

INVERTER VRF SYSTEM (I SERIES-TOP DISCHARGE)



TRUST AIR CONDITIONING EQUIPMENT CO.
Prepared By: Engineering & R & D Department.

Installation

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توجه:

شرکت تراست حق تغییر مشخصات دستگاه ها را در جهت بهبود و ارتقای کیفیت برای خود محفوظ می دارد.

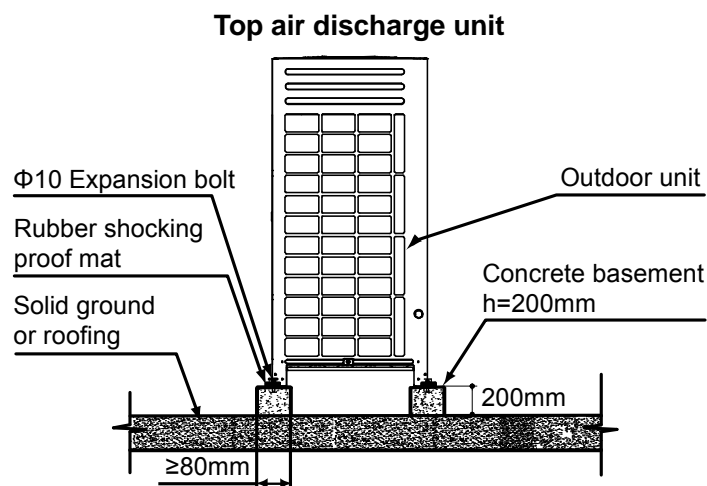
2015-03

1. Select installation position

- Ensure that the outdoor unit is installed in a dry, well-ventilated place.
- Ensure that the noise and exhaust ventilation of the outdoor unit do not affect the neighbors of the property owner or the surrounding ventilation.
- Ensure that the outdoor unit is installed in a well-ventilated place that is possibly closest to the indoor unit.
- Ensure that the outdoor unit is installed in a cool place without direct sunshine exposure or direct radiation of high-temp heat source.
- Do not install the outdoor unit in a dirty or severely polluted place, so as to avoid blockage of the heat exchanger in the outdoor unit.
- Do not install the outdoor unit in a place with oil pollution or full of harmful gas such as sulfurous gas.
- Do not install the outdoor unit in a place surrounded by salty air. (Except for the models with corrosion-resistant function)

2. Foundation for installation

- A solid, correct base can: Avoid the outdoor unit from sinking and avoid the abnormal noise generated due to base.
- Base types: Steel structure base or concrete base (See the figure below for the general making method)



Note: The key points to make basement:

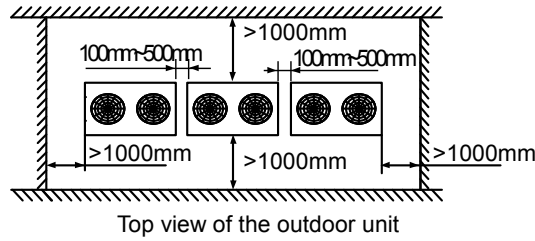
- The master unit's basement must be made on the solid concrete ground . Refer to the structure diagram to make concrete basement in detail, or make after field measurements.
- In order to ensure every point can contact equality, the basement should be on completely level.
- If the basement is placed on the roofing, the detritus layer isn't needed, but the concrete surface must be flat. The standard concrete mixture ratio is cement 1/ sand 2/ carpolite 4, and adds Φ10 strengthen reinforcing steel bar, the surface of the cement and sand plasm must be flat, border of the basement must be chamfer angle.
- Before construct the unit base, please ensure the base is directly supporting the rear and front folding edges of the bottom panel vertically, for the reason of these edges are the actual supported sites to the unit.
- In order to drain off the seeper around the equipment, a discharge ditch must be setup around the basement.
- Please check the affordability of the roofing to ensure the load capacity.
- When piping from the bottom of the unit, the base height should be no less than 200mm.

3. Installation space

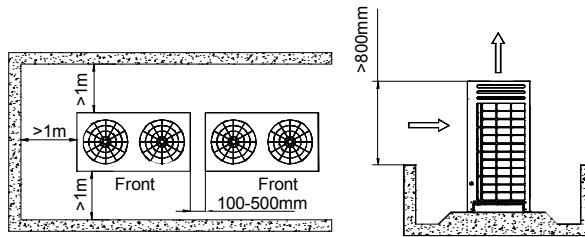
TMVV4I252(8) ~ TMVV4I450(16)

Unit: mm

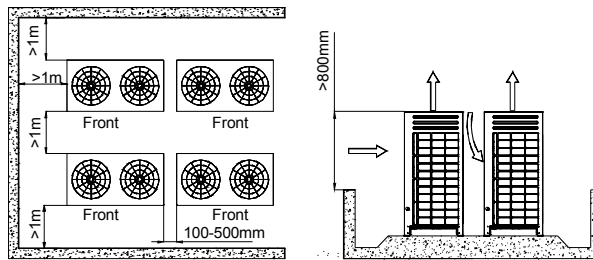
- ◆ When installing the unit, leave enough space for maintenance.



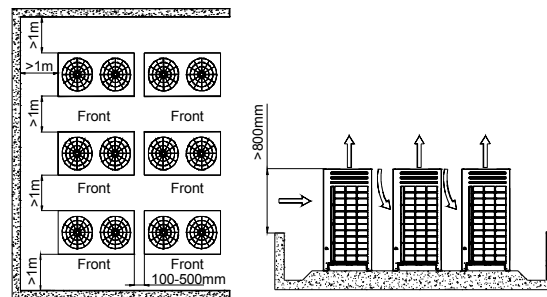
- ◆ When the outdoor unit is higher than the surrounding obstacle
- One row



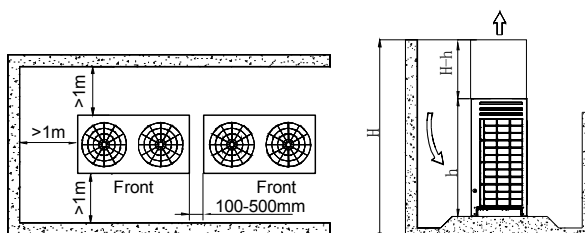
Two rows



More than two rows



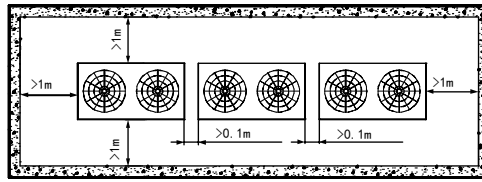
When the outdoor unit is lower than the surrounding obstacle, refer to the layout used when the outdoor unit is higher than the surrounding obstacle. However, to avoid cross connection of the outdoor hot air from affecting the heat exchange effect, please add an air director onto the exhaust hood of the outdoor unit to facilitate heat dissipation. See the figure below. The height of the air director is HD (namely H-h). Please make the air director on site.



TMVV4I560(20) ~ TMVV4I900(32)

Unit: mm

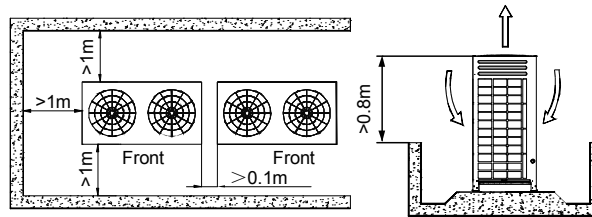
- When installing the unit, leave enough space for maintenance.



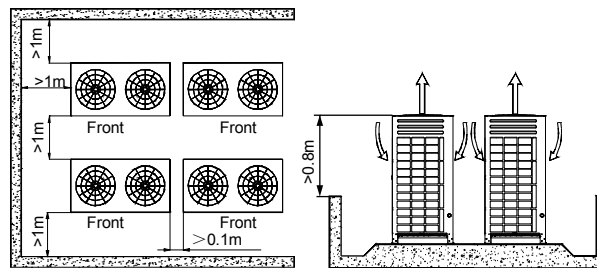
Top view of the outdoor unit

- When the outdoor unit is higher than the surrounding obstacle

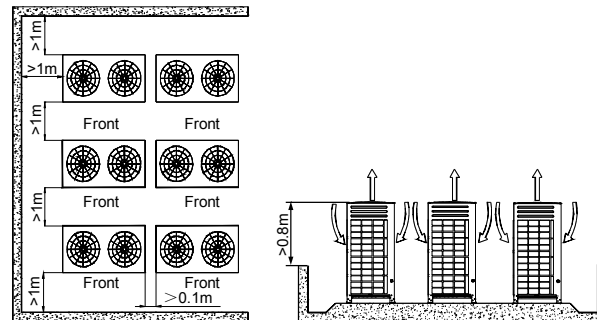
One row



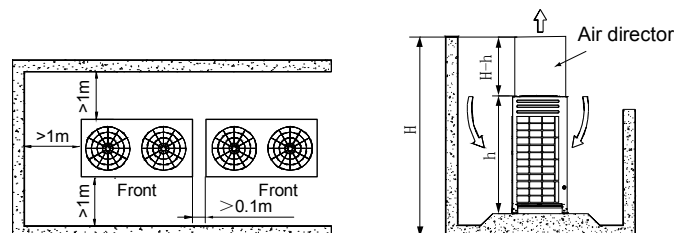
Two rows



More than two rows



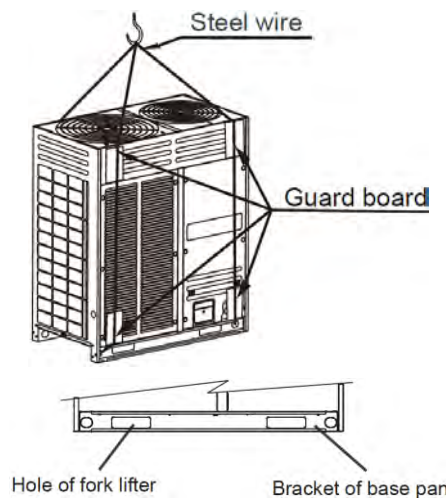
- When the outdoor unit is lower than the surrounding obstacle, to avoid cross connection of the outdoor hot air from affecting the heat exchange effect, please add an air director onto the exhaust hood of the outdoor unit to facilitate heat dissipation. See the figure below. The height of the air director is HD (namely H-h). Please make the air director on site.



4. Lifting method

- Do not remove any package before the hoisting. Use two ropes to hoist the machine, keep the machine in balance, and then raise it safely and steadily. In case of no package or if the package is damaged, use plates or packing material to protect it.
- When conveying and hoisting the outdoor unit, keep it upright, ensure that the slope does not exceed 30°, and keep safety in mind.
- Steel wire can be used for conveying:
- Use 4 steel wires of the size above $\Phi 6\text{mm}$ to convey the outdoor unit. Pay attention to the gravity center and prevent sliding and tip-over of the outdoor unit.
- In order to prevent scratch and deformity the outdoor unit, apply a guard board to the surface of contact between the steel wire and the air conditioner.
- Remove the cushion for use in the transporter after finishing the transport.

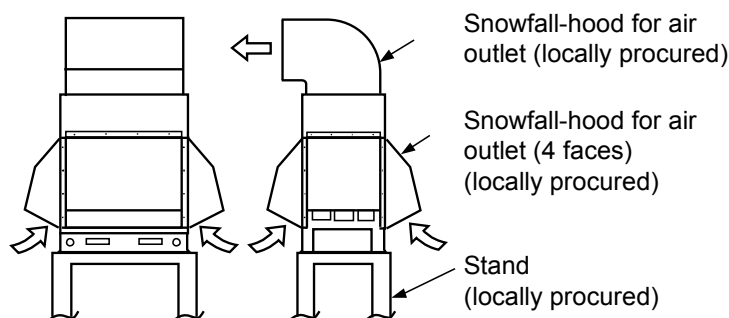
Fork lifter can be used for conveying.



5. Set the snow-proof facility

Installation in a snowfall area

1. Install the outdoor unit on a higher foundation than the snowfall or set up a stand to install the unit so that snowfall will not affect the unit.
 - ♦ Set up a stand higher than the snowfall.
 - ♦ Apply an angled structure to the stand so that drainage will not be prevented. (Avoid using a stand with a flat surface.)
2. Mount a snowfall-hood onto the air inlet and the air outlet.
 - ♦ Leave enough space for the snowfall-hood so that it will not be an obstacle for the air inlet and the air outlet.

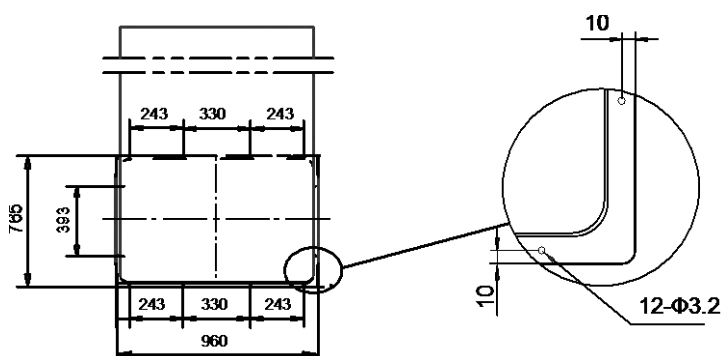
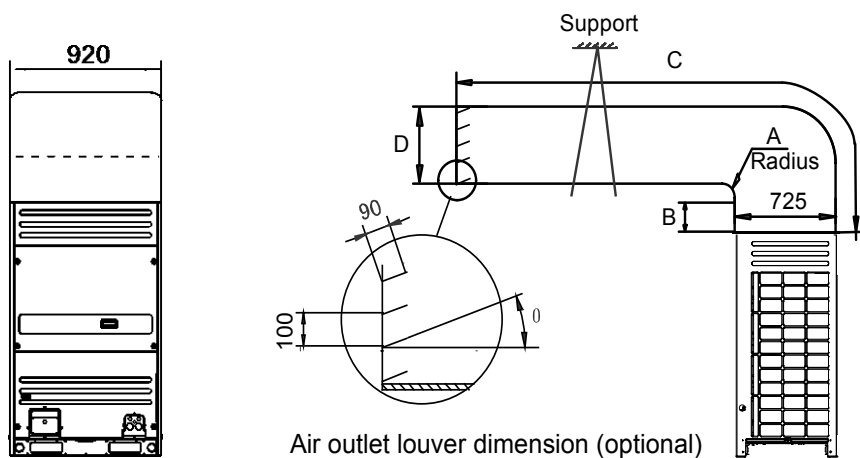


6. Air ventilation assembly installation

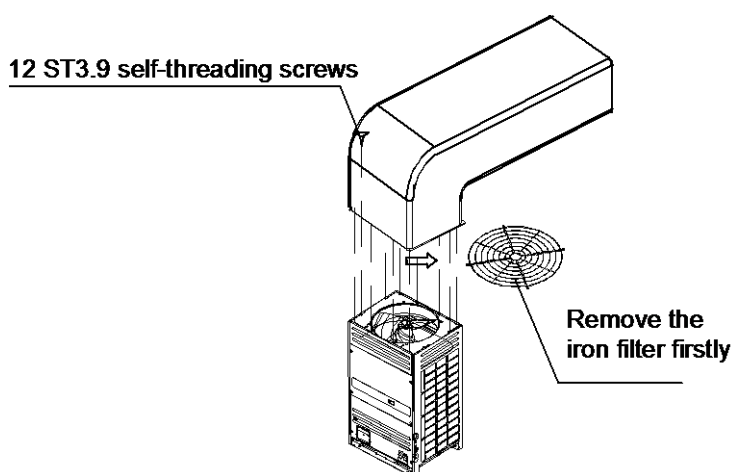
The ventilation assembly is provided at the field installation. When installing, please take off the mesh cover firstly, and then install the unit as the following method.

TMVV4I252(8)/TMVV4I280(10)

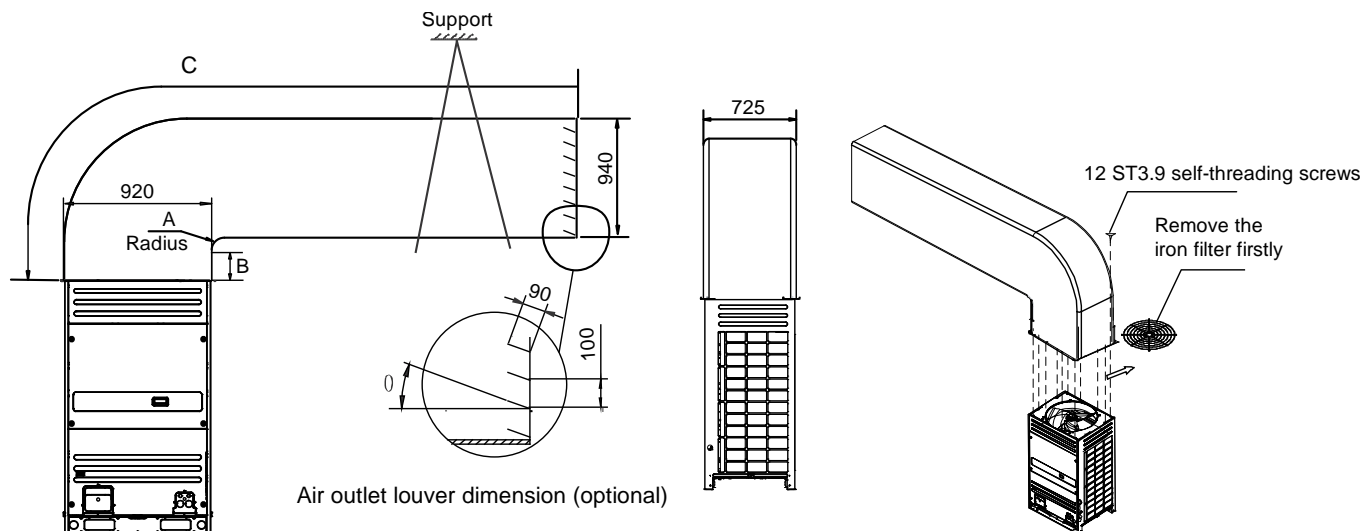
Example A



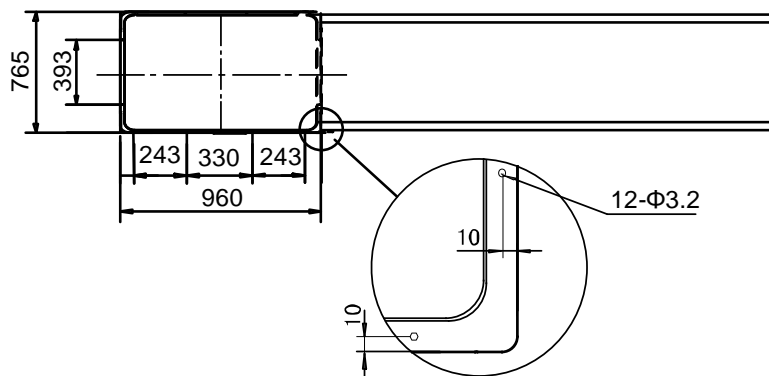
Size (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 8000$
D	$725 \leq D \leq 760$
θ	$\theta \leq 15^\circ$



Example B

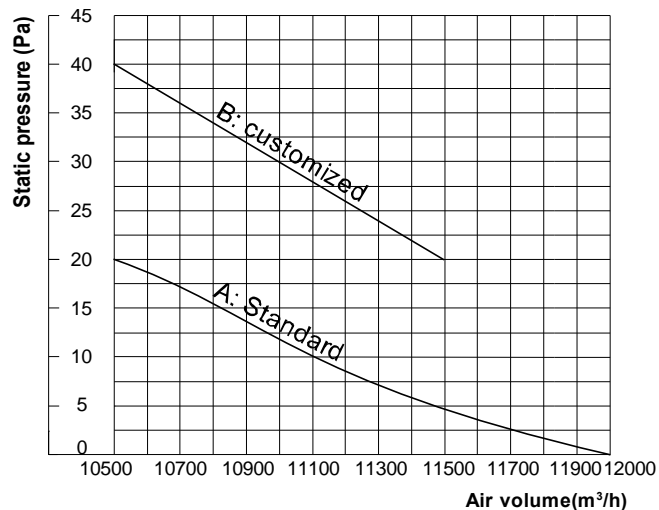


Air outlet louver dimension (optional)



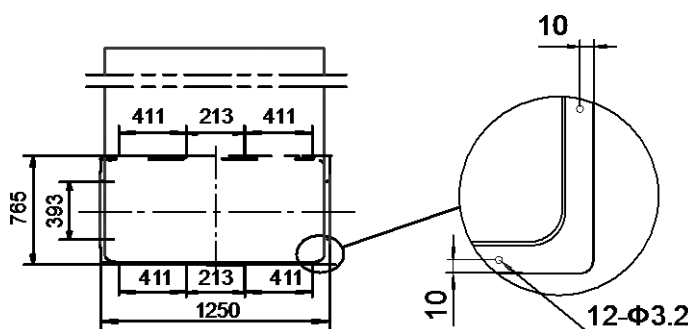
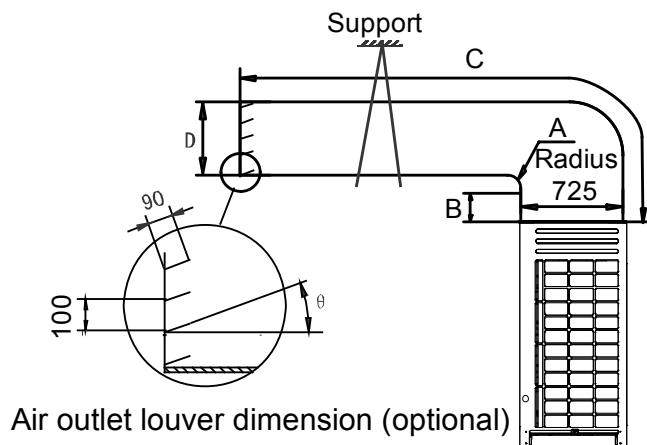
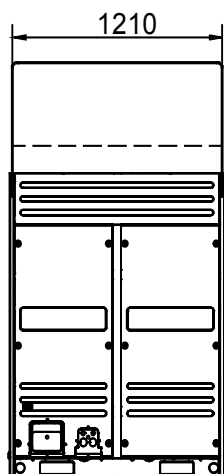
Curve diagram of static pressure, air flow volum.

Size (mm)	
A	A ≥ 300
B	B ≥ 250
C	C ≤ 8000
θ	θ ≤ 15°



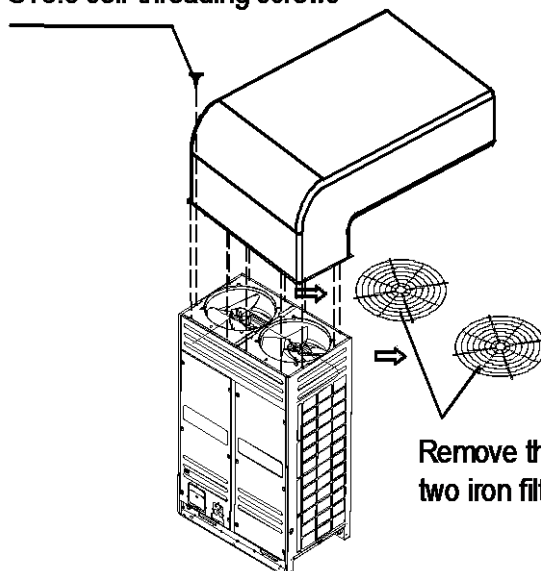
TMVV4I335(12) ~ TMVV4I450(16)

Example A

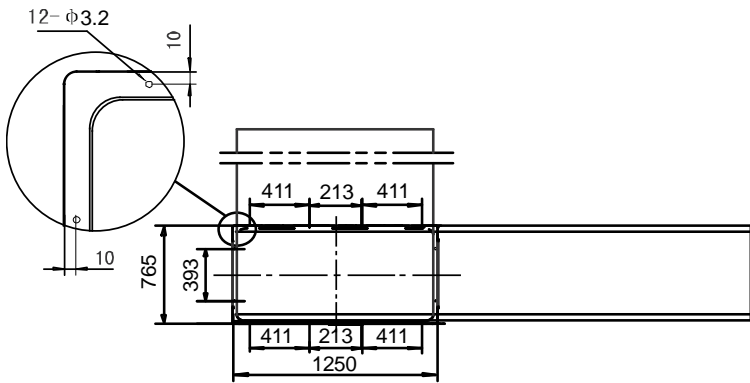
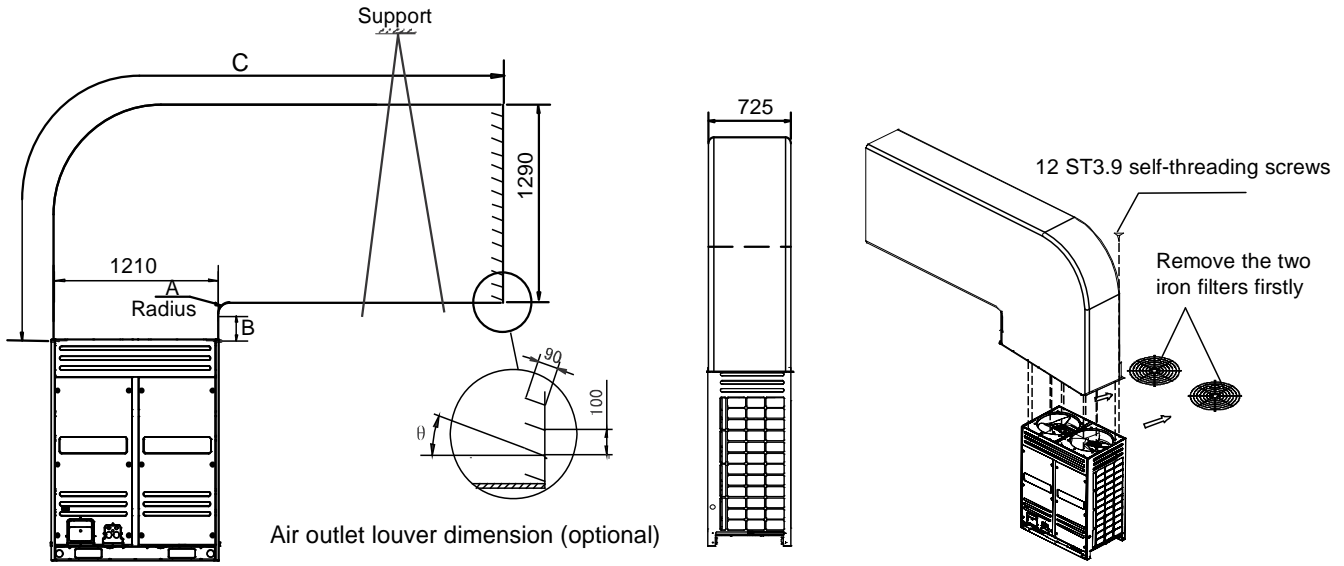


Size (mm)	
A	A ≥ 300
B	B ≥ 250
C	C ≤ 8000
D	725 ≤ D ≤ 760
θ	θ ≤ 15°

12 ST3.9 self-threading screws

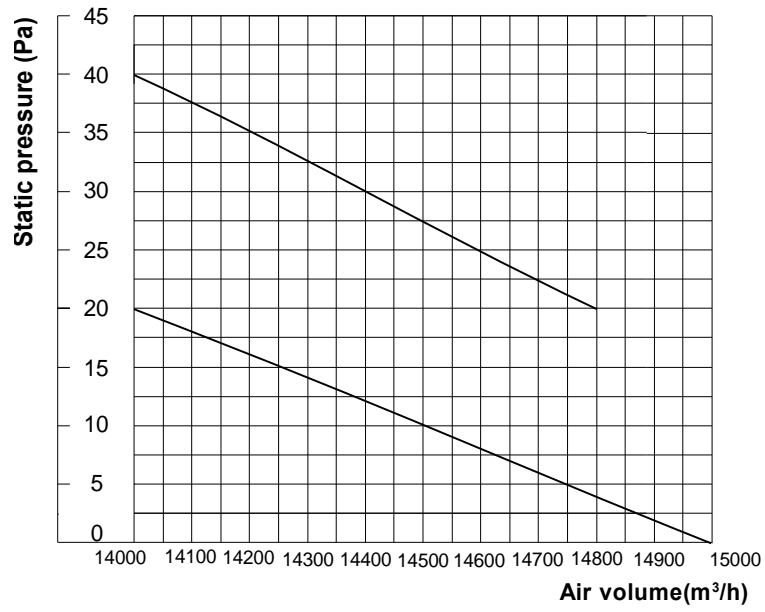


Example B

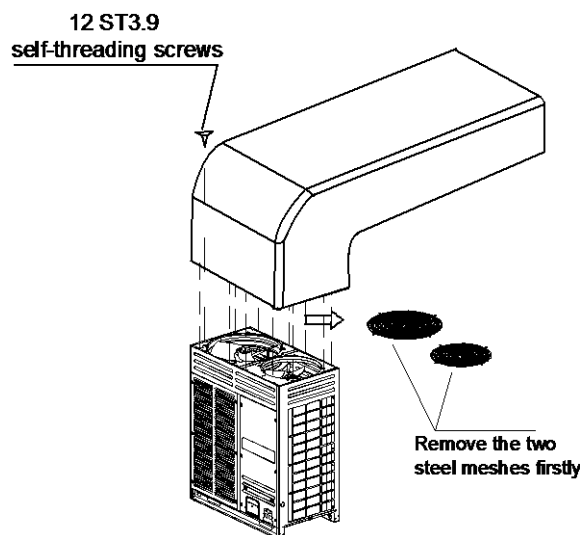
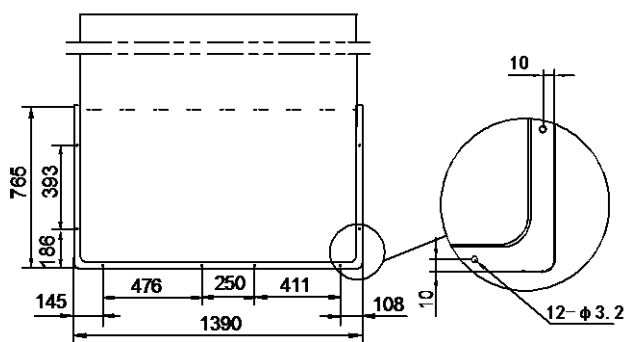
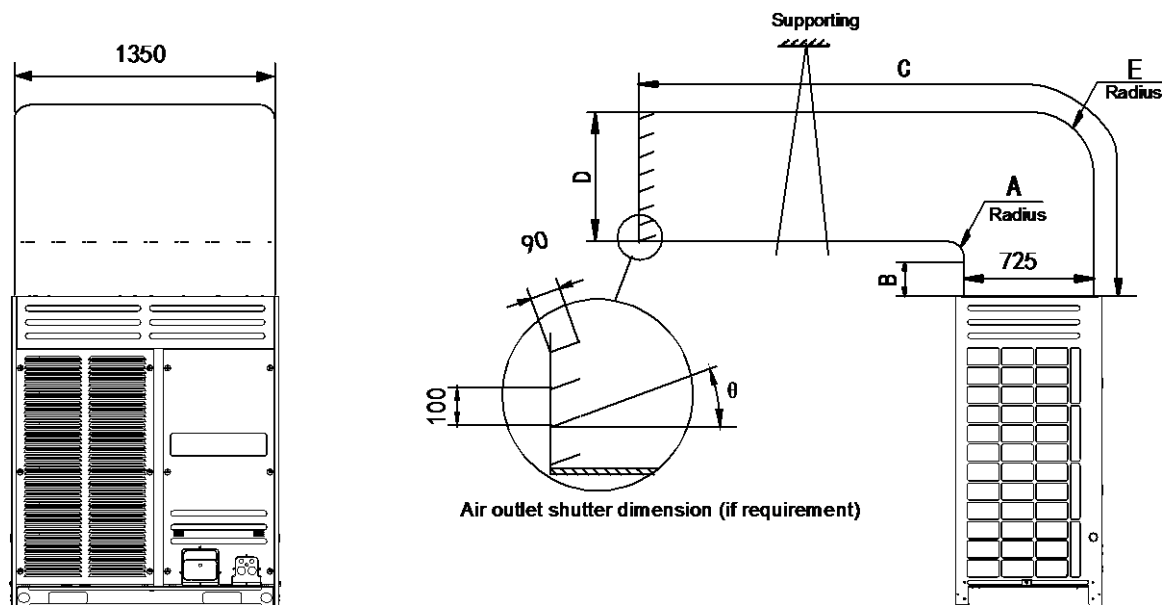


Size (mm)	
A	A ≥ 300
B	B ≥ 250
C	C ≤ 8000
θ	θ ≤ 15°

Curve diagram of static pressure, air flow volumn.



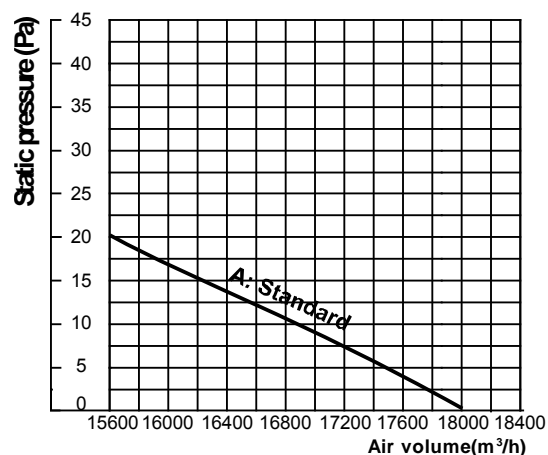
TMVV4I560(20)



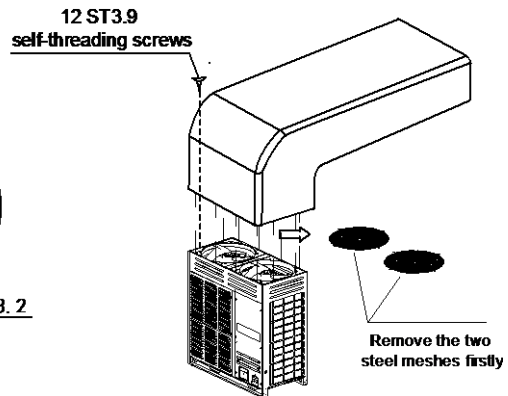
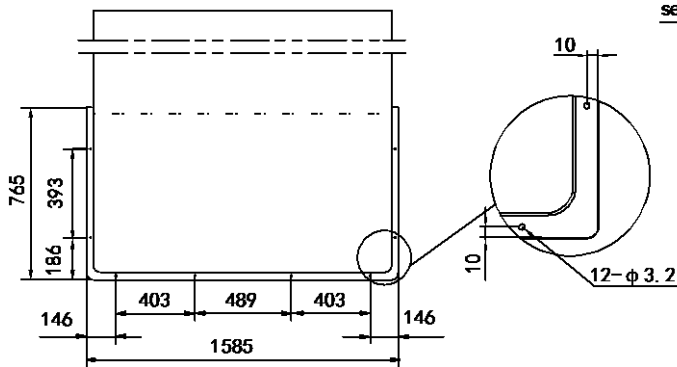
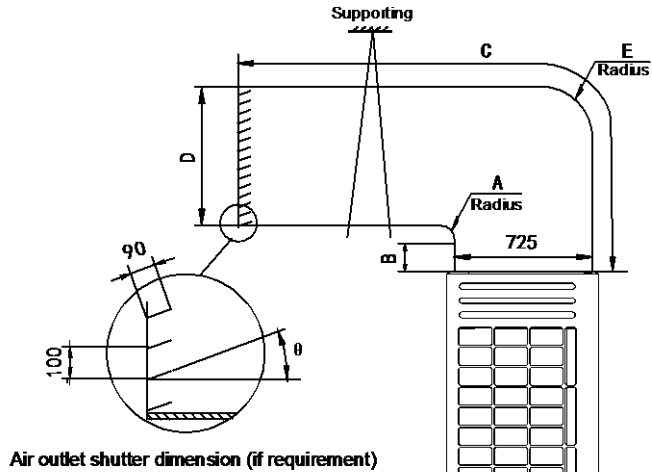
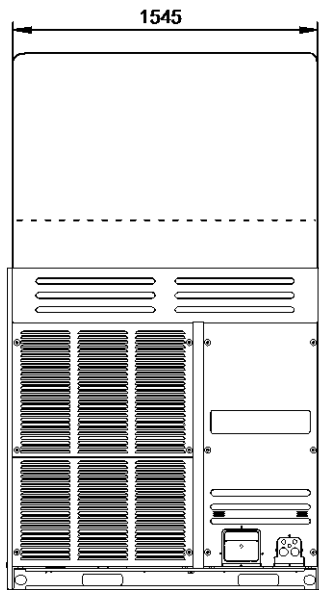
Size (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$725 \leq D \leq 760$
E	$E = A + 725$
θ	$\theta \leq 15^\circ$

Static pressure	Note
0Pa	Factory default
0~20Pa	Remove the steel meshes, connect the air deflector pipe within 3 meters (length of C)
Over 20Pa	Need to be customized

Curve diagram of static pressure & air flow volume.



TMVV4I615(22), TMVV4I670(24)



Size (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$725 \leq D \leq 760$
E	$E = A + 725$
θ	$\theta \leq 15^\circ$

Static pressure	Note
0Pa	Factory default
0~20Pa	Remove the steel meshes, connect the air deflector pipe within 3 meters (length of C)
Over 20Pa	Need to be customized

Note:

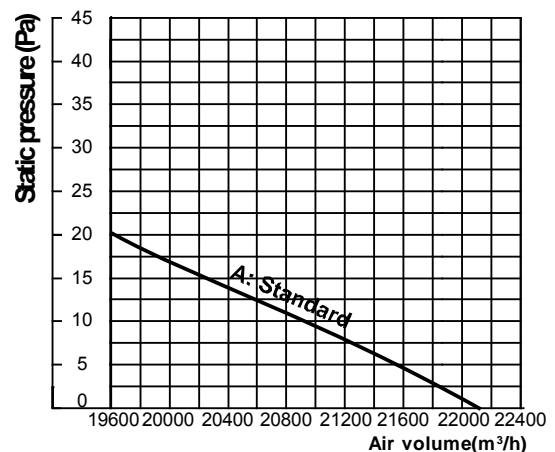
Before install the ventilation assembly, please remove the steel meshes firstly, otherwise, they would decrease the air supply volume.

1. Increase shutters would decrease the air supply volume, as well as cooling (heating) capacity and energy efficiency would be decreased, the larger angle of the shutter, the more effect to the unit. So we don't recommend to apply shutter, if necessary to apply shutter, please ensuring the angle should not over than 15° .

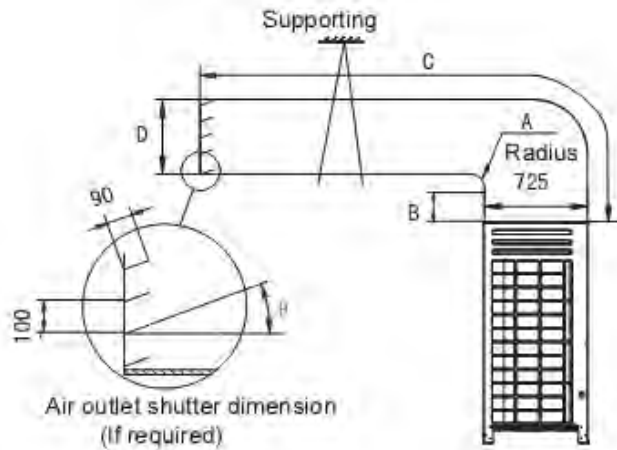
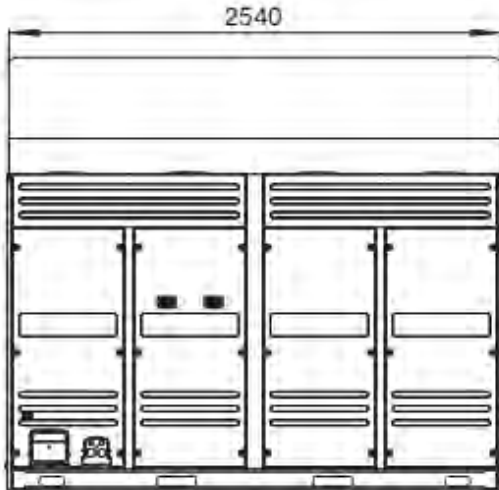
2. The bending place at ventilated duct should be not more than 1 (show in above figure), otherwise, operation malfunction would be caused.

3. Install the flexible connector between the unit and the air deflector pipe to avoid vibration noise.

Curve diagram of static pressure & air flow volume.



TMVV4I730(26) ~ TMVV4I900(32)



Size (mm)	
A	A ≥ 300
B	B ≥ 250
C	C ≤ 10000
D	600 ≤ D ≤ 760
θ	θ ≤ 15°

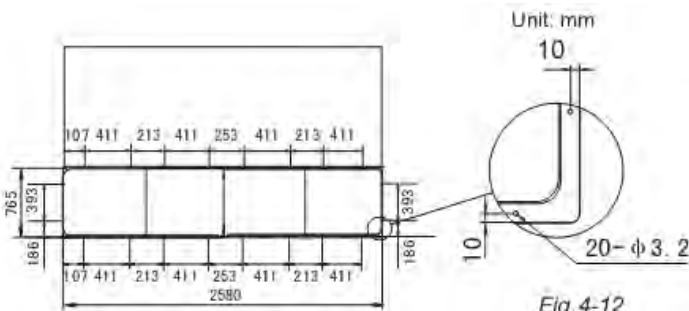
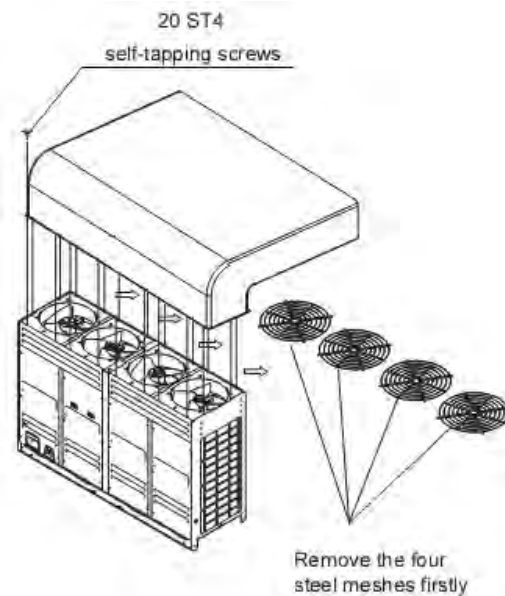
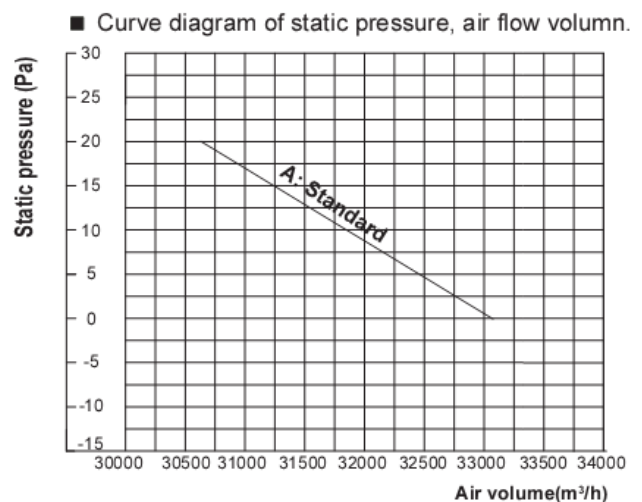


Fig. 4-12



Static pressure	Note
0Pa	Factory default
0~20Pa	Remove the steel meshes, connect the air deflector pipe within 3 meters (length of C)
Over 20Pa	Need to be customized

Curve diagram of static pressure & air flow volume.



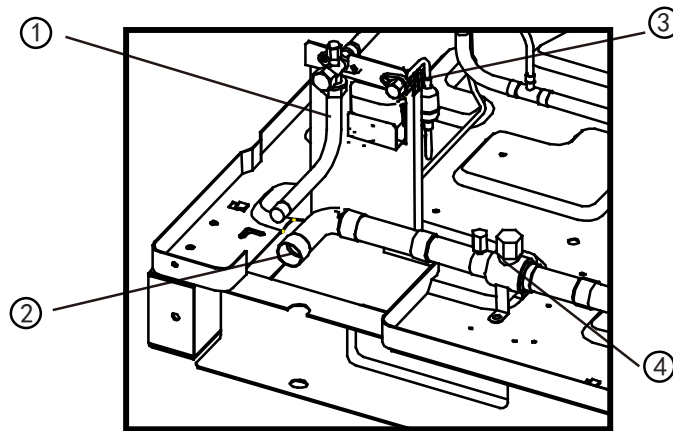
Note:
Before install the ventilation assembly, please remove the steel meshes firstly, otherwise, they would decrease the air supply volume.

1. Increase shutters would decrease the air supply volume, as well as cooling (heating) capacity and energy efficiency would be decreased, the larger angle of the shutter, the more effect to the unit. So we don't recommend to apply shutter, if necessary to apply shutter, please ensuring the angle should not over than 15°.
2. The bending place at ventilated duct should be not more than 1 (show in above figure), otherwise, operation malfunction would be caused.
3. Install the flexible connector between the unit and the air deflector pipe to avoid vibration noise.

7. Refrigerant piping installation

7.1 Valve instruction

25.2/28/33.5/40/45kW



1	Connect the liquid pipe (accessory, field installation)
2	Connect the gas pipe
3	Gauge point
4	Low pressure float valve

56/61.5/67kW

Unit (mm)

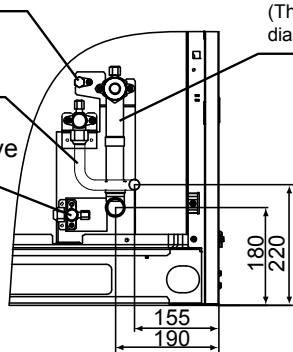
Gauge point

Lo. pressure
Detect the pressure
Refrigerant replenishment
vacuumizing

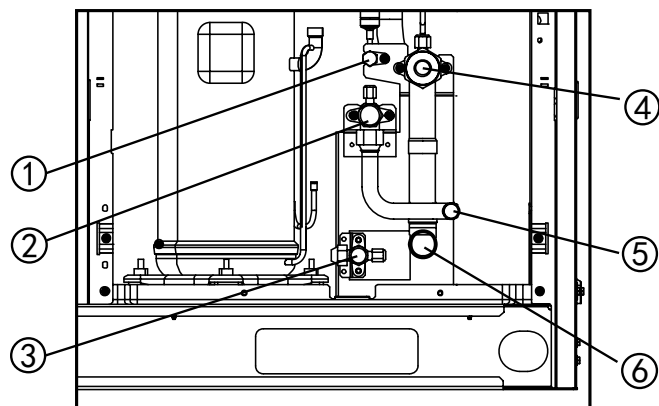
Liquid side
(The connected pipe
diameter is $\Phi 19.1$)

Oil discharge valve
Lo.pressure
Detect and discharge
the refrigeration oil

Gas side
(The connected pipe
diameter is $\Phi 31.8$)



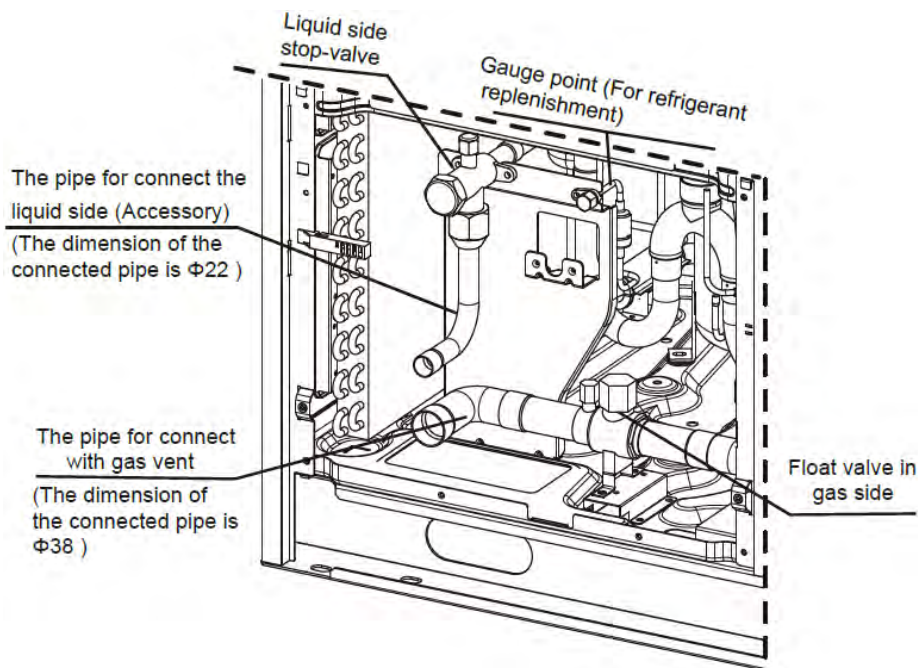
R1,R2 section view



1	Gauge point (Low pressure valve, for detecting the pressure/Refrigerant replenishment/vacuuming)
2	Liquid side shut off valve (High pressure valve)
3	Oil discharge valve (Low pressure, for detecting and discharging the refrigeration oil)
4	Gas side shut off valve (Low pressure valve)
5	Connect to liquid pipe (Need to be installed in field)
6	Connect to gas pipe (Need to be installed in field)

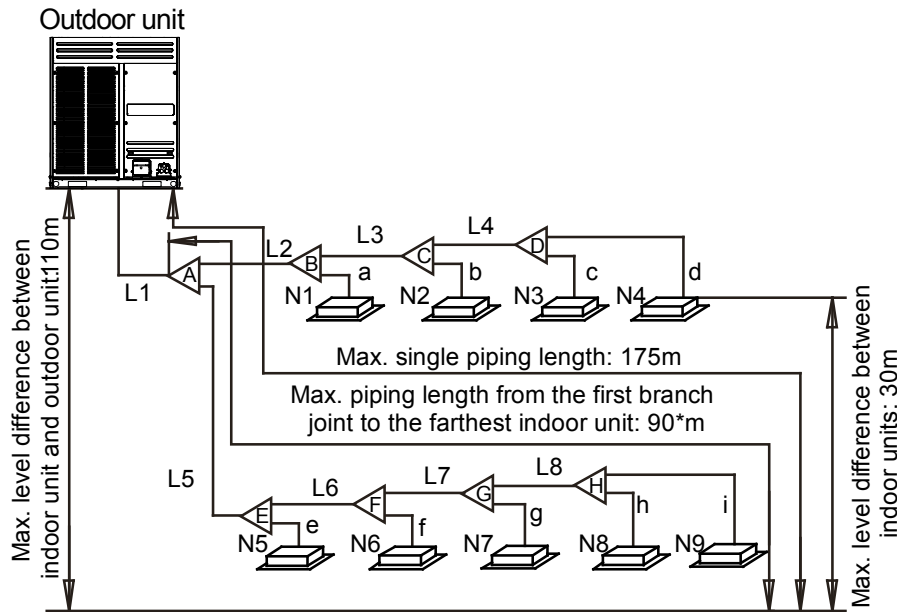
73/78.5/85/90kW

Unit (mm)



Model	Liquid pipe	Gas pipe
73/78.5/85/90kW	Φ22.2	Φ38.1

7.2 Refrigerant piping length permitted value



Piping length		Permitted value			Piping	
		25.2~45kW	56-67kW	73-90kW		
Piping length	Actual total piping length	≤350m ^{*1}	≤1000m ^{*2}		*1:L1+L2+L3+L4+L5+L6+L7+L8+L9+a+b+c+d+e+f+g+h+i+j *2:L1+(L2+L3+L4+L5+L6+L7+L8)×2+a+b+c+d+e+f+g+h+i (refer to note 1)	
	Maximum single piping length	Actual length	≤150m	≤175m	≤165m	L1+L5+L6+L7+L8+i (refer to note 2)
		Equivalent length	≤175m	≤200m	≤190m	
	Maximum piping length from the first branch joint to the farthest indoor unit	≤40m	≤40/90*m		L5+L6+L7+L8+i (refer to note 3)	
Level difference	Level difference between indoor unit and outdoor unit	Outdoor unit up	≤70m	≤70m	≤50m	(refer to note 4)
		Outdoor unit down	≤70m	≤110m	≤90m	(refer to note 5)
	Level difference between indoor units	≤15m	≤30m		/	

Note:

The indoor units should be installed as possible as equal in the both sides of the U-shape branch joint.

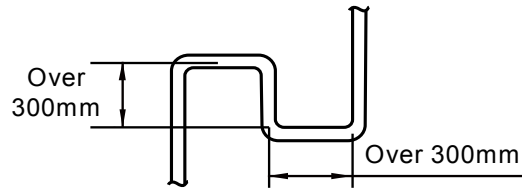
- When counting the total piping length, the actual length of above distribution pipes must be doubled. (Expect the main pipe and the distribution pipes): Total piping length=1+(L2+L3+L4+L5+L6+L7+L8+L9)×2+a+b+c+d+e+f+g+h+i+j≤1000m
- The equivalent length of each branch pipe is 0.5m.
- The allowable piping length from the first branch joint to the farthest indoor unit should be equal to or less than 40m, but when the following conditions are all met, the allowable length can be extended to 90m.
 - The piping length from each indoor unit to the nearest branch joint assembly should be less than 40m. (a, b, c, ...j≤40m)
 - The length difference between (the outdoor unit to the farthest indoor unit) and (the outdoor unit to the nearest indoor unit) ≤ 40m. [(L1+L5+L8+L9+j)-(L1+L2+L3+a)]≤40m
 - It needs to increase all the pipe diameters of the main distribution pipes which between the first and the last branch joint assembly. (Please change the pipe diameter at field) If the pipe diameter of the main slave pipe is the same as the main pipe, then it is no need to be increased.

When: 40m<L5+L8+L9+j≤90m L2,L3,L4,L5,L6,L7,L8,L9 need to increase the pipe diameter of the distribution pipe.

Increasing size as the following:

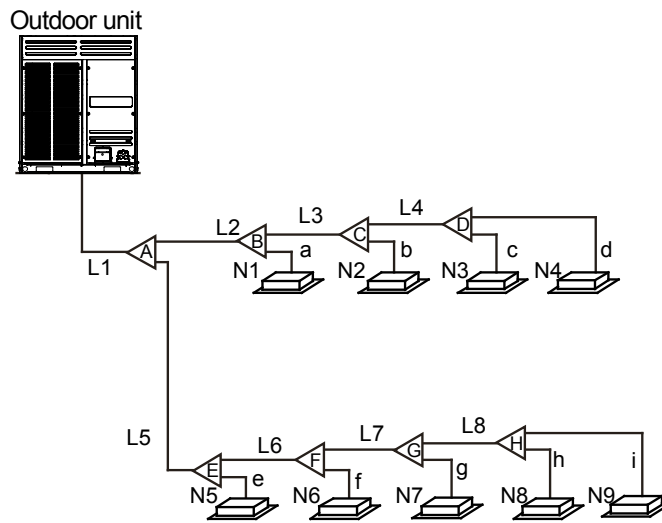
Φ9.5→Φ12.7	Φ12.7→Φ15.9	Φ15.9→Φ19.1	Φ19.1→Φ22.2	Φ22.2→Φ25.4	Φ25.4→Φ28.6
Φ28.6→Φ31.8	Φ31.8→Φ38.1	Φ38.1→Φ41.3	Φ41.3→Φ44.5	Φ44.5→Φ54.0	

4. When the outdoor unit is higher than indoor units and the level difference is over 20m, it is recommended to set an oil return bend every 10m in the gas pipe of the main pipe, the specification of the oil return bend refers to below figure.



5. When the outdoor unit is lower than indoor units and the level difference is more than 40m, the liquid pipe of the main pipe need to increase one size.

7.3 Refrigerant piping selection



● Pipe name

Main pipe	L1
Indoor unit main pipe	L2, L3, L4, L5, L6, L7, L8
Indoor unit branch pipe	a, b, c, d, e, f, g, h, i
Indoor unit branch pipe assembly	A, B, C, D, E, F, G, H

● Table1: Indoor unit branch pipe selection (a~i)

Capacity of indoor unit (A×100W)	Branching pipe length≤10m		Branching pipe length≥10m	
	Gas side	Liquid side	Gas side	Liquid side
A≤45	Φ12.7	Φ6.4	Φ15.9	Φ9.5
A≥56	Φ15.9	Φ9.5	Φ19.1	Φ12.7

● Table 2: Indoor unit main pipe selection (L1~L8) for 25.2kW~45kW

Capacity of indoor unit (A×100W)	Indoor unit main pipe (mm)		
	Gas side	Liquid side	Available branching pipe
A<166	Φ19.1	Φ9.53	TFQZHN-01D
166≤A<230	Φ22.2	Φ9.53	TFQZHN-02D
230≤A<330	Φ22.2	Φ12.7	TFQZHN-02D
330≤A<460	Φ28.6	Φ12.7	TFQZHN-03D

● Table 2: Indoor unit main pipe selection (L1~L8) for 56kW~90kW

Capacity of indoor unit (A×100W)	Indoor unit main pipe (mm)		
	Gas side	Liquid side	Available branching pipe
A<166	Φ15.9	Φ9.53	TFQZHN-01D
166≤A<230	Φ19.1	Φ9.53	TFQZHN-01D
230≤A<330	Φ22.2	Φ9.53	TFQZHN-02D
330≤A<460	Φ28.6	Φ12.7	TFQZHN-03D
460≤A<660	Φ28.6	Φ15.9	TFQZHN-03D
660≤A<920	Φ31.8	Φ19.1	TFQZHN-03D
920≤A<1080	Φ38.1	Φ19.1	TFQZHN-04D

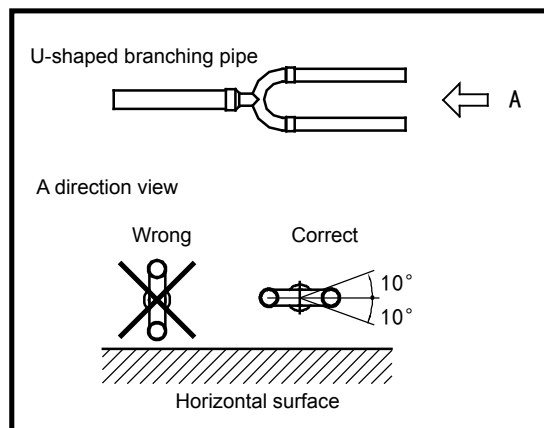
● Table 3: Main pipe selection (L1)

Model	When the equivalent length of all liquid pipes<90m			When the equivalent length of all liquid pipes≥90m		
	Gas side (mm)	Liquid side (mm)	The 1 st branching pipe	Gas side (mm)	Liquid side (mm)	The 1 st branching pipe
25.2kW	Φ22.2	Φ12.7	FQZHN-02D	Φ25.4	Φ12.7	TFQZHN-02D
28kW	Φ25.4	Φ12.7	FQZHN-02D	Φ25.4	Φ12.7	TFQZHN-02D
33.5kW	Φ28.6	Φ12.7	FQZHN-03D	Φ28.6	Φ15.9	TFQZHN-03D
40/45kW	Φ28.6	Φ15.9	FQZHN-03D	Φ31.8	Φ15.9	TFQZHN-03D
56/61.5/67kW	Φ28.6	Φ15.9	FQZHN-03D	Φ31.8	Φ19.1	TFQZHN-03D
73/78.5/85/90kW	Φ31.8	Φ19.1	FQZHN-03D	Φ38.1	Φ22.2	TFQZHN-04

Note: the main pipe L1 can be selected from table2 or table3, the larger size should be finally selected.

8. Branch pipe installation

The branching pipe must be installed horizontally and error angle of it should not be larger than 10°. Otherwise, refrigerant assignment will be uneven and malfunction will be caused.



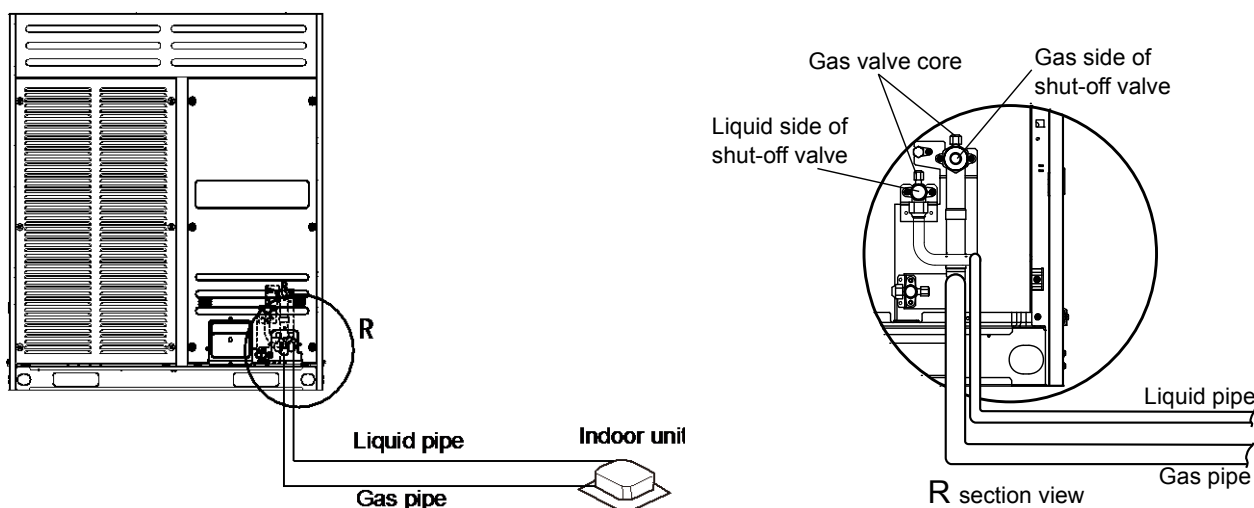
9. Remove dirt or water in the piping

- Make sure there is no any dirt or water in the pipe before connecting the piping to the outdoor units.
- Wash the piping with high pressure nitrogen, never use refrigerant of the outdoor unit to do that.

10. Gas tightness test

- Upon set up the indoor unit pipeline, please connect the Hi-pressure pipe with liquid side shut-off valve and connect Lo-pressure pipe with gas side shut off valve firstly.
- Use the vacuum pump discharging air inside the pipe from the two pistons (pistons of liquid side shut off valve and gas side shut off valve) simultaneously, until to the -1kgf/cm².

- Close the vacuum pump, charge 40kgf/cm² nitrogen gas from the pistons of the two shut-off valves simultaneously. Pressure inside should be maintained at there no less than 24 hrs.

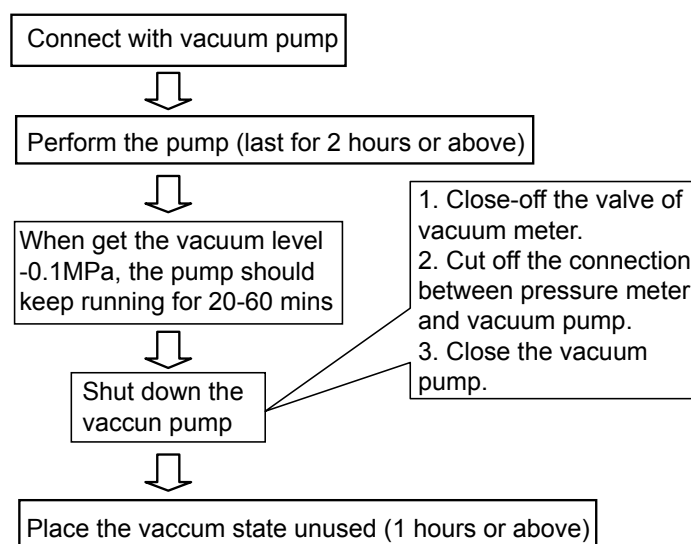


Note:

- Pressurized nitrogen (3.9MPa; 40kgf/cm²) is used for airtightness test.
- It is not allowed to use oxygen, combustible gas or toxic gas to conduct the airtightness test.
- When welding, please use wet cloth insulating the low pressure valve for protection.
- To avoid the equipment be damaged, the pressure maintained time should not last too long.

11. Vacuum

- Use the vacuum pump which vacuum level lower than -0.1MPa and the air discharge capacity above 40L/min.
- The outdoor unit is not necessary to vacuum, don't open the outdoor unit gas and liquid pipe shut-off valves.
- Make sure the vacuum pump could result as -0.1MPa or below after 2 hours or above operation. If the pump operated 3 hours or above could not achieve to -0.1MPa or below, please check whether water mix or gas leak inside of the pipe.



Caution:

- Don't mix up the different refrigerants or abuse the tools and measurements which directly contact with refrigerants.
- Don't adopt refrigerant gas for air vacuuming.
- If vacuum level could not get to -0.1MPa, please check whether resulted by leakage and confirm the leakage site. If no leakage, please operate the vacuum pump again 1 or 2 hrs.

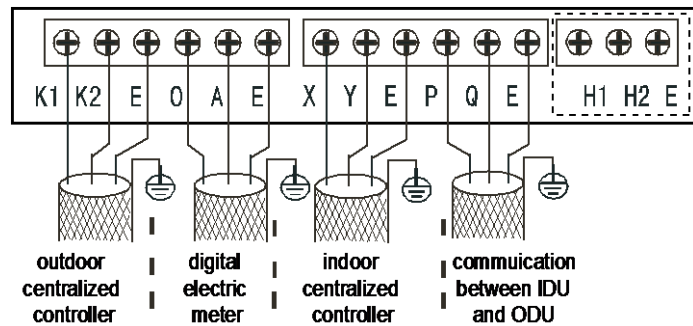
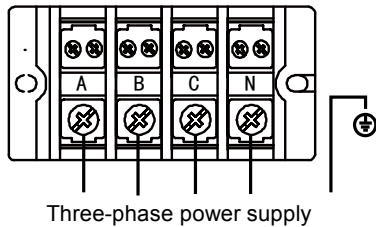
12. Additional refrigerant charge

Calculate the additional refrigerant charge according to the diameter and the length of the liquid side pipe of the outdoor/indoor unit connection. The refrigerant is R410A.

Pipe size of liquid side	Additional refrigerant charge per meter (kg)
Φ6.35	0.022
Φ9.53	0.057
Φ12.7	0.11
Φ15.9	0.17
Φ19.1	0.26
Φ22.2	0.36
Φ25.4	0.52
Φ28.6	0.68

13. Electric wiring installation

13.1 Wiring terminals instruction



13.2 Electric wiring installation

Note:

Please select power supply for indoor unit and outdoor unit separately.

The power supply should have specified branch circuit with leakage protector and manual switch.

The power supply, leakage protector and manual of all the indoor units connecting to the same outdoor unit should be universal. (Please set all the indoor unit power supply of one system into the same circuit. It should turn on or shut down the unit at the same time, otherwise, the service life would affect seriously, even the unit may not turn on.)

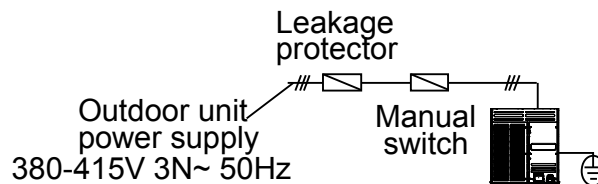
Please put the connective wiring system between indoor unit and outdoor unit with refrigerant piping system together.

It is suggested to use 3-core shielded wire as signal wire between indoor and outdoor units, multi-core wire is unavailable.

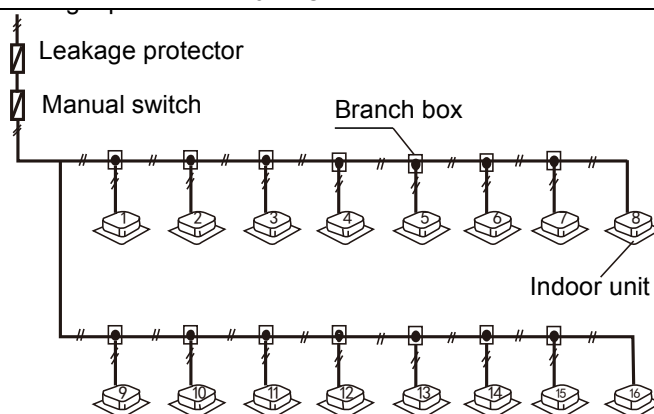
Please comply with relevant National Electric Standard.

Power wiring should be done by professional electrician.

13.2.1 Outdoor unit powering supply wiring



13.2.2 Indoor unit powering supply wiring



Note:

- Set refrigerant piping system, signal wires between indoor units and signal wires between outdoor units into one system.
- Power must unified supply to all indoor units in the one system.
- Please do not put the signal wires and power wires in the same wire tube; keep distance between the two tubes. (Keep distance above 300mm, when current capacity of power supply less than 10A, and Keep distance above 500mm, when current capacity of power supply less than 50A)

13.3 Signal wiring installation

The signal wire should be shielded wire. Using other wiring shall create signal interference, thus leading to error operation.

The shielded nets at the two sides of shielded wires are either grounded to the earth, or connected with each other and jointed to the sheet metal along to the earth.

Signal wire could not be bound together with refrigerant pipeline and power wire. When power wire and signal wire is distributed in parallel form, keep gap between them above 300mm so as to preventing signal interference.

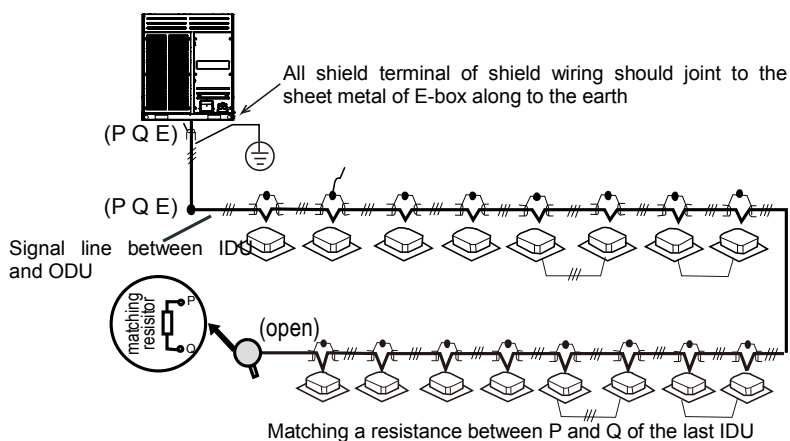
Signal wire could not form closed loop.

Signal wire has polarity, so be careful when connecting.

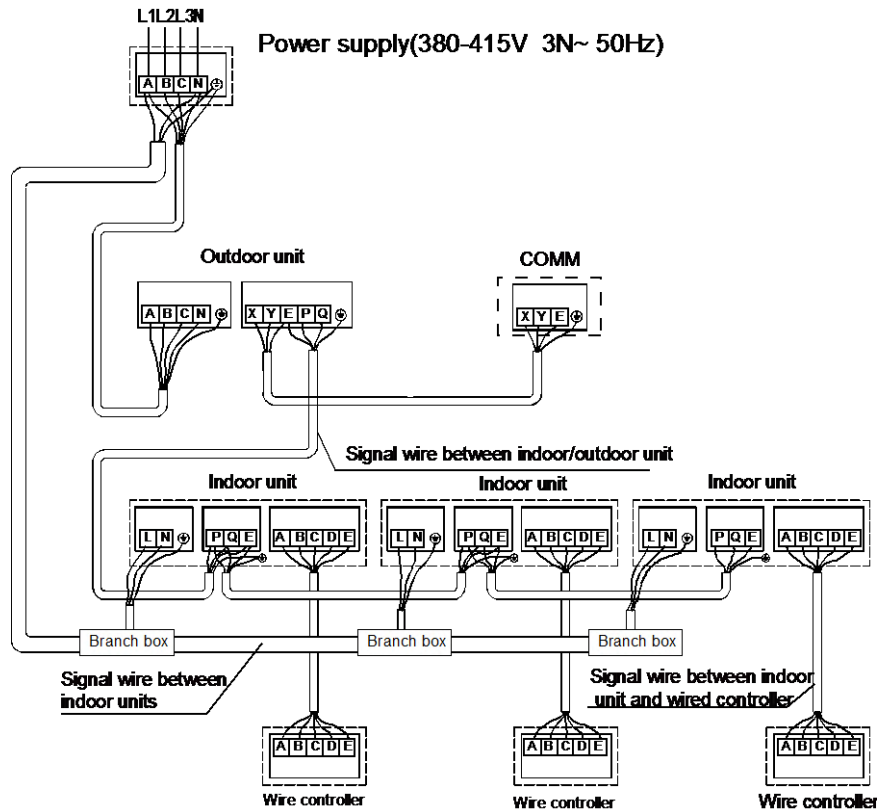
The shield net should be grounded at the wiring terminal of outdoor unit. The inlet and outlet wire net of indoor communication wire should be connected directly and could not be grounded, and form open circuit at the shield net of final indoor unit.

13.3.1 Signal wire between outdoor unit and indoor unit

Signal wire of indoor/outdoor unit adopts 3-core shielded wire ($\geq 0.75\text{mm}^2$) which has polarity, please connect it correctly.



13.3.2 Example connection of wiring

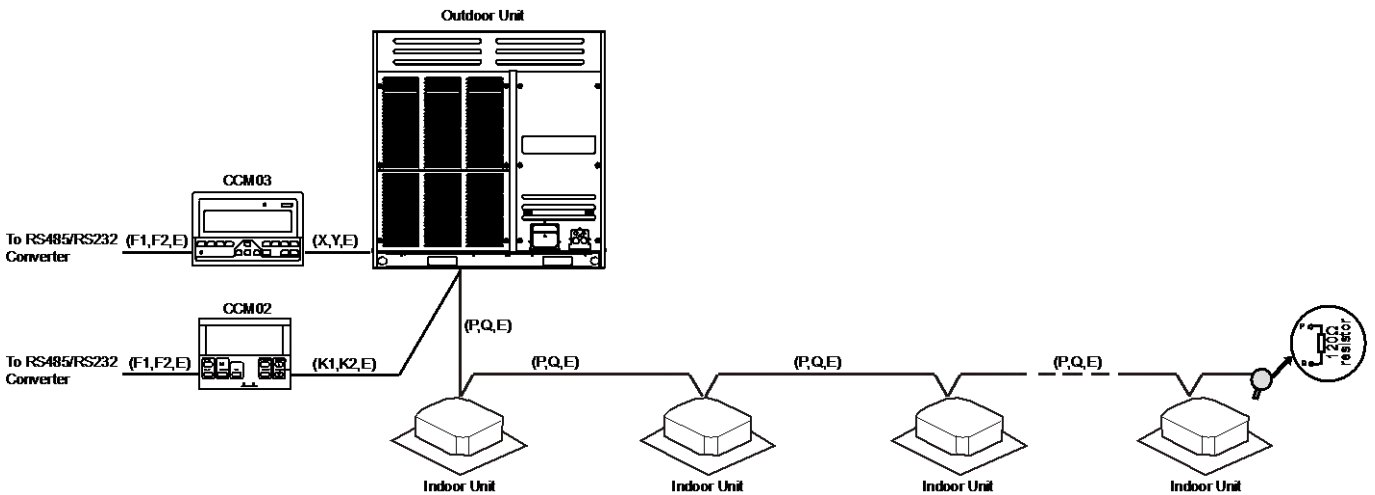


13.3.3 Signal wire of centralized control

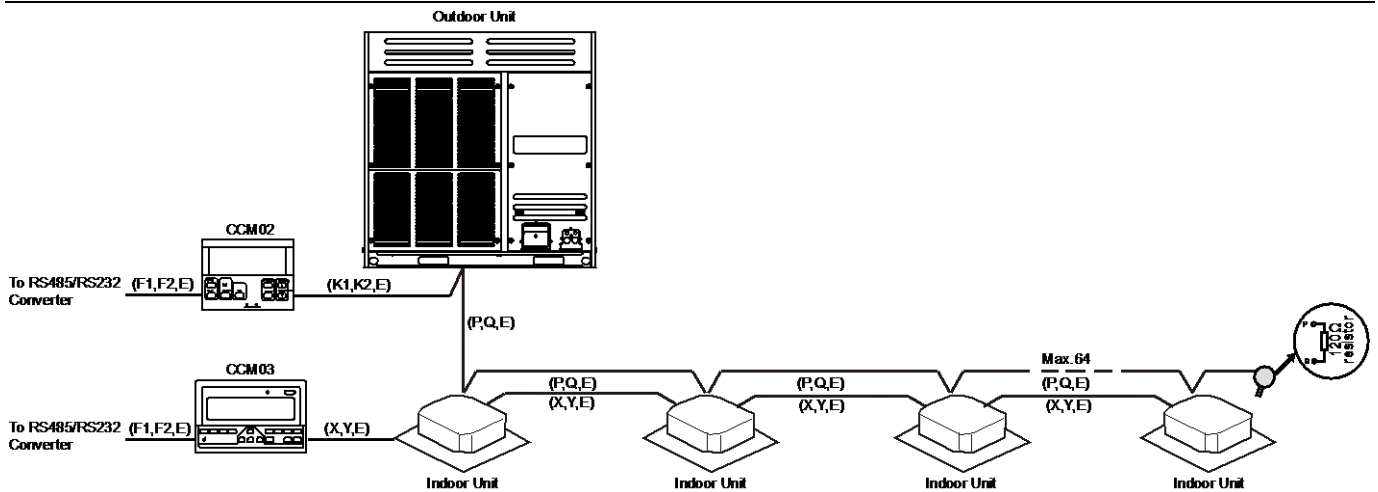
Signal wire of centralized control

When centralized control is needed, one CCM03 (central controller of indoor unit) can only control the indoor units which are in the same refrigerant system **via the port X Y E of outdoor unit**. Outdoor unit will automatically distribute the address to indoor units without any manual setting. Remote controller can enquiry and modify every indoor unit address.

The diagram below shows the connection of signal wire in this case:



Besides, CCM03 can also connect indoor units **via the port X Y E of indoor unit**. However, one more group of wire(X Y E between indoor units) is needed; it is more complex and not suggested. Anyway, the diagram below shows the connection of signal wire in this case:



14. Running test

14.1 Inspection and confirmation before commissioning

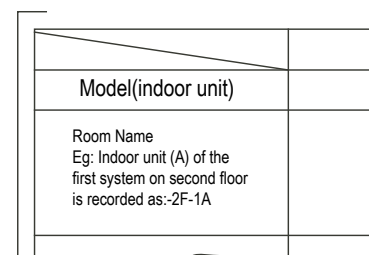
- Check and confirm that refrigeration pipe line and communication wire of indoor and outdoor units have been connected to the same refrigeration system. Otherwise, operation troubles shall happen.
- Power voltage is within $\pm 10\%$ rated voltage.
- Check and confirm that the power wire and control wire are correctly connected.
- Check whether wire controller is properly connected.
- Before powering on, confirm there is no short circuit to each line.
- Check whether all units have passed nitrogen pressure-keeping test for 24 hours with R410A: $40\text{kg}/\text{cm}^2$.
- Confirm whether the system to debugging has been carried out vacuum drying and packed with refrigeration as required.

14.2 Preparation before debugging

- Calculate the additional refrigerant quantity for each set of unit according to the actual length of liquid pipe.
- Keep required refrigerant ready.
- Keep system scheme, system piping diagram and control wiring diagram ready.
- Record the setting address code on the system scheme.
- Turn on power switches of outdoor unit in advance, and keep connected for above 12 hours so that heater heating up refrigerant oil in compressor.
- Turn on gas pipe stop valve, liquid pipe stop valve, oil balance valve and air balance valve totally. If the above valves do not be turned on totally, the unit should be damaged.
- Check whether the power phase sequence of outdoor unit is correct.
- All dial switch of indoor and outdoor units have been set according to the Technical Requirement of Product.

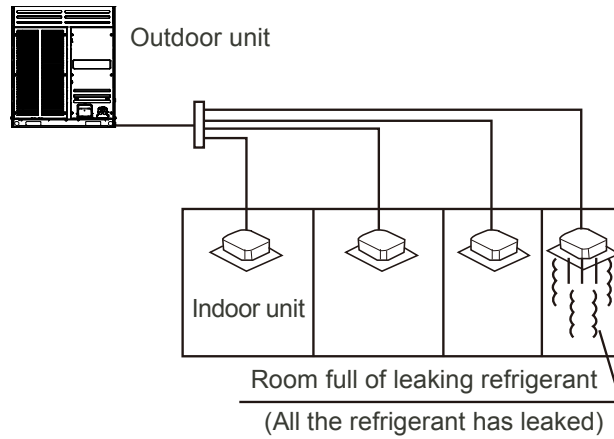
14.3 Fill the name of connected system

To clearly identify the connected systems among two or more indoor units and outdoor units, select names for every system and record them on the nameplate on the outdoor electric control box cover.



14.4 Caution on refrigerant leakage

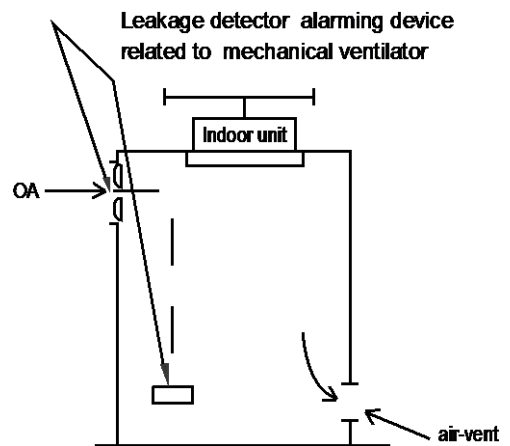
- This air conditioner adopts R410A as refrigerant, which is safe and noncombustible.
- The room for air conditioner should be big enough that refrigerant leakage cannot reach the critical thickness. Besides this, you can take some action on time.
- R410A critical thickness: 0.3 [kg/m³], (Critical thickness: the max thickness of Freon without any harm to person)



- Calculate the critical thickness through following steps, and take necessary actions.
 1. Calculate the refrigerant charge (A [kg])
 2. Total refrigerant charge = delivered refrigerant charge (nameplate) + supplemental refrigerant charge
 3. Calculate the indoor volume (B [m³]) (as the minimum volume)
 4. Calculate the refrigerant thickness.

$$\frac{A \text{ kg}}{B \text{ m}^3} \leq \text{critical thickness } 0.3\text{kg/m}^3$$

- Countermeasure to overhigh refrigerant thickness
 1. Install mechanical ventilator to reduce the refrigerant thickness under critical level. (Ventilate regularly)
 2. Install leakage detector alarming device related to mechanical ventilator if you cannot regularly ventilate.





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