

TROPICAL INVERTER VRF SYSTEM (X SERIES)



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.

1 Preface

1.1 Notes for Installers Boxes

The information contained in this Engineering Data Book may primarily be of use during the system design stage of a Trust V5 X Series VRF project. Additional important information which may primarily be of use during field installation has been placed in boxes, such as the example below, titled “Notes for installers”.

Notes for installers



- Notes for installers boxes contain important information which may primarily be of use during field installation, rather than during desk-based system design.

1.2 Definitions

In this Engineering Data Book, the term “applicable legislation” refers to all national, local and other laws, standards, codes, rules, regulations and other legislation that apply in a given situation.

1.3 Precautions

All system installation including installation of piping and electrical works must only be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation.

2 Unit Placement and Installation

2.1 Outdoor Units

2.1.1 Placement considerations

Placement of outdoor units should take account of the following considerations:

- Air conditioners should not be exposed to direct radiation from a high-temperature heat source.
- Air conditioners should not be installed in positions where dust or dirt may affect heat exchangers.
- Air conditioners should not be installed in locations where exposure to oil or to corrosive or harmful gases, such as acidic or alkaline gases, may occur.
- Air conditioners should not be installed in locations where exposure to salinity may occur unless the anti-corrosion treatment for high-salinity areas customization option has been added and the precautions described in Installation Manual, 10 “Installation in Areas of High Salinity” are taken.
- Outdoor units should be installed in well-drained, well-ventilated positions that are as close as possible to the indoor units.

2.1.2 Spacing

Outdoor units must be spaced such that sufficient air may flow through each unit. Sufficient airflow across heat exchangers is essential for outdoor units to function properly. Figures 3-2.1 to 3-2.3 show spacing requirements in three different scenarios.

If the particular circumstances of an installation require a unit to be placed closer to a wall than specified in Figures 3-2.1 to 3-2.3, a discharge duct should be installed. Refer to Installation Manual, 3 “Outdoor Unit Ducting and Shielding”. Depending on the height of adjacent walls relative to the height of the units, ducting may be required. Refer to Installation Manual, 3 “Outdoor Unit Ducting and Shielding”.

Figure 3-2.1: Single unit installation (unit: mm)

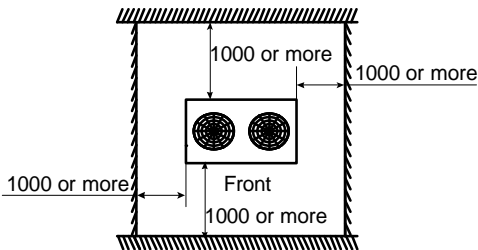


Figure 3-2.2: Single row installation (unit: mm)

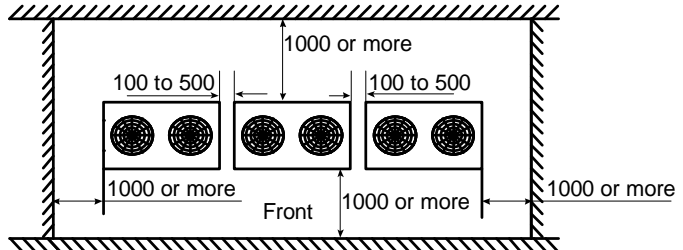
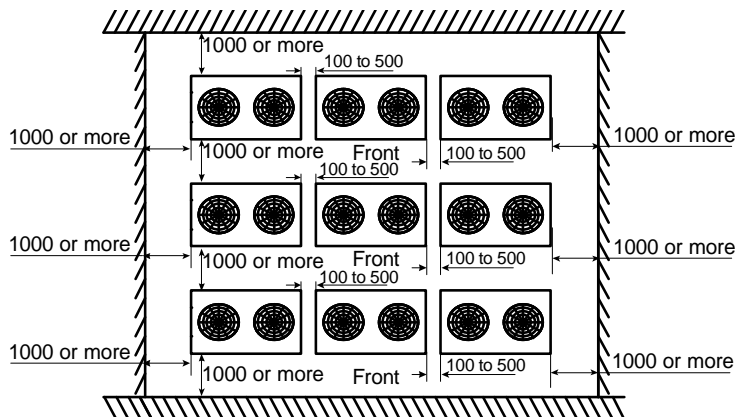


Figure 3-2.3: Multi-row installation (unit: mm)



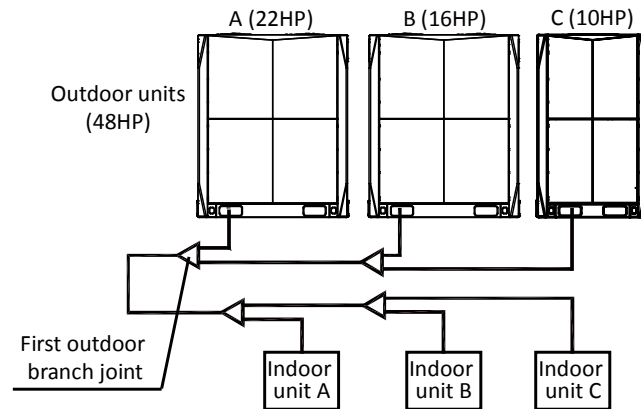
2.1.3 Master and slave unit positioning

In systems with multiple outdoor units, the units should be placed in order from largest capacity unit to smallest capacity unit. The largest capacity unit must be placed on the first branch, and be set as the master unit, while the others should be set as slave units. Refer to the V5 X Service Manual, Control Manual for details of how to set units as master/slave.

The example in Figure 3-2.4 illustrates the placing of units in a 48HP combination:

- Place the 22HP unit on the first branch and set it as the master unit.
- Place the 16HP and 10HP units on the next branches and set them as slave units.

Figure 3-2.4: Positioning of master and slave units



2.1.4 Base structures

Outdoor unit base structure design should take account of the following considerations:

- A solid base prevents excess vibration and noise. Outdoor unit bases should be constructed on solid ground or on structures of sufficient strength to support the units' weight.
- Bases should be at least 200mm high to provide sufficient access for installation of piping.
- Either steel or concrete bases may be suitable.
- A typical concrete base design is shown in Figure 3-2.5. A typical concrete specification is 1 part cement, 2 parts sand and 4 parts crushed stone with $\Phi 10\text{mm}$ steel reinforcing bar. The edges of the base should be chamfered.
- To ensure that all contact points are equally secure, bases should be completely level. Base design should ensure that the points on the units' bases designed for weight-bearing support are fully supported. Bolt spacings should be as per Figure 3-2.6 and Table 3-2.1.
- A drainage ditch should be provided to allow drainage of condensate that may form on the heat exchangers when the units are running in heating mode. The drainage should ensure that condensate is directed away from roadways and footpaths, especially in locations where the climate is such that condensate may freeze.

Figure 3-2.5: Outdoor unit typical concrete base structure design (unit: mm)

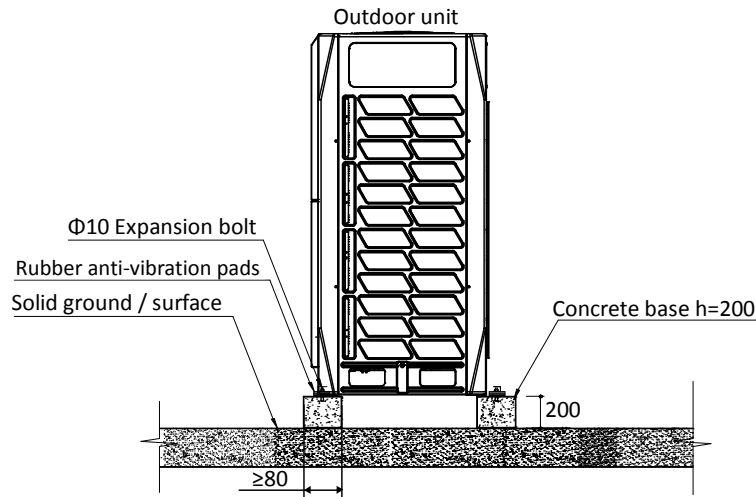


Figure 3-2.6: Expansion bolt positioning

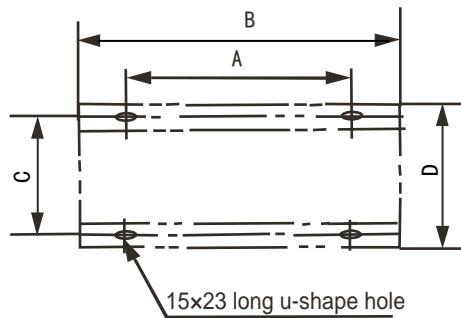


Table 3-2.1: Expansion bolt spacings

Dimension (mm)	8, 10, 12HP	14, 16, 18, 20, 22HP
A	740	1090
B	990	1340
C	723	723
D	790	790

2.1.5 Acceptance and unpacking

Notes for installers



- When units are delivered check whether any damage occurred during shipment. If there is damage to the surface or outside of a unit, submit a written report to the shipping company.
- Check that the model, specifications and quantity of the units delivered are as ordered.
- Check that all accessories ordered have been included. Retain the Owner's Manual for future reference.

2.1.6 Hoisting

Notes for installers



- Do not remove any packaging before hoisting. If units are not packaged or if the packaging is damaged, use suitable boards or packing material to protect the units.
- Hoist one unit at a time, using two ropes to ensure stability.
- Keep units upright during hoisting, ensuring that the angle to the vertical does not exceed 30°.

2.2 Indoor Units

2.2.1 Placement considerations

Placement of indoor units should take account of the following considerations:

- Sufficient space for drain piping and for access during servicing and maintenance should be allowed.
- To ensure a good cooling/heating effect, short-circuit ventilation (where outlet air returns quickly to a unit's air inlet) should be avoided.
- To prevent excessive noise or vibration during operation, suspension rods or other weight-bearing fixings should typically be able to bear twice the unit's weight.

Notes for installers



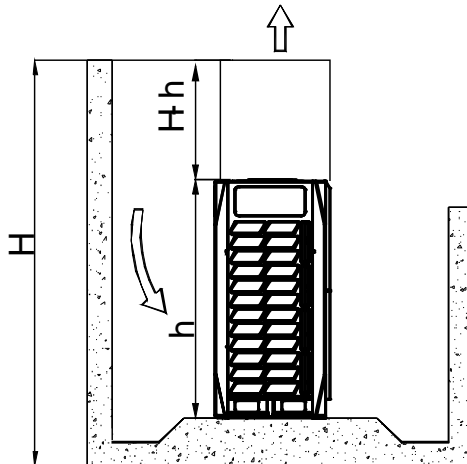
- Before installing an indoor unit, check that the model to be installed is as specified in the construction drawings and confirm the correct orientation of the unit.
- Ensure that units are installed at the correct height.
- To allow smooth condensate drainage and to ensure unit stability (to prevent excessive noise or vibration), ensure that units are level to within 1° of the horizontal. If a unit is not level to within 1° of the horizontal, water leakage or abnormal vibration/noise may occur.

3 Outdoor Unit Ducting and Shielding

3.1 Ducting Requirements

Depending on the height of adjacent walls relative to the height of the units, ducting may be required to ensure proper air discharge. In the situation depicted in Figure 3-3.1, the vertical section of ducting should be at least $H-h$ high.

Figure 3-3.1: Top of unit below top of adjacent wall



3.2 Design Considerations

Outdoor unit ducting design should take account of the following:

- Each duct should contain no more than one bend.
- Vibration isolation should be added to the connection between the unit and the ducting to avoid vibration/noise.
- Installing louvers is not recommended as doing so decreases airflow, impacting upon cooling/heating performance and energy efficiency. If the installation situation necessitates louvers, they should be installed at an angle no greater than 15° to the horizontal, to minimize the impact on airflow.

3.3 Ducting for 8HP, 10HP and 12HP Units

3.3.1 Option A – Transverse ducting

Figure 3-3.2: Transverse ducting for 8HP, 10HP and 12HP units (unit: mm)

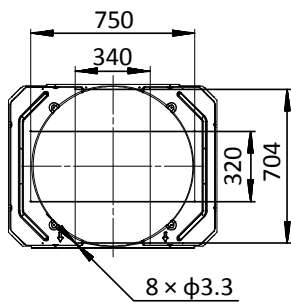
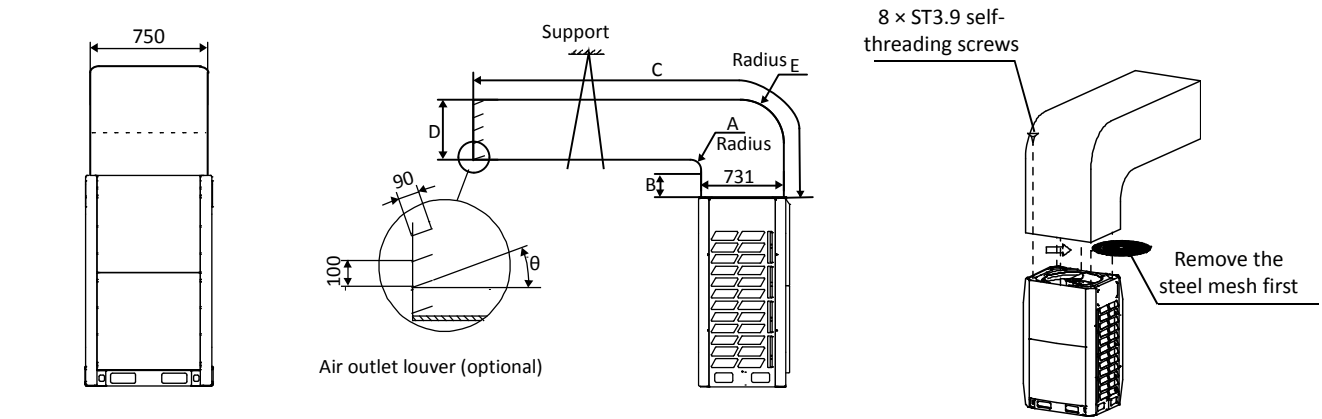


Table 3-3.1: Duct dimensions

Dimensions (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$731 \leq D \leq 770$
E	$E = A + 731$
θ	$\theta \leq 15^\circ$

Table 3-3.2: External static pressure

ESP (Pa)	Remarks
0	Factory default
0 – 20	Remove steel mesh and connect to duct < 3m long
> 20	Customization option

3.3.2 Option B – Longitudinal ducting

Figure 3-3.3: Longitudinal ducting for 8HP, 10HP and 12HP units (unit: mm)

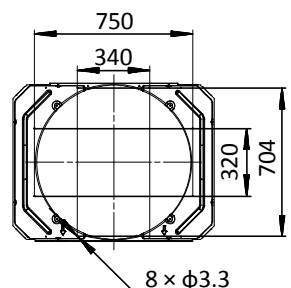
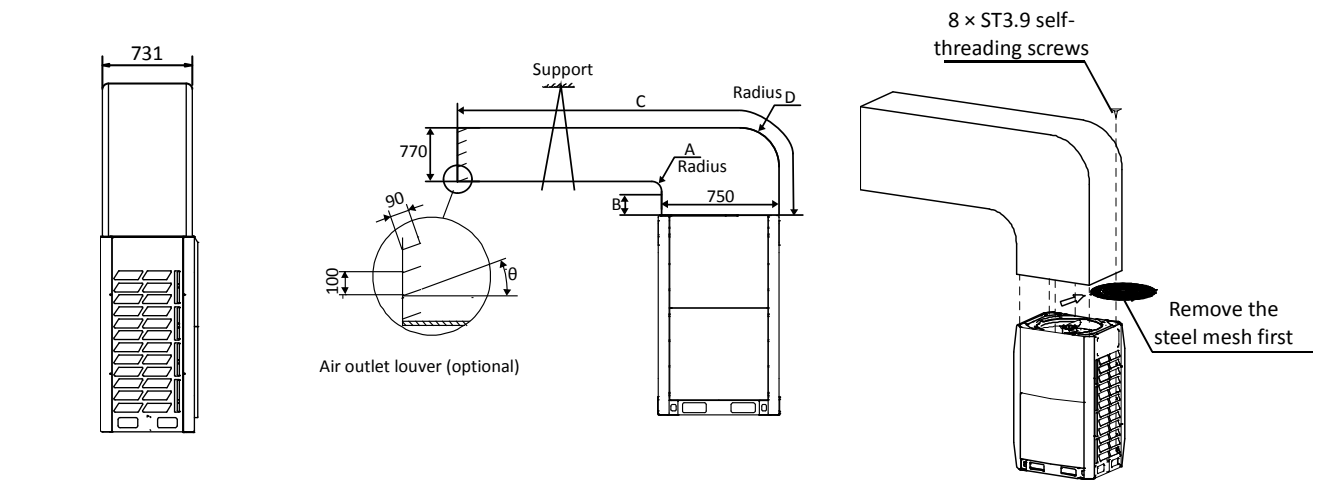


Table 3-3.3: Duct dimensions

Dimensions (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$D = A + 750$
θ	$\theta \leq 15^\circ$

Table 3-3.4: External static pressure

ESP (Pa)	Remarks
0	Factory default
0 – 20	Remove steel mesh and connect to duct < 3m long
> 20	Customization option

3.4 Ducting for 14HP, 16HP, 18HP, 20HP and 22HP Units

3.4.1 Option A – Transverse ducting

Figure 3-3.4: Transverse ducting for 14HP, 16HP, 18HP, 20HP and 22HP units (unit: mm)

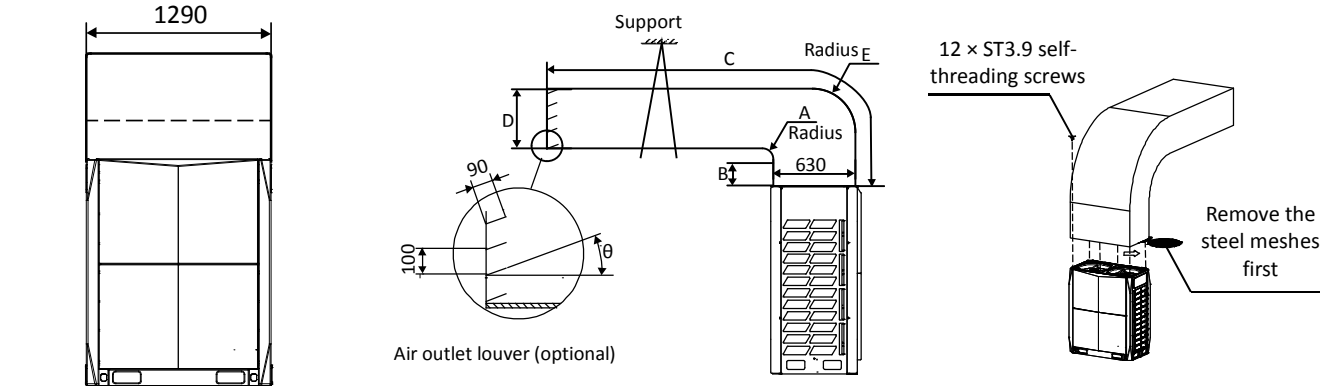


Table 3-3.5: Duct dimensions

Dimensions (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$630 \leq D \leq 660$
E	$E = A + 630$
θ	$\theta \leq 15^\circ$

Table 3-3.6: External static pressure

ESP (Pa)	Remarks
0	Factory default
0 – 20	Remove steel mesh and connect to duct < 3m long
> 20	Customization option

3.4.2 Option B – Longitudinal ducting

Figure 3-3.5: Longitudinal ducting for 14HP, 16HP, 18HP, 20HP and 22HP units (unit: mm)

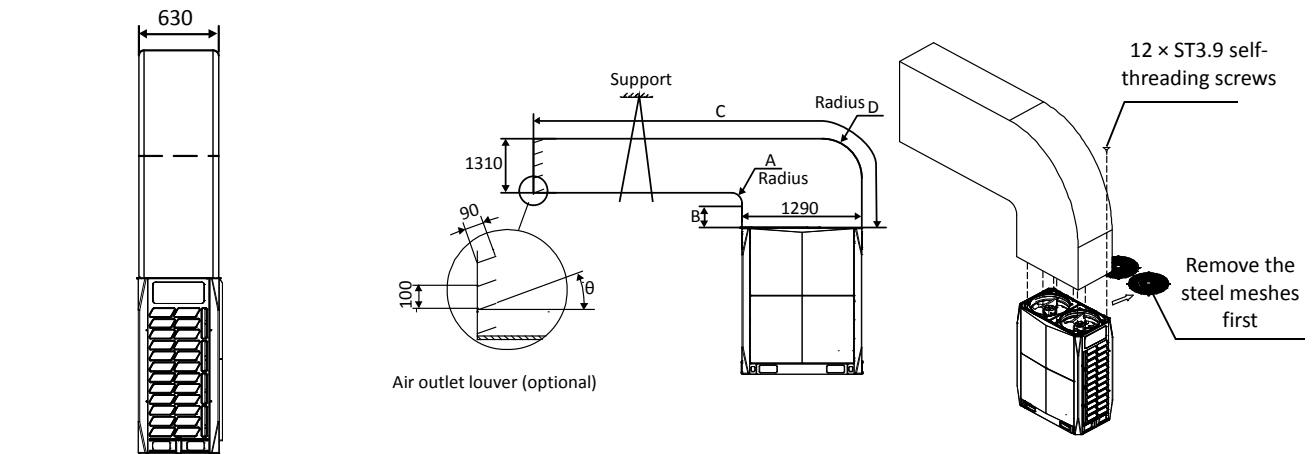


Table 3-3.7: Duct dimensions

Dimensions (mm)	
A	$A \geq 300$
B	$B \geq 250$
C	$C \leq 3000$
D	$D = A + 1290$
θ	$\theta \leq 15^\circ$

Table 3-3.8: External static pressure

ESP (Pa)	Remarks
0	Factory default
0 – 20	Remove steel mesh and connect to duct < 3m long
> 20	Customization option

3.5 Fan Performance

The default external static pressure of outdoor units' air outlets is zero. With the steel mesh cover removed the external static pressure is 20Pa. With customization options, external static pressure can be increased to 40Pa.

Figure 3-3.6: 8HP and 10HP units fan performance

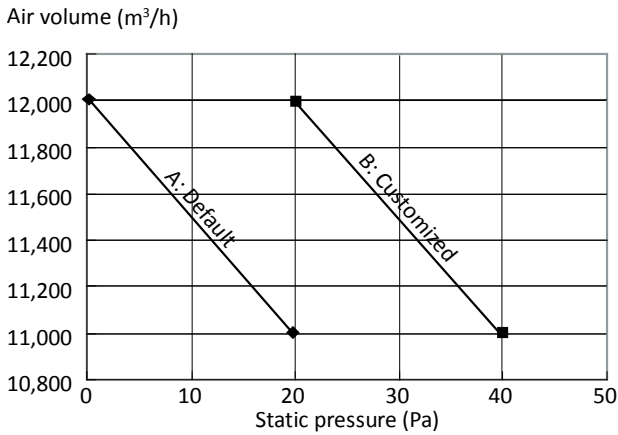


Figure 3-3.7: 12HP units fan performance

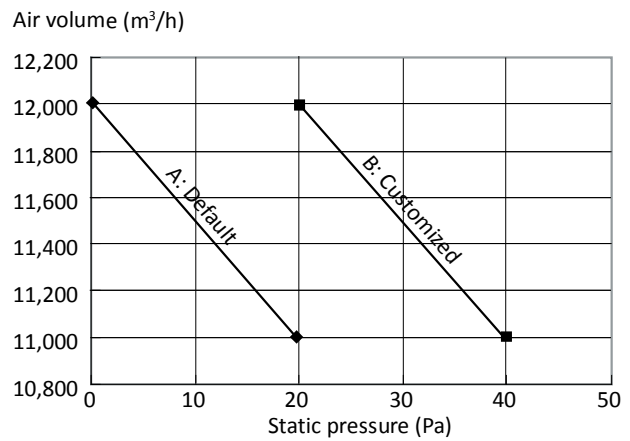


Figure 3-3.8: 14HP and 16HP units fan performance

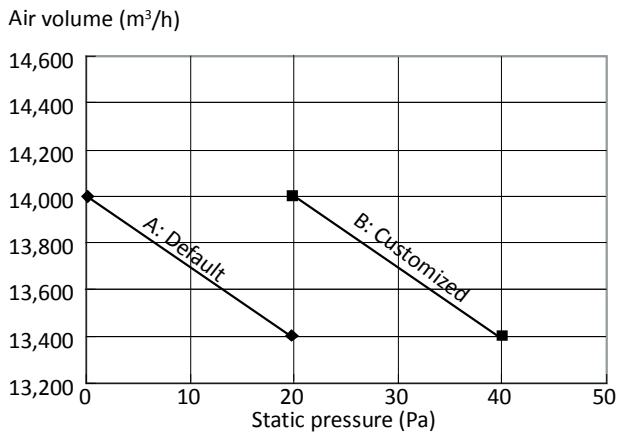


Figure 3-3.9: 18HP units fan performance

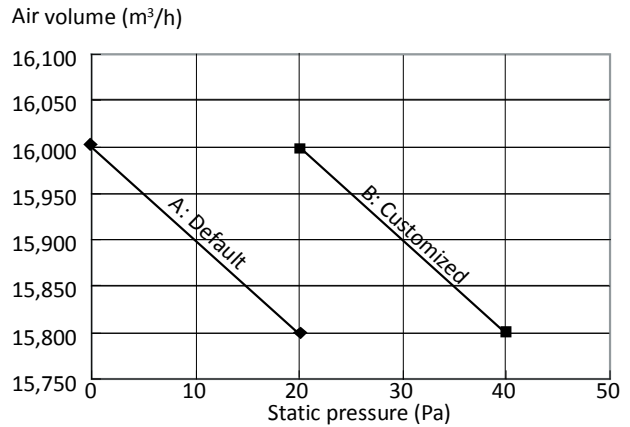
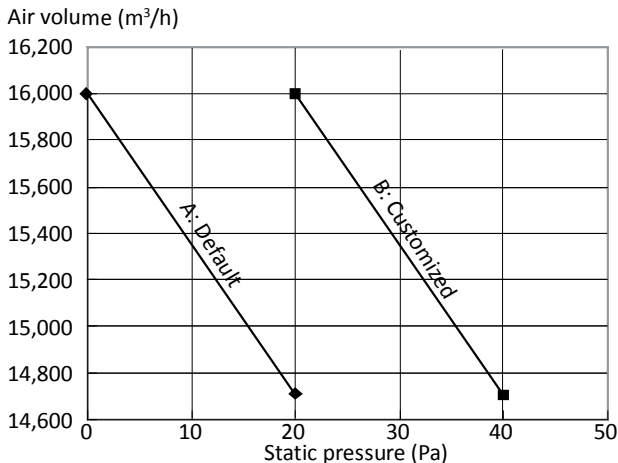


Figure 3-3.10: 20HP and 22HP units fan performance



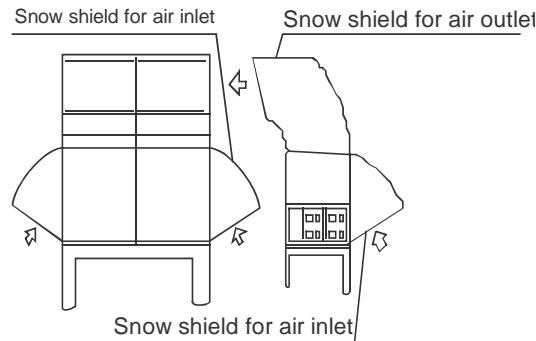
Notes for installers

- Before installing outdoor unit ducting, be sure to remove the unit's steel mesh cover, otherwise airflow will be adversely affected.

3.6 Snow Shielding

In areas of high snowfall, snow shields should be installed on air inlets and outlets to prevent snow from entering the units. Additionally, the height of the base structures should be increased so as to raise the units further off the ground.

Figure 3-3.11: Outdoor unit snow shielding



4 Refrigerant Piping Design

4.1 Design Considerations

Refrigerant piping design should take account of the following considerations:

- The amount of brazing required should be kept to a minimum.
- On the two inside sides of the first indoor branch joint ("A" in Figures 3-4.2 and 3-4.3) the system should, as far as possible, be equal in terms of number of units, total capacities and total piping lengths.

4.2 Material Specification

Only seamless phosphorus-deoxidized copper piping that complies with all applicable legislation should be used. Temper grades and minimum thicknesses for different diameters of piping are specified in Table 3-4.1.

Table 3-4.1: Piping temper and thickness

Piping outer diameter (mm)	Temper ¹	Minimum thickness (mm)
Φ6.35	O (annealed)	0.8
Φ9.53		0.8
Φ12.7		0.8
Φ15.9		1.0
Φ19.1		1.0
Φ22.2	1/2H (half hard)	1.2
Φ25.4		1.2
Φ28.6		1.3
Φ31.8		1.5
Φ38.1		1.5
Φ41.3		1.5
Φ44.5		1.5
Φ54.0		1.8

Notes:

1. O: coiled piping; 1/2H: straight piping.

4.3 Permitted Piping Lengths and Level Differences

The piping length and level difference requirements that apply are summarized in Table 3-4.3 and are fully described as follows (refer to Figure 3-4.2):

1. **Requirement 1:** The total length of piping in one refrigerant system should not exceed 1000m. When calculating the total length of piping, the actual length of the indoor main pipes (the piping between the first indoor branch joint and all other indoor branch joints, L_2 to L_{12}) should be doubled.
2. **Requirement 2:** The piping between the farthest indoor unit (N_9) and the first outdoor branch joint (N) should not exceed 175m (actual length) and 200m (equivalent length). (The equivalent length of each branch joint is 0.5m.)
3. **Requirement 3:** The piping between the farthest indoor unit (N_9) and first indoor branch joint (A) should not exceed 40m in length ($\sum\{L_7 \text{ to } L_{10}\} + i \leq 40\text{m}$) unless the following conditions are met and the following measures taken, in which case the permitted length is up to 90m:

Conditions:

- a) Each indoor auxiliary pipe (from each indoor unit to its nearest branch joint) joint does not exceed 40m in length (a to m each $\leq 40\text{m}$).
- b) The difference in length between {the piping from first indoor branch joint (A) to the farthest indoor unit (N_9)} and {the piping from the first indoor branch joint (A) to the nearest indoor unit (N_1)} does not exceed 40m. That is: $(\sum\{L_7 \text{ to } L_{10}\} + i) - (\sum\{L_2 \text{ to } L_3\} + a) \leq 40\text{m}$.

Measures:

- a) Increase the diameter of the indoor main pipes (the piping between the first indoor branch joint and all other indoor branch joints, L_2 to L_{12}) as per Table 3-4.2, except for indoor main pipes which are already the same size as the main pipe (L_1), for which no diameter increases are required.
4. **Requirement 4:** The largest level difference between indoor unit and outdoor unit should not exceed 90m (if the outdoor unit is above) or 110m (if the outdoor unit is below). Additionally: (i) If the outdoor unit is above and the level difference is greater than 20m, it is recommended that an oil return bend with dimensions as specified in Figure 3-4.1 is set every 10m in the gas pipe of the main pipe; and (ii) if the outdoor unit is below and the level difference is more than 40m, the liquid pipe of the main pipe (L_1) should be increased as per Table 3-4.2.
 5. **Requirement 5:** The largest level difference between indoor units should not exceed 30m.

Table 3-4.2: Diameter increase requirements

Original (mm)	Increased (mm)
Φ9.53	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

Figure 3-4.1: Oil return bend (unit: mm)

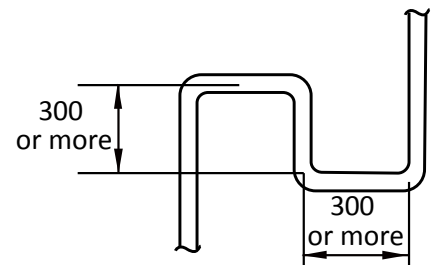
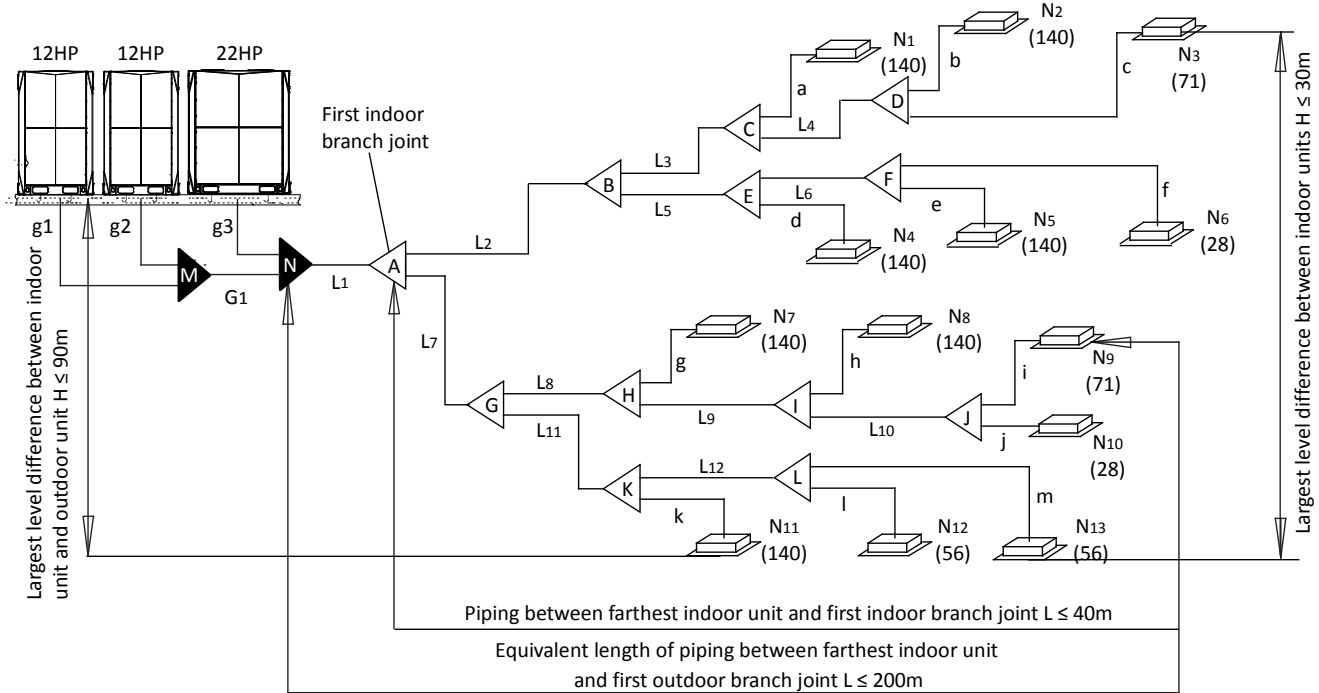


Figure 3-4.2: Permitted refrigerant piping lengths and level differences



Legend		Figures in parentheses indicate indoor unit capacity indexes.
L ₁	Main pipe	
L ₂ to L ₁₂	Indoor main pipes	
a to m	Indoor auxiliary pipes	
A to L	Indoor branch joints	
M, N	Outdoor branch joints	
g ₁ to g ₃ , G ₁	Outdoor connection pipes	

Table 3-4.3: Summary of permitted refrigerant piping lengths and level differences

		Permitted values	Piping in Figure 3-4.2
Piping lengths	Total piping length ¹	≤ 1000m	$L_1 + 2 \times \sum\{L_2 \text{ to } L_{12}\} + \sum\{a \text{ to } m\}$
	Piping between farthest indoor unit and first outdoor branch joint ²	Actual length	≤ 175m
		Equivalent length	≤ 200m
	Piping between farthest indoor unit and first indoor branch joint ³	≤ 40m / 90m	$\sum\{L_7 \text{ to } L_{10}\} + i$
Level differences	Largest level difference between indoor unit and outdoor unit ⁴	Outdoor unit is above	≤ 90m
		Outdoor unit is below	≤ 110m
	Largest level difference between indoor units ⁵	≤ 30m	

Notes:

1. Refer to Requirement 1, above.
2. Refer to Requirement 2, above.
3. Refer to Requirement 3, above.
4. Refer to Requirement 4, above.
5. Refer to Requirement 5, above.

4.4 Selecting Piping Diameters

Tables 3-4.4 to 3-4.8, below, specify the required pipe diameters for the indoor and outdoor piping. The main pipe (L₁) and first indoor branch joint (A) should be sized according to whichever of Tables 3-4.4 and 3-4.5 indicates the larger size.

Figure 3-4.3: Selecting piping diameters

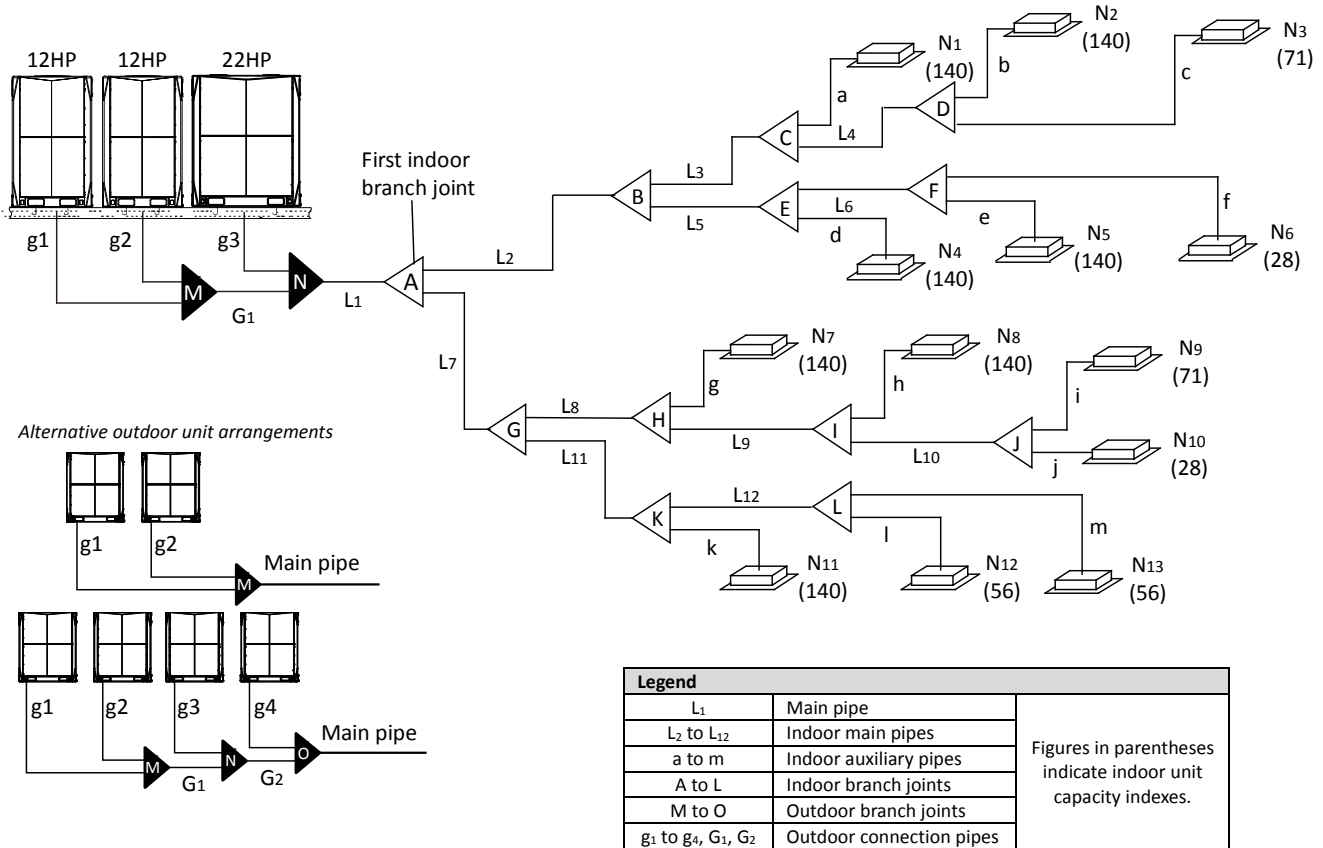


Table 3-4.4: Main pipe¹ (L₁), indoor main pipes (L₂ to L₁₂) and indoor branch joint kits

Total capacity of indoor units (kW)	Gas pipe (mm)	Liquid pipe (mm)	Branch joint kit
Capacity < 16.6	Φ15.9	Φ9.53	FQZHN-01D
16.6 ≤ Capacity < 23	Φ19.1	Φ9.53	FQZHN-01D
23 ≤ Capacity < 33	Φ22.2	Φ9.53	FQZHN-02D
33 ≤ Capacity < 46	Φ28.6	Φ12.7	FQZHN-03D
46 ≤ Capacity < 66	Φ28.6	Φ15.9	FQZHN-03D
66 ≤ Capacity < 92	Φ31.8	Φ19.1	FQZHN-03D
92 ≤ Capacity < 135	Φ38.1	Φ19.1	FQZHN-04D
135 ≤ Capacity < 180	Φ41.3	Φ22.2	FQZHN-05D
180 ≤ Capacity	Φ44.5	Φ25.4	FQZHN-05D

Notes:

- The main pipe (L₁) and first indoor branch joint (A) should be sized according to whichever of Tables 3-4.4 and 3-4.5 indicates the larger size.

Table 3-4.5: Main pipe¹ (L₁) and first indoor branch joint (A)

Total capacity of outdoor units	Equivalent length of all liquid pipes < 90m			Equivalent length of all liquid pipes ≥ 90m		
	Gas pipe (mm)	Liquid pipe (mm)	Branch joint kit	Gas pipe (mm)	Liquid pipe (mm)	Branch joint kit
8HP	Φ22.2	Φ9.53	FQZHN-02D	Φ22.2	Φ12.7	FQZHN-02D
10HP	Φ22.2	Φ9.53	FQZHN-02D	Φ25.4	Φ12.7	FQZHN-02D
12-14HP	Φ25.4	Φ12.7	FQZHN-02D	Φ28.6	Φ15.9	FQZHN-03D
16HP	Φ28.6	Φ12.7	FQZHN-03D	Φ31.8	Φ15.9	FQZHN-03D
18-22HP	Φ28.6	Φ15.9	FQZHN-03D	Φ31.8	Φ19.1	FQZHN-03D
24HP	Φ28.6	Φ15.9	FQZHN-03D	Φ31.8	Φ19.1	FQZHN-03D
26-34HP	Φ31.8	Φ19.1	FQZHN-03D	Φ38.1	Φ22.2	FQZHN-04D
36-50HP	Φ38.1	Φ19.1	FQZHN-04D	Φ38.1	Φ22.2	FQZHN-04D
52-66HP	Φ41.3	Φ22.2	FQZHN-05D	Φ44.5	Φ25.4	FQZHN-05D
68-88HP	Φ44.5	Φ25.4	FQZHN-05D	Φ54.0	Φ25.4	FQZHN-06D

Notes:

- The main pipe (L₁) and first indoor branch joint (A) should be sized according to whichever of Tables 3-4.4 and 3-4.5 indicates the larger size.

Table 3-4.6: Outdoor connection pipes (g1 to g4, G₁, G₂)

Pipes	Outdoor unit capacity	Gas pipe (mm)	Liquid pipe (mm)
g1 to g4	8-12HP	Φ25.4	Φ12.7
	14-22HP	Φ31.8	Φ15.9
G ₁		Φ38.1	Φ19.1
G ₂		Φ41.3	Φ22.2

Table 3-4.7: Outdoor branch joint kits (N to O)

No. of outdoor units	Branch joint kit
2	FQZHW-02N1D
3	FQZHW-03N1D
4	FQZHW-04N1D

Table 3-4.8: Indoor auxiliary pipes (a to m)

Capacity of indoor unit (kW)	Pipe length ≤ 10m		Pipe length > 10m ¹	
	Gas pipe (mm)	Liquid pipe (mm)	Gas pipe (mm)	Liquid pipe (mm)
≤ 4.5	Φ12.7	Φ6.35	Φ15.9	Φ9.53
≥ 5.6	Φ15.9	Φ9.53	Φ19.1	Φ12.7

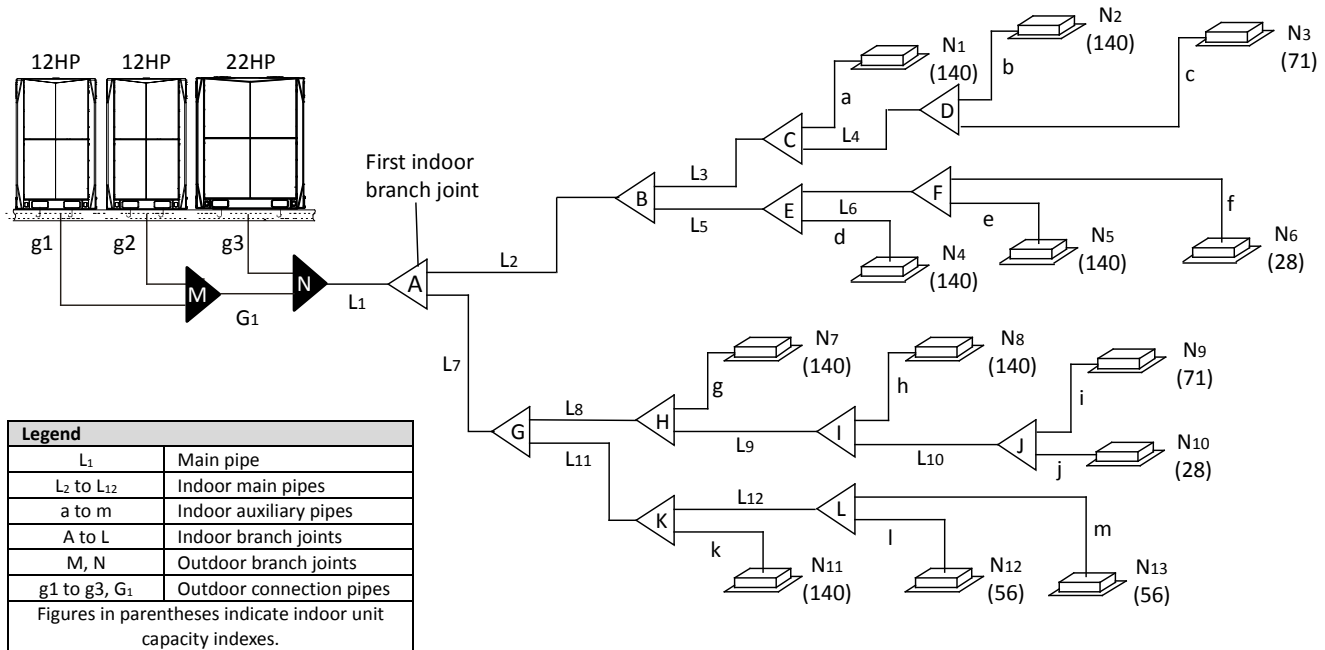
Notes:

- An indoor auxiliary pipe should not be larger than the indoor main pipe immediately upstream of it. For indoor auxiliary pipes greater than 10m in length with indoor units of capacity great than or equal to 5.6kW, the gas and liquid side pipes should each either be sized according to this table, or else be the same size as the indoor main pipe immediately upstream, whichever is smaller.

4.5 Refrigerant Piping Selection Example

The example below illustrates the piping selection procedure for a system consisting of three outdoor units (22HP + 12HP + 12HP) and 13 indoor units. The system's equivalent total piping length is in excess of 90m; the piping between the farthest indoor unit and the first indoor branch joint is less than 40m in length; and each indoor auxiliary pipe (from each indoor unit to its nearest branch joint) is less than 10m in length.

Figure 3-4.4: Refrigerant piping selection example



Step 1: Select indoor auxiliary pipes

- Indoor units N₁ to N₅, N₇ to N₉ and N₁₁ to N₁₃ are of capacity 5.6kW or greater and their indoor auxiliary pipes are less than 10m in length. Refer to Table 3-4.8. Indoor auxiliary pipes a to e, g to i, and k to m are $\Phi 15.9 / \Phi 9.53$.
- Indoor units N₆ and N₁₀ are of capacity less than 4.5kW and their indoor auxiliary pipes are less than 10m in length. Refer to Table 3-4.8. Indoor auxiliary pipes f and j are $\Phi 12.7 / \Phi 6.35$.

Step 2: Select indoor main pipes and indoor branch joints B to L

- The indoor units (N₂ and N₃) downstream of indoor branch joint D have total capacity of $14 + 7.1 = 21.1$ kW. Refer to Table 3-4.4. Indoor main pipe L₄ is $\Phi 19.1 / \Phi 9.53$. Indoor branch joint D is FQZHN-01D.
- The indoor units (N₁ to N₆) downstream of indoor branch joint B have total capacity of $14 \times 4 + 7.1 + 2.8 = 65.9$ kW. Refer to Table 3-4.4. Indoor main pipe L₂ is $\Phi 28.6 / \Phi 15.9$. Indoor branch joint B is FQZHN-03D.
- The other indoor main pipes and indoor branch joints C and E to L are selected in the same fashion.

Step 3: Select main pipe and indoor branch joint A

- The indoor units (N₁ to N₁₃) downstream of indoor branch joint A have total capacity of $14 \times 7 + 7.1 \times 2 + 5.6 \times 2 + 2.8 \times 2 = 129$ kW. The system's equivalent total piping length is in excess of 90m. The total capacity of the outdoor units is $22 + 12 + 12 = 46$ HP. Refer to Tables 3-4.4 and 3-4.5. Main pipe L₁ is the larger of $\Phi 38.1 / \Phi 19.1$ and $\Phi 38.1 / \Phi 22.2$, hence $\Phi 38.1 / \Phi 22.2$. Indoor branch joint A is FQZHN-04D.

Step 4: Select outdoor connection pipes and outdoor branch joints

- The master unit is 22HP and the slave units are 12HP. Refer to Table 3-4.6. Outdoor connection pipes g₁ and g₂ are $\Phi 25.4 / \Phi 12.7$ and outdoor connection pipe g₃ is $\Phi 31.8 / \Phi 15.9$.
- Refer to Table 3-4.6. Outdoor connection pipe G₁ is $\Phi 38.1 / \Phi 19.1$.

- There are three outdoor units in the system. Refer to Table 3-4.7. Outdoor branch joints M and N are FQZHW-03N1D.

4.6 Branch Joints

Branch joint design should take account of the following:

- U-shaped branch joints should be used – tee joints are not suitable. Branch joint dimensions are given in Tables 3-4.9 and 3-4.10.
- To avoid accumulation of oil in the outdoor units, outdoor branch joints should be installed horizontally and must not be higher than the outdoor unit refrigerant outlets. Refer to Figure 3-5.9 in Installation Manual, 5.6 “Branch Joints”. Indoor branch joints may be installed either horizontally or vertically.
- To ensure even distribution of refrigerant, branch joints should not be installed within 500mm of a 90° bend, another branch joint or the straight section of piping leading to an indoor unit, with the minimum 500mm being measured from the point where the branch joint is connected to the piping, as shown in Figure 3-4.5.

Figure 3-4.5: Branch joint spacing and separation from bends (unit:mm)

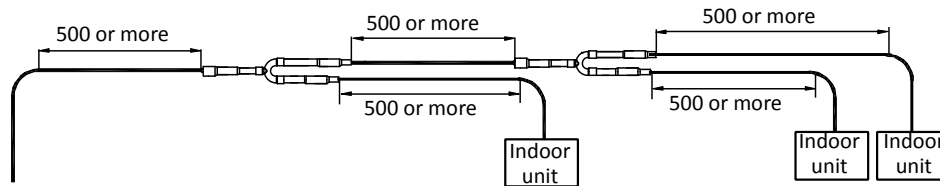


Table 3-4.9: Indoor branch joint dimensions (unit: mm)

Model	Gas side joints	Liquid side joints
TFQZHN-01D		
TFQZHN-02D		
TFQZHN-03D		
TFQZHN-04D		
TFQZHN-05D		
TFQZHN-06D		

Table 3-4.10: Outdoor branch joint dimensions (unit: mm)

Model	Gas side joints	Liquid side joints
TFQZHW-02N1D		
TFQZHW-03N1D		
TFQZHW-04N1D		

4.7 Refrigerant Leakage Precautions

R410A refrigerant is not flammable in air at temperatures up to 100°C at atmospheric pressure and is generally considered a safe substance to use in air conditioning systems. Nevertheless, precautions should be taken to avoid danger to life in the unlikely event of a major refrigerant leakage. Precautions should be taken in accordance with all applicable legislation. Where no applicable legislation exists, the following may be used as a guide:

- Air conditioned rooms should be large enough that if leakage of all the refrigerant in the system occurs, the concentration of the refrigerant in the room does not reach a level dangerous to health.
- A critical concentration (at which point R410A becomes dangerous to human health) of 0.3 kg/m³ can be used.
- The potential concentration of refrigerant in a room following a leak can be calculated as follows:
 - Calculate the total amount in of refrigerant in the system (“A”) as the nameplate charge (the charge in the system when delivered from the factory) plus the additional charge added as per Installation Manual, 8.1 “Calculating Additional Refrigerant Charge”.
 - Calculate the total volume (“B”) of the smallest room into which refrigerant could potentially leak.
 - Calculate the potential refrigerant concentration as A divided by B.
 - If A/B is not less than 0.3 kg/m³, countermeasures such installing mechanical ventilators (either ventilating regularly or controlled by refrigerant leakage detectors) should be taken.
- Since R410A is heavier than air, particular consideration should be given to leak scenarios in basement rooms.

Figure 3-4.6: Potential refrigerant leak scenario

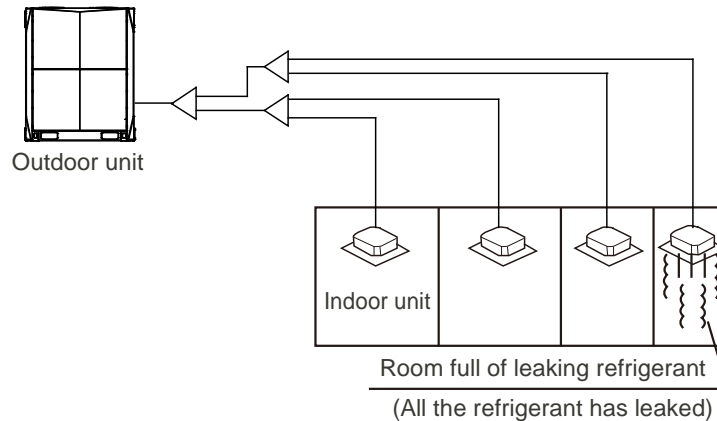
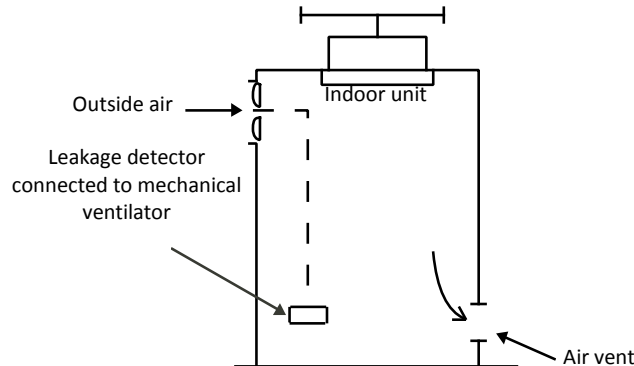


Figure 3-4.7: Mechanical ventilator controlled by refrigerant leak detector



5 Refrigerant Piping Installation

5.1 Procedure and Principles

5.1.1 Installation procedure

Notes for installers



Installation of the refrigerant piping system should proceed in the following order:



Note: Pipe flushing should be performed once the brazed connections have been completed with the exception of the final connections to the indoor units. That is, flushing should be performed once the outdoor units have been connected but before the indoor units are connected.

5.1.2 Three principles for refrigerant piping

	Reasons	Measures
CLEAN	Particles such as oxide produced during brazing and/or building dust can lead to compressor malfunction	<ul style="list-style-type: none"> Seal piping during storage¹ Flow nitrogen during brazing² Pipe flushing³
DRY	Moisture can lead to ice formation or oxidization of internal components leading to abnormal operation or compressor damage	<ul style="list-style-type: none"> Pipe flushing³ Vacuum drying⁴
SEALED	Imperfect seals can lead to refrigerant leakage	<ul style="list-style-type: none"> Pipe manipulation⁵ and brazing² techniques Gastightness test⁶

Notes:

1. See Installation Manual, 5.2.1 "Pipe delivery, storage and sealing".
2. See Installation Manual, 5.5 "Brazing".
3. See Installation Manual, 5.8 "Pipe Flushing".
4. See Installation Manual, 5.10 "Vacuum Drying".
5. See Installation Manual, 5.3 "Manipulating Copper Piping".
6. See Installation Manual, 5.9 "Gastightness Test".

5.2 Storing Copper Piping

5.2.1 Pipe delivery, storage and sealing

Notes for installers



- Ensure that piping does not get bent or deformed during delivery or whilst stored.
- On construction sites store piping in a designated location.
- To prevent dust or moisture entering, piping should be kept sealed whilst in storage and until it is about to be connected. If piping is to be used soon, seal the openings with plugs or adhesive tape. If piping is to be stored for a long time, charge the piping with nitrogen at 0.2-0.5MPa and seal the openings by brazing.
- Storing piping directly on the ground risks dust or water ingress. Wooden supports can be used to raise piping off the ground.
- During installation, ensure that piping to be inserted through a hole in a wall is sealed to ensure dust and/or fragments of wall do not enter.
- Be sure to seal piping being installed outdoors (especially if being installed vertically) to prevent rain entering.

5.3 Manipulating Copper Piping

5.3.1 De-oiling

Notes for installers



- Lubrication oil used during some copper pipe manufacturing processes can cause deposits to form in R410A refrigerant systems, causing system errors. Oil-free copper piping should therefore be selected. If ordinary (oily) copper piping is used, it must be cleaned with gauze dipped in tetrachloroethylene solution prior to installation.

Caution

- Never use carbon tetrachloride (CCl₄) for pipe cleansing or flushing, as doing so will seriously damage the system.

5.3.2 Cutting copper piping and removing burrs

Notes for installers



- Use a pipe cutter rather than a saw or cutting machine to cut piping. Rotate the piping evenly and slowly, applying even force to ensure that the piping does not become deformed during cutting. Using a saw or cutting machine to cut piping runs the risk of copper shavings entering the piping. Copper shavings are difficult to remove and pose a serious risk to the system if they enter the compressor or block the throttling unit.
- After cutting using a pipe cutter, use a reamer/scrapper to remove any burrs that have formed at the opening, keeping the opening of the piping downwards to avoid copper shavings from entering the piping.
- Remove burrs carefully to avoid scratches, which may prevent a proper seal being formed and lead to refrigerant leakage.

5.3.3 Expanding copper piping ends

Notes for installers

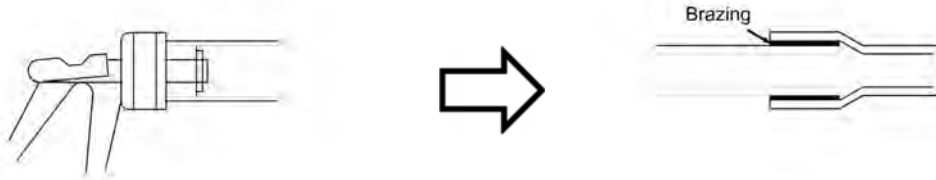


- Ends of copper piping can be expanded so that another length of piping can be inserted and the joint brazed.
- Insert the expanding head of the pipe expander into the pipe. After completing pipe expansion, rotate the copper pipe a few degrees to rectify the straight line mark left by the expanding head.

Caution

- Ensure that the expanded section of piping is smooth and even. Remove any burrs that remain after cutting.

Figure 3-5.1: Expanding copper piping ends



5.3.4 Flared joints

Flared joints should be used where a screw thread connection is required.

Notes for installers

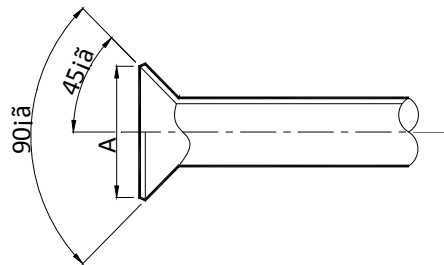


- Before flaring 1/2H (half hard) piping, anneal the end of the pipe to be flared.
- Remember to place the flare nut on the piping before flaring.
- Ensure the flared opening is not cracked, deformed or scratched, otherwise it will not form a good seal and refrigerant leakage may occur.
- The diameter of the flared opening should be within the ranges specified in Table 3-5.1. Refer to Figure 3-5.2.

Table 3-5.1: Flared opening size ranges

Pipe (mm)	Flared opening diameter (A) (mm)
Φ6.35	8.7 - 9.1
Φ9.53	12.8 - 13.2
Φ12.7	16.2 - 16.6
Φ15.9	19.3 - 19.7
Φ19.1	23.6 - 24.0

Figure 3-5.2: Flared opening



- When connecting a flared joint, apply some compressor oil to the inner and outer surfaces of the flared opening to facilitate the connection and rotation of the flare nut, ensure firm connection between the sealing surface and the bearing surface, and avoid the pipe becoming deformed.

5.3.5 Bending piping

Bending copper piping reduces the number of brazed joints required and can improve quality and save material.

Notes for installers



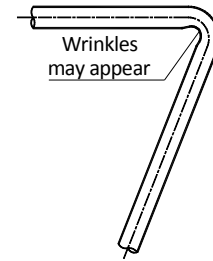
Piping bending methods

- Hand bending is suitable for thin copper piping ($\Phi 6.35\text{mm} - \Phi 12.7\text{mm}$).
- Mechanical bending (using a bending spring, manual bending machine or powered bending machine) is suitable for a wide range of diameters ($\Phi 6.35\text{mm} - \Phi 54.0\text{mm}$).

Caution

- When using a spring bender, ensure that the bender is clean before inserting it in the piping.
- After bending a copper pipe, ensure that there are no wrinkles or deformation on either side of the pipe.
- Ensure that bend angles do not exceed 90° , otherwise wrinkles may appear on the inner side of the pipe, and the pipe may buckle or crack. Refer to Figure 3-5.3.
- Do not use a pipe that has buckled during the bending process; ensure that the cross section at the bend is greater than $2/3$ of the original area.

Figure 3-5.3: Pipe bending in excess of 90°



5.4 Refrigerant Piping Supports

When the air conditioning is running, the refrigerant piping will deform (shrink, expand, droop). To avoid damage to piping, hangers or supports should be spaced as per the criteria in the Table 3-5.2. In general, the gas and liquid pipes should be suspended in parallel and the interval between support points should be selected according to the diameter of the gas pipe.

Table 3-5.2: Refrigerant piping support spacings

Pipe (mm)	Interval between support points (m)	
	Horizontal Piping	Vertical Piping
< $\Phi 20$	1	1.5
$\Phi 20 - \Phi 40$	1.5	2
> $\Phi 40$	2	2.5

Suitable insulation should be provided between the piping and the supports. If wooden dowels or blocks are to be used, use wood that has undergone preservative treatment.

Changes in refrigerant flow direction and refrigerant temperature result in movement, expansion and shrinkage of the refrigerant piping. Piping should therefore not be fixed too tightly, otherwise stress concentrations may occur in the piping, with the potential for rupturing.

5.5 Brazing

Care must be taken to prevent oxide forming on the inside of copper piping during brazing. The presence of oxide in a refrigerant system adversely affects the operation of valves and compressors, potentially leading to low efficiency or even compressor failure. To prevent oxidation, during brazing nitrogen should be flowed through the refrigerant piping.

Notes for installers



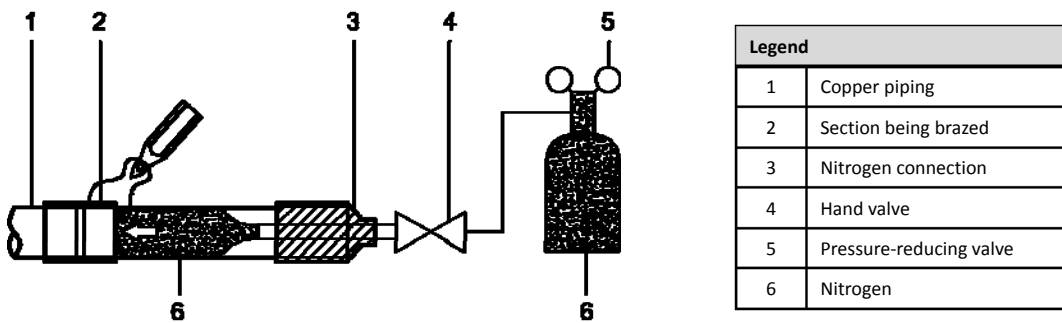
Warning

- Never flow oxygen through piping as doing so aids oxidation and could easily lead to explosion and as such is extremely dangerous.
- Take appropriate safety precautions such as having a fire extinguisher to hand whilst brazing.

Flowing nitrogen during brazing

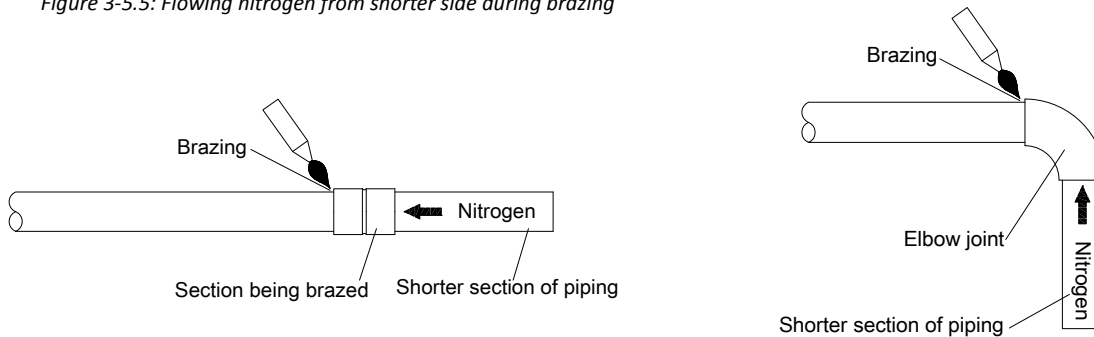
- Use a pressure reducing valve to flow nitrogen through copper piping at 0.02-0.03MPa during brazing.
- Start the flow before brazing starts and ensure that the nitrogen continuously passes through the section being brazed until the brazing is complete and the copper has cooled down completely.

Figure 3-5.4: Flowing nitrogen through piping during brazing



- When joining a shorter section of piping to a longer section, flow nitrogen from the shorter side to allow better displacement of air with nitrogen.
- If the distance from the point where nitrogen enters the piping to the joint to be brazed is long, ensure that the nitrogen is flowed for sufficient time to discharge all the air from the section to be brazed before commencing brazing.

Figure 3-5.5: Flowing nitrogen from shorter side during brazing

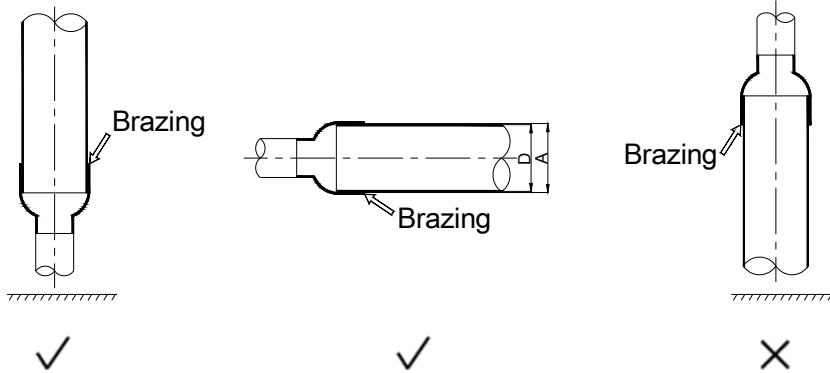


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Piping orientation during brazing

Brazing should be conducted downwards or horizontally to avoid filler leakage.

Figure 3-5.6: Piping orientation during brazing



Piping overlap during brazing

Table 3-5.3 specifies the minimum permissible piping overlap and the range of permissible gap sizes for brazed joints on piping of different diameters. Refer also to Figure 3-5.7.

Figure 3-5.7: Piping overlap and gap for brazed joints

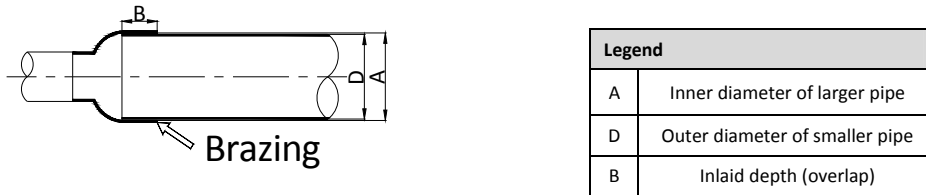


Table 3-5.3: Piping overlap and gap for brazed joints¹

D (mm)	Minimum permissible B (mm)	Permissible A – D (mm)
5 < D < 8	6	0.05 - 0.21
8 < D < 12	7	
12 < D < 16	8	0.05 - 0.27
16 < D < 25	10	
25 < D < 35	12	0.05 - 0.35
35 < D < 45	14	

Notes:

1. A, B, D refer to the dimensions shown in Figure 3-5.7.

Filler

- Use a copper/phosphorus brazing alloy (BCuP) filler that does not require flux.
- Do not use flux. Flux can cause corrosion of piping and can affect the performance of compressor oil.
- Do not use anti-oxidants when brazing. Residue can clog piping and damage components.

5.6 Branch Joints

Notes for installers



- Use U-shaped branch joints as specified on the construction drawings – do not replace U-shaped branch joints with tee joints.
- To avoid accumulation of oil in the outdoor units, outdoor branch joints should be installed horizontally and must not be higher than the outdoor unit refrigerant outlets. Refer to Figure 3-5.9.
- Indoor branch joints may be installed either horizontally or vertically. Horizontal branch joints must be installed at an angle to the horizontal not exceeding 10° in order to avoid uneven distribution of refrigerant and possible malfunction. Refer to Figure 3-5.8.

Figure 3-5.8: Branch joint orientation

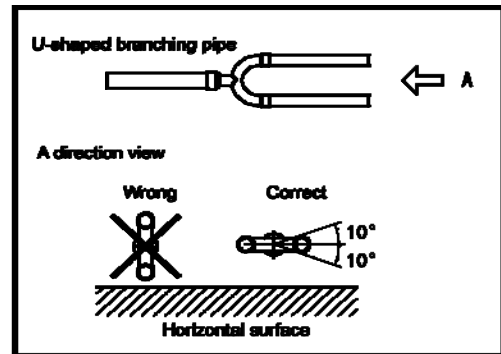
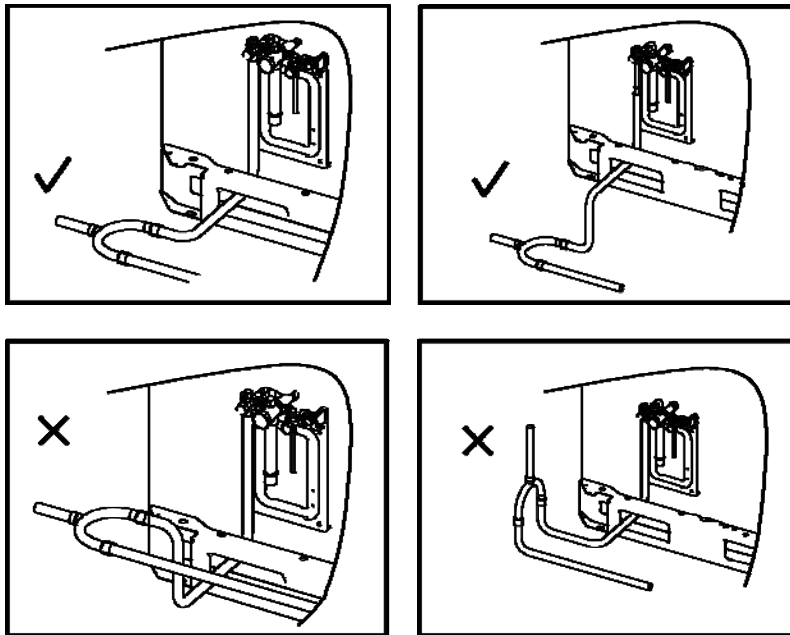


Figure 3-5.9: Installation of outdoor branch joints

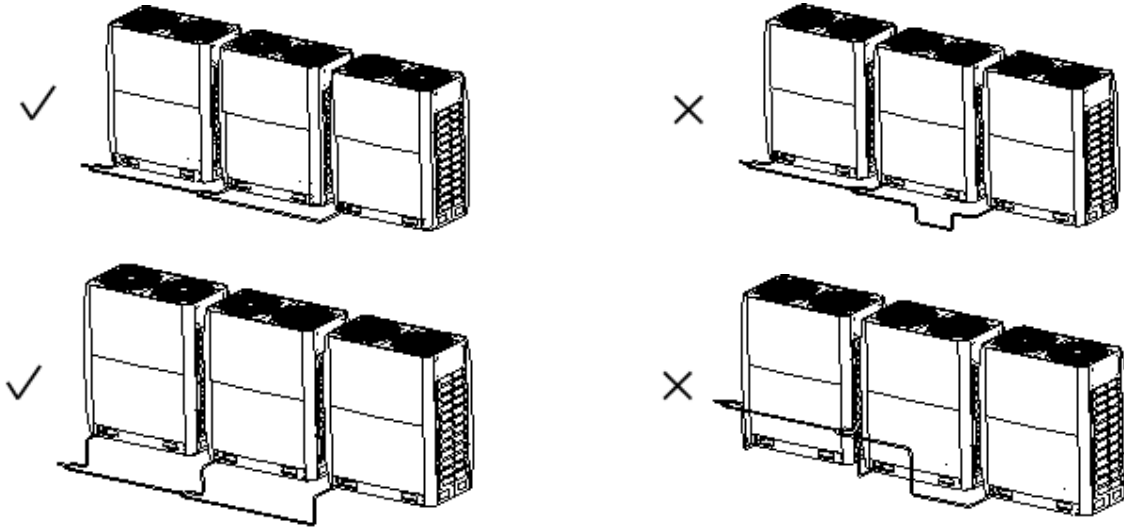


- To ensure even distribution of refrigerant, a limitation is placed on how close branch joints may be installed to bends, other branch joints and the straight sections of piping leading to indoor units. Refer to Installation Manual, 4.6 “Branch Joints”.

5.7 Piping Connections Between Outdoor Units

The piping connecting the outdoor units should be horizontal and must not be higher than the refrigerant outlets. If necessary, to avoid obstacles the piping may be vertically offset below the outlets. When inserting a vertical offset to avoid an obstacle, the whole outdoor piping should be offset, rather than just the section adjacent to the obstacle. Refer to Figure 3-5.10.

Figure 3-5.10: Piping connections between outdoor units



Outdoor piping should be installed in a metal casing to protect against exposure to sunlight, rain, wind and other potential causes of damage.

5.8 Pipe Flushing

5.8.1 Purpose

To remove dust, other particles and moisture, which could cause compressor malfunction if not flushed out before the system is run, the refrigerant piping should be flushed using nitrogen. As described in Installation Manual, 5.1.1 "Installation procedure", pipe flushing should be performed once the piping connections have been completed with the exception of the final connections to the indoor units. That is, flushing should be performed once the outdoor units have been connected but before the indoor units are connected.

Notes for installers



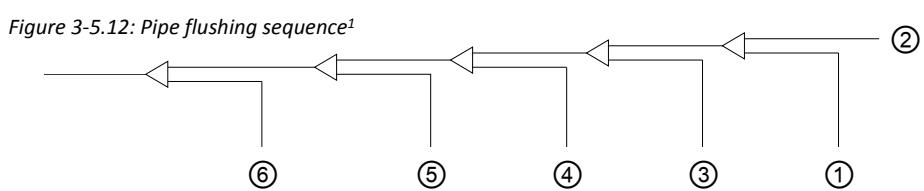
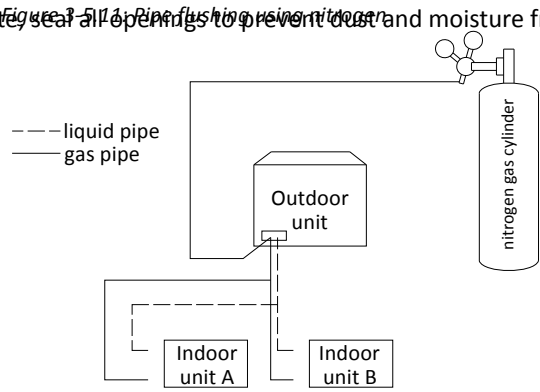
Warning

Only use nitrogen for flushing. Using carbon dioxide risks leaving condensation in the piping. Oxygen, air, refrigerant, flammable gases and toxic gases must not be used for flushing. Use of such gases may result in fire or explosion.

Procedure

The liquid and gas sides can be flushed simultaneously; alternatively, one side can be flushed first and then Steps 1 to 8 repeated, for the other side. The flushing procedure is as follows:

1. Cover the inlets and outlets of the indoor units to prevent dirt getting blown in during pipe flushing. (Pipe flushing should be carried out before connecting the indoor units to the piping system.)
2. Attach a pressure reducing valve to a nitrogen cylinder.
3. Connect the pressure reducing valve outlet to the inlet on the liquid (or gas) side of the outdoor unit.
4. Use blind plugs to block all liquid (gas) side openings, except for the opening at the indoor unit which is furthest from the outdoor units ("Indoor unit A" in Figure 3-5.11).
5. Start to open the nitrogen cylinder valve and gradually increase the pressure to 0.5MPa.
6. Allow time for nitrogen to flow as far as the opening at indoor unit A.
7. Flush the first opening:
 - a) Using suitable material, such as a bag or cloth, press firmly against the opening at indoor unit A.
 - b) When the pressure becomes too high to block with your hand, suddenly remove your hand allowing gas to rush out.
 - c) Repeatedly flush in this manner until no further dirt or moisture is emitted from the piping. Use a clean cloth to check for dirt or moisture being emitted. Seal the opening once it has been flushed.
8. Flush the other openings in the same manner, working in sequence from indoor unit A towards the outdoor units. Refer to Figure 3-5.12.
9. Once flushing is complete, seal all openings to prevent dust and moisture from entering.



Notes:

1. 1-2-3-4-5-6 working towards the outdoor units.

5.9 Gastightness Test

5.9.1 Purpose

To prevent faults caused by refrigerant leakage, a gastightness test should be performed before system commissioning.

5.9.2 Procedure

Notes for installers



Warning

Only dry nitrogen should be used for gastightness testing. Oxygen, air, flammable gases and toxic gases must not be used for gastightness testing. Use of such gases may result in fire or explosion.

Procedure

The gastightness test procedure is as follows:

Step 1

- Once the piping system is complete and the indoor and outdoor units have been connected, vacuum the piping to -0.1MPa.

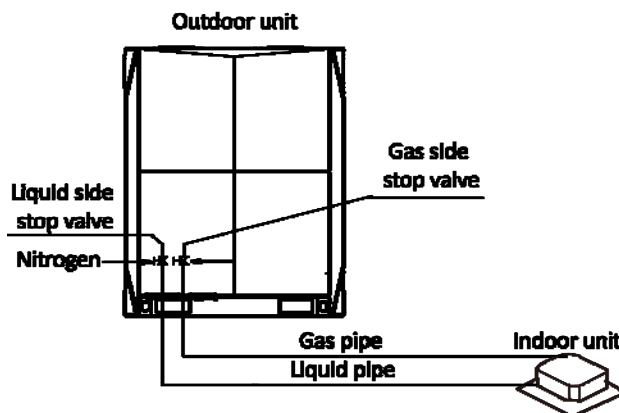
Step 2

- Charge the piping with nitrogen at 4MPa and leave for at least 24 hours.
- After the test period of at least 24 hours, observe the pressure in the piping and assess whether or not the observed pressure indicates the presence of a leak. Allow for any change in ambient temperature over the test period by adjusting the reference pressure by 0.01MPa per 1°C of temperature difference. Adjusted reference pressure = Pressure at pressurization + (temperature at observation – temperature at pressurization) x 0.01MPa. Compare the observed pressure with the adjusted reference pressure. If they are the same, the piping has passed the gastightness test.
- If the observed pressure is lower than the adjusted reference pressure, the piping has failed the test. Refer to Installation Manual, 5.9.3 “Leak detection”. Once the leak has been found and fixed, the gastightness test should be repeated.

Step 3

- If not continuing straight to vacuum drying (see Installation Manual, 5.10 “Vacuum Drying”) once the gastightness test is complete, reduce the system pressure to 0.5-0.8MPa and leave the system pressurized until ready to carry out the vacuum drying procedure.

Figure 3-5.13: Gastightness test



5.9.3 Leak detection

Notes for installers



The general methods for identifying the source of a leak are as follows:

1. Audio detection: relatively large leaks are audible.
2. Touch detection: place your hand at joints to feel for escaping gas.
3. Soapy water detection: small leaks can be detected by the formation of bubbles when soapy water is applied to a joint.
4. Refrigerant leak detection: for leaks that are difficult to detect, refrigerant leak detection may be used as follows:
 - a) Pressurize the piping with nitrogen at 0.3MPa.
 - b) Add refrigerant into the piping until the pressure reaches 0.5MPa.
 - c) Use a halogen refrigerant detector to find the leak.
 - d) If the leak source cannot be found, continuing charging with refrigerant to a pressure of 4MPa and then search again.

5.10 Vacuum Drying

5.10.1 Purpose

Vacuum drying should be performed in order to remove moisture and non-condensable gases from the system. Removing moisture prevents ice formation and oxidization of copper piping or other internal components. The presence of ice particles in the system would cause abnormal operation, whilst particles of oxidized copper can cause compressor damage. The presence of non-condensable gases in the system would lead to pressure fluctuations and poor heat exchange performance.

Vacuum drying also provides additional leak detection (in addition to the gastightness test).

5.10.2 Procedure

Notes for installers



During vacuum drying, a vacuum pump is used to lower the pressure in the piping to the extent that any moisture present evaporates. At 5mmHg (756mmHg below typical atmospheric pressure) the boiling point of water is 0°C. Therefore a vacuum pump capable of maintaining a pressure of -756mmHg or lower should be used. Using a vacuum pump with a discharge in excess of 4L/s and a precision level of 0.02mmHg is recommended.

Caution

- Before performing vacuum drying, make sure that all the outdoor unit stop valves are firmly closed.
- Once the vacuum drying is complete and the vacuum pump is stopped, the low pressure in the piping could suck vacuum pump lubricant into the air conditioning system. The same could happen if the vacuum pump stops unexpectedly during the vacuum drying procedure. Mixing of pump lubricant with compressor oil could cause compressor malfunction and a one-way valve should therefore be used to prevent vacuum pump lubricant seeping into the piping system.

Procedure

The vacuum drying procedure is as follows:

Step 1

- Connect the blue (low pressure side) hose of a pressure gauge to the master unit gas pipe stop valve, the red (high pressure side) hose to the master unit liquid pipe stop valve and the yellow hose to the vacuum pump.

Step 2

- Start the vacuum pump and then open the pressure gauge valves to start vacuum the system.
- After 30 minutes, close the pressure gauge valves.
- After a further 5 to 10 minutes check the pressure gauge. If the gauge has returned to zero, check for leakages in the refrigerant piping.

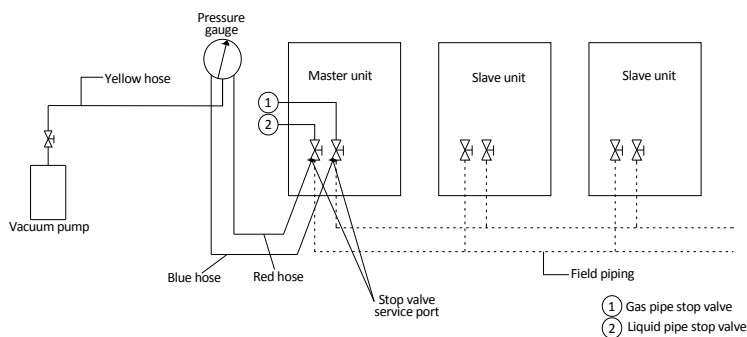
Step 3

- Re-open the pressure gauge valves and continue vacuum drying for at least 2 hours and until a pressure difference of 756mmHg or more has been achieved. Once the pressure difference of at least 756mmHg has been achieved, continue vacuum drying for 2 hours.

Step 4

- Close the pressure gauge valves and then stop the vacuum pump.
- After 1 hour, check the pressure gauge. If the pressure in the piping has not increased, the procedure is finished. If the pressure has increased, check for leakages.
- After vacuum drying, **keep the blue and red hoses connected to the pressure gauge and to the master unit stop valves**, in preparation for refrigerant charging (see Installation Manual, 8 “Charging Refrigerant”).

Figure 3-5.14: Vacuum drying



Pressure gauge

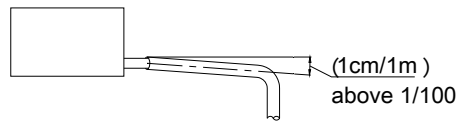
6 Drain Piping

6.1 Design Considerations

Drain piping design should take account of the following considerations:

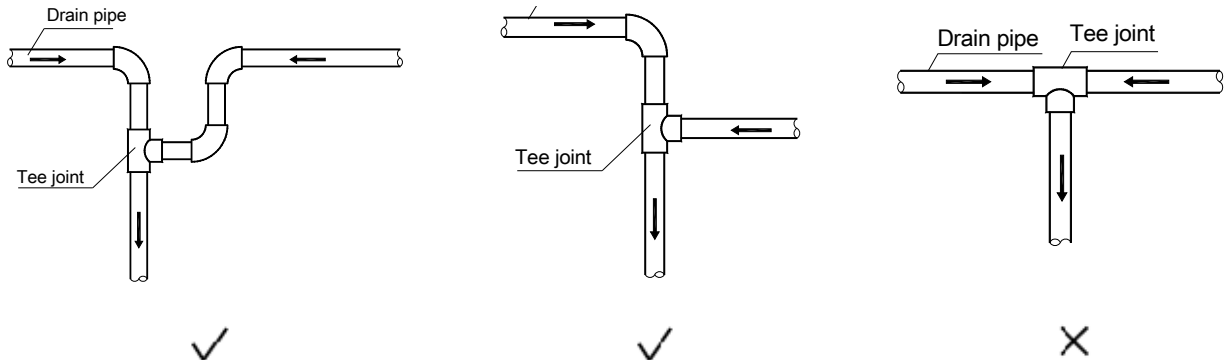
- Indoor unit condensate drain piping needs to be of sufficient diameter to carry the volume of condensate produced at the indoor units and installed at a slope sufficient to allow drainage. Discharge as close as possible to the indoor units is usually preferable.
- To prevent the drain piping becoming excessively long, consideration should be given to installing multiple drain piping systems, with each system having its own drainage point and providing drainage for a subset of the overall set of indoor units.
- The routing of drain piping should take into consideration the need to maintain sufficient slope for drainage whilst avoiding obstacles such as beams and ducting. The drain piping slope should be at least 1:100 away from indoor units. Refer to Figure 3-6.1.

Figure 3-6.1: Drain piping minimum slope requirement



- To avoid backflow and other potential complications, two horizontal drain pipes should not meet at the same level. Refer to the Figure 3-6.2 for suitable connection arrangements. Such arrangements also allow the slope of the two horizontal pipes to be selected independently.

Figure 3-6.2: Drain piping joints – correct and incorrect configurations



- Branch drain piping should join main drain piping from the top, as shown in Figure 3-6.3.
- Recommended support/hanger spacing is 0.8 – 1.0m for horizontal piping and 1.5 – 2.0m for vertical piping. Each vertical section should be fitted with at least two supports. For horizontal piping, spacings greater than those recommended leads to sagging and deformation of the pipe profile at the supports which impedes water flow and should therefore be avoided.
- Air vents should be fitted at the highest point of each drain piping system to ensure that condensation is discharged smoothly. U-bends or elbow joints should be used such that the vents face downwards, to prevent dust entering the

Figure 3-6.3: Branch drain piping joining main drain piping

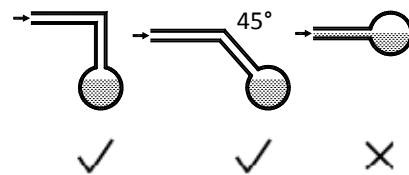
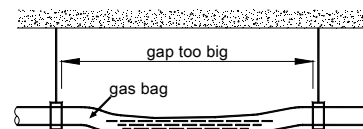
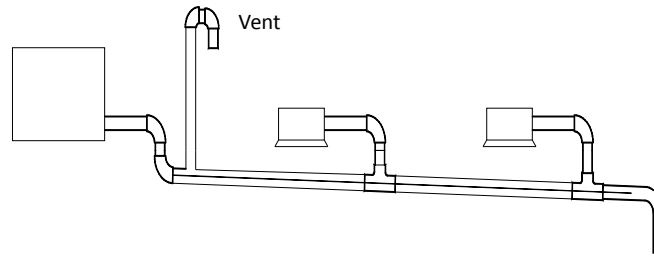


Figure 3-6.4: Effect of insufficient drain piping support



piping. Refer to Figure 3-6.5. Air vents should not be installed too close to indoor unit lift pumps.

Figure 3-6.5: Drain piping air vents

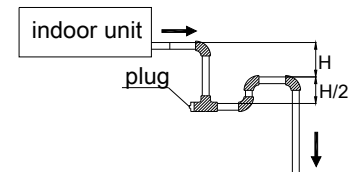


- Air conditioner drain piping should be installed separately from waste, rainwater and other drain piping and should not come into direct contact with the ground.
- Drain piping diameter should be not less than the indoor units’ drain piping connection.
- To allow inspection and maintenance, the piping clamps shipped with units should be used to attach drain piping to indoor units – adhesive should not be used.
- Thermal insulation should be added to drain piping to prevent condensation forming. Thermal insulation should extend all the way to the connection with the indoor unit.
- Units with drain pumps should have separate drain piping systems from systems that use natural drainage.

6.2 Water Traps

For indoor units with a high negative pressure differential at the outlet of the drainage pan, a trap should be fitted to the drain piping to prevent poor drainage and/or water being blown back into the drainage pan. Traps should be arranged as in Figure 3-6.6. The vertical separation H should be in excess of 50mm. A plug may be fitted to allow cleaning or inspection.

Figure 3-6.6: Drain piping water traps



6.3 Selecting Piping Diameters

Select branch drainage piping (the drain piping connection to each unit) diameters according to indoor unit flow volume and select main drainage piping diameters according to the combined flow volume of the upstream indoor units. Use a design assumption of 2 liters of condensate per horsepower per hour. For example, the combined flow volume of three 2HP units and two 1.5HP units would be calculated as follows:

$$\begin{aligned} \text{Combined flow volume} &= 3 \times 2 \text{ L/HP/h} \times 2\text{HP} &&= 18 \text{ L/h} \\ &+ 2 \times 2 \text{ L/HP/h} \times 1.5\text{HP} \end{aligned}$$

Tables 3-6.1 and 3-6.2 specify the required piping diameters for horizontal and vertical branch piping and for main piping. Note that main piping should use PVC40 or larger.

Table 3-6.1: Horizontal drain piping diameters

PVC piping	Nominal diameter (mm)	Capacity (L/h)		Remarks
		Slope 1:50	Slope 1:100	
PVC25	25	39	27	Branch piping only
PVC32	32	70	50	
PVC40	40	125	88	Branch or main piping
PVC50	50	247	175	
PVC63	63	473	334	

Table 3-6.2: Vertical drain piping diameters

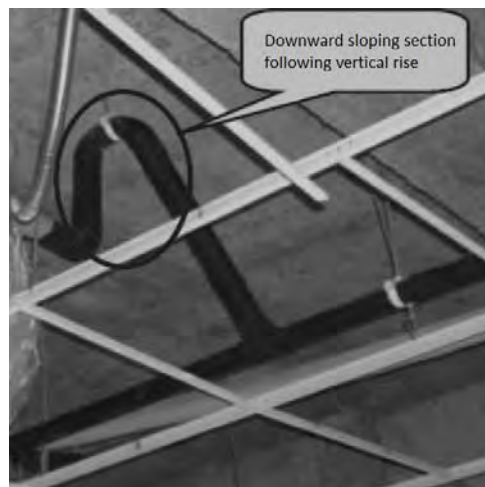
PVC piping	Nominal diameter (mm)	Capacity (L/h)	Remarks
PVC25	25	220	Branch piping only
PVC32	32	410	
PVC40	40	730	Branch or main piping
PVC50	50	1440	
PVC63	63	2760	
PVC75	75	5710	
PVC90	90	8280	

6.4 Drain Piping for Units with Lift Pumps

Drain piping for units with lift pumps should take account of the following additional considerations:

- A downward sloping section should immediately follow the vertically rising section adjacent to the unit, otherwise a water pump error will occur. Refer to Figure 3-6.7.
- Air vents should not be installed on vertically rising sections of drain piping, otherwise water may be discharged through the air vent or water flow may be impeded.

Figure 3-6.7: Downward sloping section of drain piping



6.5 Drain Piping Installation

Notes for installers



Installation of the drain piping should proceed in the following order:



Caution

- Ensure that all joints are firm and once the drain piping is all connected conduct a watertightness test and water flow test.
- Do not connect air conditioner drain piping to waste, rainwater or other drain piping and do not let air conditioner drain piping come into direct contact with the ground.
- For units with drain pumps, test that the drain pump functions properly by adding water to the unit's drainage pan and running the unit. To allow inspection and maintenance, the pipe clamps shipped with units should be used to attach drain piping to indoor units – adhesive should not be used.

6.6 Watertightness Test and Water Flow Test

Once installation of a drainage piping system is complete, watertightness and water flow tests should be performed.

Notes for installers



Watertightness test

- Fill the piping with water and test for leakages over a 24-hour period.

Water flow test (natural drainage test)

- Slowly fill the drainage pan of each indoor unit with at least 600ml of water through the inspection port and check that the water is discharged through the outlet of the drain piping.

Caution

- The drain plug in the drainage pan is for removing accumulated water prior to performing indoor unit maintenance. During normal operation, the drain should be plugged to prevent leakage.

7 Insulation

7.1 Refrigerant Piping Insulation

7.1.1 Purpose

During operation, the temperature of the refrigerant piping varies. Insulation is required to ensure unit performance and compressor lifespan. During cooling, the gas pipe temperature can be very low. Insulation prevents condensation forming on the piping. During heating, the gas pipe temperature can rise to as high as 100°C. Insulation serves as necessary protection from burns.

7.1.2 Selecting insulation materials

Refrigerant piping insulation should be closed-cell foam of B1 fire resistance rating that can withstand a constant temperature of over 120°C and that complies with all applicable legislation.

7.1.3 Thickness of insulation

Minimum thicknesses for refrigerant piping insulation are specified in Table 3-7.1. In hot, humid environments, the thickness of insulation should be increased over and above the specifications in Table 3-7.1.

Table 3-7.1: Refrigerant piping insulation thickness

Pipe outer diameter (mm)	Minimum insulation thickness (mm)
Φ6.35	15
Φ9.53	
Φ12.7	
Φ15.9	20
Φ19.1	
Φ22.2	
Φ25.4	
Φ28.6	
Φ31.8	
Φ38.1	25
Φ41.3	
Φ44.5	
Φ54.0	

7.1.4 Installation of piping insulation

With the exception of joint insulation, insulation should be applied to piping before fixing the piping in place. Insulation at joints in refrigerant piping should be applied after the gastightness test has been completed.

Notes for installers



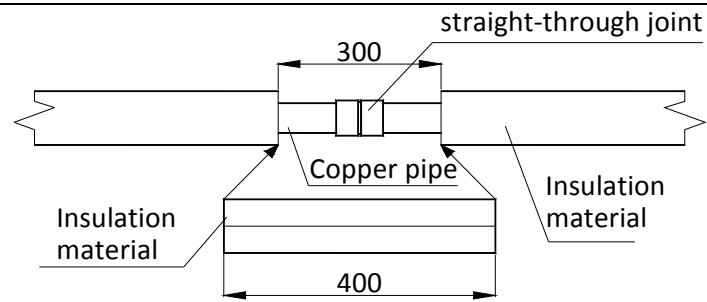
- Installation of insulation should be carried out in a manner suited to the type of insulation material being used.
- Ensure there are no gaps at the joints between sections of insulation.
- Do not apply tape too tightly as doing so may shrink insulation, reducing its insulating properties leading to condensation and loss of efficiency.
- Insulate gas and liquid pipes separately, otherwise heat exchange between the two sides will greatly impact efficiency.
- Do not bind the separately insulated gas and liquid pipes together too tightly as doing so can damage the joints between sections of insulation.

7.1.5 Installation of joint insulation

Insulation at joints in the refrigerant piping should be installed after the gastightness test has been successfully completed. The procedure at each joint is as follows:

1. Cut a section of insulation 50 to 100mm longer than the gap to be filled. Ensure that the cross-sectional and longitudinal openings are all cut evenly.
2. Embed the section into the gap ensuring that the ends abut tightly to the sections of insulation either side of the gap.
3. Glue the longitudinal cut and the joints with the sections of insulation either side of the gap.
4. Seal the seams with tape.

Figure 3-7.1: Installation of joint insulation (unit: mm)



7.2 Drain Piping Insulation

- Use rubber/plastic insulating tube with a B1 fire resistance rating.
- The insulation should typically be in excess of 10mm thick.
- For drain piping installed inside a wall, insulation is not required.
- Use suitable adhesive to seal seams and joints in the insulation and then bind with cloth reinforced tape of width not less than 50mm. Ensure tape is fixed firmly to avoid condensation.
- Ensure the drain piping insulation adjacent to the indoor unit drainage water outlet is fixed to the unit itself using adhesive, to prevent condensation and dripping.

7.3 Ducting Insulation

- Suitable insulation should be added to ducting in according with all applicable legislation.

8 Charging Refrigerant

8.1 Calculating Additional Refrigerant Charge

The additional refrigerant charge required depends on the lengths and diameters of the outdoor and indoor liquid pipes. Table 3-8.1 shows the additional refrigerant charge required per meter of equivalent pipe length for different diameters of pipe. The total additional refrigerant charge is obtained by summing the additional charge requirements for each of the outdoor and indoor liquid pipes, as in the following formula, where L_1 to L_8 represent the equivalent lengths of the pipes of different diameters. Assume 0.5m for the equivalent pipe length of each branch joint.

$$\begin{aligned}
 \text{Additional refrigerant charge R (kg)} &= (L_1 @ \Phi 6.35) \times 0.022 \\
 &+ (L_2 @ \Phi 9.53) \times 0.057 \\
 &+ (L_3 @ \Phi 12.7) \times 0.110 \\
 &+ (L_4 @ \Phi 15.9) \times 0.170 \\
 &+ (L_5 @ \Phi 19.1) \times 0.260 \\
 &+ (L_6 @ \Phi 22.2) \times 0.360 \\
 &+ (L_7 @ \Phi 25.4) \times 0.520 \\
 &+ (L_8 @ \Phi 28.6) \times 0.680
 \end{aligned}$$

Table 3-8.1: Additional refrigerant charge

Liquid side piping (mm)	Additional refrigerant charge per meter of equivalent length of piping (kg)
Φ6.35	0.022
Φ9.53	0.057
Φ12.7	0.110
Φ15.9	0.170
Φ19.1	0.260
Φ22.2	0.360
Φ25.4	0.520
Φ28.6	0.680

8.2 Adding Refrigerant

Notes for installers



Caution

- Only charge refrigerant after performing a gastightness test and vacuum drying.
- Never charge more refrigerant than required as doing so can lead to liquid hammering.
- Only use refrigerant R410A - charging with an unsuitable substance may cause explosions or accidents.
- Use tools and equipment designed for use with R410A to ensure required pressure resistance and to prevent foreign materials from entering the system.
- Refrigerant must be treated in accordance with applicable legislation.
- Always use protective gloves and protect your eyes when charging refrigerant.
- Open refrigerant containers slowly.

Procedure

The procedure for adding refrigerant is as follows:

Step 1

- Calculate additional refrigerant charge R (kg) (see Installation Manual, 8.1 “Calculating Additional Refrigerant Charge”)

Step 2

- Place a tank of R410A refrigerant on a weighing scale. Turn the tank upside down to ensure refrigerant is charged in a liquid state. (R410A is a blend of two different chemicals compounds. Charging gaseous R410A into the system could mean that the refrigerant charged is not of the correct composition).
- After vacuum drying (see Installation Manual, 5.10 “Vacuum Drying”), the blue and red pressure gauge hoses should still be connected to the pressure gauge and to the master unit stop valves.

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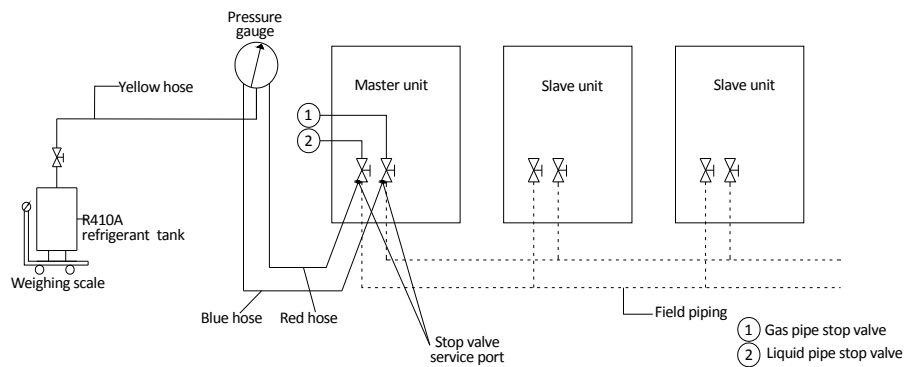
Step 3

- Loosen the connection port which connected with yellow pipeline and the pressure gauge, and open the refrigerant tank slightly to let the refrigerant eliminate the air. Caution: open the tank slowly to avoid freezing your hand.
- Set the weighing scale to zero.

Step 4

- Open the three valves on the pressure gauge to begin charging refrigerant.
- When the amount charged reaches R (kg), close the three valves. If the amount charged has not reached R (kg) but no additional refrigerant can be charged, close the three valves on the pressure gauge, run the outdoor units in cooling mode, and then open the yellow and blue valves. Continue charging until the full R (kg) of refrigerant has been charged, then close the yellow and blue valves. Note: Before running the system, be sure to complete all the pre-commissioning checks as listed in Installation Manual, 11.3 “Pre-commissioning Checks” and be sure to open all stop valves as running the system with the stop valves closed would damage the compressor.

Figure 3-8.1: Charging refrigerant



Pressure gauge

9 Electrical Wiring

9.1 General

Notes for installers



Caution

- All installation and wiring must be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation.
- Electrical systems should be grounded in accordance with all applicable legislation.
- Overcurrent circuit breakers and residual-current circuit breakers (ground fault circuit interrupters) should be used in accordance with all applicable legislation.
- Wiring patterns shown in this data book are general connection guides only and are not intended for, or to include all details for, any specific installation.
- The refrigerant piping, power wiring and communication wiring are typically run in parallel. However the communication wiring should not be bound together with the refrigerant piping or power wiring. To prevent signal interference, the power wiring and communication wiring should not be run in the same conduit. If the power supply is less than 10A, a separation of at least 300mm between power wiring and communication wiring conduits should be maintained; if the power supply is in the range 10A to 50A then a separation of at least 500mm should be maintained.

9.2 Power Supply Wiring

Power supply wiring design and installation should adhere to the following requirements:

- Separate power supplies should be provided for the indoor units and outdoor units.
- Where five or more outdoor units are installed, additional residual current protection (leakage protection) should be installed as shown in Figure 3-9.1.
- All the indoor units in a system (i.e. all the indoor units connected to the same set of outdoor units) should be tied into the same power circuit with the same power supply, overcurrent and residual current protection (leakage protection) and manual switch, as shown in Figure 3-9.2. Do not install separate protectors or manual switches for each indoor unit. Powering on and shutting down all indoor units in a system should be done simultaneously. The reason for this is that if an indoor unit that is running were to suddenly power off whilst the other indoor units continued running, the evaporator of the powered-off unit would freeze since refrigerant would continue flowing to that unit (its expansion valve would still be open) but its fan would have stopped. The indoor units that remain running would not get sufficient refrigerant so their performance would suffer. Additionally, liquid refrigerant returning directly to the compressor from the powered-off unit would cause liquid hammering, potentially damaging the compressor.
- For outdoor unit power wire sizing and circuit breaker sizing, refer to Table 2-6.1 in Technical Manual, 6 “Electrical Characteristics”.

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Figure 3-9.1: Outdoor unit power supply wiring

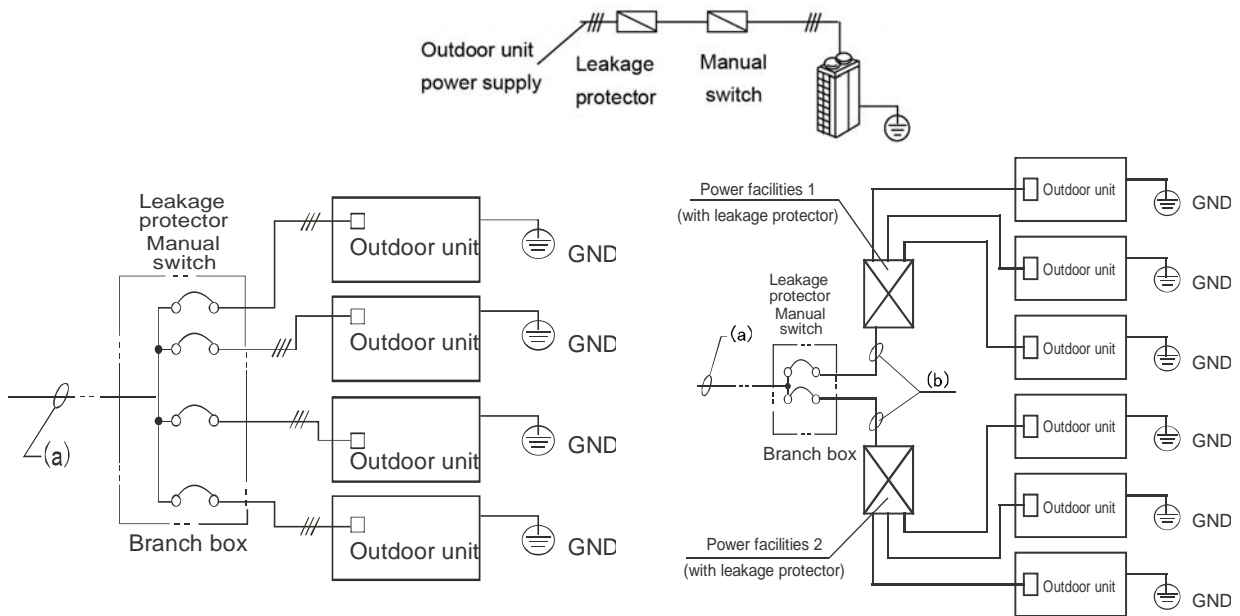
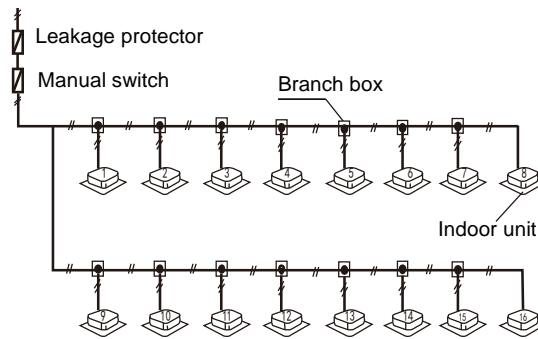


Figure 3-9.2: Indoor unit power supply wiring

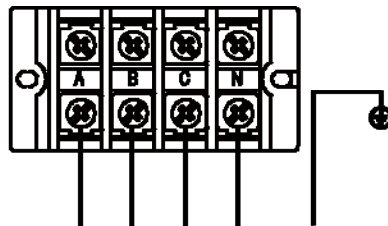


Notes for installers



The 3-phase, 380-415V, 50 or 60Hz power supply should be connected to the outdoor unit power supply terminals as shown in Figure 3-9.3.

Figure 3-9.3: Outdoor unit 3-phase power supply terminals

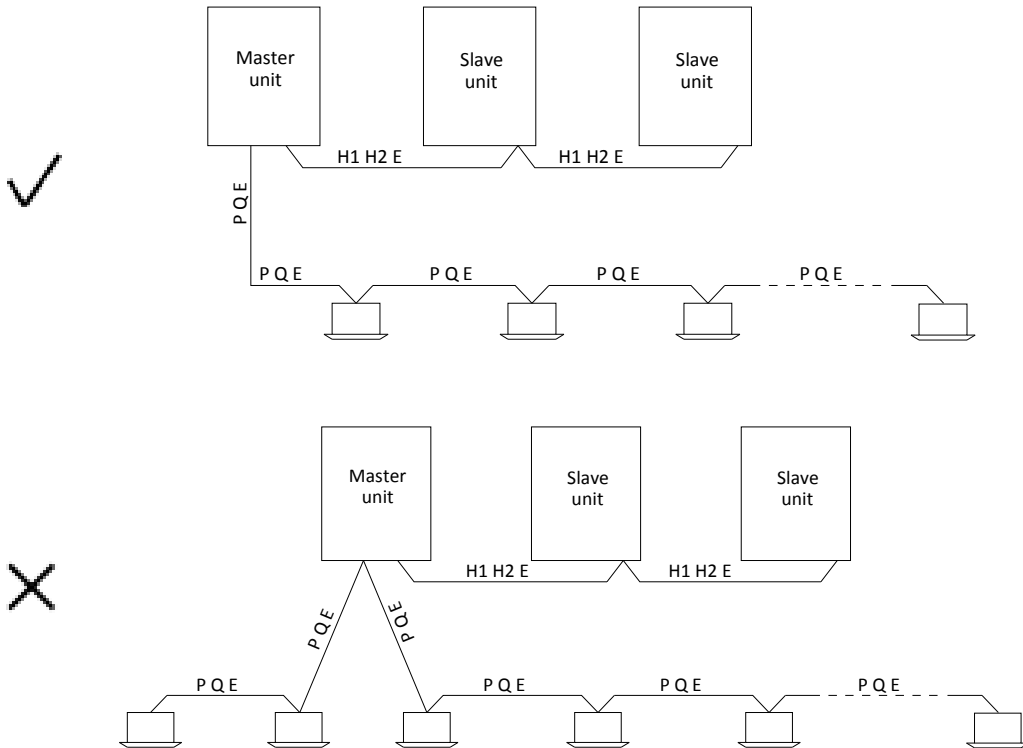


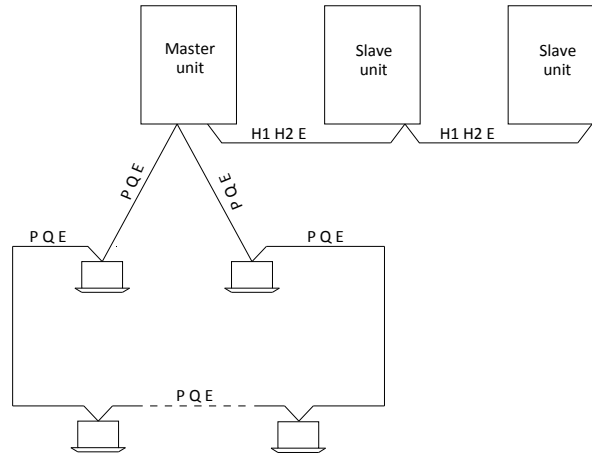
9.3 Communication Wiring

Communication wiring design and installation should adhere to the following requirements:

- 0.75mm² three-core shielded cable should be used for communication wiring. Using other types of cable can lead to interference and malfunction.
- **Indoor communication wiring:**
 - The P and Q communication wires should be connected one unit after another in a daisy chain from the outdoor unit to the final indoor unit as shown in Figure 3-9.4. At the final indoor unit, a 120Ω resistor should be connected between the P and Q terminals. After the final indoor unit, the communication wiring should NOT be continued back to the outdoor unit – that is, do not attempt to form a closed loop.
 - The P and Q communication wires and should NOT be grounded.
 - The shielding nets of the communication wires should be connected together and grounded. Grounding can be achieved by connecting to the metal casing adjacent to the P Q E terminals of the outdoor unit electrical control box.
- **Outdoor communication wiring:**
 - The H1 and H2 communication wires should be connected one unit after another in a daisy chain from the master outdoor unit to the final slave outdoor unit as shown in Figure 3-9.4.

Figure 3-9.4: Communication wiring configurations – correct and incorrect examples





Notes for installers



The communication wires should be connected to the master outdoor unit terminals indicated in Figure 3-9.5 and Table 3-9.1.

Caution

- Communication wiring has polarity. Care should be taken to connect the poles correctly.

Figure 3-9.5: Master outdoor unit communication terminals

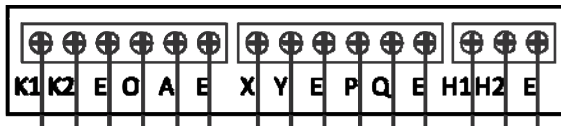
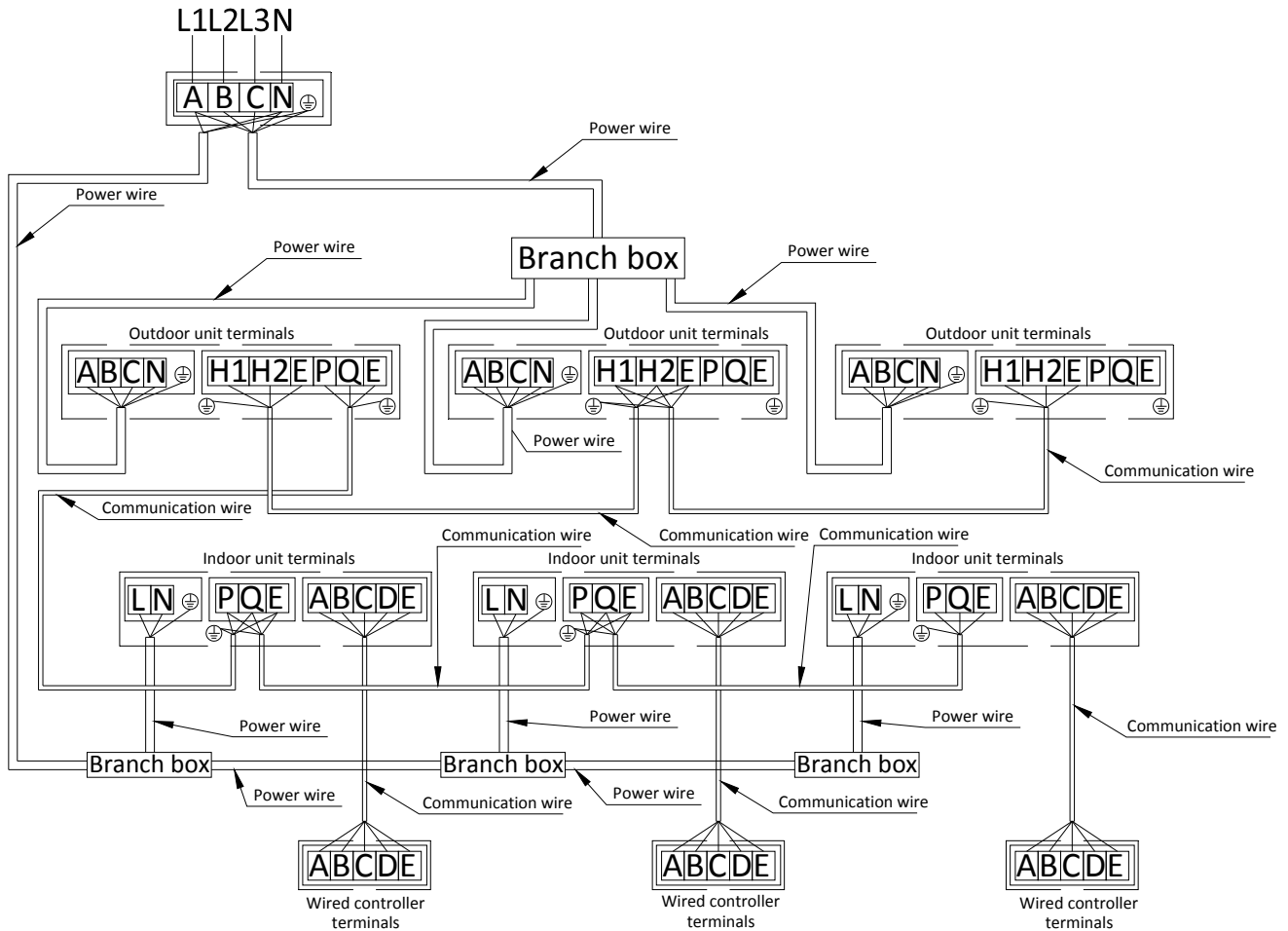


Table 3-9.1: Communication connections

Terminals	Connection
K1 K2 E	Connect to outdoor unit centralized monitor
O A E	Connect to digital energy meter
X Y E	Connect to indoor unit centralized controller
P Q E	Connect between indoor units and master outdoor unit
H1 H2 E	Connect between outdoor units

9.4 Wiring example

Figure 3-9.6: System power and communication wiring example



10 Installation in Areas of High Salinity

10.1 Caution

Do not install outdoor units where they could be directly exposed to sea air. Corrosion, particularly on the condenser and evaporator fins, could cause product malfunction or inefficient performance.

Outdoor units installed in seaside locations should be placed such as to avoid direct exposure to the sea air and additional anticorrosion treatment options should be selected, otherwise the service life of the outdoor units will be seriously affected.

Air conditioning installed in seaside locations should be run regularly as the running of the outdoor unit fans helps prevent build-up of salt on the outdoor unit heat exchangers.

10.2 Placement and Installation

Outdoor units should be installed 300m or more from the sea. If possible, well-ventilated indoor locations should be chosen. (When installing outdoor units indoors, outdoor unit discharge ducts should be added. See Installation Manual, 3 "Outdoor Unit Ducting and Shielding".) Refer to Figure 3-10.1. If it is necessary to install outdoor units outside, direct exposure to the sea air should be avoided. A canopy should be added to shield the units from sea air and rain, as shown in

Figure 3-10.2.

Ensure that base structures drain well so that outdoor unit footings do not become waterlogged. Check that outdoor unit casing drainage holes are not blocked.

Figure 3-10.1: Installation in a well-ventilated indoor area

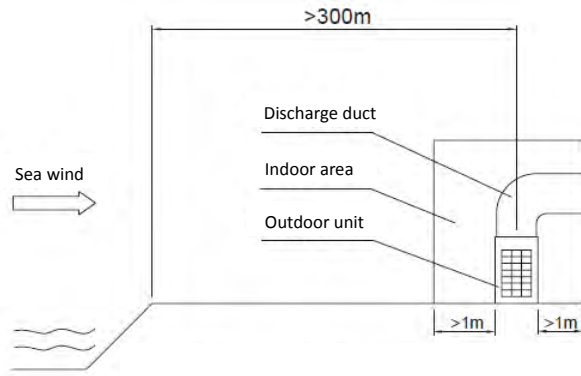
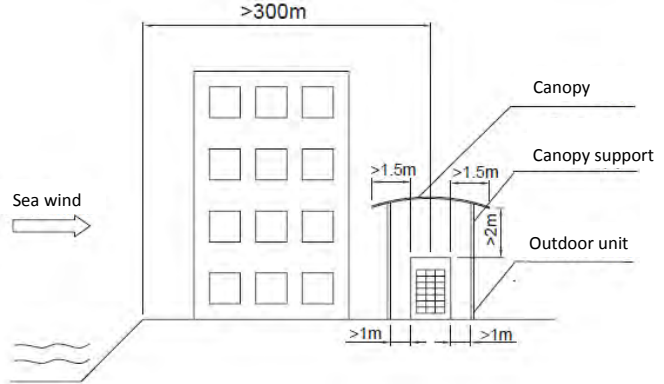


Figure 3-10.2: Installation outdoors under a canopy



10.3 Inspection and maintenance

In addition to standard outdoor unit servicing and maintenance, the following additional inspections and maintenance should be undertaken for outdoor units installed in seaside locations:

- A comprehensive post-installation inspection should check for any scratches or other damage to painted surfaces and any damaged areas should be repainted/repaired immediately.
- The units should be regularly cleaned using (non-salty) water to remove any salt that has accumulated. Areas cleaned should include the condenser, the refrigerant piping system, the outside surface of the unit casing and the outside surface of the electric control box.
- Regular inspections should check for corrosion and if necessary corroded components should be replaced and/or anti-corrosion treatments should be added.

11 Commissioning

11.1 Outdoor Unit Address and Capacity Settings

Before running a system for the first time, set each outdoor unit's address on switch ENC1 on each outdoor unit's main PCB. Refer to Table 3-11.1. The capacity of each outdoor unit (on switch ENC2 on each outdoor unit's main PCB) is factory-set and should not need changing. Check that the capacity settings are correct. Refer to Table 3-11.1.

Table 3-11.1: Outdoor unit address and capacity settings

Address settings		Capacity settings	
0	Master unit	0	8HP
1	Salve unit 1	1	10HP
2	Salve unit 2	2	12HP
3	Salve unit 3	3	14HP
≥4	Invalid	4	16HP
		5	18HP
		6	20HP
		7	22HP

11.2 Multi-system Projects

For projects with multiple refrigerant systems, each independent refrigeration system (i.e. each system of up to four outdoor units and their connected indoor units) should be given a test run independently, before the multiple systems that make up a project are run simultaneously.

11.3 Pre-commissioning Checks

Before turning on the power to the indoor and outdoor units, ensure the following:

1. All indoor and outdoor refrigeration piping and communication wiring has been connected to the correct refrigeration system and the system to which each indoor and outdoor unit belongs is clearly marked on each unit or recorded in some other suitable place.
2. Pipe flushing, gastightness testing and vacuum drying have been satisfactorily completed as per instructions.
3. All condensate drain piping is complete and a watertightness test has been satisfactorily completed.
4. All power and communication wiring is connected to the correct terminals on units and controllers. (Check that the different phases of the 3-phase power supplies have been connected to the correct terminals).
5. No wiring has been connected in a short-circuit.
6. The power supplies to indoor and outdoor units have been checked and the power supply voltages are within $\pm 10\%$ of the rated voltages for each product.
7. All control wiring is 0.75mm² three-core shielded cable and the shielding has been grounded.
8. The outdoor units' address and capacity switches are set correctly (see Installation Manual, 11.1 "Outdoor Unit Address and Capacity Settings") and all other indoor and outdoor unit field settings have been set as required.
9. The additional refrigerant charge has been added as per Installation Manual, 8 "Charging Refrigerant". Note: In some circumstances it may be necessary to run the system in cooling mode during the refrigerant charging procedure. In such circumstances, points 1 to 8 above should be checked before running the system for the purpose of charging refrigerant and the outdoor unit liquid, gas and oil balance valves should be opened.

During commissioning, it is important that you:

- Keep a supply of R410A refrigerant at hand.
- Keep the system layout, system piping and control wiring diagrams at hand.

11.4 Commissioning Trial Runs

11.4.1 Commissioning test run of single refrigerant system

Once all the pre-commissioning checks in Installation Manual, 11.3 "Pre-commissioning Checks" have been completed, a test run should be performed as described below and a V5 X Series System Commissioning Report (see Installation Manual, 12 "Appendix to Installation Manual – System Commissioning Report") should be completed as a record of the operating status of the system during commissioning.

Note: When running the system for commissioning test runs, if the combination ratio is 100% or less, run all the indoor units and if the combination ratio is more than 100%, run indoor units with total capacity equal to the total capacity of the outdoor units.

The test run procedure is as follows:

1. Open the outdoor unit liquid, gas and oil balance valves.
2. Turn on the power to the outdoor units.
3. If manual addressing is being used, set the addresses of each indoor unit.
4. Leave the power on for a minimum of 12 hours prior to running the system to ensure that the crankcase heaters have

heated the compressor oil sufficiently.

5. Run the system:
 - a) Run the system in cooling mode with the following settings: temperature 17°C; fan speed high.
 - b) After one hour, complete Sheet A of the system commissioning report then check the system parameters using the SW2 system check button on each outdoor unit's main PCB and complete the cooling mode columns of one Sheet D and one Sheet E of the system commissioning report for each outdoor unit.
 - c) Run the system in heating mode with the following settings: temperature 30°C; fan speed high.
 - d) After one hour, complete Sheet B of the system commissioning report then check the system parameters using the SW2 system check button on each outdoor unit's main PCB and complete the heating mode columns of one Sheet D and one Sheet E of the system commissioning report for each outdoor unit.
6. Finally, complete Sheet C of the system commissioning report.

11.4.2 Commissioning test run of multiple refrigerant systems

Once the commissioning test run of each refrigerant system has been satisfactorily completed as per Installation Manual, 11.4.1 "Commissioning test run of single refrigerant system", run the multiple systems that make up a project simultaneously and check for any abnormalities.

12 Appendix– System Commissioning Report

A total of up to 11 report sheets should be completed for each system:

- One Sheet A, one Sheet B and one Sheet C per system.
- One Sheet D and one Sheet E per outdoor unit.

V5 X Series System Commissioning Report – Sheet C

Project name and location	System name
---------------------------	-------------

RECORD OF ISSUES SEEN DURING COMMISSIONING				
No.	Description of observed issue	Suspected cause	Troubleshooting undertaken	Serial no. of relevant unit
1				
2				
3				

OUTDOOR UNIT FINAL CHECKLIST				
	Master unit	Slave unit 1	Slave unit 2	Slave unit 3
SW2 system check performed?				
Any abnormal noise?				
Any abnormal vibration?				
Fan rotation normal?				

	Commissioning engineer	Dealer	Midea representative
Name:			
Signature:			
Date:			

V5 X Series System Commissioning Report – Sheet D

Project name and location		System name	
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DSP1 content	Parameters displayed on DSP2	Remarks	Observed values	
			Cooling mode	Heating mode
- 0	Outdoor unit address	Master unit: 0; slave units: 1, 2, 3		
- 1	Outdoor unit capacity	Refer to Note 1		
- 2	Number of outdoor units	Displayed on master unit PCB only		
- 3	Number of indoor units as set on PCB	Displayed on master unit PCB only		
- 4	Outdoor unit output metric (total of all units)	Displayed on master unit PCB only		
- 5	Indoor unit demand metric (total of all units)			
- 6	Outdoor unit output metric (master unit)			
- 7	Operating mode	Refer to Note 2		
- 8	Outdoor unit output metric (this unit)			
- 9	Fan A speed index	Refer to Note 3		
10	Fan B speed index	Refer to Note 3		
11	Evaporator pipe temperature (°C) (Sensor T2B/T2)	Actual value = value displayed		
12	Condenser pipe temperature (°C) (Sensor T3)	Actual value = value displayed		
13	Outdoor ambient temperature (°C) (Sensor T4)	Actual value = value displayed		
14	Inverter compressor A discharge temperature (°C)	Actual value = value displayed		
15	Inverter compressor B discharge temperature (°C)	Actual value = value displayed		
16	Main inverter module temperature (°C)	Actual value = value displayed		
17	Saturation temperature (°C) corresponding to the discharge pressure	Actual value = value displayed + 30		
18	Inverter compressor A current (A)	Actual value = value displayed		
19	Inverter compressor B current (A)	Actual value = value displayed		
20	EXVA position	Steps = value displayed × 8		
21	EXVB position	Steps = value displayed × 8		

Table continued on next page ...

V5 X Series System Commissioning Report – Sheet E

Project name and location	System name
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... table continued from previous page

DSP1 content	Parameters displayed on DSP2	Remarks	Observed values	
			Cooling mode	Heating mode
22	Compressor discharge pressure (MPa)	Actual value = value displayed x 0.1		
23	Reserved			
24	Number of indoor units currently in communication with master unit	Actual value = value displayed		
25	Number of indoor units currently operating	Actual value = value displayed		
26	Priority mode	Refer to Note 4		
27	Silent mode	Refer to Note 5		
28	Static pressure mode	Refer to Note 6		
29	DC voltage A	Actual value = value displayed x 10		
30	DC voltage B	Actual value = value displayed x 10		
31	Reserved			
32	Most recent error or protection code	000 is displayed if no error or protection events have occurred since start-up		
33	Error clearance metric	Actual value = value displayed		
34	----	End		

Notes:

1. Outdoor unit capacity setting:
 - 0: 8HP; 1: 10HP; 2: 12HP; 3: 14HP; 4: 16HP; 5: 18HP; 6: 20HP; 7: 22HP.
2. Operating mode:
 - 0: off; 2: cooling; 3: heating; 4: forced cooling.
3. The fan speed index is related to the fan speed in RPM as described in the V5 X Service Manual, Installation Manual.
4. Priority mode:
 - 0: heating priority; 1: cooling priority; 2: VIP priority or voting priority; 3: heating only; 4: cooling only.
5. Silent mode:
 - 0: night silent mode; 1: silent mode; 2: super silent mode; 3: no silent mode.
6. Static pressure mode:
 - 0: standard static pressure; 1: low static pressure; 2: medium static pressure; 3: high static pressure.

13 Individual Controllers

Table 3-13.1: Individual controllers

Item		Type											
		C1	C2	P4	C4	DL	W1	FC	FS	CO	DM	DH	DF
Standard Controller		RM05/BG(T)E-A						KJR-29B			KJR-27B/BGE(A)		
Optional Controllers	Wireless remote controller	RM02/BGE-A						RM02/BGE-A RM05/BG(T)E-A			—		
	Wired remote controller	KJR-12B; KJR-29B; KJR-90D; KJR-86C; KJR-120C						KJR-12B; KJR-90D; KJR-86C; KJR-120C			—		
	Hotel key card interface module	MD-NIM05						—			—		
	Infrared sensor controller	MD-NIM09						—			—		
	Digital power meter	DTS634; DTS636						—			—		
	Remote alarm controller	KJR-32B						—			—		
Electricity distribution module		MD-NIM10						—			—		

Abbreviations:

C1: One-way Cassette; C2: Two-way Cassette; P4: Compact Four-way Cassette; C4: Four-way Cassette; W1: Wall-mounted;

FC: Ceiling & Floor; FS: Floor Standing; CO: Console; DL: Low Static Pressure Duct; DM: Medium Static Pressure Duct;

DH: High Static Pressure Duct; DF: Fresh Air Processing Unit; HR: Heat Recovery Ventilator

14 Centralized Controllers

Table 3-14.1: Centralized controllers

Item	Model	Features
Indoor centralized controllers	MD-CCM03; CCM30	Control up to 64 indoor units within a maximum connection length of 1,200m. Control multiple units as a group or assign individual temperature settings to each unit.
Weekly schedule centralized controller	MD-CCM09	Same functions as MD-CCM03 with additional weekly schedule timer function which allows up to four scheduled periods per day, each with its own operating mode and temperature settings, which can be applied to either a single indoor unit or all the indoor units as a group.
Outdoor unit centralized monitor	MD-CCM02	Check parameters, protection codes and error codes for up to eight refrigerant systems with up to 32 outdoor units.
Unified on/off controller	KJR-90B	Individual or simultaneous on/off control and status monitoring for up to 16 indoor units.
Group controller	KJR-150A	Link up to 16 indoor units for control from a single wired or remote controller.

15 Network Control System and Building Management Systems

Table 3-15.1: Network control system and building management systems

Item	Model	Features
Midea's fourth generation network control system	Hardware	<ul style="list-style-type: none"> Up to 4 M-interface gateways, 64 refrigerant systems, 1,024 indoor units and 250 outdoor units can be controlled from one PC. Import floor plans and create clear visual representations of system layouts. Remote anytime, anywhere access via PC, tablet computer or smart phone using VPN/WAN connection. Patented calculation method estimates the energy consumption of each indoor unit to equitably divide electricity charges among building occupants.
	Software	
BACnet gateway	MD-CCM08	<ul style="list-style-type: none"> Enables communication between VRF and BMS. Control and monitoring of air-conditioning systems using BACnet® protocol. Up to 256 indoor units and 128 outdoor units can be connected to BMS.
LonWorks gateway	LonGW64	<ul style="list-style-type: none"> Enables communication between VRF and BMS. Control and monitoring of air-conditioning systems using LonWorks® protocol. Up to 64 indoor units can be connected to BMS.
Modbus gateway	CCM-18A/N; CCM-18A/N-U	<ul style="list-style-type: none"> Enables communication between VRF and BMS. Control and monitoring of air-conditioning systems using Modbus® protocol. Up to 64 indoor units and 4 outdoor units can be connected to BMS.
KNX gateway	MD-KNX	<ul style="list-style-type: none"> Enables communication between VRF and BMS. Control and monitoring of air-conditioning systems using KNX® protocol. Each gateway can only be connected to one indoor unit.



Air Conditioning Systems

Cooling & Heating

TRUST AIR-CONDITIONING EQUIPMENT CO.

Shiraz office: 8 th floor, Alvand Bldg., Dostan St.,
Moaliabad Ave., SHIRAZ, IRAN., Post code: 71877-14446

Tel.: +98-71-36341070

Fax.: +98-71-36341094

Tehran office: No. 19- koohe nour St.- Motahhari St.-

TEHRAN, IRAN., Post code: 15876-73111

Tel.: +98-21-89389

Fax.: +98-21-88541903

Ahwaz office: No. 309- Kaveh St.- AHWAZ, IRAN., Post code: 61939-47911

Tel.: +98-61-32230647-8

Fax.: +98-61-32230647

E-mail: info@trustacs.com

Web site: <http://www.trustacs.com>

برند برتر در اولین جشنواره بین المللی
برترین نام و نشان های تجاری ایران

