigerant (kg)

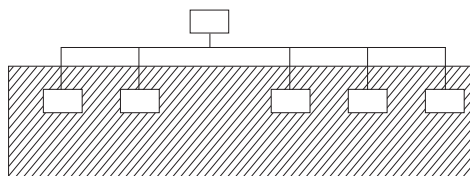
Min. volume of the indoor unit installed room (m³)

≤ Density limit (kg/m³)

The density limit of refrigerant which is used in multi air conditioners is 0.44 kg/m³ (ISO 5149).

NOTE

1 Definition for minimum room volume



- (1) No partition (shaded portion)
- (2) When there is an effective opening with the adjacent room for ventilation of leaking refrigerant gas (an opening 0.15% or larger than the respective floor spaces at the top or bottom of the door).

2 SPACE REQUIREMENT

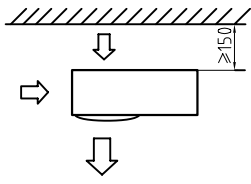


Chart 1

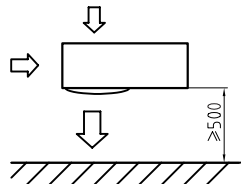


Chart 2

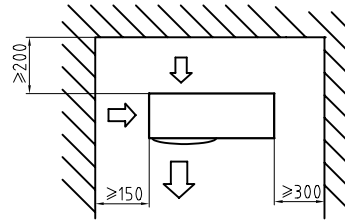


Chart 3

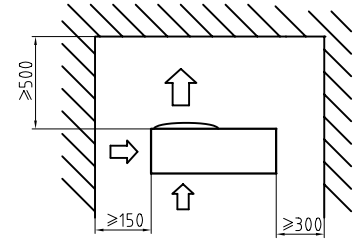


Chart 4

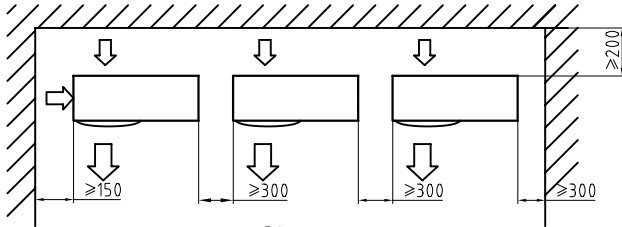


Chart 5

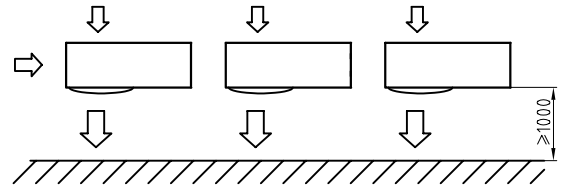


Chart 6

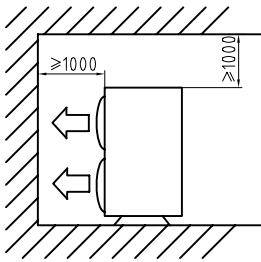


Chart 7

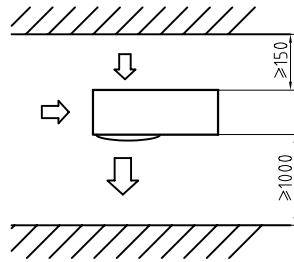


Chart 8

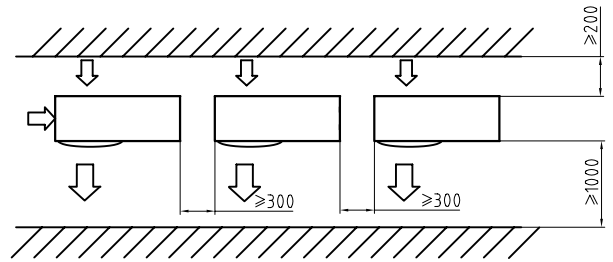


Chart 9

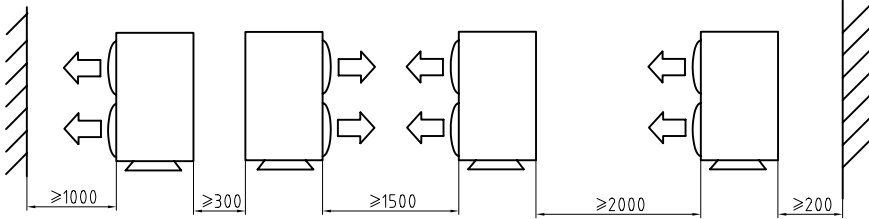


Chart 10

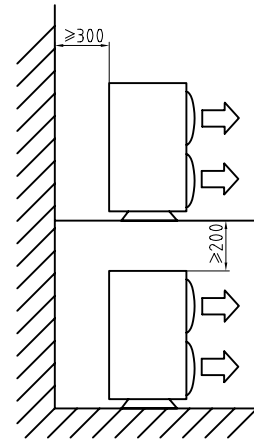


Chart 11

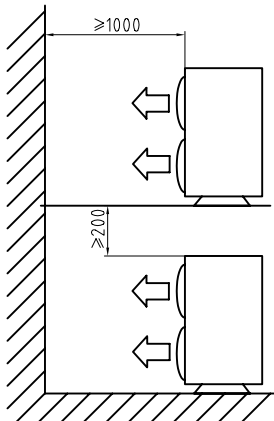




Chart 12

3 PRECAUTION

 CAUTION If the warning is not observed, it may cause injure or damage to the equipment.

 WARNING If the warning is not observed, it may cause serious casualties.

CAUTION

- Install drain piping according to this installation manual to ensure favoring drainage, and insulate the pipe to prevent condensation.
- Make sure all welding rods should contain 7% silver.
- Installation in the following places may cause trouble. If it is unavoidable, please consult with the dealer.
 - (1)A place full of machine oil;
 - (2)A saline place such as coast;
 - (3)Hot-spring resort;
 - (4)A place full of sulfide gas;
 - (5)A place where there is high frequency machines such as wireless installation, welding machine, medical facilities.
 - (6)A place of special environmental conditions.
- Using a torque wrench, tighten the flare nuts to the specified torque setting.
- The appliance shall be installed in accordance with national wiring regulations.
- This appliance is not intended for use by persons (including children) with reduced physical, sensory, or mental capacities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.
- Children should be supervised to ensure that they do not play with the appliance.
- If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.
- The appliance shall be installed in accordance with national wiring regulations, and shall be provided to ensure all-pole disconnection from the supply mains, and distance between the poles shall be more than 3 mm.
- Only qualified technician is allowed to perform the maintenance.

WARNING

- Ensure an electrical leakage breaker is fitted. This is to prevent the risk of electric shock.
- Installation and servicing of air conditioning equipment can be hazardous due to system pressure and electric components. Ask the trained and qualified service personnel to install, repair or service your equipment.
- Before performing service or maintenance operations on system, turn off main power switch of the unit. Otherwise electrical shock could cause personal injury.
- According to this manual, do not install this unit by yourself. Because improper installation may lead to water leakage, electric shocks or fire.
- When one unit is installed in a small room, it is necessary to measure the system refrigerant quantity, so that the leaked refrigerant amount does not exceed the limit. If the leak amount exceeds the limit, it may cause an oxygen deficiency accident.
- Be sure to use only the specified accessories and parts for installation. Failure using may result in water leakage, electric shocks, fire, or the unit falling.
- If refrigerant leaks during the installation work, don't touch them! Or it will frostbite you! And ventilate the room immediately.
- Electrical work must be performed by qualified personnel according to local laws and regulations and this installation manual. Ensure the air conditioner uses a designated power supply.
- When connecting the installation wiring, be sure that all fixing terminals are securely fixed.

4 INSTALLATION TOOLS REQUIRED

4.1 New Refrigerant Air Conditioner Installation

- This air conditioner adopts the new HFC refrigerant (R410A) which doesn't destroy ozone layer. R410A refrigerant is apt to be affected by impurities such as water, oxidizing membrane, and oils because the working pressure of R410A refrigerant is approx. 1.6 times of refrigerant R22. Accompanied with the adoption of the new refrigerant, the refrigeration machine oil has also been changed. Therefore, during installation work, be sure that water, dust, former refrigerant, or refrigeration machine oil does not enter into the new type refrigerant R410A air conditioner circuit.
- To prevent mixing of refrigerant of refrigerating machine oil, the sizes of connecting sections of charging port on main unit and installation tools are different from those used for the conventional refrigerant units. Accordingly, special tools are required for the new refrigerant (R410A) units. For connecting pipes, use new and clean piping materials with high pressure fittings made for R410A only, so that water and dust does not enter. Moreover, do not use the existing piping because there are some problems with pressure fittings and possible impurities in existing piping.

4.2 Changes in the product and components

- In air conditioners using R410A, in order to prevent any other refrigerant from being accidentally charged, the service port diameter size of the outdoor unit control valve (3 way valve) has been changed.
- In order to increase the pressure resisting strength of the refrigerant piping, flare processing diameter and opposing flare nuts sizes have been changed.

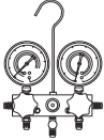


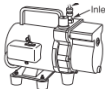



New tools for R410A	Applicable to R410A	New tools for R410A	Applicable to R410A
Gauge manifold		Flare tool (clutch type)	
Charge hose		Vacuum pump adapter	
Electronic balance for Refrigerant charging		Gas leakage detector	
Torque wrench			

Table 1

- Incidentally, the "refrigerant cylinder" comes with the refrigerant designation (R410A) and protector coating in the U.S.'s ARI specified rose color (ARI color code: PMS 507).
- The charge port size of refrigerant cylinder should be as same a the charge hose's port size.

5 INTRODUCTION

5.1 Combination

The Indoor units can be installed in the following range, To learn which models of indoor units are compatible with MVi unit, refer to the product catalogs.

Total capacity/quantity of indoor units table:

Combination table:

Outdoor unit	Capacity match ratio	Total quantity of indoor units (max)
112	50%-130%	6
140		8
160		9

Table 2

Capacity match ratio=Total nominal capacity of indoor unit/nominal capacity of outdoor unit

5.2 Standard attached fittings

Please check whether the follow fittings are of full scope. If there are some attached fitting free for use immediately, please restore them carefully.



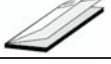

No.	Accessories part	Qty.	No.	Accessories part	Qty.
1	Drain connector 	1	4	Connector tube 	2
2	Drainage plug	2	5	Installation manual 	1
3	Mounting pads 	4			

Table 3

5.3 Optional accessories

To install the above outdoor units, the following optional parts are also required.

1. Indoor unit
2. Remote controller
3. Distribution joint

6 SELECTION LOCATION

⚠ CAUTION

The installation of the air conditioning unit must be positioned in a location that can sufficiently support its weight and give protection against adverse environmental conditions. Failure to do so may result in unit damage and possible human injury.

⚠ WARNING

Ensure that the unit is placed where there is no risk of flammable gases.
Ensure the outdoor unit is fixed to the base, to prevent movement of the unit.

Place selection

MVi system is suitable for installation in a commercial and light industrial environment.

- Obtain permission from the customer to install the unit in a site that satisfies the following conditions:
 - 1) A place that complies with the requirement mentioned in the second page.
 - 2) A place that permits level installation of the unit.
 - 3) A place that provides enough space for servicing safely.
 - 4) A place that the drainage from the unit will not pose a problem.
 - 5) A place that the unit does not bother next door neighbors.
 - 6) A place where the indoor unit and outdoor units' piping and wiring lengths come within the allowable ranges.
- Avoid installing in following places:
 - 1) A place exposed to air with high salt content (ex. Seaside area)
 - 2) A place exposed to large quantities of sulfide gas (ex. Hot spring).
 - 3) A place where organic solvent is used nearby.
 - 4) A place close to a machine generation high frequency.
 - 5) A place with poor ventilation.

⚠ CAUTION

- When the outdoor unit is installed in a place where always exposed to strong wind like a coast or on the roof of a high building, please apply the windproof measures referring to the following examples:
Install the unit so that its discharge port faces to the obstacle, keeps a distance as 500mm or more between the unit and the obstacle. Ensure the air out-let direction is vertical to the wind direction of the operation season of air conditioner.
- In regions with significant snowfall, the outdoor unit should be provided with a platform and snow-proof duct.

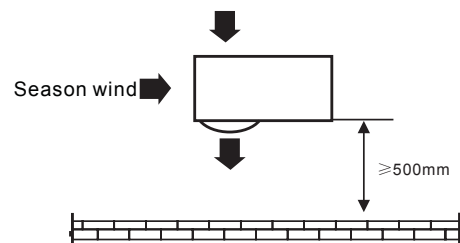


Chart 13

7 TRANSFER AND FIXUP OUTDOOR UNIT

⚠ CAUTION

- Please carry the unit to installation place with its initial packaging as best as possible.
- Be careful when hang the unit with sling (for example), because the center of gravity is not the epicenter of this unit, and some methods should be taken for its overturn.
- The gradient shouldn't exceed 45° when transit the unit. Don't store the unit in decumbent.
- Bring the unit slowly by grabbing the left and right grips.
- Place your hands on the corner instead of holding the suction inlet in the side of the case, otherwise the case could be deformed.
- Take care not to let hands or other objects come in and contact with the rear fins. Or it will hurt your hands and damage the unit.

7.2 How to prevent overturn

If it is necessary to prevent the unit from falling over, the following method can be for your information:

- Prepare all 4 wires as indicated in the drawing.
- Unscrew the top plate at the 4 locations indicated A and B.
- Put the screws through the nooses and screw them back tight.

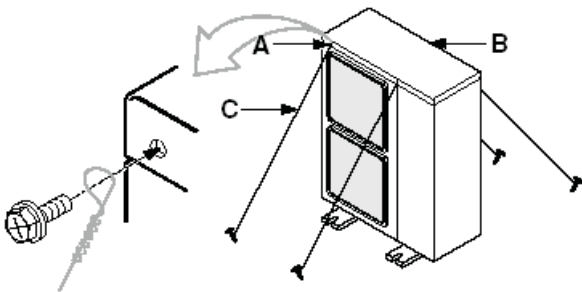
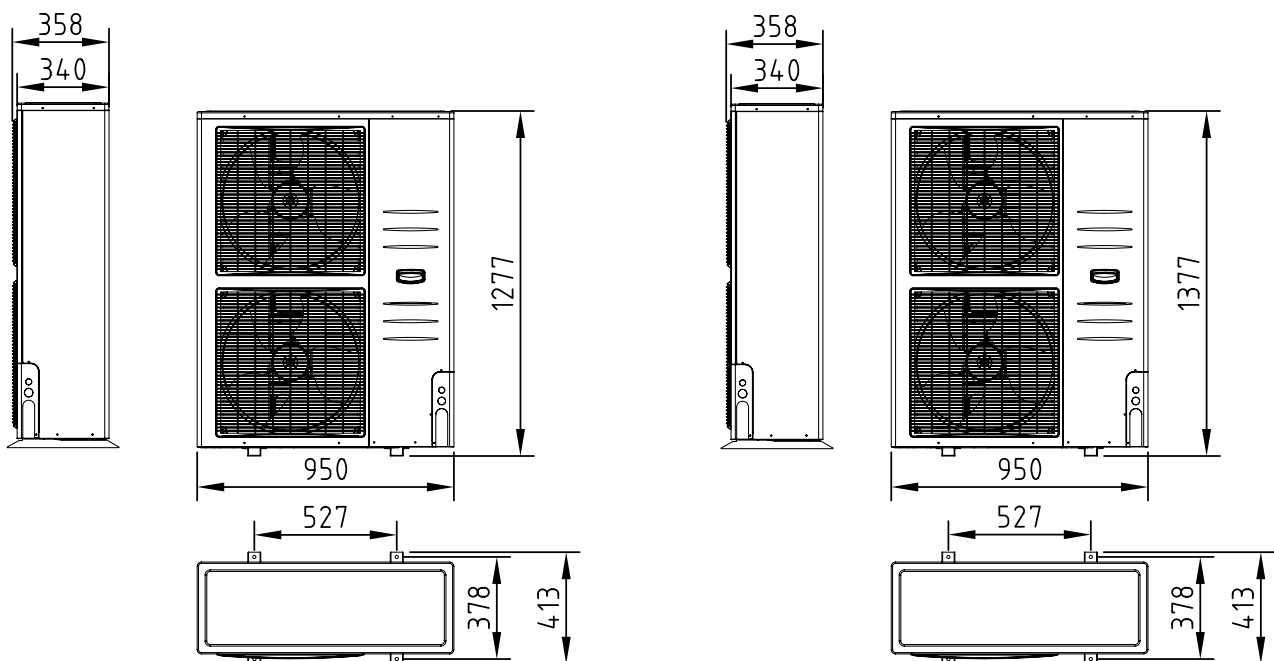


Chart 14

A Location of the 2 fixation holes on the front side
B Location of the 2 fixation holes on the back side
C Wires: field supply

7.3 Unit dimension



YAV 112/140

YAV 160

Chart 15

7 TRANSFER AND FIXUP OUTDOOR UNIT

7.4 Fixup outdoor unit

- Before installation, check strength and horizon of the base for preventing abnormal vibration and noise.
- According to the following diagram, fix the base firmly with the anchor bolts. (Anchor bolt, nut: M10,4pairs)
- Base create:
 - 1) Use concrete or a similar material to create the base, and ensure good drainage. Ordinarily, ensure a base height of 5 cm or more. If a drain pipe is used, or for use in cold-weather regions, ensure a height of 15 cm or more at the feet on both sides of the unit. (In this case, leave clearance below the unit for the drain pipe, and to prevent freezing of drainage water in cold-weather regions.)
 - 2) Refer to chart 16 for the anchor bolt dimensions.
 - 3) Set the out margin of the anchor bolt to 25mm or less.

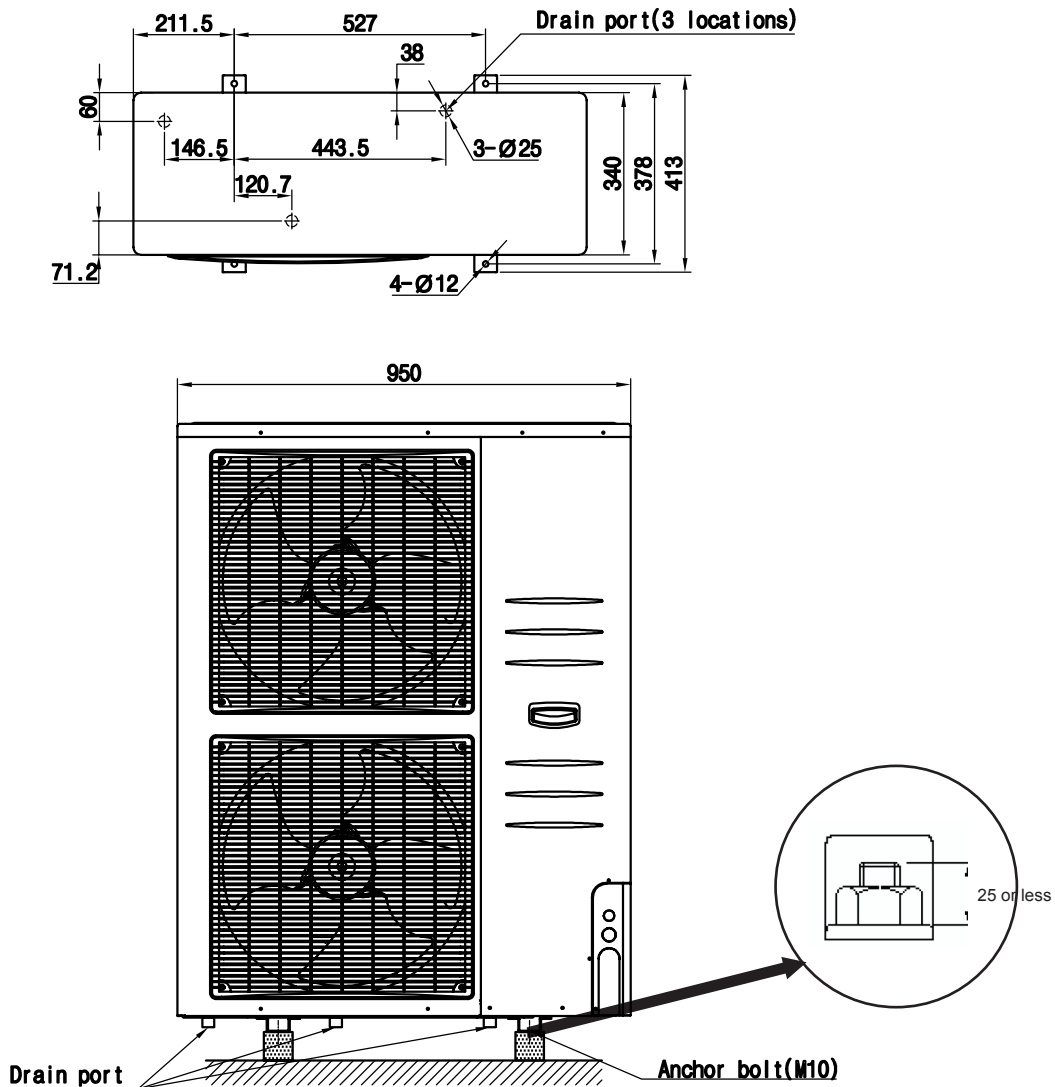


Chart 15

8 REFRIGERANT PIPING

8.1 Installation synopsis

Field pipes can be installed in three directions, this character increases the flexible of installation.

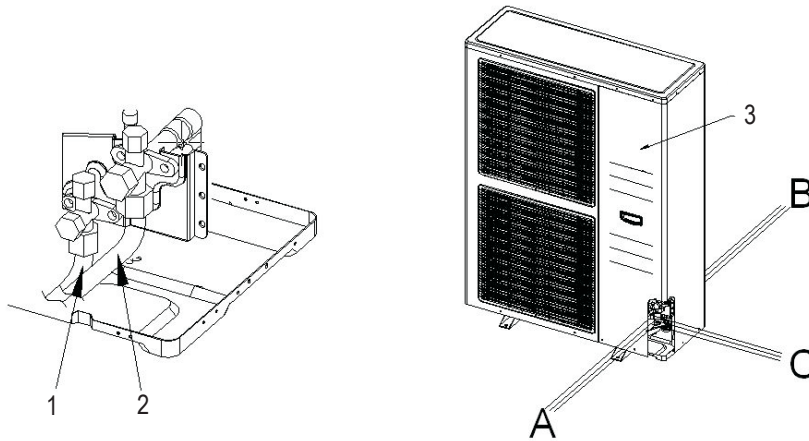


Chart 17

- 1 Connecting liquid pipe (field supply)
- 2 Connecting gas pipe
- 3 Front plate

- A the front
- B the rear
- C the side

- Please knock out the hole as shown in the figure. Do not remove the pipe cover from the cabinet so that the knockout hole can be easily punched. To knock out, it is easily taken off by hands by punching a position at the lower side of 3 connected parts with screwdriver along the guide line.
- After marking the knockout hole, remove the burr and mount the attached protective bush and guard material for pass-through part in order to protect pipes and wires.

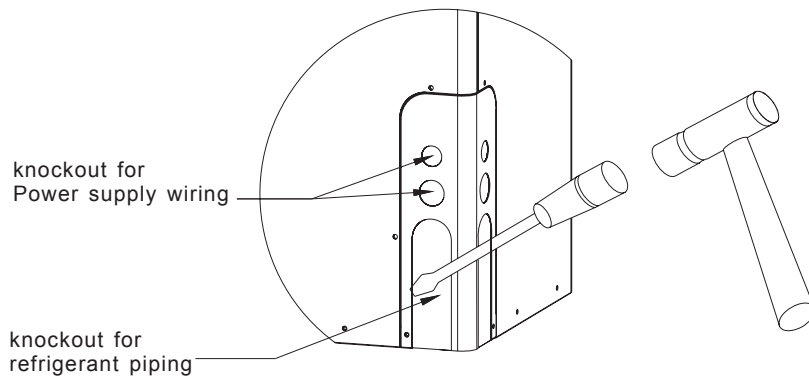


Chart 18

8 REFRIGERANT PIPING

WARNING

- It is forbidden to discharge refrigerant into the atmosphere. Collect the refrigerant in accordance with the Freon collection and destruction law.
- If the refrigerant gas leaks during installation work, ventilate the room immediately.
- Do not use flux when brazing the refrigerant piping. For brazing, use phosphor copper brazing filler metal (BCuP) which does not require a flux.

Piping procedure:

- 1)Keep stop valve on outdoor unit in “off” status (ex-factory specification) as original, dismantle end caps on refrigerant lines and the unit, and proceed quickly flare connection.
- 2)Leakage test. For details, please refer to chapter 8.8 Leakage test.
- 3)Vacuum the system. For details, please refer to chapter 8.9 Vacuum process.
- 4)Addition refrigerant charge. For details, please refer to chapter 8.10 addition refrigerant charge.
- 5)After completion of above operation, keep stop valve (commonly used by liquid and gas) on the outdoor unit totally open. By then, refrigerant cycle between indoor unit is all connected.

CAUTION

- If being put aside for long period after end caps being removed, breakdown may happen to tubes because of invasion of dust, water and foreign matter into pipe, so please proceed connection operation as following rapidly.
- Before tightening flare nuts, a layer of attached cooling engine oil should be thinly applied on the sealed pad surface between tubes and connectors.
- Please proceed tubing connections with two wrenches and refer to table 4 for tightening torque.
- Please apply attached refrigerant lines thermal insulation materials for insulation on indoor lateral flare connection areas.

Attentions on application of flexible couplings:

- 1)Please apply flexible coupling at indoor lateral interconnecting areas.
- 2)Bending angle cannot exceed 90°, and bending cannot be repeated more than 3 times.
- 3)To reach appropriate torque as per torque wrench:

Tube diameter (mm)	tightening torque, approximate	Tube thickness (mm)
Φ6.35	14-18 N.m (140-180kgf.cm)	0.8
Φ9.52	34-42 N.m (340-420kgf.cm)	0.8
Φ12.7	49-61 N.m (490-610kgf.cm)	0.8
Φ15.88	68-82 N.m (680-820kgf.cm)	1.0
Φ19.05	100-120 N.m (1000-1200kgf.cm)	1.0

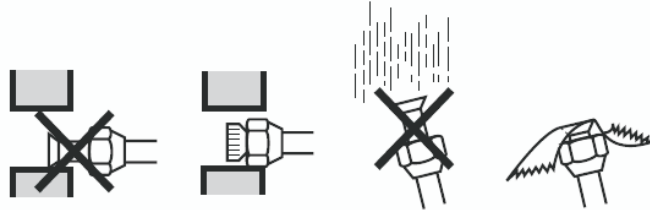
Table 4

8 REFRIGERANT PIPING

8.2 How to braze?

⚠ CAUTION

- Do not allow anything other than the designated refrigerant to get mixed into the freezing cycle, such as air, etc. If any refrigerant gas leaks while working on the unit, ventilate the room thoroughly right away.
- In order to prevent dirt, liquid or dust from entering the piping, cure the piping with a pinch or taping. Great caution is needed when passing copper tubes through walls.
- Only use the flare nuts included with the unit. Using different flare nuts may cause the refrigerant leakage.



Place	Installation period	Protection method
Outdoor unit	More than a month	Pinch the pipe
	Less than a month	Pinch or tape the pipe
Indoor unit	Regardless of the period	

Chart 19

Ensure using a nitrogen blow when brazing. Brazing without carrying out nitrogen replacement or releasing nitrogen into the piping will create large quantities of oxidized nitrogen into the piping, these would prevent normal operation of valves and compressors. So, please braise tubes as followings:

Insert nitrogen into the tubing, and set the pressure to 0.02MPa with the reducing valve.

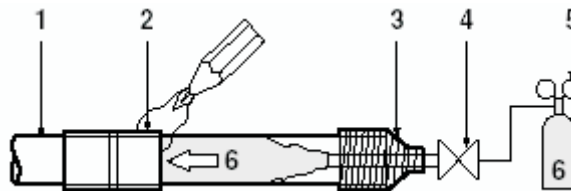


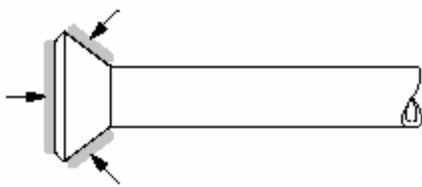
Chart 20

- | | |
|----------------------|------------------|
| 1 Refrigerant piping | 4 Handvalve |
| 2 Part to be brazed | 5 Reducing valve |
| 3 Taping | 6 Nitrogen |

8 REFRIGERANT PIPING

8.3 How to connect flare?

- See the following table for flare part machining dimensions.
- When connecting the flare nuts, apply refrigerant oil to the inside and outside of the flares and turn them three or four times at first. (Use only original oil from Airwell)



- 1 Piping union
- 2 Spanner
- 3 Flare nut
- 4 Torque wrench

Chart 21

- When loosening a flare nut, always use two wrenches in combination. When connecting the piping, always use a spanner and torque wrench in combination to tighten the flare nut.
- See the following table for tightening torque.
Applying too much torque may cause the flares to creak.

Tube diameter (mm)	Tightening torque, approximate	Tube thickness (mm)	Flare size A (mm)	Flare Shape
Φ6.35	14-18 N.m (140-180kgf.cm)	0.8	9.6~10.0	
Φ9.52	34-42 N.m (340-420kgf.cm)	0.8	12.8~13.2	
Φ12.7	49-61 N.m (490-610kgf.cm)	0.8	15.4~15.8	
Φ15.88	68-82 N.m (680-820kgf.cm)	1.0	19.3~19.7	
Φ19.05	100-120 N.m (1000-1200kgf.cm)	1.0	22.9~23.3	

Table 5

- After all the tubing has been connected, using nitrogen to perform a gas leak check.
- When without torque wrench, please take following method as standard when tightening flare nut with wrench, stop it and only rotate to angle stated as blow table when tightening torque increases quickly.

Tube diameter (mm)	Futher tightening angle	Spanner length (mm)
Φ6.35	60~90	About 150
Φ9.52	60~90	About 200
Φ12.7	30~60	About 250
Φ15.88	30~60	About 300
Φ19.05	20~35	About 450

Table 6

8 REFRIGERANT PIPING

8.4 How to handle stop valve?

- The stop valves for indoor-outdoor connecting piping are closed at shipment from the factory. Make sure to keep the valve open during operation. The names of parts of the stop valve are shown as following:

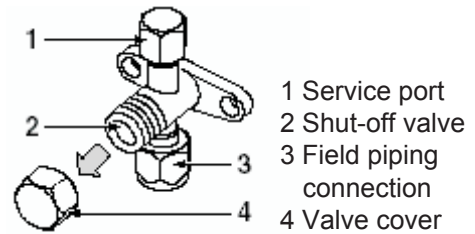


Chart 22

- Since the side boards may be deformed if only a torque wrench is used when loosening or tightening flare nuts, so always lock the shut-off valve with a wrench and then use a torque wrench.

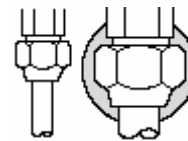
Do not place wrenches on the valve cover! This may result in a refrigerant leak.



Chart 23

1 Spanner
2 Torque wrench

- For cooling operation under low ambient temperature or any other operation under low pressure, apply silicon pad or similar to prevent freezing of the gas stop valve flare nut.



Silioon sealign pad
(Make sure there is no gap)

Chart 24

8.5 How to handle the valve cover?

- The valve cover is sealed where indicated by the arrow:
- After operating the valve, be sure to tighten the valve cover properly.
- Check for refrigerant leakage after tightening the cap.

Tightening torque	
Liquid pipe	13.5~16.5N.m
Gas pipe	22.5~27.5N.m

Table 7

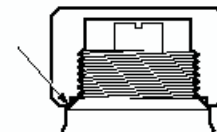
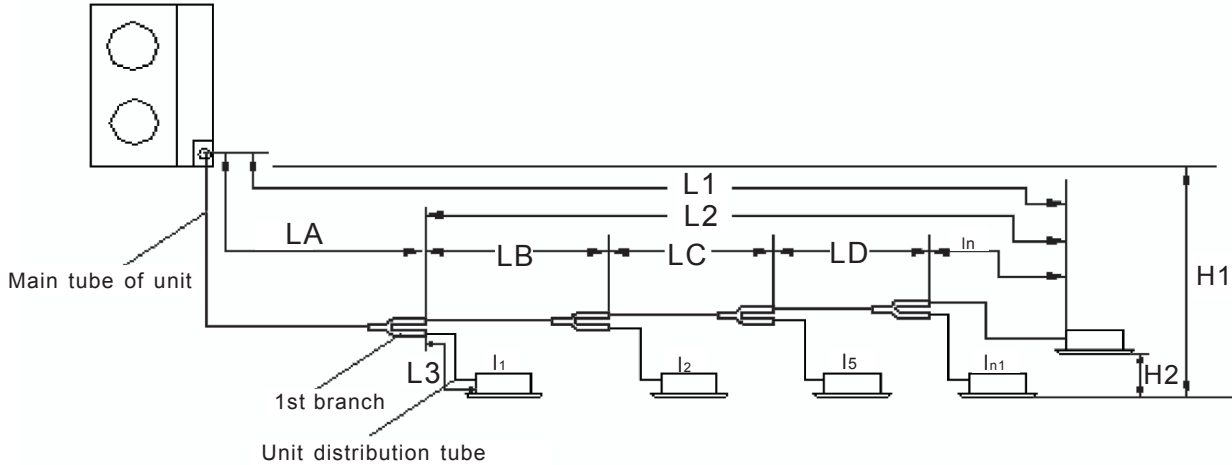


Chart 25

8 REFRIGERANT PIPING

8.6 Pipe selection and how to calculate



Caution: Do not use commercially available distribution joint for the liquid tubing. Be sure to use special R410A distribution joints which supplied by Airwell only. (Part No. 463750190)

Chart 26

- Ranges that apply to refrigerant tubing lengths and differences in installation heights.

Items	Marks	Contents		Length(m)
Allowable tubing length	L1	Max. tubing length	Actual tubing length	≤ 150
			Equivalent tubing length	≤ 175
	LA	Max. tubing length	≤ 80	
	$\Delta L(L2-L3)$	Difference between the max. length and the min. length from the NO.1 distribution joint	≤ 40	
	$l_1, l_2 \sim l_n$	Max. length of each distribution tube	≤ 30	
	$l_1 + l_2 + \dots + l_n - 1 + L1$	Total max. tubing length including length of each distribution tube (only narrow tubing)	≤ 200	
Allowable elevation difference	H1	When outdoor unit is installed higher than indoor unit	≤ 50	
		when outdoor unit is installed lower than indoor unit	≤ 40	
	H2	Max. difference between indoor units	≤ 15	

Table 8

- L1 – Maximum allowable tube length;
- L2 – Maximum tubing length from the first distribution;
- L3 – Minimum tubing length from the first distribution;
- LA – Main tube of the unit between the ODU and the first distribution;

8 REFRIGERANT PIPING

■ Main tubing size (LA):

Below Capacity(kW)	14(5hp)								
Over Capacity(kW)	0								
Main tubing size(LA)	<32			≥32			≥66		
ODU model	11.2	14	16	11.2	14	16	11.2	14	16
Gas tubing(mm)	Φ15.88	Φ15.88	Φ19.05	Φ19.05	Φ19.05	Φ22.23	Φ19.05	Φ19.05	Φ22.23
Liquid Tubing(mm)	Φ9.52			Φ9.52			Φ12.70		

Table 9 (1)

Below Capacity(kW)	20.2(7.2hp)								
Over Capacity(kW)	14.0(5hp)								
Main tubing size(LA)	<25			≥25			≥56		
ODU model	11.2	14	16	11.2	14	16	11.2	14	16
Gas tubing(mm)	Φ15.88	Φ15.88	Φ19.05	Φ19.05	Φ19.05	Φ22.23	Φ19.05	Φ19.05	Φ22.23
Liquid Tubing(mm)	Φ9.52			Φ9.52			Φ12.70		

Table 9 (2)

Note:1 When only one indoor unit is connected to a 6HP unit, connect Φ19.05 gas tubing up to just before the indoor unit, then use a socket or similar device (field supply) to change the tube diameter to Φ15.88 and connect the gas tube to the indoor unit.

2 Siphon setting:If the outdoor unit is installed higher than indoor unit, a siphon is needed every 5 meters in the passage of vertical gas tube. If the outdoor unit is installed lower than indoor unit, no need any siphon.

8 REFRIGERANT PIPING

8.6 Pipe selection and how to calculate

- Main tubing size after distribution (LB,LC...)

		LB,LC...	
Total capacity after distribution	Below KW	6(2.2hp)	20.2(7.2hp)
	Over KW	0	6(2.2hp)
Tubing size	Gas tubing(mm/inch)	Φ12.7(1/2")	Φ15.88(5/8")
	Liquid tubing(mm/inch)	Φ9.52(3/8")	

Table 10

- Indoor unit tubing connection (I1, I2...In-1)

		I _{n-1}
Indoor unit type	22,28,36,45,56	63,71,90,110
Gas tubing(mm/inch)	Φ12.7(1/2")	Φ15.88(5/8")
Liquid tubing(mm/inch)	Φ6.35(1/4")	Φ9.52(3/8")

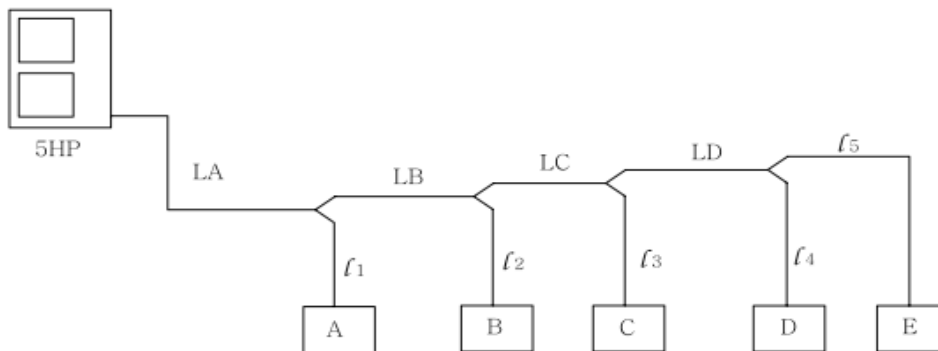
Table 11

- Required Copper Tubing Dimensions (unit: mm/inch)

Copper tubing	Outer diameter(mm/inch) Tube thickness	6.35(1/4")	9.25(3/8")	12.7(1/2")	15.88(5/8")	19.05(3/4")
	Tube thickness	0.8	0.8	0.8	1.0	1.0

Table 12

- Installation sample: one project install a VRF system, following is the sketch map:



- (1) Choose result of the indoor unit model:

Room number	Indoor unit model	Nominal capacity of indoor unit (KW)
A	SXV45	4.5
B	CKV22	2.2
C	CKV36	3.6
D	PNV56	5.6
E	PNV22	2.2

- (2) Calculate the actual capacity match ratio:

$$\text{Actual capacity match ratio} = \frac{4.5+2.2+3.6+5.6+2.2 \times 100\%}{14} = 129.3\%$$

It meets the capacity match ratio requirement range [50%,130%].

8 REFRIGERANT PIPING

Chose outdoor unit model as YAV140 (14KW) is the most economical.

(3) Pipe calculation and selection:

Pipe number	Actual length (m)	Sum of nominal capacity after every branch (KW)	Pipe select result Gas pipe/liquid pipe (mm)	According as
LA	80	18.1	Φ19.05/Φ12.70	Table 9
LB	10	13.6	Φ15.88/Φ9.52	Table 10
LC	10	11.4	Φ15.88/Φ9.52	Table 10
LD	20	7.8	Φ15.88/Φ9.52	Table 10
I 1	30	--	Φ12.7/Φ6.35	Table 11
I 2	5	--	Φ12.7/Φ6.35	Table 11
I 3	5	--	Φ12.7/Φ6.35	Table 11
I 4	10	--	Φ12.7/Φ6.35	Table 11
I 5	30	--	Φ12.7/Φ6.35	Table 11

(3) Additional refrigerant charge calculation (Please refer to chapter 9.6):

Liquid pipe size (mm)	Length (m)	Unit charge (g/m)	Total chage (kg)
Φ 6.35	80	25	2
Φ 9.52	40	55	2.2
Φ 12.7	80	120	9.6

Then the system need to add 13.8kg refrigerant R410A.

8.7 Additional refrigerant charge calculation

Additional refrigerant charge amount is calculated from the liquid tubing total length as follows.

Calculate the amount of refrigerant charge per meter according to liquid tubing size:

Liquid tubing size	Amount of refrigerant charge(g/m)
Φ 6.35	25
Φ 9.52	55
Φ 12.7	120

Table 13

*Always charge accurately using a scale of weighing ,so

The required additional refrigerant charge (kg)=(25Xa+55Xb+120Xc)X10⁻³

a: Total length of Φ6.35(mm) liquid tube

b: Total length of Φ9.52(mm) liquid tube

c: Total length of Φ12.7(mm) liquid tube

Following table offers the refrigerant charge amount at shipment (for outdoor unit):

Heat Pump Unit (kg)	112	140	160
	4.5	5.5	6.5

Table 14

8 REFRIGERANT PIPING

8.8 Leakage test

After the refrigerant piping has finished, execute a leakage test.

- (1) Connect a nitrogen gas bomb as shown in the figure blow, and apply pressure.
- (2) Please comply following steps to apply pressure:
STEP 1: Apply pressure 0.3Mpa (3.0kg/cm2G) for 3 minutes or more.
STEP 2: Apply pressure 1.5Mpa (15 kg/cm2G) for 3 minutes or more.
STEP3: Apply pressure 3.73Mpa (38kg/cm2G) for approx. 24 hours.
- (3) Check the changment of pressure after 24 hours.
- (4) Leaked position check: When a pressure down is detected in STEP1, STEP2, or STEP3,checking the leakage at the connecting points. Check leakage with hearing sense, feeler, foaming agent, etc,and perform re-brazing or re-tightening of flare if leakage is detected.

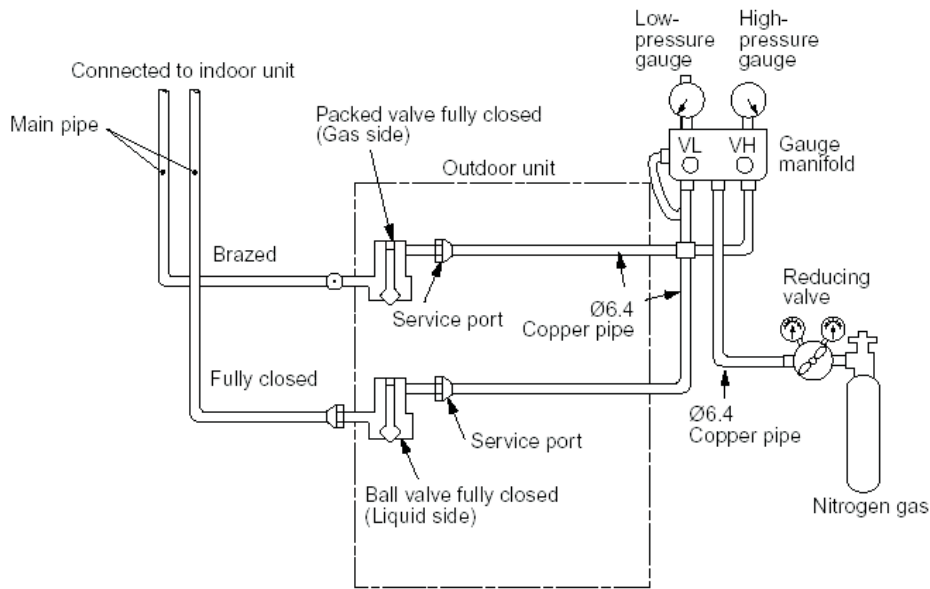


Chart 27

⚠ WARNING

- 1 Be sure to apply pressure to suction gas side, discharge gas side, and liquid side.
- 2 Never use "Oxygen", "Flammable gas" and "Noxious gas" in a leakage test.
- 3 If there is no leakage, the pressure will not go down. Considering the change of ambient temp, pressure drop by 0.01Mpa(0.1Kg/cm2G) per 10C is normal in 24 hours after pressure is applied.

8 REFRIGERANT PIPING

8.9 Vacuum process

⚠ WARNING

- For protection of the earth's environment, do not discharge the refrigerant gas in the air.
- Using a vacuum pump, eliminate the remaining air (nitrogen gas, etc.) in the unit. If gas remains, performance and reliability of the unit may be reduced.

After the leakage test, discharge nitrogen gas. Then connect the gauge manifold to the service ports at suction gas side, discharge gas side and liquid side, and connect the vacuum pump as shown in the following figure.

Be sure to perform vacuuming for suction gas side, discharge gas side and liquid side.

- Be sure to perform vacuuming from both suction gas side, discharge gas side and liquid side.
- Be sure to perform vacuuming from both liquid and gas sides at the same time.
- Use a vacuum pump with counter-flow preventive function so that oil in the pump does not back up in the pipe of the air conditioner when the pump has been stopped. (If oil in the vacuum pump enters in to the air conditioner with R410A refrigerant, an error may occur in the refrigeration cycle.)

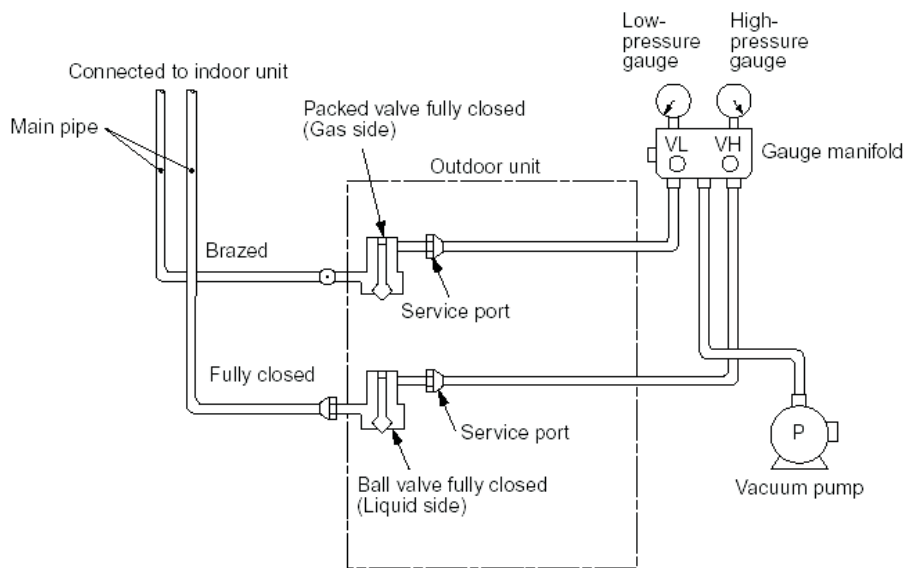


Chart 28

- Use a vacuum pump that has a high vacuum (below -755mmHg) and a large exhaust gas amount (over 40L/minute).
- Perform vacuuming for 2 or 3 hours though time differs due to pipe length. In this time, check all packed valves at liquid, gas and balance sides are fully closed.
- If vacuuming valve amount is not decreased to below -755mmHg even after vacuuming for 2 hours or more, continue vacuuming for 1 hour or more. If -755mmHg or less cannot be obtained by 3 hours or more vacuuming, detect and repair the leak.
- When the vacuuming valve has reached -755mmHg or less after vacuuming for 2 hours or more, close valves VL and VH on the gauge manifold fully. Stop the vacuum pump, leave it as it is for 1 hour and then check the vacuum does not change. If it does change then there may be a leak within the system.
- After the above procedure for vacuuming has finished, exchange the vacuum pump with a refrigerant cylinder and advance to the additional charging of refrigerant.

8 REFRIGERANT PIPING

8.10 Addition refrigerant charge

1. After vacuuming work, exchange the vacuum pump with the refrigerant bomb and then start the additional charging work of refrigerant.
2. Calculating the amount of additional refrigerant required.
3. When the system is charged with refrigerant at the factory, the amount of refrigerant needed for the pipes on site is not included. Calculate the additional amount required, and add that amount to the system. Please refer to '8.7 Additional refrigerant charge calculation'.

Charging of refrigerant:

- Keeping valve of the outdoor unit closed is sure to charge the liquid refrigerant into service port at liquid side.
- If the specified amount of refrigerant cannot be charged, open fully valves of outdoor unit at liquid and discharge/suction gas sides, operate the air conditioner in COOL mode under condition that valve at suction gas side is a little returned to close side, and then charge refrigerant into service port at suction gas side. In this time, choke the refrigerant slightly by operating valve of the bomb to charge liquid refrigerant. The liquid refrigerant may be charged suddenly, therefore be sure to charge refrigerant gradually.
- When refrigerant leaks and refrigerant shortage occurs in the system, recover the refrigerant in the system and recharge refrigerant newly up to the correct level.

8.11 Installation of drain pipe

CAUTION

- Drain line must be inclined downward (minimum 1/100).
- Drain line must be PVC pipes with 25 of extra diameter.
- Drain hose can be matched to spot constriction to cut with knife.
- Please do not put drain pipe directly to the sewer that may produce sulfur gas of a location that may produce bad smell.
- Please make sure no water leakage at interconnecting area of drain pipes.
- When drain pipe has to cross indoor, thermal insulation material (foam polyethylene with gravity of 0.03kg/m³ and minimum 9mm of thickness) from the market must be applied to wrap the pipe and stick adhesive tape on the surface to prevent invasion of air and condensation.
- If outdoor unit would work under cold, please insulate the drainage pipe.

9 FIELD WIRING

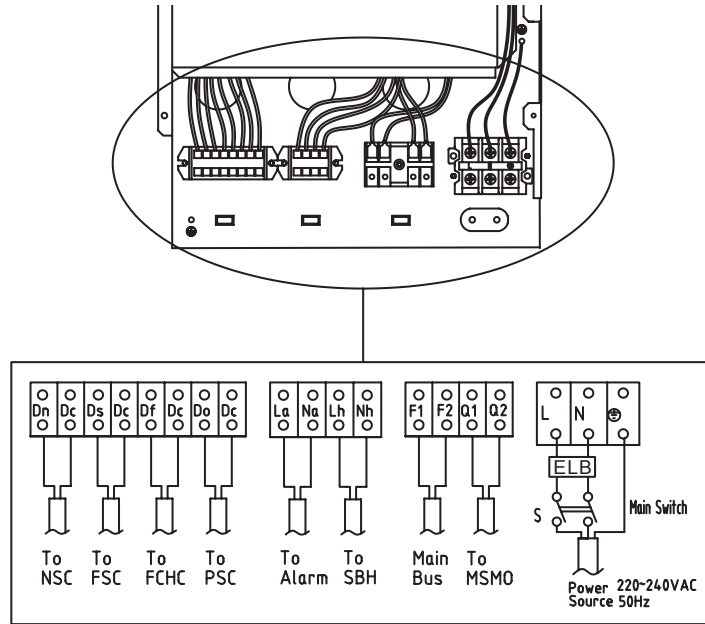


Chart 29

9.1 Requirement of the wiring

For VRF system, all indoor units must be supplied with one power supply (220V/50Hz 1 phase, please refer to 9.2.2). IDU power supply can either use the same power supply from outdoor unit(preferred) or use a separate power supply. For indoor unit wires requirement, please refer to indoor installation manual; outdoor unit wires requirement is as below:

(1)Power supply wire:

Outdoor unit model	Phase and Frequency	Volts	ELB	Wire section	Maximum length
112	Single phase-50Hz	220V	≥ 40A	6mm ²	25m
140	Single phase-50Hz	220V	≥ 40A	6mm ²	25m
160	Single phase-50Hz	220V	≥ 40A	6mm ²	25m

Table 15

ELB:Electricity leakage breaker.

(2)Communication wire:

Main communication wire	R/C communication wire
1.02mm twisted wires	1.02mm twisted wires
≤ 2000m	≤ 100m

Table 16

⚠ CAUTION

- 1 Suggest use shielded two twisted wires, If use shielded wires, the wires must be grounded;
- 2 Power wires and communication wires cannot be placed in one slot; they must be separated;

9 FIELD WIRING

9.2 Power supply wiring

9.2.1 Power supply for outdoor unit

- Unscrew and remove the service lid, please refer to chart 30.
- Press the power supply wiring under the wire clip.
- Connect the power supply wiring to the power supply terminal block.

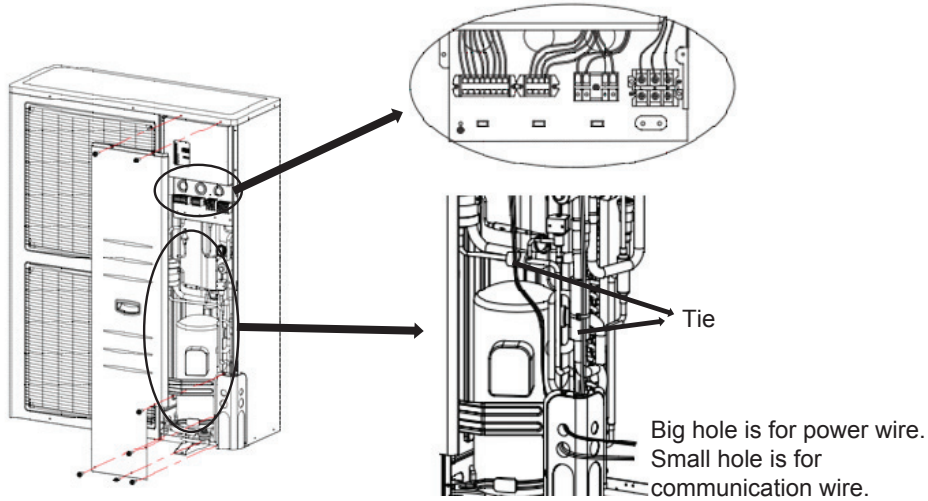


Chart 30

⚠ CAUTION

To avoid hot copper tube damaging wires, connecting wires going through the inner of outdoor unit are forbidden to touch any copper tube. Special passage has been designed in VRF outdoor unit for wiring, please follow the instruction in above drawing and fix the wires with ties.

9.2.2 Power supply for indoor unit

- Requirement of power supply wire connection for indoor units please refer to relevant installation manual.
- All indoor units of one refrigerant system must be supplied with one power supply.
- Every indoor unit should install one power breaker and one electricity leakage breaker in its power supply wire, meanwhile, one higher level power breaker and one higher level leakage breaker should be installed in the main power supply wire.
- Wiring example: (one outdoor unit connect with five indoor units)

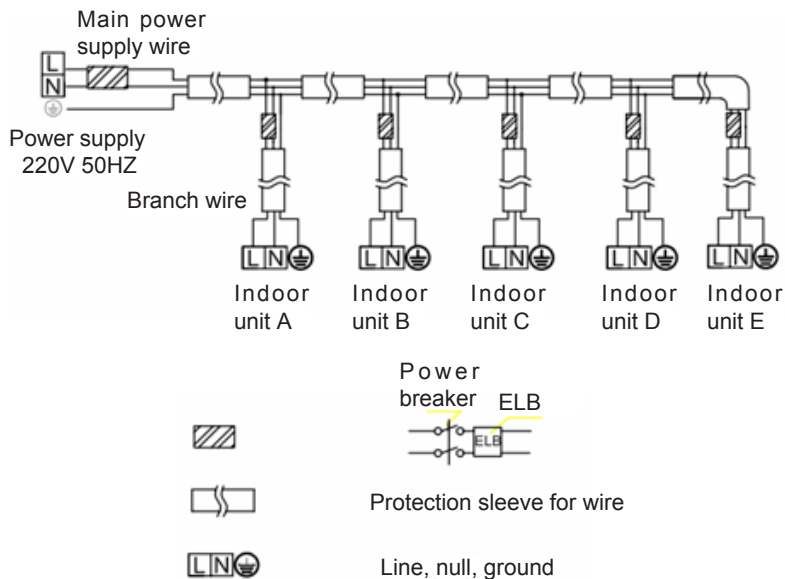


Chart 31

9 FIELD WIRING

⚠ CAUTION

Never shut off the sub power breaker of any indoor unit unless in emergency conditions, otherwise the whole VRF system cannot run normally.

9.3 Main communication wiring

Main communication wiring is connect the wire to the terminal block F1/F2 , it connect between outdoor unit and indoor unit or between the indoor units. For indoor units' connection please refer to the installation manual of indoor unit. For outdoor unit, connect the communication wire as following steps:

- Unscrew and remove the service lid, please refer to chart 30.
- Connect the communication wire to the terminal block F1,F2.
- Tie the wire tightly.

Main communication wiring supply two connecting types: L-link type and T-link type.

Example: (One outdoor unit connect with five indoor units)

(1) L-link type system:

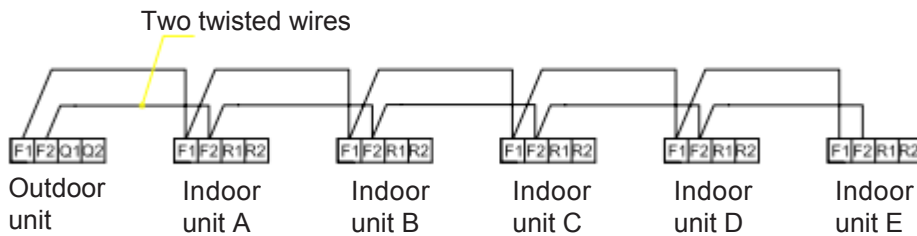


Chart 32

(2) T-link type system:

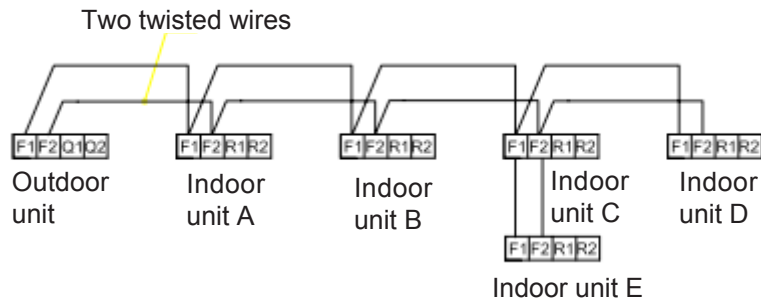


Chart 33

Following link type is not allowed!

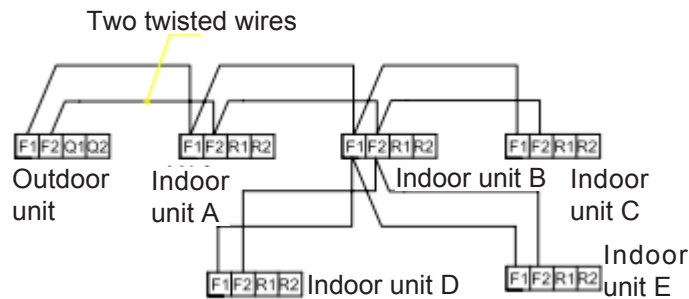


Chart 34

9 FIELD WIRING

9.4 R/C communication wiring

R/C communication wiring is connect the wire to the terminal block R1/R2 , it connect between the indoor units and must according to following rules:

- 1.Up to 16 indoor units can be connected in one R/C communication wiring;
- 2.All of indoor units must be in L link type;
- 3.Up to one LWC/LWCS can be connected in one indoor unit;
- 4.Up to two LWC/LWCS can be connected in one R/C communication wiring;
- 5.If a LWCS is connected in the R/C communication wiring, all the indoor units must be of the same one user address.
6. R/C communication wiring shall not be explored to sun light or UV.
7. R/C communication wiring can't be tied together with power supply wiring.

LWC:local wiring controller.

LWCS:simple version for local wiring controller.

Wiring example: one outdoor unit connect with five indoor unit

(1) Only one R/C communication wiring in a refrigerant system:

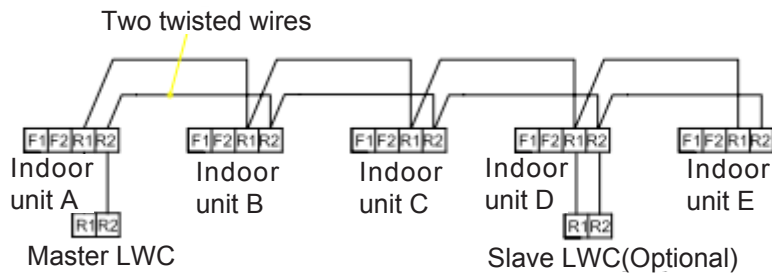


Chart 35

(2) More than one R/C communication wiring in a refrigerant system:

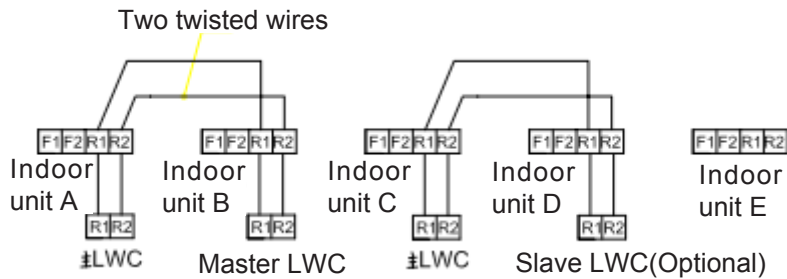


Chart 36

9 FIELD WIRING

9.5 Dry contact function introduction

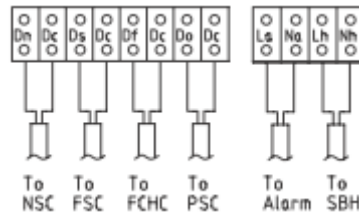


Chart 37

9.5.1 Dry contact with low voltage output definition

- NSC: Night mode; when these two pins (Dn and Dc) are connected, the unit will enter night mode, it is main for decrease the noise level (Optional).
- FSC: Forced shut off; when these two pins (Ds and Dc) are connected, the unit will be shut off. It can be used for emergency.(Optional)
- FCHC: Forced cool or heat mode; these two pins are available only when outdoor unit is in mode by dry contact set from HMI; Df and Dc open is forced cool mode; Df and DC short is forced heat mode (Optional).
- PSC: Power shedding mode. When these two pins (Do and Dc) are connected, the unit will enter power shedding mode. (Optional)

9.5.2 Dry contact with high voltage output definition:

- Alarm: Short La and Na, an alarm signal with 220V voltage will be sent out when there is fault in system;
- Base heater: Short Lh and Nh, 220v power will be supplied in some conditions.

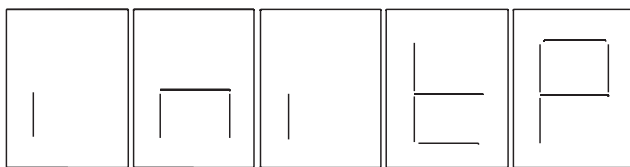
10 INSTALLATION SETTING THROUGH HMI

Outdoor controller board has a HMI (Human Machine Interface) which you can set the status of the outdoor unit. There are two important settings for installation — address setting procedure and outdoor control mode setting.

10.1. Address Setting Procedure

Before normal running, ITEST is a must process for address setting when the unit is powered on for the first time. ITEST has to be done only after all installation works are finished.

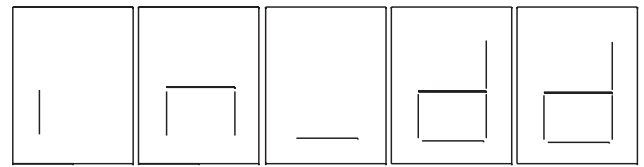
1. When outdoor is powered on for the first time, "initP" will start blinking on the HMI for about 30 seconds. (Chart 38)
2. And then, HMI will display "in_dd", which reminds you to go to ITEST for address setting. (Chart 39)
3. Long press MODE button for 5 seconds, then ODU will enter ITEST process and LED1~LED5 will blink "itEst". (Chart 40)
4. After about 3-6 minutes, ITEST process will be finished, and HMI will display as "noFbo". (Chart 41)
5. After that, you can run the VRF system normally.



LED1 LED2 LED3 LED4 LED5



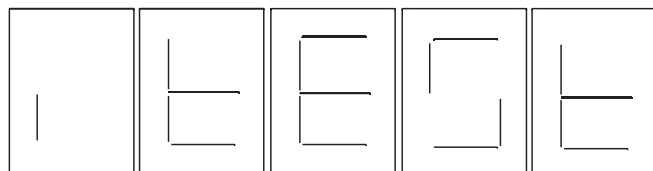
Chart 38



LED1 LED2 LED3 LED4 LED5



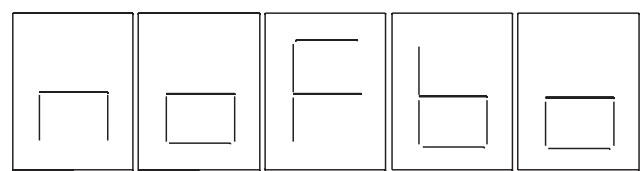
Chart 39



LED1 LED2 LED3 LED4 LED5



Chart 40



LED1 LED2 LED3 LED4 LED5



Chart 41

10 INSTALLATION SETTING THROUGH HMI

10.2 Outdoor Control Mode Setting:

1. There are four kinds of control mode — Mode by First win IDU, Mode (Forced Cooling/ Heating) by ODU Dry contact, Mode by OAT and Mode by Master IDU.

1. The default outdoor control mode is mode by first win IDU. To set different outdoor control mode, ODU should be at Stand By state and HMI's display is "noFbo". (Chart 41)

3. Press MODE button and you can see LED1~LED5 blinking "CLoCK", then press Up or DOWN button till you see LED1~LED5 blinking "ConMS" and press SET button to confirm the selection. (Chart 42)

4. Press MODE button to entry the next level. Then press UP or DOWN button to scroll as "MbFWi"> "Mbody"> "MboAt"> "MbMid". Press SET button to confirm the selection.

a. MbFWi — Mode by First win IDU (Chart 43)

b. Mbody — Mode (Forced Cooling/ Heating) by ODU Dry contact (Chart 44)

c. MboAt — Mode by OAT (Chart 45)

d. MbMid — Mode by Master IDU (Chart 46)

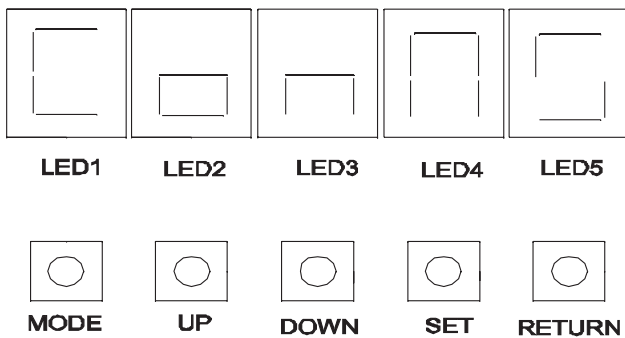


Chart 42

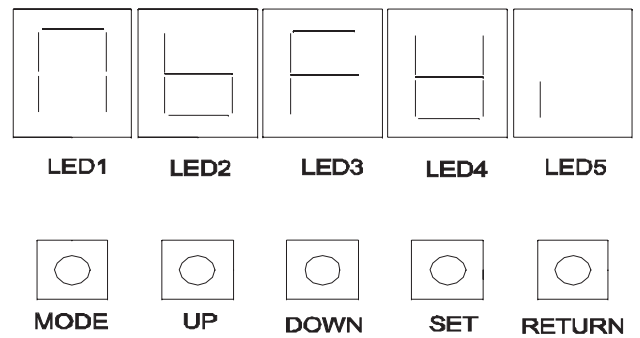


Chart 43

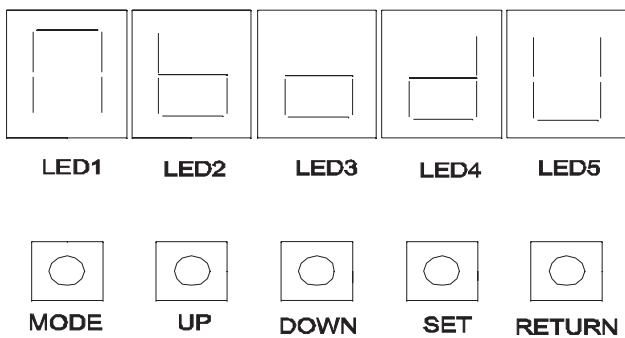


Chart 44

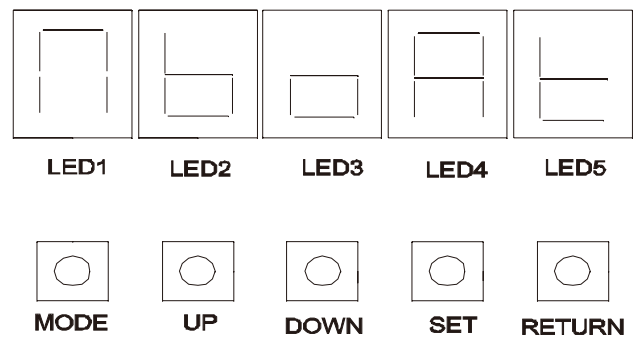


Chart 45

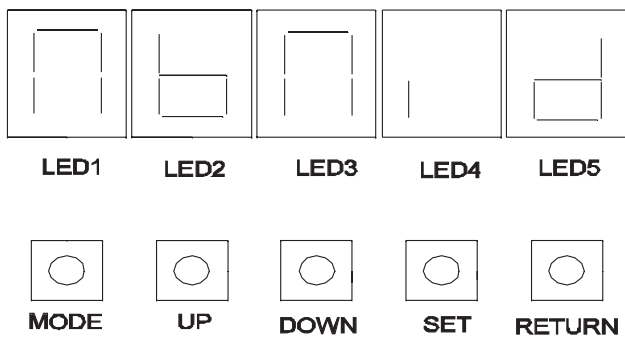
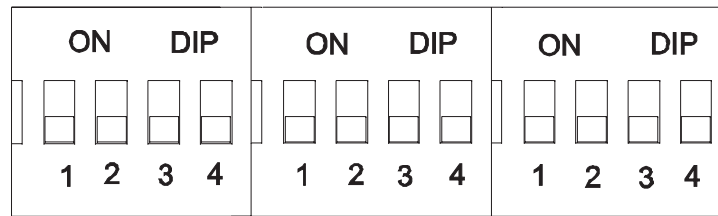


Chart 46

10 INSTALLATION SETTING THROUGH HMI

10.3 Dip switch introduction

1. There are twelve dip switches on main controller board. Refer to following picture:



From left to right: DS1, DS2 ... DS11, DS12

Chart 47

2. The first four dip switches define outdoor nominal capacity.
3. The second four dip switches define different compressor and driver .
4. According these eight switches, we can define the outdoor model.

Model	DS1	DS2	DS3	DS4	DS5	DS6	DS7	DS8	Compressor model	Driver model
A(4HP)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ANB33	Hitachi X-Y1
B(5HP)	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ANB33	Hitachi X-Y1
F(6HP)	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	Toshiba	Toshiba X-Y1

Table 17

5. Two dip switches (DS9,DS10) are used to define the LONG TUBE. The other two is for future use, default state is OFF. If the total tube length is more than 100 meters, we call it LONG TUBE.

Total tube length (m)	DS9	DS10
(0,100]	OFF	OFF
(100,200]	OFF	ON

Table 18

11 APPENDIX

11.1 Letter VS HMI display

Letter	Display	Letter	Display	Number	Display
A	A	n	n	1	1
b	b	o	o	2	2
C	C	P	P	3	3
d	d	q	q	4	4
E	E	r	r	5	5
F	F	S	S	6	6
G	G	T	T	7	7
H	H	U	U	8	8
i	i	v	v	9	9
J	J	W	W	0	0
K	K	X	NA		
L	L	y	y		
M	M	Z	Z		

11 APPENDIX

11.2 HMI display content explanation

	Display Content	Full Description
1	in itP	Initial process
2	in itS	Initial state
3	in_88	Initial state with fault occurs, "88" is fault code.
4	noF88	Normal off with fault occurs.
5	FS088	Force shut off with fault occurs.
6	FS0_.	Force shut off without any fault.
7	d iRCn	Diagnostic
8	itEST	Installation test.
9	LtStE	Lab test.
10	CtEST	(System refrigerant) charge test.
11	PtEST	Product line test.
12	PH888	Product line test in heating mode, "888" is compressor operating speed.
13	PC888	Product line test in cooling mode.
14	noFbo	Normal off caused by off command.
15	CLoCt	Clock
16	oDUPIU	Outdoor unit parameter monitor.
17	oDUPS	Outdoor unit parameter setting.
18	FC_88	Force cooling with fault occurs.
19	FC888	Force cooling without fault occurs.
20	FH888	Force heating with fault occurs.
21	FH_88	Force heating without fault occurs.
22	nC_88	Normal cooling state with fault happens.
23	nC888	Normal cooling state without fault.
24	nH_88	Normal heating state with fault happens.
25	nH888	Normal heating state without fault.
26	ConnS	(ODU) control mode setting.
27	nbodu	Mode (forced cooling/heating) by outdoor unit's dry contact.
28	nbFh ,	Mode by first win indoor unit.
29	nbOAt	Mode (according) by OAT
30	nbIn id	Mode (according) by master indoor unit.

11 APPENDIX

11.3 Protection Code

No.	Malfunction code	Malfunction name
1	A1	Mode conflict
2	A2	Water overflow
3	A3	No feedback from IFAN Motor
4	A4	IDU EEPROM Fault 2
5	A5	IDU No Main BUS communication fault
6	A6	IDU SPI Communication fault
7	A7	IDU local bus power manage circuit fault
8	A8	IDU local bus power management fault
9	A9	IDU No physical address
10	AA	IDU No user address
11	Ab	IDU No ODU physical address
12	AC	IDU Power up register failure
13	Ad-AF	For futures
14	b1	Defrost
15	b2	RAT sensor is disconnected
16	b3	RAT sensor is shorted
17	b4	ICIT sensor is disconnected
18	b5	ICIT sensor is shorted
19	b6	ICMT sensor is disconnected
20	b7	ICMT sensor is shorted
21	b8	ICOT sensor is disconnected
22	b9	ICOT sensor is shorted
23	bA	IDU EEPROM Fault 1
24	bb	IDU cold air proofed protection.
25	bC	IDU Bad HBS com. fault
26	bd	Overheating
27	bE -bF	For future
28	d1	Comp discharge protection
29	d2	High pressure protection for sensor
30	d3	High pressure protection for switch

11 APPENDIX

11.3 Protection Code

No.	Malfunction code	Malfunction name
31	d4	Low pressure protection for sensor
32	d5	Low pressure protection for switch
33	d6	OFAN Fault
34	d7	CDT sensor is disconnected
35	d8	CDT sensor is shorted
36	d9	High pressure sensor Fault
37	dA	Low pressure sensor Fault
38	db	ODU No main BUS com. fault
39	dc	ODU SPI Communication fault
40	dd	ODU No PA/UA matching table
41	dE	ODU power management circuit fault
42	dF	ODU EEPROM Fault 2
43	E1	ODU power management fault
44	E2	ODU No physical address
45	E3	Driver IC fault (Hitachi Driver)
46	E4	Over current protection (Hitachi Driver)
47	E5	Heat sink overheating (Hitachi Driver)
48	E6	Temperature unusual rise (Hitachi Driver)
49	E7	DCI Driver com. error (Hitachi Driver)
50	E8	Under voltage protection (Hitachi Driver)
51	E9	Over voltage protection (Hitachi Driver)
52	EA	Driver current detection circuit fault (Hitachi Driver)
53	Eb	Momentary power failure detection (Hitachi Driver)
54	EC	Driver Micro computer reset (Hitachi Driver)
55	Ed	Synchronism loss detection (Hitachi Driver)
56	EE	Set ODU dip switch in reserve range
57	EF	For future
58	F1	OAT sensor is disconnected
59	F2	OAT sensor is shorted
60	F3	OCIT sensor is disconnected
61	F4	OCIT sensor is shorted
62	F5	OCMT sensor is disconnected

11 APPENDIX

11.3 Protection Code

No.	Malfunction code	Malfunction name
63	F6	OCMT sensor is shorted
64	F7	OCOT sensor is disconnected
65	F8	OCOT sensor is shorted
66	F9	CST sensor is disconnected
67	FA	CST sensor is shorted
68	Fb	ODU EEPROM Fault 1
69	FC	Deicing
70	FD	Oil returning cycle
71	FE	ODU Bad HBS com. fault
72	FF	For future
73	H1	Physical address collision fault
74	H2	The total IDU normal capacity is out of range
75	H3~HF	For future
76	L1	IGBT short-circuiting (Toshiba driver)
77	L2	Position Detecting Circuit failure (Toshiba driver)
78	L3	Current sensor failure (Toshiba driver)
79	L4	Compressor motor lock (Toshiba driver)
80	L5	Compressor breakdown (Toshiba driver)
81	L6	Heat sink sensor abnormal temp. (Toshiba driver)
82	L7	Heat sink sensor short-circuiting/release (Toshiba driver)
83	L8	Case thermostat operation (Toshiba driver)
84	L9-LF	For future

