Tentative

621471-10050 EN

Always read before installation

AISIN GHP Aisin Gas Heat Pump Air Conditioner

GHP OUTDOOR UNIT INSTALLATION INSTRUCTIONS

[Model P224 - P280 - P355]

■ Models

Outdoor unit		Gas type	
		LPG	NG
Multi type	P224 (8HP)	TGMP224D1 P	TGMP224D1 N
	P280 (10HP)	TGMP280D1 P	TGMP280D1 N
	P355 (13HP)	TGMP355D1 P	TGMP355D1 N

■ Safety precautions

The following symbols are used to indicate important instructions. Always read, understand and follow these instructions carefully.

WARNING	Failure to observe the prescriptions indicated with this symbol could result in serious injury or death
CAUTION	Failure to observe the prescriptions indicated with this symbol could result in damage to the unit.
	This symbol indicates a forbidden action.
	This symbol indicates a necessari action.

■ Notice for the installer

WARNING	This unit has to be installed by specialised technical personnel. The installation must be performed in accordance with the contents of this manual. If this unit is not properly installed, it will not realize its full performance potential and could cause injury or damage.

This manual contains technical prescriptions, precautions and procedures to install the AISIN GHP outdoor unit properly. It is addressed to specialised technical personnel with a basic knowledge of gas heat pumps installation methods. Failure to observe the procedures herein indicated, could result in malfunction and damage to the unit.
Before beginning the installation of an AISIN GHP outdoor unit, read anc fully understand the contents of this manual.
This manual contains also technical prescriptions, precautions and procedures to install separately sold accessorizes (remote controllers, exhaust extension etc.)

After the installation, always call the local AISIN Authorised Service Centre to perform the outdoor and indoor units commissioning.

8 HP – TGMP224D1 [N – P] [NG – LPG]

10 HP – TGMP280D1 [N – P] [NG – LPG]

13 HP – TGMP335D1 [N – P] [NG – LPG]

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Outdoor unit specifications

LPG Model				TGMP224D1- P	TGMP280D1- P	TGMP355D1- P
Natural gas Model				TGMP224D1- N	TGMP280D1- N	TGMP355D1- N
Rated Output				8 HP	10 HP	13 HP
Rated cooling capacity *			kW (frig./h)	22.4 (19.300)	28.0 (24.000)	35.5 (30.600)
Rated heating capacity **			kW (kcal/h)	26.5 (22.900)	33.5 (28.800)	42.5 (36.500)
Electrical features	Power supply		V	230 single phase / 200 single phase (auto transformer supplied)		
	Corrente d'avviamento		A	20		
	Power consumption	Cooling	kW	0.82		
		Heating		0.86		
	Running current	Cooling	A	4.5		
		Heating		4.7		
Fuel gas	Consumption (NG – LPG)	Cooling	kW	16.0	19.7	25.6
		Heating		16.3	21.3	26.0
	Supply pressure			**Category**	**Country**	**Test Pressure**
				II2H3+	IT – GB – IE – ES – GR - PT	G20-20 mbar G30/G31-30/37 mbar
				II2H3B/P	DK – FI – SE – NO – SI – SK CZ – EE – LV – LT – LU	G20-20 mbar G30/G31-30 mbar
				II2H3B/P	HU	G20-25 mbar G30/G31-30 mbar
				II2ER3+	FR	G20/G25-20/25 mbar G30/G31-28/30 mbar
				II2L3B/P	NL	G25-25 mbar G30/G31-30 mbar
				I2E	DE	G20-20 mbar
				I2H	AT	G20-20 mbar
				I2H	CH	G20-20 mbar
				I2ER(B)	BE	G20/G25-20/25 mbar
				I3+	BE	G30/G31-28/30 mbar
				I3B/P	CY	G30/G31-30 mbar
				I3B/P	MT	G31-30mbar
Engine	Type			Water cooled vertical type, 4 cycle, 3 cylinder		
	Displacement		cm^3	952		
	Rated output		kW	6.0	7.5	9.5
	Revolution range	Cooling	rpm	1.000~1.500	1.000~1.600	1.000~2.050
		Heating		1000~2.200	1.000~2.800	1.000~2.800
	Lubricant	Type		AISIN GHP OIL L10.000 G **(refill every 10.000 hours, replace every 30.000 hours)**		
		Quantity	lt.	35		
Engine coolant	Type			AISIN Coolant S		
	Quantity		lt.	15		
	Concentration (standard / cold district)		%	50 / 65		
Compressor	Type x number of units			Scroll X 2		
	Specified refrigeration oil			NL 10		
	Quantity		lt.	4		
	Revolution range	Cooling	rpm	1.700~2.550	1.700~2.720	1.700~3.485
		Heating		1.700~3.740	1.700~4.760	1.700~4.760
	Transmission			Poli V belt		
Refrigerant	Type			R410A		
	Quantity		kg	11.5	11.5	12
Noise level		Standard mode	dB(A)	56	56	57
		Silent mode		54	54	55
Piping	Refrigerant	Gas	mm	Ø 19.1	Ø 22.2	Ø 25.4
		Liquid		Ø 9.5		Ø 12.7
	Fuel gas			R 3 / 4"		
	Exhaust drain		mm	Ø 15 (Ø 30 cold district)		
Piping permissible length (actual / equivalent)			m	165 / 190		
Permissible height difference between indoor units				15		
Permissible height difference between indoor and outdoor units				+ 50 / - 40		
External dimensions		Height	mm	2.100		
		Width		1.424		
		Depth		890		
Weight			Kg	580		595
Connectable indoor units	Number			16		
	Capacity		%	50 – 150		

* Cooling capacity is measured according to the following conditions : indoor temperature 27°C DB / 19,5°C WB ; Outdoor temperature 35°C DB
** Heating capacity is measured according to the following conditions : indoor temperature 21°C DB ; Outdoor temperature 7°C DB / 6°C WB

1-2. Parts provided

The following parts are provided with this outdoor unit. Please check the contents.

	Name	
	Reducer (Gas)	Reducer (Liquid)
Shape		
Quantity	3 types (1 piece each)	2 types (1 piece each)
Location provided	Inside refrigerant compartment	
Notes	To select the proper reducer, refer to "4-2. Refrigerant piping installation specifications" on page 11.	

2. Locally procured parts

The following items are required for installing this GHP.

Part	Application
Anchor bolt	For installing outdoor unit (M12 × 4 pcs)
Washer, nut	For installing outdoor unit (M12 × 4 pcs)
Suspension (M10), nut	For installing indoor units (4 pcs per indoor unit)
Copper piping (C1220T)	For refrigerant piping (Refer to pages 11 to 15)
Hardened vinyl piping (VP)	For indoor unit and outdoor unit drain (VP20, VP25, VP30)
Steel piping (SGP)	For fuel gas piping (3/4B)
Strong gas hose	For fuel gas piping
Insulation	For refrigerant and drain pipe insulation
Power supply wire	For electric power supply for indoor and outdoor unit (Refer to "9-1. Power supply wire" on page 33)
Communication wire between indoor and outdoor units	For communication between indoor and outdoor units (Refer to page "9-2. Communication wire between indoor and outdoor units" on page 34)
Remote control wire	For connecting indoor unit and remote controller (Refer to "9-3. Remote control wire" on page 33)
Ground wire	For grounding the outdoor unit
Refrigerant	For charging (R410A)
Compressor oil	For applying to flange packings and flares (NL10)
Crimp piping	For branch piping

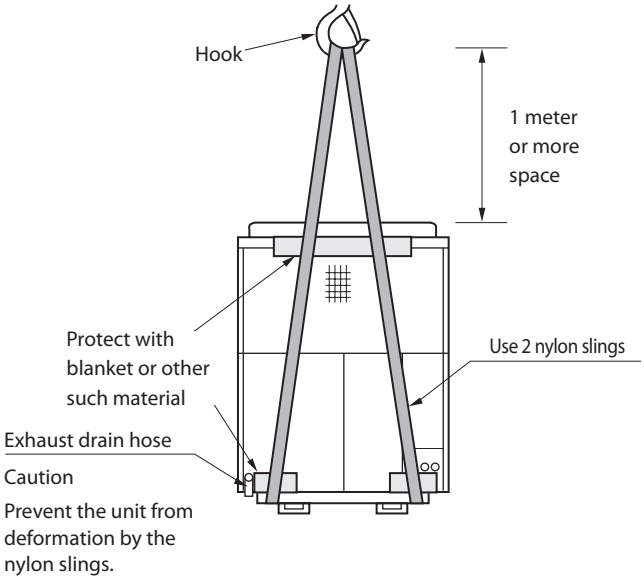
1. Transporting the Outdoor Unit

1-1. Checking the transport route

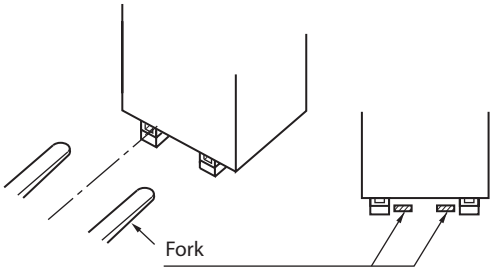
- Make sure that the route to the installation site and any passageways are large enough for the outdoor unit to be transported through.
- Make sure that the route to the installation site has the strength to withstand the weight of the outdoor unit.

1-2. Methods for transporting the outdoor unit

- Use a nylon sling rigged in the manner shown in the illustration.
  Use protection wherever necessary to prevent the outdoor unit from damage or deformity.



- If a forklift is used for transport, spread the fork as wide as possible for fitting in the opening at the bottom of the unit (as shown in the illustration). Insert the forks completely, using care not to damage the unit with them.



- Do not tilt the unit more than 30°. (Never tip the unit on its side)

1-3. Dimensions related to transporting the outdoor unit

Outdoor unit		Transport dimensions (mm)	Weight (kg)
Multi-type for buildings	P224	1440(W) × 996(D) × 2100(H)	580kg
Multi-type for buildings	P280		580kg
Multi-type for buildings	P355		595kg

* The weight of cold district specification and odor-resistant specification is added 5kg each.

2. Installation

2-1. Selecting the location for installation

Warning

- **Never install the outdoor unit in a location where the exhaust gas could flow into the room.**
  Make sure that exhaust gas is not being discharged near an air intake port or windows where it could be drawn into the room and cause gas poisoning or asphyxiation.
- **Never install the unit in an area where flammable gas is generated, flows into, accumulates or leaks.**
  Never install in an area where volatile materials are handled. Installation in such locations could result in fire or explosion.

- **Always install the outdoor unit in an outdoor location and with ample outdoor air flow.**
  If the exhaust gas accumulates, it could cause gas poisoning or asphyxiation.
- **Make sure that the area where the outdoor unit is going to be installed is strong enough to withstand its weight.**
  If the location is not strong enough, the outdoor unit could fall over and cause injury or damage.
- **Always discharge the exhaust gas to the air in a location where the gas will not cause adverse affects on the surrounding area.**
  If the exhaust gas is exhausted into the exhaust vent or ditch, it could be drawn into the room and it could cause gas poisoning or asphyxiation.

Caution

- **Never install the unit in a location where its exhaust gas or air from its blower fan will come in contact with plants or animals.**
  The exhaust gas could cause harm to these plants or animals.
- **If the unit is installed at high location, install a ladders or railings for the operators.**
  If these are not installed, the operator could fall.

Important reminder

- **Always install the outdoor unit in an area where its operating noise and vibration will not cause problems for those below or surrounding the unit. (This is especially important when installing in residential areas.)**
- **Never allow air from the blower fan of the outdoor unit blow on nearby homes.**
- **Install in a level location where rainwater cannot penetrate and water cannot accumulate.**
- **Install the outdoor unit in a location where it will not be exposed to strong winds.**
- **The outdoor unit can cause interference with electrical equipment. Always install in a location distant enough from the electrical equipments like televisions, radios, computers and telephones, and their antennas, electrical wires, signal wires and so on.**
- **Never install the outdoor unit in a location where heat from it could adversely affect other equipment.**
- **If the unit is installed in a region with heavy snowfall, install the optional snow protection hood. Also make sure that the base for the unit is high enough so as not to be affected by accumulated snow.**
- **Allocate the route for loading/unloading the equipment, materials and parts for maintenance at the installation site (minimum route width: 1200 mm, maximum mass of equipment, materials and parts: 250 kg).**

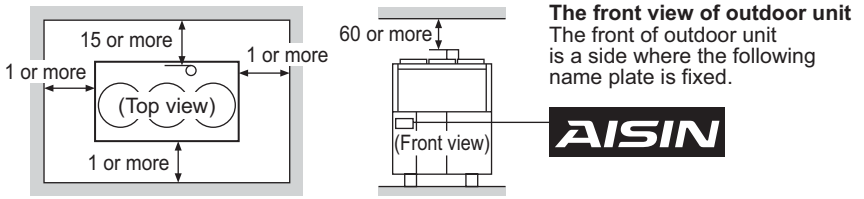
2-2. Space required for installation

1) Provide sufficient distance from flammable materials

⚠ Warning

- **Install the outdoor unit in the proper distance from flammable items, which is defined as a fire-prevention certified gas-operated equipment. (as shown in the drawings below)**
  If the distance requirement are not provided, it could result in fire.

Fire-prevention certified gas-operated equipment



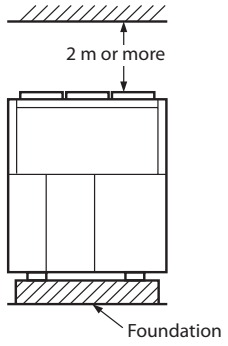
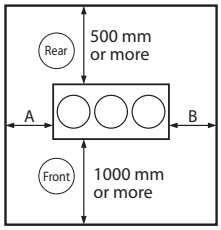
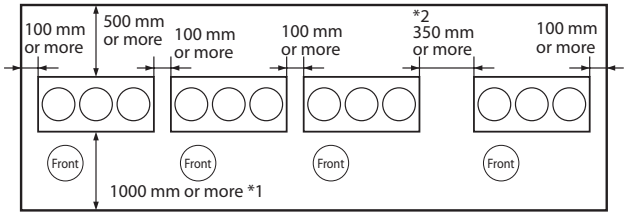
Distance from flammable materials (cm)

2) Installation space

⚠ Caution

- **The following drawing shows the minimum installation space for providing room for intake air and inspection and maintenance operations.**
  If these space requirements are not provided, it could result in injury to the maintenance personnel and damage to the equipment.

Always provide ample space for inspecting and maintaining the piping for the refrigerant and the fuel gas.

Front view	Top view
 Provide 2 meters or more of space above the unit.	<One unit installation>  One of either the A dimension or the B dimension must be 100 mm or more. 350 mm or more for the other surfaces. *1 This should be 1200 mm or more when the snow hood is mounted. *2 When 4 or more units are mounted continuously, provide a service space every 3 unit. <Multiple units installation> 

Important reminder

- **When 4 sets or more of outdoor units are installed in the same location, nearby walls or other objects could obstruct air flow and result in short circuiting. Due to prevention of performance decline and damage by short circuit, winder installation space is necessary. Please contact with an authorized dealer about installation way.**

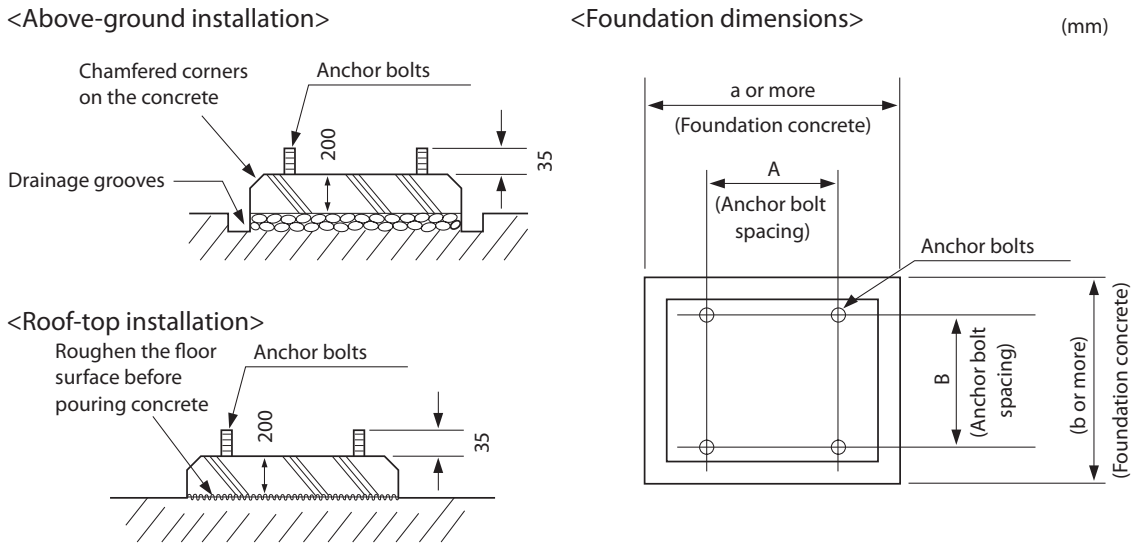
2-3. Foundation and anchor bolt specifications

1) Foundation shape

Warning

- **The foundation must provide a firm and level surface for installing the outdoor unit. This foundation must be capable of preventing the outdoor unit from tipping in the event of strong winds (typhoons, etc.) or seismic activity.**
  If the unit does tip, the gas lines will rupture and leak and cause injury or damage.

- The foundation must be in accordance with the drawings below and have the necessary strength. In order to be capable of protecting the outdoor unit from rain, dust and damage, the height of the foundation height must be 200 mm from the floor surface and have a groove that directs exhaust water away from the unit.
- The foundation must support the weight of the outdoor unit evenly and must be flat and smooth so that water will not accumulate on the upper surface.
- Never use an improper or poorly constructed foundation. A poorly constructed foundation will not provide the necessary strength.
- Condensation water may drip from the bottom of the outdoor unit. Install a drain pan if this water has the potential for causing problems.



Installation location/Seismic design	Foundation dimensions (mm)		Anchor bolt spacing (mm)	
	a	b	A	B
Above-ground/Level 0.4 G, Vertical 0.2G	1450	1050	760	956
Roof-top/Level 1.0G, Vertical 0.5G	1650	1600	760*	956*

* Refer to “3-3. 3) Antivibrant stand” when installing the antivibrant stand.

Important reminder

- **If the foundation is smaller than the specified dimensions or if the seismic design is larger than that shown in the chart above, appropriate design change such as to connect the foundation to the building (floor slab) with steel rods should be made by qualified professional in accordance with the appropriate building equipment seismic tolerance design and installation policy.**

2) Anchor bolts

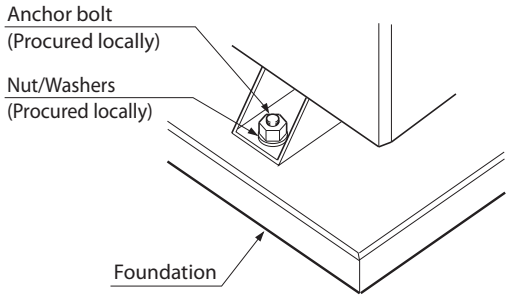
Warning

- **Use anchor bolts that satisfy the specifications shown in the chart below. Make sure the legs for the outdoor unit and firmly secured with washers and bolts.**
  If the strength is insufficient and the unit does tip, the gas lines will rupture and leak and cause injury or damage.

Required anchor bolt pull out resistance strength

Size	M12
Short-term permissible pull-out load	6.7kN
Type	• Male mechanical anchor • Resin anchor • Embedded anchor

- Never use a female mechanical anchor with an insufficient pull out resistance strength.

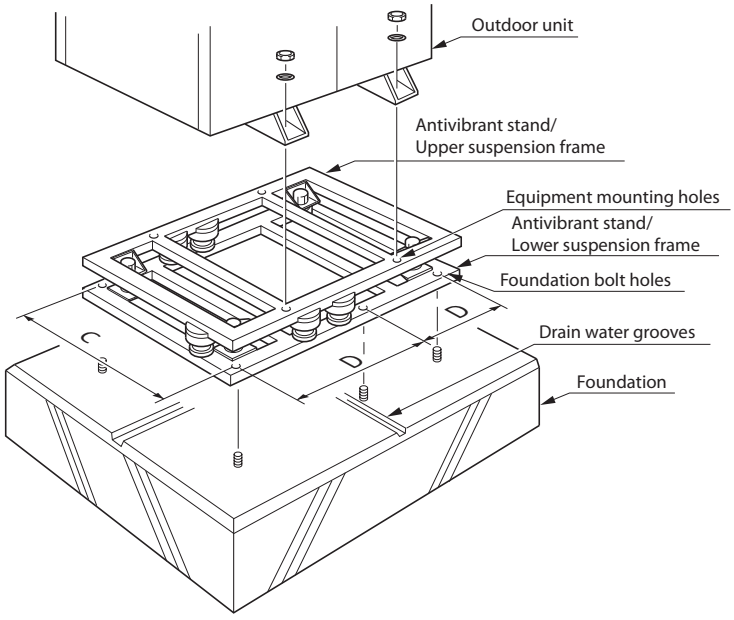


3) Antivibrant stand

- Use this antivibrant stand when installing the outdoor unit on a roof or balcony, or when operating noise or vibration could cause problems in lower floors or nearby buildings.
  (For specific information about installing, refer to the manual provided with the antivibrant stand.)
- When using the antivibrant stand, refer to the table below for the spacing of the anchor bolts in the foundation.
- Provide sufficient grooves in the top of the foundation for draining water so that it will not accumulate inside the lower frame of the antivibrant stand.
- The foundation is the full surface of the base foundation. Make this surface level and provide a smooth finish to it so that the lower frame of the antivibrant stand will make even contact.

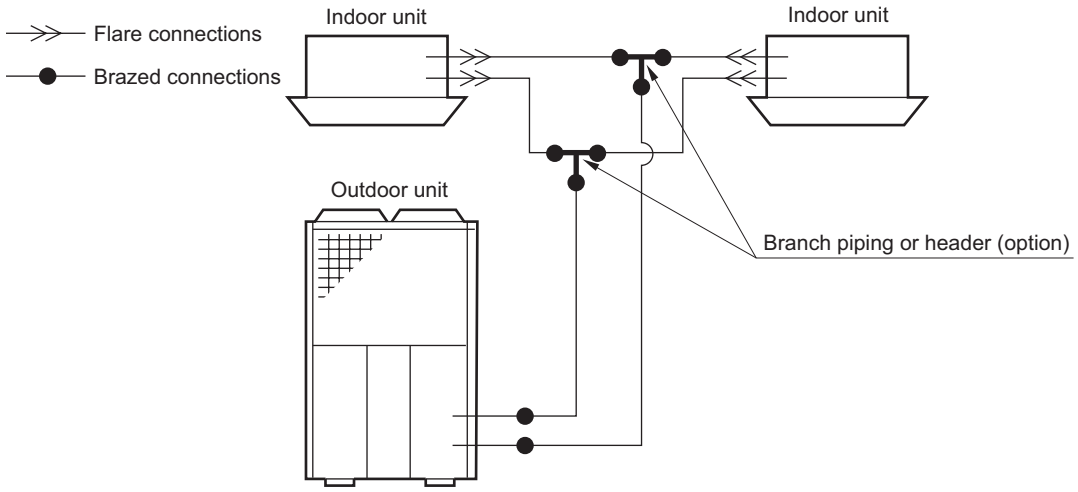
Model	C Dimension (mm)	D Dimensions (mm)
AGVJ560D1	936 (*)	950 (*)
AGWJ560D1		

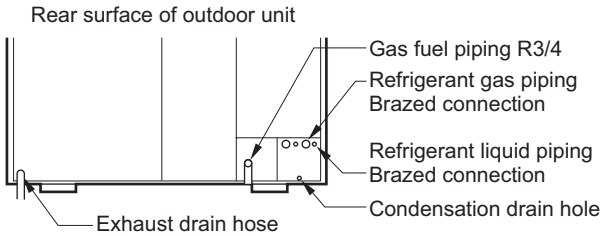
* When using the bracket provided to secure in place, please refer to the installation manual provided with the antivibrant stand.



3. Refrigerant Piping

3-1. Outline drawing of refrigerant piping





3-2. Refrigerant piping installation specifications

Indoor Unit		Item					
		Refrigerant piping diameter (mm)		Acceptable piping length (m) Relative length/ Actual length	Acceptable height difference (m)		Compressor oil
		Gas	Liquid		Outdoor unit on top	Outdoor unit at bottom	
Multi type for buildings	224P	ø19.1 *1(ø22.2)	ø9.5 *1(ø12.7)	190 /165 *2	50	40	NL10
	280P	ø22.2 *1(ø25.4)	ø9.5 *1(ø12.7)				
	355P	ø2.54 *1(ø28.6)	ø12.7 *1(ø15.9)				

*1 If the piping length exceeds 100m, install one rank wider pipe (at the piping diameter specified within ( ) parentheses).

*2 When total capacity of connected multi type or hi-power multi type outdoor unit for buildings exceeds 130% of rated capacity, restrict the acceptable piping length (actual length) to 100m.

2) Multi-type for buildings (TGMP224D·TGMP280D·TGMP355D)
)

- Make sure that the total extension refrigerant piping length remains within 350m.
- If the refrigerant piping length exceeds 100m, use pipes with wider diameters indicated on page 11 for the main piping, for both liquid and gas.
  Ex: ø15.88 → ø19.05
- R410A is used for this unit. Resistance pressure for O material piping that is ø 19.05 or greater is insufficient. Make sure to use a minimum thickness of 1/2H or H materials. For ø 19.05 piping however, as long as the thickness is 1.05mm or greater, O materials can be used.
- Do not bend and use piping with an external size of ø28.58 or greater.
- Refrigerant piping can be arranged in several ways: line branch, header branch and line/header combination. Decide arrangement based on the layout of the indoor units.
- Always strive to make the length of refrigerant piping as short as possible and to keep the difference in height between the indoor and outdoor units as small as possible.
- Once a header has been branched, it cannot be branched again.
- For TKFDP900/P1120/P1600 M7 (large-size floor-standing ducts), use a reducer just in front of the indoor unit entrance line to match with the pipe diameter (Take care of the reducer on-site).

■ Piping specifications

- Refrigerant piping specifications: Outer diameter × thickness (mm)
  ø 6.35 × 0.8 (O material or OL material) ø 9.52 × 0.8 (O material or OL material)
  ø 12.7 × 0.8 (O material or OL material) ø 15.88 × 1.0 (O material or OL material)
  ø 19.05 × 1.0 (1/2H or H material) ø 22.22 × 1.0 (1/2H or H material)
  ø 25.4 × 1.0 (1/2H or H material) ø 28.58 × 1.0 (1/2H or H material)
  ø 31.75 × 1.1 (1/2H or H material)
  *1 For ø 19.05 piping however, as long as the thickness is 1.05mm or greater, O materials can be used.
  *2 Should not exceed the outdoor unit main piping diameter.

(1) Interval from outdoor unit to No. 1 branch (Fig. A below)			
Outdoor unit	P224	P280	P355
Gas pipe	ø19.1	ø22.2	ø25.4
Liquid pipe	ø9.5	ø9.5	ø12.7

*

(2) Interval from branch to branch (Fig. B, C below)						
Total capacity of downflow indoor units	Less than P70	P70 or more less than P180	P180 or more less than P371	P371 or more less than P540	P540 or more less than P700	P700 or more less than P924
Gas pipe	ø12.7	ø15.88	ø19.05	ø25.4	ø28.58	
Liquid pipe	ø9.52		ø12.7	ø15.88		

(3) Interval from branch to indoor unit (Fig. a, b, c, d, e, f below)					
Indoor unit	P22,28	P36,45,56	P71,80,90, 112,140,160	P224 Refer to **Note**	P280 Refer to **Note**
Gas pipe	ø9.52	ø12.7	ø15.88	ø19.05	ø22.22
Liquid pipe	ø 6.35		ø 9.52		

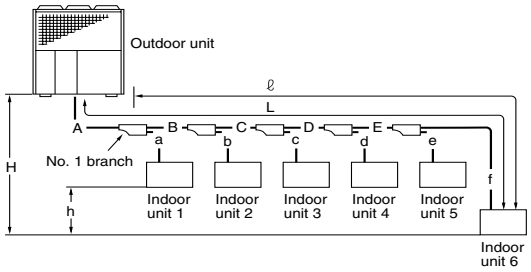
Note

■ **If there are multiple header branches or line headers, indoor units of P224 or more cannot be connected after the header branch piping (shown as c,d,e,f in illustration below). To connect indoor units of P224 or more, connect to a line branch (shown as a, b in illustration below)**

(Note) For sizes ø 19.05 or greater, use C1220T-1/2 or H materials.
For ø19.05 piping however, as long as the thickness is 1.05mm or greater, O materials can be used.

■ Selecting branch piping and permissible piping length

Line branch method

Connection example (When 6 indoor units are connected) Note: If there is a difference of elevation between the indoor and outdoor units, make sure to install as small a trap as possible in the gas line for every 10m of elevation difference.			
Permissible piping length	Maximum piping length (L) (Relative length/ Actual length)	A + B + C + D + E + f	185/160 m or less
	Maximum piping length after No.1 branch (ℓ)	B + C + D + E + f	40 m or less
Permissible height difference	Height difference between Indoor unit - outdoor unit (H)	When outdoor unit is installed above indoor unit	50 m or less
		When outdoor unit is installed below indoor unit	40 m or less
	Height difference between indoor unit and indoor unit (h)		15 m or less
Divergence piping	Divergence piping kit selection method • The divergence piping size differs depending upon the volume of the connected indoor units (total capacity of downflow). Select using the chart below.		

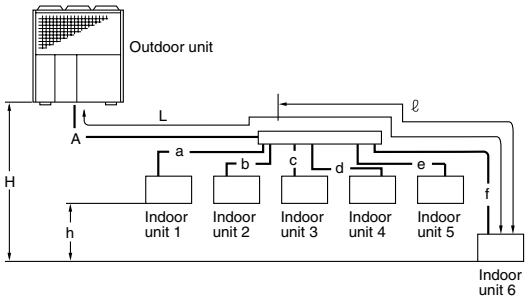
Total volume downstream	Branch piping kit
Less than 180	TMDIS-22-1
180 or more to less than 371	TMDIS-180-1
371 or more to less than 540	TMDIS-371-1
540 or more	TMDIS-540-1

Remember the following:

- Remember to match the indoor unit and indoor branch pipe size to the indoor unit's connection pipe size.
- Always install branch connections (for both gas and liquid) as either a "horizontal branch" or "vertical branch".

Header branch method

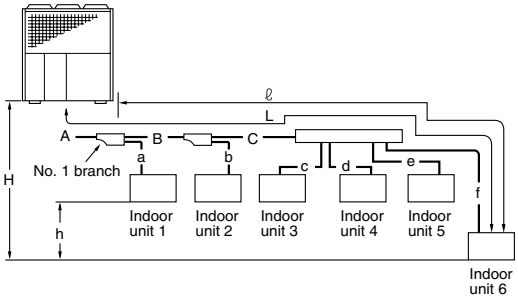
<table>
<tr><td colspan="2">Connection example
(When 6 indoor units are connected)

Note: If there is a difference of elevation between the indoor and outdoor units, make sure to install as small a trap as possible in the gas line for every 10m of elevation difference.</td><td> 
</td></tr>
<tr><td rowspan="2">Permissible piping length</td><td>Maximum piping length (L)
(Relative length/Actual length)</td><td>A + f</td><td>150/120 m or less</td></tr>
<tr><td>Maximum piping length after No.1 branch (ℓ)</td><td>f</td><td>40 m or less</td></tr>
<tr><td rowspan="3">Permissible height difference</td><td rowspan="2">Height difference between Indoor unit - outdoor unit (H)</td><td>When outdoor unit is installed above indoor unit</td><td>50 m or less</td></tr>
<tr><td>When outdoor unit is installed below indoor unit</td><td>40 m or less</td></tr>
<tr><td>Height difference between indoor unit and indoor unit (h)</td><td colspan="2">15 m or less</td></tr>
<tr><td>Divergence piping</td><td colspan="3">Header kit selection method
• Connect crimp piping (obtain on-site) to the junctions (on the indoor unit connection side) in accordance with the number of indoor units to be connected.
• Refer to the header kit (sold separately) for the crimp piping size.
<table>
<tr><th>Total capacity of downflow</th><th>Header kit model</th><th>Number of branches</th></tr>
<tr><td>Less than 180</td><td>TMHEAD4-22-1</td><td>Maximum 4 branches</td></tr>
<tr><td>180 or more to less than 371</td><td>TMHEAD6-180-1</td><td>Maximum 6 branches</td></tr>
<tr><td>371 or more to less than 540</td><td>TMHEAD8-371-1</td><td rowspan="2">Maximum 8 branches</td></tr>
<tr><td>540 or more</td><td>TMHEAD8-540-1</td></tr>
</table>
Remember the following:
• Match the header and indoor unit piping to the connection piping size of the indoor unit.
• Always install the header (both gas and liquid sides) as a “horizontal branch”.
• 224 and 280 indoor units cannot be connected to a header.</td></tr>
</table>

Line - header multiple branches

Connection example
(When 6 indoor units are connected)

Note: If there is a difference of elevation between the indoor and outdoor units, make sure to install a small a trap as possible in the gas line for every 10m of elevation difference.



Permissible piping length	Maximum piping length (L) (Relative length/Actual length)	A + B + C + f	185/160 m or less
	Maximum piping length after No.1 branch (ℓ)	B + C + f	40 m or less
Permissible height difference	Height difference between Indoor unit - outdoor unit (H)	When outdoor unit is installed above indoor unit	50 m or less
		When outdoor unit is installed below indoor unit	40 m or less
	Height difference between indoor unit and indoor unit (h)		15 m or less

Divergence piping

Divergence piping kit selection method

- The divergence piping size differs depending upon the volume of the connected indoor unit (total capacity of downflow). Select using the chart below.

Total volume downstream	Branch piping kit
Less than 180	TMDIS-22-1
180 or more to less than 371	TMDIS-180-1
371 or more to less than 540	TMDIS-371-1
540 or more	TMDIS-540-1

Remember the following:

- Remember to match the indoor unit and indoor branch pipe size to the indoor unit's connection pipe size.
- Always install branch connections (for both gas and liquid) as either a "horizontal branch" or "vertical branch".

Header kit selection method

- Connect crimp piping (obtain on-site) to the junctions (on the indoor unit connection side) in accordance with the number of indoor units to be connected.
- Refer to the header kit (sold separately) for the crimp piping size.

Total capacity of downflow	Header kit model	Number of branches
Less than 180	TMHEAD4-22-1	Maximum 4 branches
180 or more to less than 371	TMHEAD6-180-1	Maximum 6 branches
371 or more to less than 540	TMHEAD8-371-1	Maximum 8 branches
540 or more	TMHEAD8-540-1	

Remember the following:

- Match the header and indoor unit piping to the connection piping size of the indoor unit.
- Always install the header (both gas and liquid sides) as a "horizontal branch".
- 224 and 280 indoor units cannot be connected to a header.

3-3. Precautions during the installation of refrigerant piping

1) Precautions against refrigerant leakage

⚠ Warning

■ **The refrigerant should never exceed the limit concentration in the air even in the rare event of refrigerant gas leakage inside a room.**
Exceeding the limit concentration of refrigerant gas in the air could cause a shortage of oxygen. The threshold density is calculated as follows.

$$\frac{\text{Total charge of refrigerant in the refrigerant equipment (kg)}}{\text{Minimum indoor volume of the room in which the indoor unit is installed (m}^3\text{)}} \leqq \text{Threshold density (kg/m}^3\text{)}$$

In the event that refrigerant gas exceeds the limit concentration in the air, an opening between rooms or a ventilation system linked to a gas leakage detector must be provided to reduce the concentration.

■ **Be sure to perform the check of refrigerant gas leakage properly.**
Even though a safe refrigerant that is non-flammable, non-toxic and odorless named fluorocarbon is used, in the event of fluorocarbon leakage, toxic gas may be produced from contacting with fire. Moreover, since the specific gravity of fluorocarbon is heavier than that of air, it could cause a shortage of oxygen from covering the floor surface.

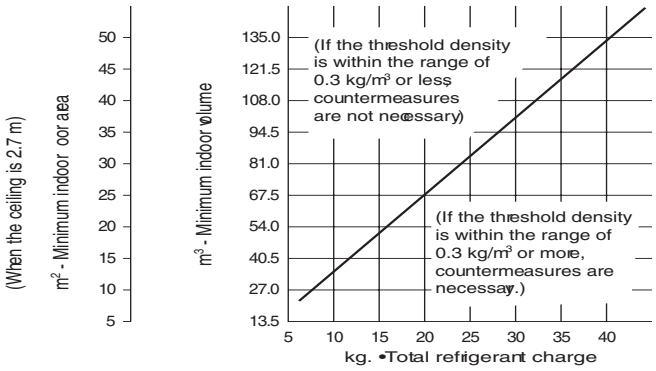
- The limit concentration is threshold that the emergency procedures can be performed without affecting the human body when refrigerant has leaked into the air.
  Threshold density: 0.3 kg/m^3
- At the time of shipping, the outdoor unit has already been charged with the amounts of refrigerant as shown below. To calculate the total amount of refrigerant, add the amount of refrigerant charged at the installations site to the amount charged at factory.

Outdoor unit		Refrigerant type	Charge amount of refrigerant (at time of shipping) (kg)
Multi-type for buildings	P450	R410A	19.0
	P560	R410A	
	P710	R410A	

- A reference for the minimum room volume and floor area in relation to the refrigerant amount is shown in the right graph. In case of exceeding the limit concentration, be sure to take either of the following countermeasures.

Countermeasure1:
Provide an opening at both the top and the bottom of the door that are 0.15% or more of the floor area. If there is no door, provide an opening.

Countermeasure2:
Provide a ventilation system linked to a gas leakage detection device.



2) General precautions

⚠ Warning

- **This equipment use non-flammable refrigerant, R410A exclusively. Never charge other refrigerant, air, oxygen, propane, alcohol and so on.**
  Doing so could cause an explosion or a fire.

- **Before brazing, be sure to remove any flammable material.**
  Failure to do so could cause a fire.
- **Be sure to use non-flammable and non-toxic cleaning liquid for washing.**
  Using an flammable cleaning liquid could cause an explosion or a fire.
- **Be sure to provide adequate ventilation to prevent the lack of oxygen when installing the refrigerant piping in the tight-dosed place.**
  If the cleaning liquid is in high temperature, that causes toxic gas.

⚠ Caution

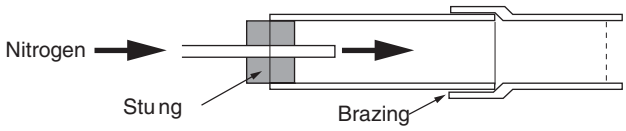
- **Be sure to collect the cleaning liquid after washing.**
  Indiscriminate chlorofluorocarbon (CFC) emission into the atmosphere is prohibited by law.

Important reminder

- **The new type of refrigerant (R410A) specifications requires much more stringent control of impurities, such as moisture and foreign material, than the previous type of refrigerant (R22). The following precautions must be followed in order to prevent damage to the equipment.**
- **During brazing, always have nitrogen gas flowing through the piping to prevent the formation of an oxidized film.**
- **Do not use any antioxidant sold on the market. It may have an adverse effect on the refrigerant and compressor oil, resulting in equipment breakdown.**

■ Refrigerant piping installation

- During the installation of the piping, always close off the ends of the piping with tape or caps to prevent moisture, dust or other impurities from entering.
- Always sufficiently flush the inside of the piping with nitrogen gas to remove moisture and other impurities.
- Always use a pipe cutter to cut piping.
- All cut sections have burrs. Always remove these burrs before joining by flaring.
- **In order to prevent oxidized film from forming inside the piping during brazing, always braze with nitrogen gas flowing through the piping. (Adjust the flow to be 3 to 5 liters per minute at a gauge pressure of 0.03 to 0.05 MPa.)**
- **When flowing nitrogen gas through the piping during brazing, be sure to block up-flow end in order to prevent air from entering.**
- Route the refrigerant piping so as to provide a space for servicing.



■ Sealing test and vacuum suction

- In order to prevent mixing of the refrigerant and compressor oil, use a gauge manifold, charge manifold and vacuum pump only for R410A.
- If there is a leak with the new refrigerant, there is the possibility that the composition of the refrigerant inside the equipment will change. Accordingly, if there is a leak, the refrigerant must be recovered and then recharged. Do not perform supplemental charging. Always perform a sealing test.
- Since systems with the new refrigerant are much more susceptible to damage from moisture than systems with the previous type of refrigerant, always perform a thorough vacuum operation (drying).

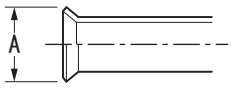
■ Charging with refrigerant

- If the refrigerant is charged as gas, its composition will change, performance will decline and breakdown could occur. Always charge as a liquid from the tank.

■ Precautions when doing flare work

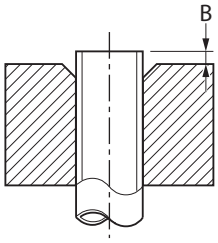
The R410A flare dimensions differ from the previous R407C dimensions.
We recommend using the R410A flare tool, but if a margin adjusting gauge can be used to adjust the margin B dimensions, then the old tool can be used.

Flare tube end: A(mm)



Copper piping outside diameter	A $^{0}_{-0.4}$
ø 6.4	9.1
ø 9.5	13.2
ø 12.7	16.6
ø 15.9	19.7
ø 19.1	24.0

Margin of copper piping opening for flaring: B (mm)



Copper piping outside diameter	When rigid (clutch type)	
	When using the R410A tool	When using the old tool
ø 6.4	0 to 0.5	1.0 to 1.5
ø 9.5		
ø 12.7		
ø 15.9		
ø 19.1		

■ Precautions when connecting flare nuts

⚠ Warning

■ **Tighten the flare nuts with double wrenches and use a torque wrench to check that the tightening torque is proper.**
If the torque is not proper, a joint broken by over tightening or a joint loose by under tightening could allow refrigerant to leak and cause a shortage of oxygen.

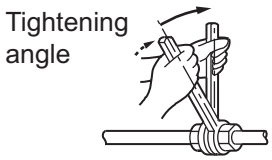
Flare nut tightening torque

Outer diameter (mm)	Nominal diameter (inch)	Flare tightening torque (N.m)
6.4	1/4	From 14 to 18
9.5	3/8	From 34 to 42
12.7	1/2	From 49 to 61
15.9	5/8	From 68 to 82
19.1	3/4	From 100 to 120

- If for unavoidable reasons the tightening torque of the flare nut cannot be checked with a torque wrench, the approximate torque can be determined by using the tightening angle (the change in the angle of the wrenches as the torque is increased) of the wrenches as a guide.

Tightening angle

Pipe diameter	Tightening angle
ø 6.4, ø 9.5	60° to 90°
ø 12.7, ø 15.9, ø 19.1	30° to 60°

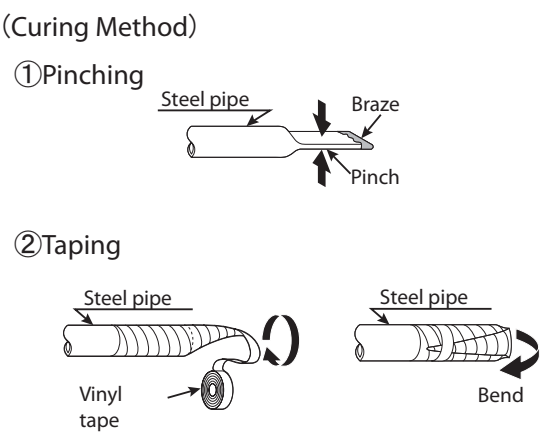


- Apply a light coating of compressor oil to the sheet surfaces of the connection before tightening the flare nut.

■ Others

- The compressor oil will absorb moisture from the air.
  The following precautions must be observed when handing compressor oil during servicing.
  - Perform the charging operation in as short amount of time as possible.
  - Only open the plug immediately before using.
  - Discard any oil remaining after use.
  - Keep the lid on the filler can tightly closed when it is being temporarily stored during the charging operation.
- Refrigerant piping care
  (Curing method)
  Be sure to care the end of piping to prevent any moisture, garbage, and dust. Failure to do so may cause a serious trouble from moisture mixing.

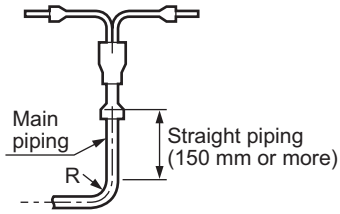
Storage location of refrigerant piping	Storage period	Curing method of the piping end
Outside	3 months or more	Pinching
	Less than 3 months	Pinching or Taping
Inside	-	Pinching or Taping



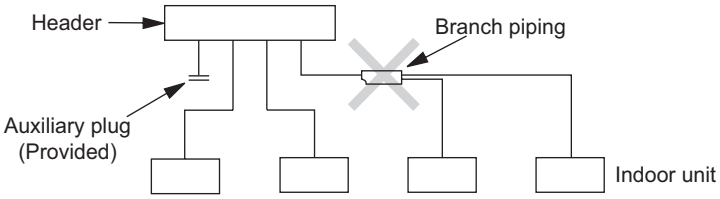
3-4. Precautions for branch piping

Important reminder

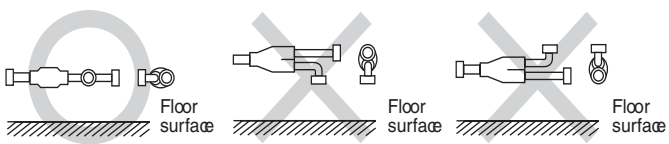
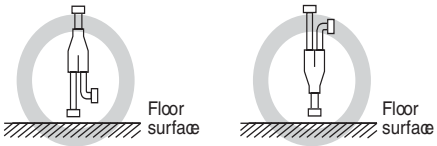
- **When connecting branch piping, do not bend the main piping near the connection.**
  If such bending is unavoidable, provide a minimum of 150 mm of straight piping.
  However, never bend and use piping with an external size of ø 28.6 or greater.



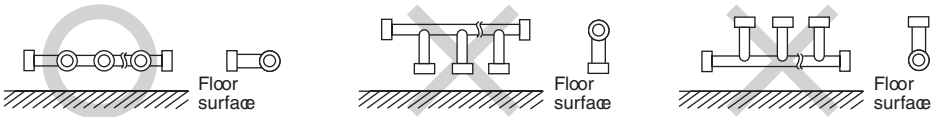
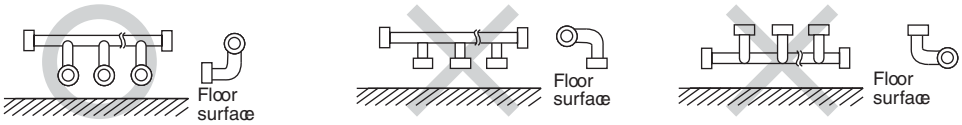
- Once a header has been branched, never perform another branching.
- When performing header branching, connect the crimp piping provided with the branch set in accordance with the number of indoor units connected.



- Always install sides branch piping, both gas and liquid sides, as either "vertical" or "horizontal".

Horizontal	Vertical
	

- Always install header branch piping for both gas and liquid sides as "horizontal".

	Horizontal
Gas side	
Liquid side	

. Closeout valve connections and opening/closing

1) Closeout valve connections

- Both of liquid and gas piping must be brazed when connecting.

Important reminder

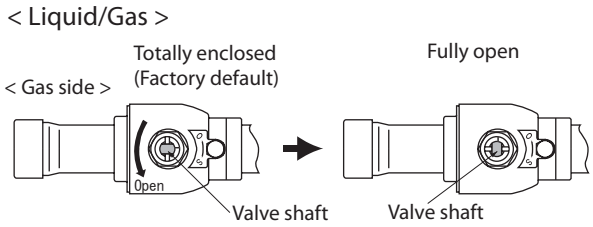
- **The connection of refrigerant piping lines is performed with all closeout valves on the outdoor unit closed (factory default). Do not operate them until all the refrigerant piping with the indoor and outdoor units has been connected, and the refrigerant leak test, vacuum operation and additional charging has been completed. Note that both the gas and liquid side valves must be fully open in operating.**

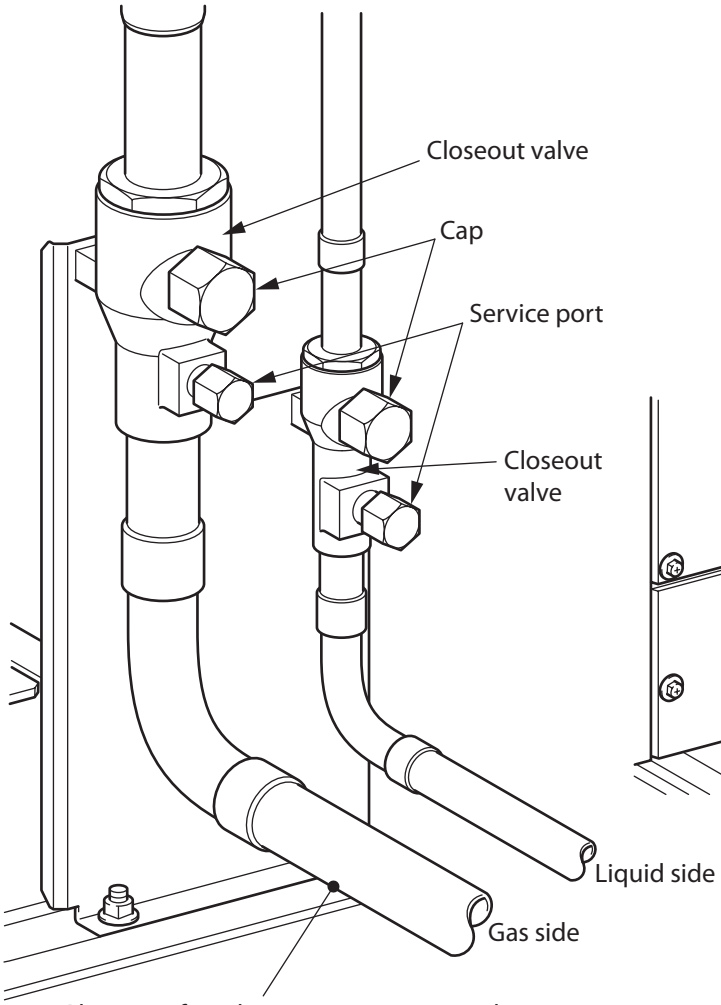
2) Opening and closing the closeout valves

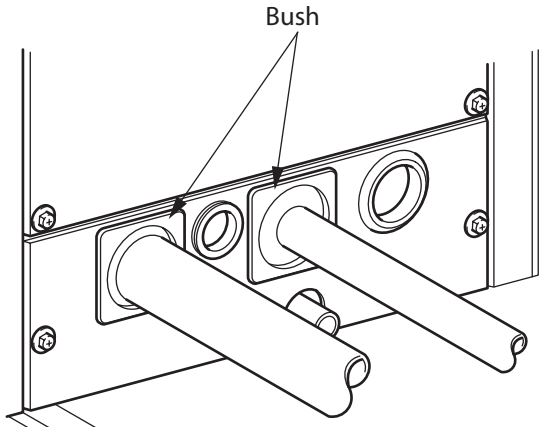
- Open the closeout valve for primarily the liquid side and then the gas side.

1. Remove the cap.
2. Turn a valve shaft to 90° counterclockwise with a spanner. It is fully opened at the position where the pin hit the stopper.
3. Firmly tighten the cap.

Liquid side	From 26 to 32N•m
Gas side	From 65 to 75N•m







Attach bushes to the clearance between a panel and piping after connecting the piping.

Please perform brazing connection with connection pipes provided locally.
(Be sure to supply nitrogen gas from the service port when brazing.)

3-6. Refrigerant gas leakage test and vacuum suction

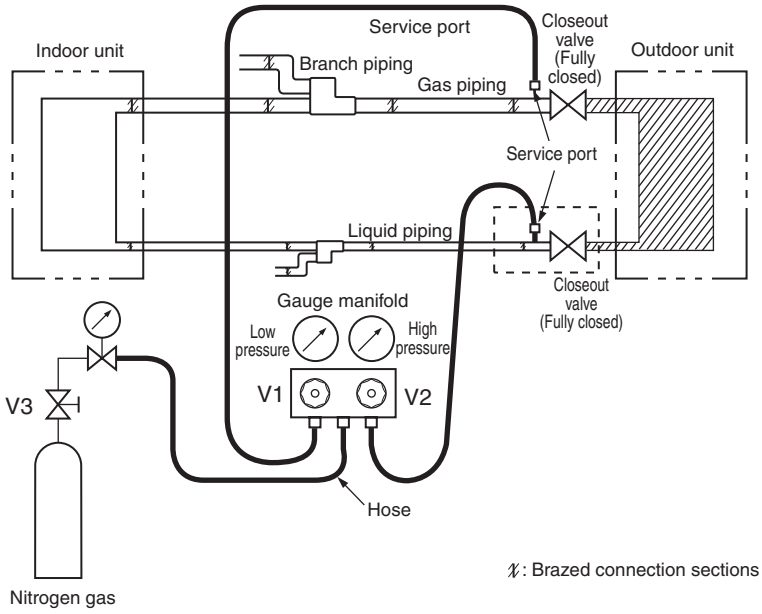
1) Refrigerant gas leakage testing

⚠ Warning

■ **After the refrigerant piping has been installed, always perform a sealing test to confirm that no refrigerant gas is leaking.**
In the rare event a refrigerant gas leak exceeds the limit concentration, a shortage of oxygen could occur.

1. Remove the service port cap for the closeout valve. Connect the gauge manifold as shown in the illustration below. Open V1, V2 and V3 and pressurize with nitrogen gas.
   - Keep the closeout valve closed. Always pressurize both the liquid and gas piping.
   - The leak test pressure is 3.8 MPa ± 0.1 MPa.

2. Slowly raise the pressure to the specified one.
   a) Once 0.5 MPa of pressure has been applied, hold pressure and let stand for 5 minutes or more. Check that there is no drop in pressure.
   b) Next, raise the pressure to 1.5MPa and again let stand for 5 minutes or more. Confirm that the pressure has not dropped.
   c) After that, increase pressure to the specified value (3.8MPa) and note the ambient temperature and pressure.
   d) Let sit at the specified pressure for one day. If there is no drop in pressure, the system is OK.
   If the ambient temperature changes by 1 C°, the pressure changes 0.01MPa accordingly. Correct as needed.
   e) If a drop in pressure is detected through steps a-d, then a leak is present. Apply a soap mixture to the welded sections and flare joints to determine the leaking sections location and then fix them. Run the leak test again once the leaks have been fixed.

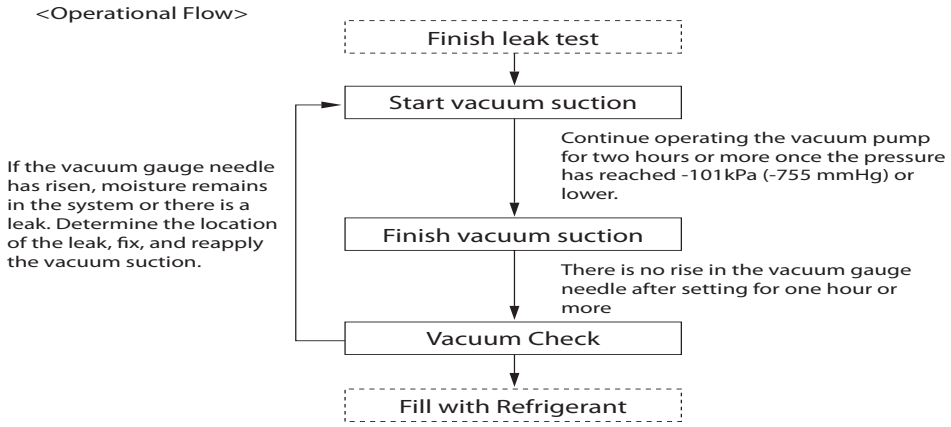


2) Vacuum suction with vacuum pump

Important reminder

- **During the refrigerant gas leak test and vacuum suction, leave the closeout valves on the outdoor unit "fully closed".**
- **Do not perform an air purge with the refrigerant inside the outdoor unit or the refrigerant tank.**
- **Use a vacuum pump which is able to attain pressure lower than -101kpa (-755mmHg).**

Apply vacuum suction to both the liquid and gas closeout valve service ports.



【When there is a possibility of moisture intrusion in piping】

① Attain pressure to 0.05Mpa with nitrogen gas after vacuumming 2 hours or more.

② Then, re-attain pressure for 1 hour or more and make sure the pressure has reached -101kpa.

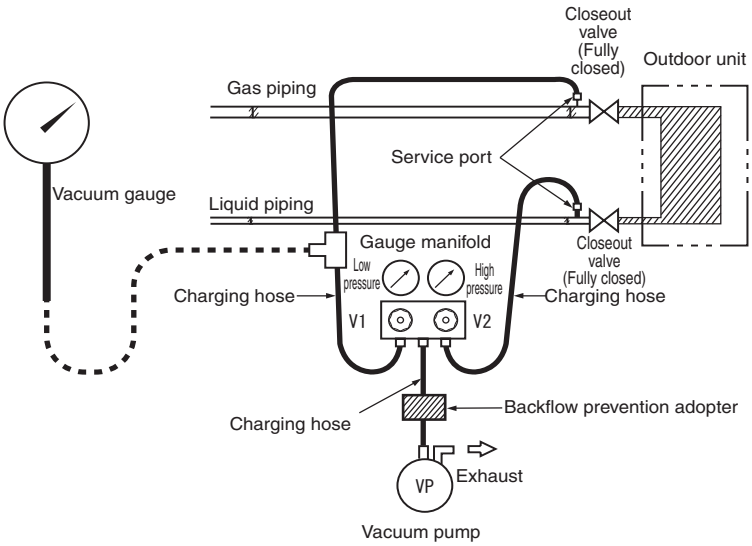
③ Repeat the step ① and ② till the pressure reaches to -101kpa.

④ When the pressure has reached -101kpa or lower, make sure that the needle on the vacuum gauge does not rise.

* Meaning of the possibility of moisture intrusion in piping
Apply the procedure above when there is any possibility such as internal condensation or rainwater mixing inside the refrigerant piping arising from prolonged construction period due to continuous spell of rainy weather like in the rainy season.

(Note) Keep the following points in mind for the R410A model.

- To avoid cross-contamination with other oil types, make sure to separate maintenance tools according to the type of refrigerant used. In particular, never use the gauge manifold and charge hose with other refrigerants (R22, R407C etc.).
- Use a backflow prevention adapter to prevent vacuum pump oil from entering into the cooling system.



3-7. Charging with refrigerant

Important reminder

- **When charging refrigerant, accurately measure the length of the piping and charge with the proper amount. If the amount of refrigerant is not proper, performance will decline and a breakdown could occur.**

1) Refrigerant charge amount

Use the following equation to determine the liquid piping size of the refrigerant piping by the length to add the refrigerant.

Charge amount (kg)= (ℓ_1 × 0.39) + (ℓ_2 × 0.28) + (ℓ_3 × 0.20) + (ℓ_4 × 0.13) + (ℓ_5 × 0.06) + (ℓ_6 × 0.028)

ℓ_1: Liquid piping ø 22.2 total length (m)
ℓ_2: Liquid piping ø 19.1 total length (m)
ℓ_3: Liquid piping: ø 15.9 total length (m)
ℓ_4: Liquid piping ø 12.7 total length (m)
ℓ_5: Liquid piping ø 9.5 total length (m)
ℓ_6: Liquid piping: ø 6.4 total length (m)

* When the number of the connected indoor unit exceeds two or more, add 1kg more amount of refrigerant charge to the above-mentioned formula.
[In case of 2 or more indoor unit connection]
Filling amount (kg) = (ℓ_1 × 0.39) + (ℓ_2 × 0.28) + (ℓ_3 × 0.20) + (ℓ_4 × 0.13) + (ℓ_5 × 0.06) + (ℓ_6 × 0.028) + 1.0

2) Refrigerant charging method

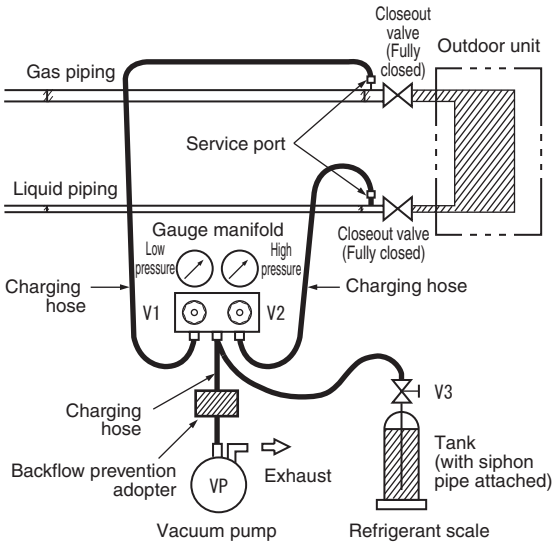
⚠ Caution

- **When charging the refrigerant, be sure to wear a leather glove.**
  If the refrigerant is put on hands, it may cause a frost bite.

Important reminder

- **Always charge the refrigerant as liquid in the tank. In case of charging as gas may cause a compositional change of the refrigerant, could result in a performance decline or a breakdown.**
- **Always use a refrigerant scale when charging the refrigerant. Using a charging cylinder may cause a compositional change of the refrigerant, could result in a performance decline or a breakdown.**
- **To avoid cross-contamination with other oil types, make sure to separate maintenance tools according to the type of refrigerant used. In particular, never use the gauge manifold and charging hose with other refrigerants (R22, R407C etc.).**

1. Place the tank (with the siphon pipe attached) on the refrigerant scale.
2. Remove the charging hose from the vacuum pump and connect it to the tank.
3. Perform an air purge of the inside of the charging hose to the gauge manifold.
4. Open valves V2 and V3 and charge with the required amount of refrigerant in the liquid state. After the charging is completed, close valves V2 and V3.

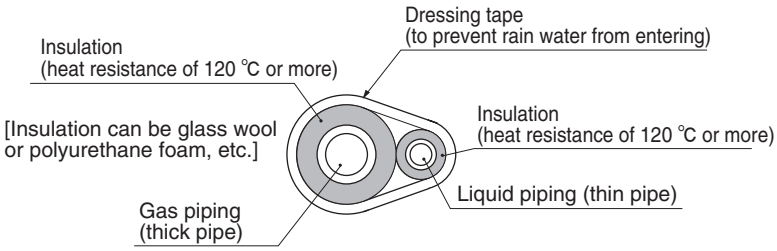


3-8. Refrigerant piping insulation and heat retention

Caution

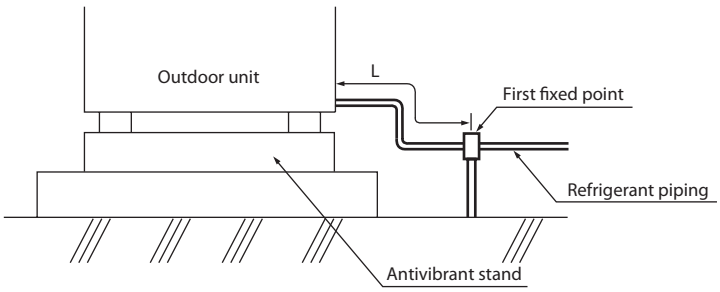
- **For refrigerant piping and drain piping, apply insulation (polyethylene form / grass wool etc.) of 10 mm or more in thickness, separately for the gas pipe and the liquid pipe. In case of exceeding DB 30 °C and RH 65%, use thicker polyethylene form than above.** Insufficient insulation work could cause a property damage from condensation dripping.

- Retain heat by applying insulation separately to the gas and liquid piping.
- Use heat insulation with a heat resistance of 120 °C or more. After the refrigerant gas leakage test has been performed, using dressing tape to wrap the insulation.
- Use the pipe cover provided for the insulation for the refrigerant piping connection in the indoor unit. Apply properly to both the gas and liquid lines as shown in the illustration below.



3-9. How to secure refrigerant piping

- If the antivibrant stand is used, the distance to the first fixed point of refrigerant piping must be at least L = 1.5 m.



4. Fuel Gas Piping Installation

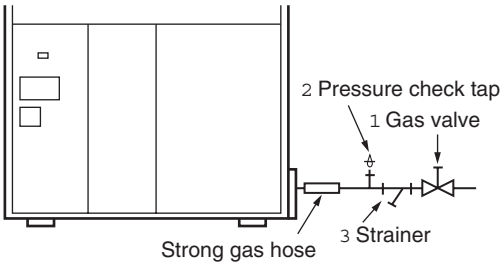
Warning

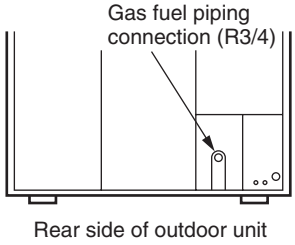
- **Only use the type of gas indicated on the name plate.**
  Using the wrong type of gas could cause incomplete combustion that could damage the outdoor unit.
- **Always perform a gas leak test after connecting the piping.**
  In the rare event of a gas leakage, a fire or explosion could occur.
- **Use a soap solution or gas leak detector for performing the gas leak test.**
  Using a frame reaction test causes a fire or explosion.
- **Always use a strong gas hose between the gas cock for the fuel gas and indoor unit.**
  Failure to do so could cause a gas leakage.
- **Plumb the piping so that the fuel gas pressure at the inlet port of the outdoor unit may have the pressure required for the gas supply standard defined by the gas utilities.**
  Incorrect pressure of fuel gas could cause a incomplete combustion or a malfunction inside the unit.

Important reminder

- **Do not apply pressure of over 4.2 kPa when testing the fuel gas line for leaks. Doing so could damage the unit's internal regulator.**

- The gas piping for the outdoor unit is installed as shown below.
- Always install the device shown as 1 in the drawing below. It is for servicing the fuel system.
- Check the devices shown as 2 and 3. They are required for checking the supplied pressure and filtering the gas. Mount them as necessary.





5. Drain Piping Installation

1) Exhaust Air Drain Piping Installation

Warning

- **Never use the same pipe for the exhaust drain for the outdoor unit and the exhaust water drain for the indoor unit.**
  If exhaust gas enters the building, it could cause gas poisoning or asphyxiation.
- **If the exhaust drain for the outdoor unit is connected to a drain water vent or ditch, or other such arrangement and the indoor unit drain is discharged to the same location, arrange the piping so that the exhaust gas in the exhaust drain is released into the atmosphere.**
  If it is not released into the atmosphere, gas poisoning or a shortage of oxygen could occur.

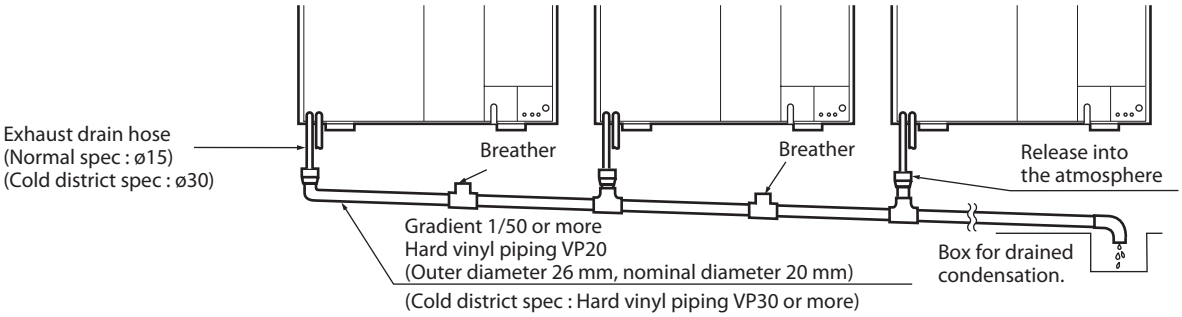
Caution

- **When installing the outdoor unit on a roof, route the exhaust drain for the outdoor unit to the drain for rainwater.**
  Routing the exhaust drain directly onto concrete or a waterproof sheet may cause damage to both.

Important reminder

- **Make sure to attach the exhaust drain pipe.**
- **Always provide the slope shown below for the drain hose. Failure to do so will damage the unit.**
- **If the drain piping is to be centralized, provide breathers on the upside of the connecting points of the pipes to avoid back pressure.**

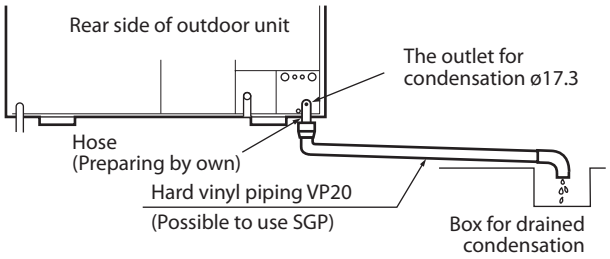
- Condensation from the exhaust gas will come out of the drain hose for the outdoor unit. Connect the drain piping with the long drain hose as below. If the short drain hose is used, since condensation does not come out, it is not necessary to perform drain piping.



- Use a drain heater (option, sold separately) in regions where the temperature can fall below 0 °C. Refer to the installation manual for the drain heater.
- In case of cold district specification, a drain heater is packed in the engine compartment without installation. Refer to the installation manual for the drain heater.
- If drain piping is frozen in cold regions (where the outdoor temperature can fall below 0°C), it may damage the unit. Be sure to take an anti-freezing measure on drain piping using insulating materials or a heater.

2) Condensation Drain Piping Installation

- From the outlet for condensation, condensation in accumulator will come out.
  Install the condensation drain piping kit, provided if there is a trouble about condensation drain.
- Never use the same pipe for both the condensation drain pipe and the exhaust gas drain pipe.
  If exhaust gas enters the outdoor unit, it could cause a breakdown



6. Exhaust Vent Installation

- Exhaust vent extension must be used an exclusive installation kit (No.: TLEJ140S1).

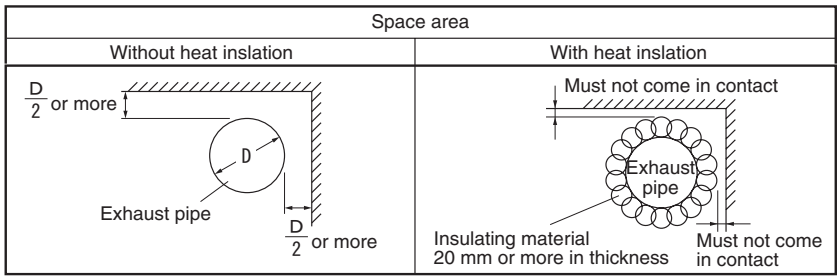
1) Precautions for exhaust vent extension

Warning

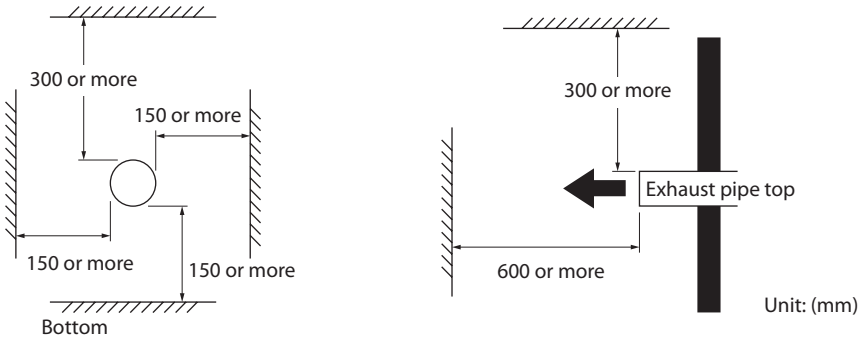
- **Do not extend the exhaust vent to a location where the exhaust gas could potentially enter the indoor.**
  Installing the exhaust vent in the location near the air intake/discharge opening into the living space could cause a gas poisoning or a shortage of oxygen.
- **Do not extend the exhaust vent to a location where flammable gas could potentially be generated, flowed, accumulated and leaked, or a volatile substance could be dealt with.**
  It may cause a fire.

- **Be sure to discharge the exhaust gas directly to the atmosphere.**
  Accumulated exhaust gas could cause a gas poisoning or a shortage of oxygen.
- **Be sure to discharge the exhaust gas to the ineffective open outdoor space.**
  Discharging exhaust gas to the ditch or groove could cause a gas poisoning or a shortage of oxygen.
- **Be sure to discharge the exhaust gas into a location where is not directed toward animals or plants.**
  Overexposure to the exhaust gas or a blow-off wind could cause a harmful influence on animals and plants.
- **Be sure to maintain the appropriate clearance against the flammable or flame resisting material covered building in accordance with the following figure.**
  Inappropriate clearance could cause a fire.

  - Distance from the exhaust piping



  - Distance from the top end opening of the exhaust piping



- In the area where outside temperature decreases 0 C° or less, there is a possibility that the inside of an exhaust pipe may freeze. Avoid extending the exhaust vent in principle.

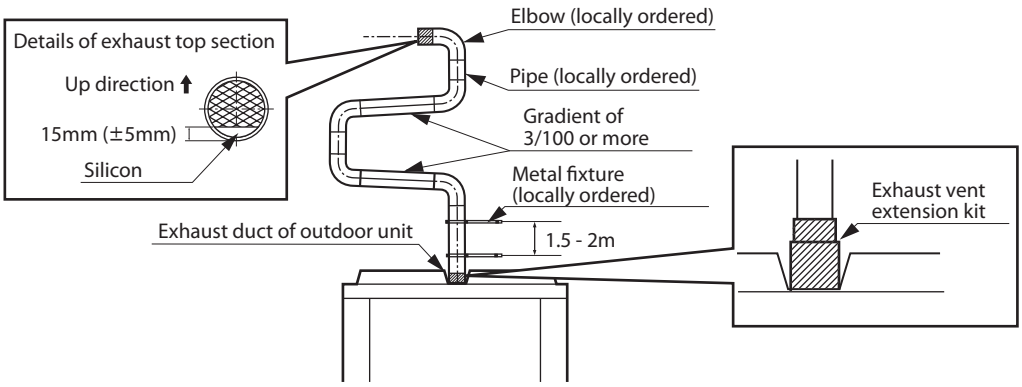
2) Exhaust vent extension

- Install the exhaust vent according to the following procedure by referring to the illustrations below.

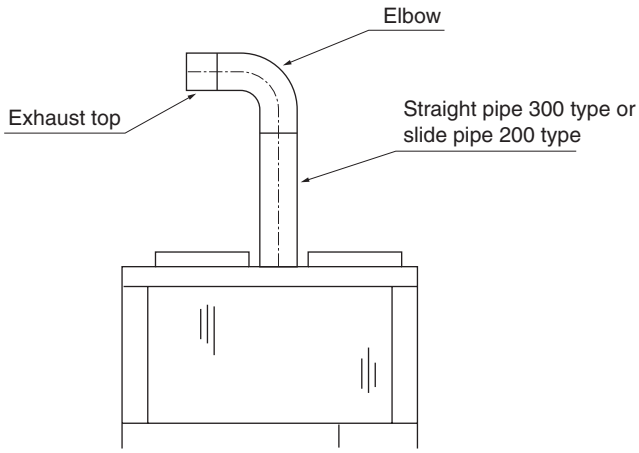
1. Secure the exclusive installation kit to the exhaust outlet of the outdoor unit according to the attached installation manual.

2. Connect the piping sequentially from the outdoor unit side, and extend the exhaust vent to the desired position according to the followings.
   - Total length of the exhaust vent extension shall not exceed 10m maximum.
   - Total number of exhaust piping curves shall not exceed 5 maximum.
   - The extended piping shall be anchored to a structure or the similar with metal fixtures at intervals of 1.5 to 2m.
   - Exhaust piping shall not be gathered or connected with the other exhaust piping in the line.

3. Attach the exhaust top in the exclusive installation kit to the exhaust vent outlet paying attention to followings.
   - An angle of the exhaust vent surface shall be adjusted vertically to the ground with a pipe elbow so that rainwater may not enter directly.
   - The lower part of wire-net surface shall be caulked with a silicone caulking so that drain water may not drip from the exhaust top in accordance with the following figure.



- In case of installing the outdoor unit on the antivibrant stand, there is a possibility that the exhaust piping may be deviated due to the vibration. Exhaust vent shall be correctly extended in accordance with the following figure.



3) Installation check

- After the extension work of the exhaust vent, make sure that there is not any leakage of exhaust gas or drain water from the piping connection with the test operation.

7. Summary of Electric Wire Installation

In case that the indoor units are TKFDP900 · 1120 (large-size floorstanding duct type), the way of installations is different. Please follow the installation manual provided with the indoor unit.

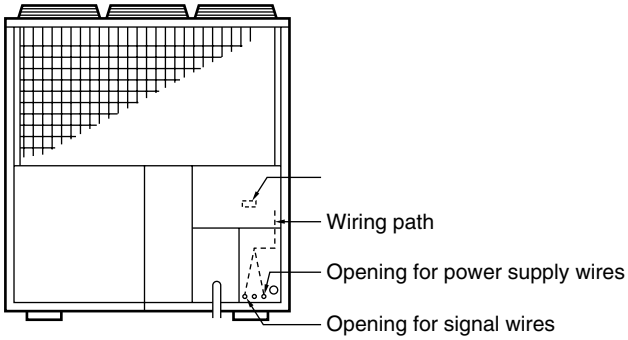
Warning

- **All electrical installation work must be performed by a certified electrician in accordance with the "technical standards as stipulated by the authority of each country related to electrical equipment", "internal wire code" and instructions provided in this manual.**
- **Improper installation could result in electrical shock, fire or other hazards.**
- **Provide a breaker for electrical leakage with the set capacity for each electrical device (sensitivity amperage 30 mA). If a breaker for electrical leakage is not installed, electrical shock could occur.**
- **Provide a capacity overload amperage breaker with the set capacity for each electrical device. If the proper overload amperage breaker is not installed, heat, fire and secondary damage from the breaker failure could occur.**
- **Never branch off of the dedicated electrical line and use it for operating other appliances. If these two devices are used on the same dedicated line, breaker failure could result in secondary damage.**
- **Always use the designated cable for wiring and make sure that it is properly connected. Makes sure the cable is secure and that the outside forces are not transferred to the terminal connection.**
  Improper connecting or fixing can result in heat, fire or other hazards.

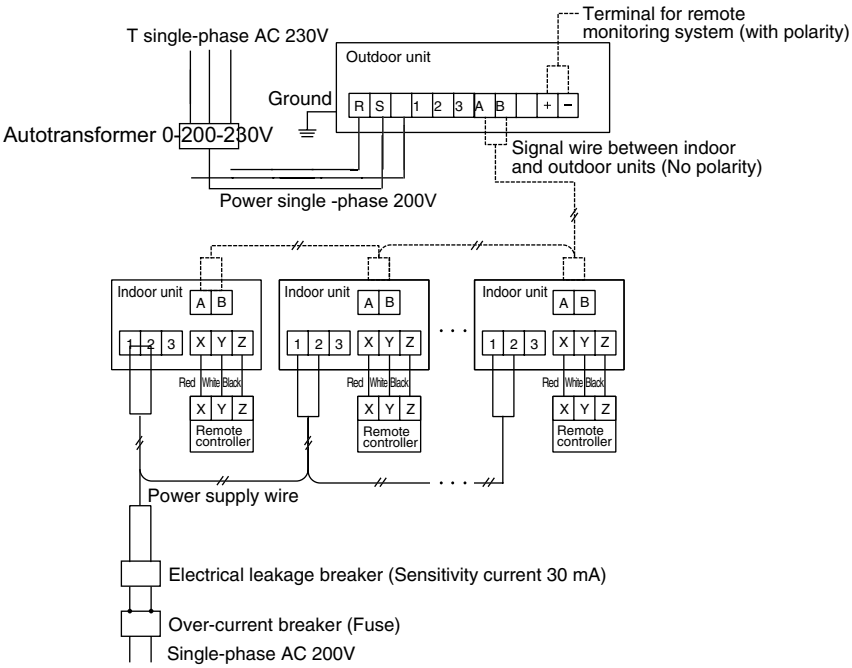
Caution

All grounding operations must be Class 3 grounding in accordance with electrical equipment technical standards. Never connect the ground wire to a gas pipe, water pipe, lightening rod or the ground for a telephone wire. Improper grounding can result in electrical shock.

7-1. Opening for power supply wires / signal wires

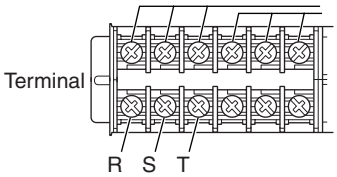
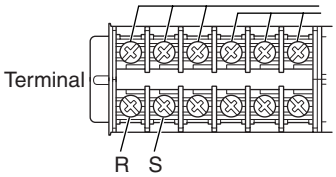
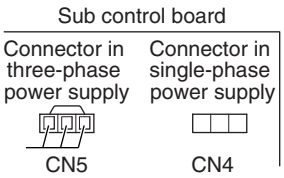
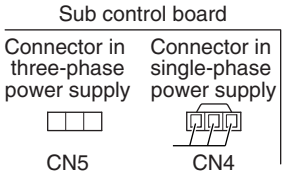


*Please bundle power supply wires and signal wires not to contact with the pipes.



7-2. Change of the outdoor unit power supply to single-phase AC200V

According to the following illustration, install the power supply wires to the terminal and reinsert the wires on the sub-control board.

	Three-phase (in factory)	Single-phase
Wiring to the terminal	 Installation Wiring (Power Supply Side)	 Installation Wiring (Power Supply Side)
Reinsert the wires on sub-control board	In factory, connecting to CN5 (white) 	Reinsert the connector (white) from CN5 (white) to CN4 (red) 

8. Electric Wire Precautions and Specifications

8-1. Power supply wire

Warning The specifications for the electrical wiring and the selection of the appropriate size must be in accordance with "technical standards as stipulated by the authority of each country related to electrical equipment" and the "internal wire code". Improper wiring can result in overheating, shorts and fire.

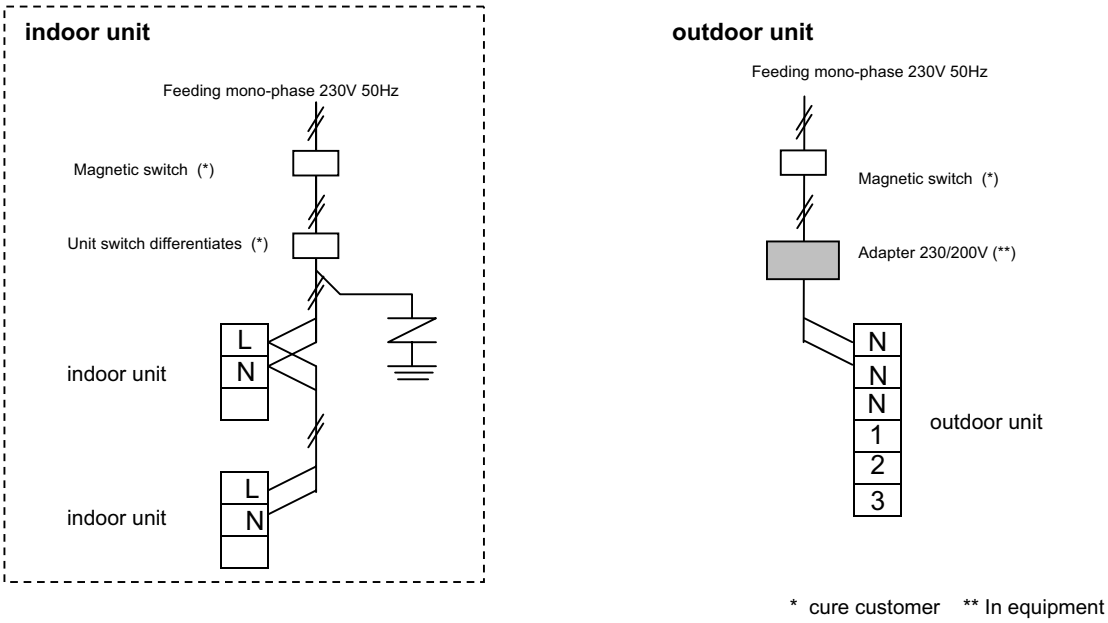
- Used cable must respect the norms of quality and emergency and must be of appropriate section.
- Put always to earth unit agreement with the norms of emergency and being used the earth lives.

Warning

- **Power supply to outdoor unit must be 200 V AC. Install the Autotransformer 0- 230 - 200 V supplied.**
- **Execute feeding system applying suitable protections according to the enforced norms.**

Indoor and outdoor unit power lines must be separated (standard specification)

Examples of connections

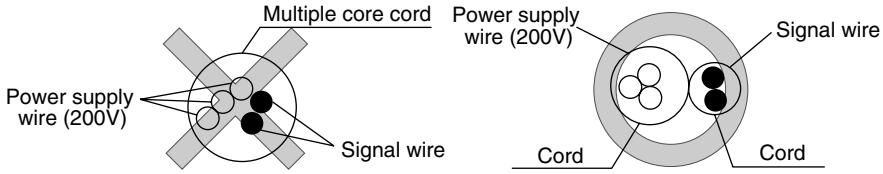


* cure customer ** In equipment

8-2. Communication wire between indoor and outdoor units

Important

■ **Never mix electrical and signal wires in a multiple core cord (200V). This will cause misoperation.**



■ **Always use shielded wire (MVVS) when using near high-frequency medical equipment, high-frequency welding equipment or any other equipment that generates high-frequency waves. These waves can cause misoperation.**
When using shielded wire, always ground the shielded side.

- Since the signal wire between the indoor and outdoor unit does not have polarity, connection can be made to either core.
- Keep the total length of the signal wire under 1000 meters (total wire length).
- Use M3.5 crimped terminals for connecting to the terminal block. (Refer to Fig. 1)
- The recommended signal wire is as shown below.

Recommended signal wire name (Code)	Thickness × number of cores
Shielded wire (MVVS)	0.75 to 2.0 mm² × 2 core * Use one type of signal wire thickness for the same network.
Vinyl cab tire round cord (VCTF)	
Vinyl cab tire round cable (VCT)	
Vinyl insulated vinyl sheath cable for controller (CVV)	

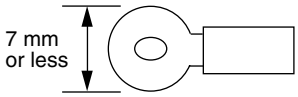


Fig. 1 Crimped terminal

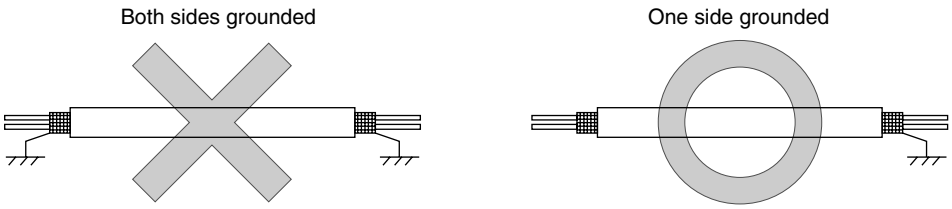
8-3. Remote control wire

Important

■ **Do not bundle or route the wires for the remote controller together with power supply wires or other electrical wires. If bundling or routing these wires together is unavoidable, use shielded wire.**

■ **When controlling multiple indoor units with one remote controller, use shielded wire for the connections between indoor units.**

■ **When using shielded wire, always only ground the shielded section to one location on the indoor unit.**



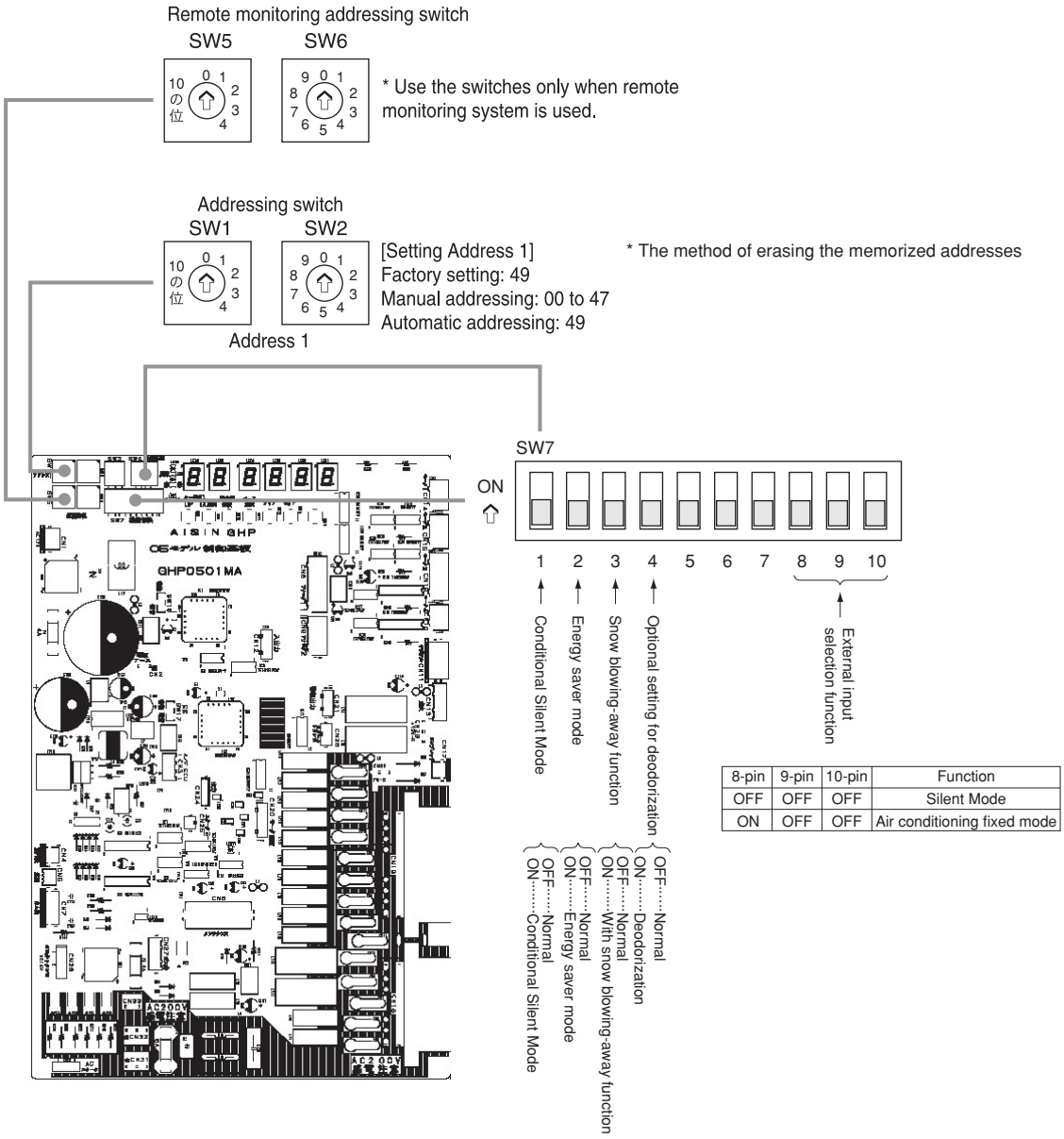
■ **Use the shielded wire shown above for the remote controller and ground one end when it is used near high-frequency medical equipment, high-frequency welding equipment or any other equipment that generates high-frequency waves. If shielded wire is not used, it could cause misoperation of the microcomputer and irregular operation of the unit.**

- Use 0.3 mm² × 3 core wire for the remote controller.
- Use shielded wire whenever the length of the remote controller wire exceeds 8 meters.
  Recommended shielded wire: MVVS3C (0.3 mm² × 3 core wire, Keihan Cable).
- If the total length of the remote controller wire exceeds 100 meters, change the thickness as shown in the table below.
- Keep the total length of the remote controller wire 600 meters or less.

	up to 100 m	up to 200 m	up to 300 m	up to 400 m	up to 600 m
Thickness × cores	0.3 mm² × 3 core	0.5 mm² × 3 core	0.75 mm² × 3 core	1.25 mm² × 3 core	2.0 mm² × 3 core

9. Setting the Circuit Board Performance Switch and Jumper Wires

9-1. Outdoor unit



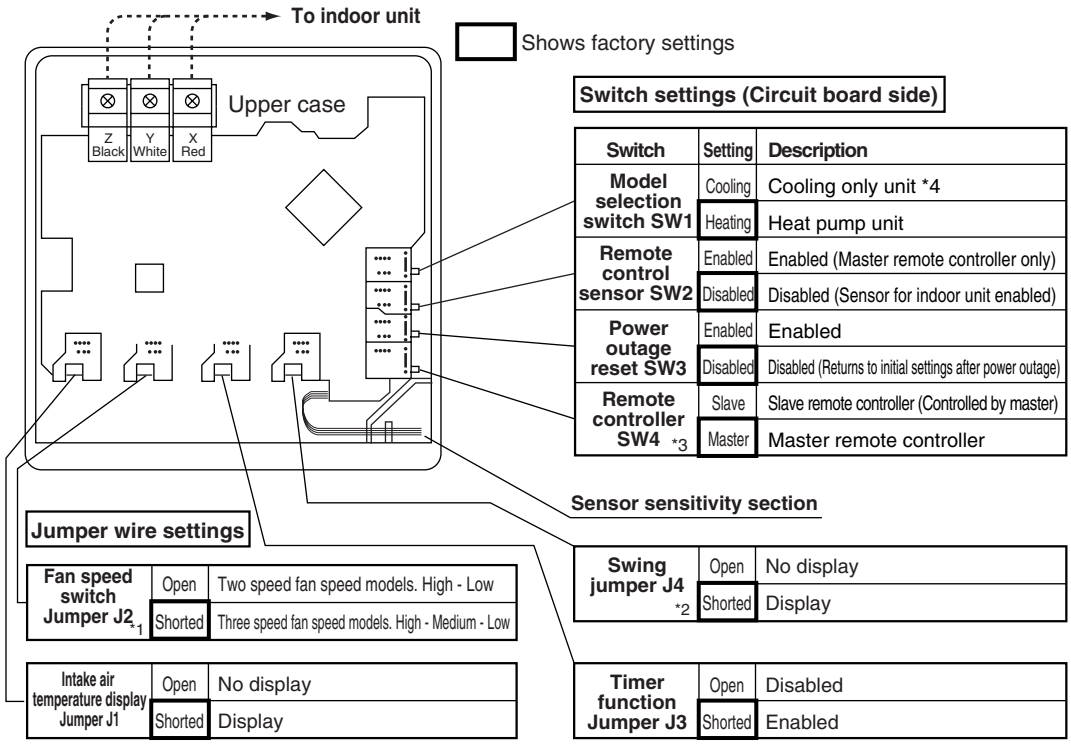
8-pin	9-pin	10-pin	Function
OFF	OFF	OFF	Silent Mode
ON	OFF	OFF	Air conditioning fixed mode

Note

■ **In case that the indoor unit is TKFDP900, P1120 and P1600M7 (large-size floor-standing duct type), the way of installation is different. Please follow the installation manual provided with the indoor unit.**

99-2. Remote controller

Remove the remote controller case and make the following settings.



*1 Refer to the following when setting jumper J2 for switching fan speed.

Jumper setting (J2)	Indoor unit model
Open (OFF)	TKU, TKUM, TKUF, TKES, TKFP, TKFD, TKE (P280)
Shorted (ON)	TKT, TKTC, TKTW, TKTS, TKR, TKE (Except P280), TKK, TKF, TKFL, TKFU

*2 Refer to the following when setting the jumper J4 for the swing display.

Jumper setting (J2)	Indoor unit model
Open (OFF)	TKR, TKU, TKUM, TKUF, TKES, TKFL, TKFU, TKFP, TKFD
Shorted (ON)	TKT, TKTC, TKTW, TKTS, TKE, TKK, TKF

*3 The following functions can only be operated from the master remote controller: inspection reset, filter sign reset and auto lift control.

*4 The TKUF is a dedicated indoor unit cooler. Set SW1 to "Cool".

(Note) When performing a test operation of the cooling mode, press the [Operate] button and after it has been set to cooling operation mode, press and hold the [Temperature setting t] button and press the [Set] button. The system will operate in forced cooling for 30 minutes. To stop the cooling test operation, press [Stop].

9-3. Indoor unit

■ Jumper wire settings

No.			Setting	Description
J1(SW7-1)			Shorted (ON)	Filter sign On
			Open (OFF)	Filter sign Off
J2(SW7-2)			Shortcircuited (ON)	Normal operation possible
			Open (OFF)	Operation permitted/prohibited
J3(SW7-3)	Enabled	J4(SW7-4)	Shortcircuited (ON)	When heating thermo is OFF/Low operation
			Open (OFF)	When heating thermo is OFF/Intermittent operation
	Disabled	-	-	When heating thermo is OFF/Stopped
			-	
J8(SW8-4)			Shortcircuited (ON)	Humidifier drain operating/Disabled
			Open (OFF)	Humidifier drain operating/On
J10(SW10-2)	Enabled	J11(SW10-3)	Shortcircuited (ON)	Remote control wind speed selection/3 speeds (H/M/L)
			Open (OFF)	Remote control wind speed selection/1 speed (H)
	Disabled		Shortcircuited (ON)	Remote control wind speed selection/2 speeds (H/L)
			Open (OFF)	Remote control wind speed selection/3 speeds (H/M/L)

(Note1) Open (OFF) indicates that it is not mounted on a board, or that it is disconnected.
(Note2) The jumper wires from J1 to J11 are not mounted on the supply board. Instead, the switches 7, 8, and 10 have the same function as the jumper wires and are installed at the same location as the jumper wires. Use the chart above to install SW 7, 8 and 10.

Dip switch SW5 settings

No.	Function	Setting	Description
SW5-1	Drain pump trial operation	ON	Trial Operation
		OFF	Automatic
SW5-2	Humidifier continuation operation	ON	Enabled
		OFF	Disabled
SW5-3	External Input	ON	Edge Input
		OFF	Level Input
SW5-4	Emergency Stop Signal	ON	Enabled
		OFF	Disabled

(Note) Factory settings are all OFF.

Dip switch SW9 settings

Switch				Function
SW9-1	OFF	SW9-2	ON	Auto lift control length 1.3m
			OFF	Auto lift control length 1.6m
	ON		ON	Auto lift control length 2.0m
			OFF	Auto lift control length 4.0m
SW9-3			ON	Louver position stop Air current attained
			OFF	Louver position stop Ceiling contamination prevention
SW9-4			ON	Fain control High speed UH,H,M
			OFF	Fan Speed Standard H,M,L

(Note) Factory settings are all OFF.

Dip switch SW6 settings

Switch	Model												
	P22	P28	P36	P45	P56	P71	P80	P90	P112	P140	P160	P224	P280
SW6-1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF
SW6-2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF
SW6-3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON
SW6-4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON

10. Address Settings

10-1. Address setting method

Note

- **Always turn off the power before operating the address switch. Changes to the address switch made when the power is on will not be received.**
- **Do not mix the two setting methods (automatic address setting and manual address setting).**
- **Always perform manual address setting when two or more outdoor units are used in the same network (same indoor/outdoor unit signal wire).**

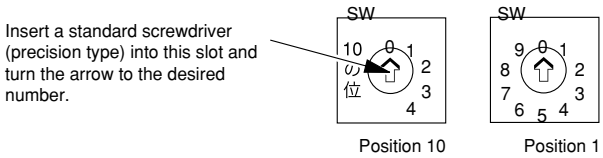
- Setting the address number
  Set the following switches as shown in the illustration below: SW1, 2, 3 and 4 on the circuit board for the indoor unit and SW1 and 2 on the circuit board for the outdoor unit.
- The outdoor number is on the circuit boards for both the outdoor and indoor unit. It is the number that tells which outdoor unit is connected to which indoor unit by refrigerant piping. Always set outdoor and indoor units connected by refrigerant piping as the same number.
- The indoor number is used for distinguishing the indoor unit. Accordingly, when there are multiple units on the same network (same indoor/outdoor signal wire) set each indoor unit so it is unique and not duplicated on other units. Enter the address that has been set on the name plate (shown below) and affix this name plate to the main unit.

Name plate

Type

Address No.

		Applications
On circuit board for indoor unit	SW1, 2	For setting number of indoor units (10 position and 1 position)
	SW3, 4	For setting number of outdoor units (10 position and 1 position)
On circuit board for outdoor unit	SW1, 2	For setting number of outdoor units (10 position and 1 position)



Address No. setting

		Indoor unit circuit board SW2,4 / Outdoor unit circuit board SW2 (1 position)									
		0	1	2	3	4	5	6	7	8	9
Indoor unit circuit board SW1,3 Outdoor unit circuit board SW1 (10 position)	0	00	01	02	03	04	05	06	07	08	09
	1	10	11	12	13	14	15	16	17	18	19
	2	20	21	22	23	24	25	26	27	28	29
	3	30	31	32	33	34	35	36	37	38	39
	4	40	41	42	43	44	45	46	47		49

49 Automatic address setting

- There are two methods for setting the address: automatic address setting and manual address setting, by using combinations of the address switches for indoor and outdoor units (Refer to the following table). **Automatic address is the normal method when outdoor units are wired individually.**

Address setting method	Outdoor unit (SW1,2)	Indoor unit	
		Outdoor number (SW3,4)	Indoor number (SW1,2)
Automatic address	49	49	49
Manual address	00 to 47	00 to 47	00 to 47

At the time of shipping, the outdoor number for the outdoor unit is set to 49, the outdoor and indoor numbers for the indoor unit are both set to 49. That is set for automatic address.

10-2. Manual address settings

Note

■ **When multiple outdoor units have been installed and operation is started all at once, an extremely large amount of current is required for starting the engines at the same time. In order to prevent an overload that would trip the breaker for the power supply, use the outdoor unit address numbers to create a time lag among the units when they are being started as shown in the chart below. Set so that the units are started in sequence from the smallest number in each group address number.**

Time lag (seconds)		0	2	4	6	8	10		26	28	30
Outdoor unit address	A Group	0	1	2	3	4	5		13	14	15
	B Group	16	17	18	19	20	21		29	30	31
	C Group	32	33	34	35	36	37		45	46	47

- When multiple outdoor units are connected on the same network (same indoor/outdoor unit signal wire), set the address manually. (Manual setting is also possible when wired to one outdoor unit).
- When multiple outdoor units are connected on the same network (same indoor/outdoor unit signal wire), set the address for the outdoor unit on the address switch on the circuit board for the outdoor unit between 00 and 47 so that it is not duplicated by the address for another outdoor unit.

10-3. Automatic address settings

Note

■ **Can only be wired as a single outdoor unit.**

- At the time of shipping, the number on the outdoor circuit board and the outdoor and indoor numbers for the indoor circuit board are set to 49 and set for automatic address.
- When the power for the indoor and outdoor unit is turned on, the addresses are automatically set. Turn on the power for the outdoor unit and all the indoor units when setting the automatic address.
- After the power is turned on, the addresses will be set in approximately one minute. After automatic address has been set, press the inspection switch on the remote controller and address number of the indoor unit will be displayed in the LCD area of the remote controller.
- Automatic addresses are setting can also be used when a single remote controller is being used to control multiple units.
- The addresses are stored in the microcomputer even when the power is turned off.
- The following is the procedure for erasing an address that has been set by automatic address setting.

Procedure

Using the maintenance feature provided on the outdoor unit board, erase addresses automatically.

1. Change to “Check Mode” (mode LED red light illuminates)

   (1) Press the “Mode Selection Switch” for one second or more (Mode LED green light illuminates)

   (2) Press the “Set Switch” and the “Clear Switch” at the same time for 2 seconds or more.

   “Check Mode” will not appear in the following instances.

   (Caution) 1) Does not operate for 10 minutes after connecting or disconnecting to a personal computer monitor
   2) Does not operate for 10 minutes after connecting or disconnecting to the remote control unit.

2. Change the code number to 57 (automatic address erasing) using the code No. UP and code No. DN switches.
3. Press the set switch (display: OFF → GO blinking).
4. Hold down the set switch at least 2 seconds or more (display: GO → END)
5. Turn off the outdoor unit, and then turn it on again.

11. Example of Indoor/Outdoor Unit Signal Wire and Address Settings

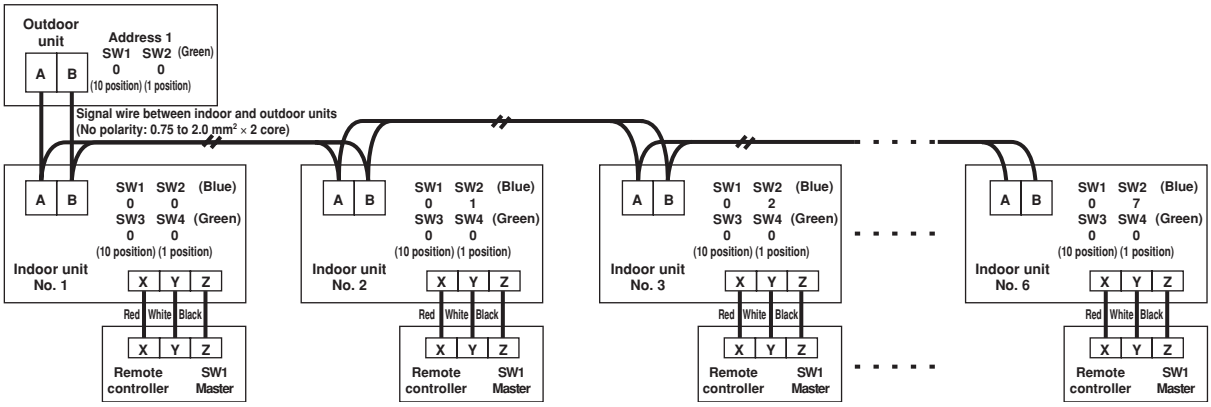
Note

- **Set the SW1 and SW2 of the indoor unit address 1 and the SW3 and SW4 of the indoor unit to the same value. (If automatic address setting is used, it is not necessary to set these switches since the addresses are configured by factory default.)**
- **Because the remote controller wire has polarity, be sure to connect it by matching X, Y, and Z.**
- **When the indoor unit is TKFDP900, P1120 and P1600M7 (large-size floor-standing duct type), the way of installation is different. Please follow the installation manual provided with the indoor unit.**

11-1. When 1 outdoor unit is installed

Note

- **The range of connectable indoor units to one outdoor unit is from 2 to 8 units.**

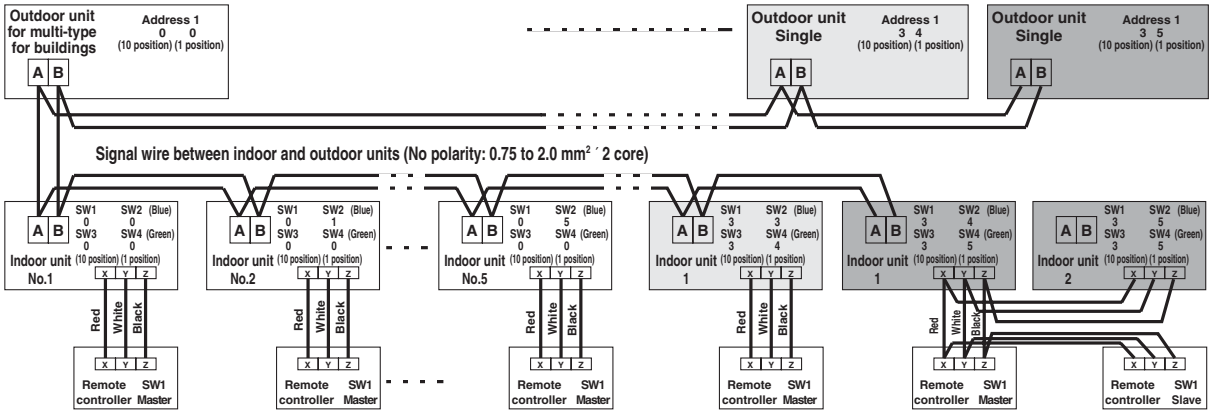


11-2. When multiple outdoor units are installed

Note

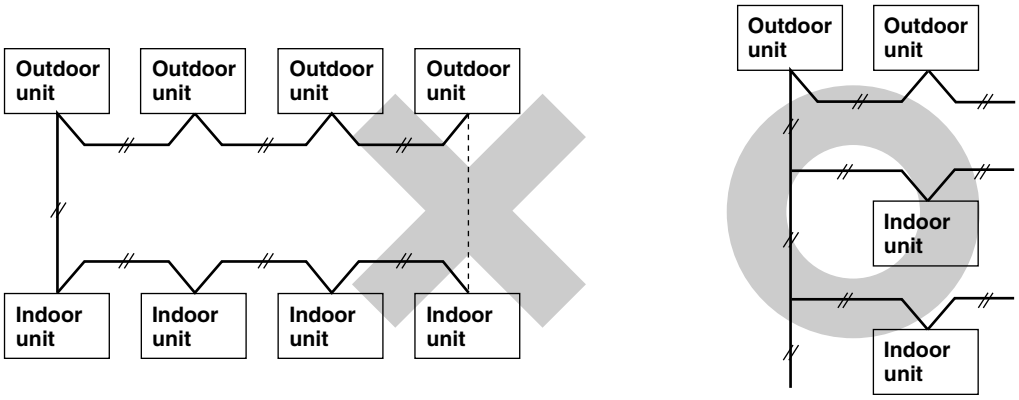
■ **Up to 48 indoor units can be connected on the same network (signal wire between indoor and outdoor units).**

* Use only one type of thickness of signal wire in the same network.



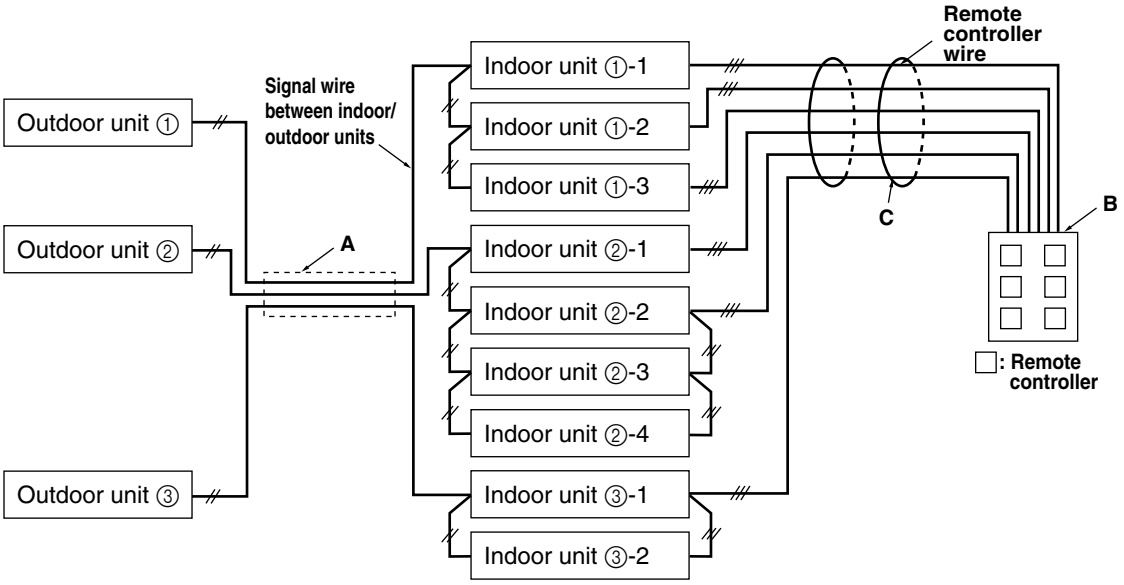
Note

■ **Use care to prevent the signal wire from becoming a loop wire when multiple outdoor units are installed.**



Note

■ **When there is a need to wire the signal wire (indoor/outdoor signal wire and remote controller wire) in parallel, use shielded wire to prevent misoperation due to communication defects. Remember that only one side of the shielded wire is to be grounded.**



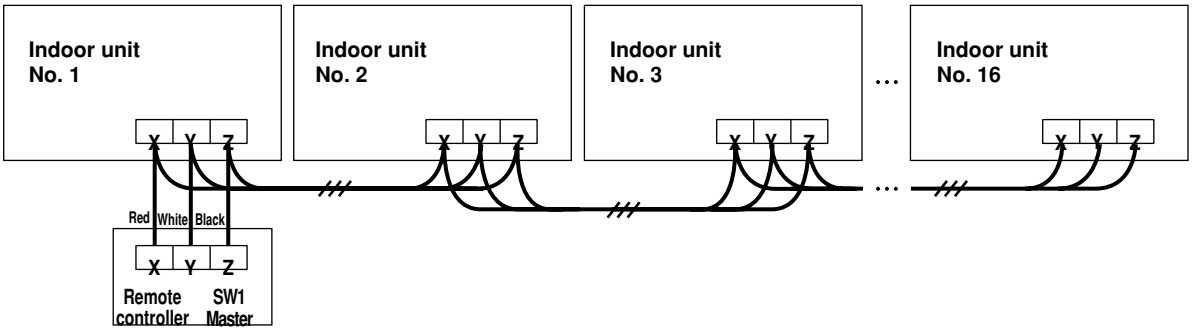
Example of parallel wiring locations
A: Duct wiring section B: Remote controller centralized wiring section C: Bundled signal wires

12. Remote Controller

12-1. Controlling multiple units with remote controller

Note

- **The X, Y, Z terminals have polarity. Always match X, Y, Z when connecting.**
- **Always use shielded wire for the jumper wires. On the indoor unit, only one side of the shielded wire is to be grounded.**

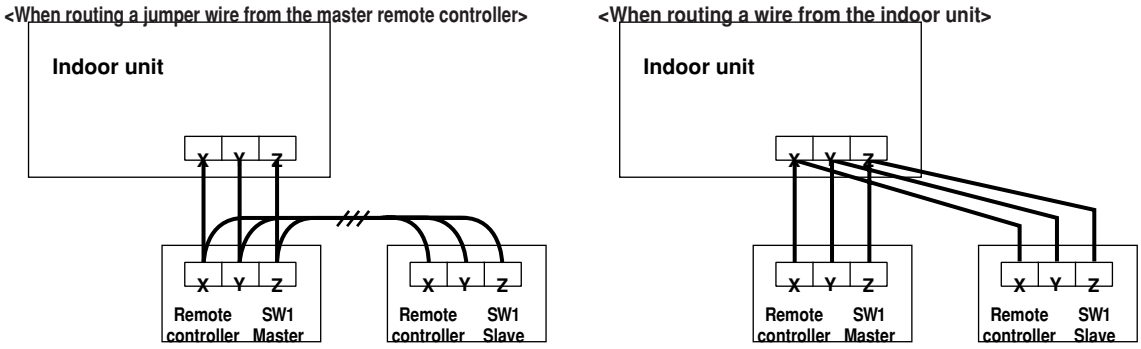


- Up to 16 indoor units can be controlled by one remote controller.
- Route the wire for the remote controller as shown in the illustration above.
- The remote controller can control simultaneous operation and stopping of the indoor units.
- The on/off of thermostat function for an indoor unit is performed by each indoor unit. However, the temperature setting can be the same for all units.

12-2. Multiple remote controllers

Note

- **The X, Y, Z terminals have polarity. Always match X, Y, Z when connecting.**
- **Always use shielded wire for the wires. On the indoor unit, only one side of the shielded wire is to be grounded.**



- One indoor unit can be controlled by two remote controllers.
- Route the wire for the remote controller as shown in the illustration above.
- When operating from multiple remote controllers, the last operation will have priority. However, the following functions can only be performed from the master remote controller: inspection reset, filter sign reset and auto lift control.
- When there are multiple remote controllers, set SW1 on the master remote controller to "Master" and SW1 on the slave remote controller to "Slave". When using normal remote control (one remote controller), set SW1 to "Master".
- Only the master remote controller can have the remote controller sensor set enabled. Mount the master remote controller at the location where the room temperature is to be monitored.

13. Method for Determining Mixing of Electrical Wires and Indoor and Outdoor Unit Signal Wires

Note

■ **Before turning on the power, always check for mixed (wrong) wiring. Improper wiring will cause damage to the indoor and outdoor unit circuit boards.**

Procedure

The following procedure can be used to identify mixed wiring.

1. Check the total number of indoor and outdoor controller (controller circuit boards) on the network.
   Please note that 2 sets of remote controllers are installed in TKFD560 and 4 sets of remote controllers are installed in TKFDP900, 1120 and 1600.

2. Measure the resistance value between interval A and B for the signal terminals on the network. If there is an interval between A and B, it is possible to measure somewhere between the indoor and outdoor units.

How to determine

- If the resistance value indicated by the units for the controller is correct, the wires are not mixed.
- If the resistance value is 80 ¾ or less, one or more units is mis-wired. (The low resistance value indicates a high number of mis-wired units.)
- If the signal wire is broken halfway, the resistance value will become larger than normal one.
  It is difficult to count the number of controller units from the results of the resistance measurement.
- The following is a table showing the relationship between the number of controllers and the resistance between A and B.

Total number of controllers	Resistance value between A and B when wired normally (¾)	Resistance value between A and B when one unit is mis-wired (¾)	Resistance value between A and B when two units are mis-wired (¾)	Resistance value between A and B when three units are mis-wired (¾)
2	4550	74	–	–
3	3033	73	37	–
4	2275	73	37	25
5	1820	72	37	25
6	1517	71	37	25
7	1300	71	36	25
8	1138	70	36	24
9	1011	70	36	24
10	910	69	36	24
20	455	64	35	24
40	228	56	32	23
60	152	50	30	22

* JA-1 and JA-2A are included in the total number of controllers.

$$\textbf{(Reference value)} = \frac{\textbf{9100 (}\Omega\textbf{)}}{\textbf{Total number of connected controllers}}$$

14. Test Operation

14-1. Before starting test operation

1. In cold district specification, at least six hours prior to the test operation, turn on the main power supply and the leakage breaker inside the outdoor unit's control box so that electricity flows into the crankcase heater.
2. Make sure that the ball valve for the outdoor unit for both the gas and liquid pipes are fully open. (Open these valves in the following sequence: liquid and then gas.)
3. Open the valve for the fuel gas.

14-2. Procedure before test operation

1. Turn on the electric leakage breaker inside the controller box for the outdoor unit.
2. Press the "inspection" button on the remote controller and make sure that the address number is properly displayed. If the address number does not come on within five minutes after the power has been turned on, reset the signal wire connections and address settings.
3. When performing cooling operations, press the [operate] button on the remote controller and set to cooling mode. Next, press and hold the [temperature setting] button and press the [set] button. The unit will operate in forced cooling mode for 30 minutes.
4. Operate the remote controller. (Fan speed, air flow direction, etc.)
5. In heating, set the operating mode to "heating" to perform heating. (It will take a little time before warm air comes out in heating mode.) Heating cannot be operated forcedlly.

14-3. Inspection items during test operation

1	Do the engine and the compressor start properly?
2	Is there any abnormal noise or vibration? (From the engine, compressor, piping or other areas.)
3	Turn on each of the indoor units. Is heating or cooling performed properly?
4	Does each function on the remote controller operate properly?
5	Check both heating and cooling operation. (Does the air become warm or cool?)
6	Check the effectiveness of the heating or cooling. Allow the unit to operate for approximately 30 minutes. Measure the temperature at both intake and blower ports. When cooling, the difference in temperature should be 10 °C or more. When heating, the difference in temperature should be 15 °C or more.
7	Measure the refrigerant pressure during operation. The following are general guidelines. l Cooling High pressure: From 2.5 to 2.7 MPa Indoor 27 °C Low pressure: From 0.8 to 1.0 MPa Outdoor 35 °C l Heating High pressure: From 2.5 to 3.0 MPa Indoor 20 °C Low pressure: From 0.6 to 0.8 MPa Outdoor 7 °C

14-4. Transfer of ownership

- Show the customer how to use the unit in accordance with the manual provided with the indoor unit.
- Explain to the customer that the power must be left on even when the unit is not used for a long period of time. By leaving the power on, it is possible to operate the air conditioner whenever heating or cooling operation is required. (Because the compressor is kept warm by the crankcase heater, seasonal compressor problems can be avoided.)

15. Diagnosing Problems

Perform inspections in accordance with error displays in the remote controller and the displayed description of the red LED on the indoor and outdoor unit circuit board.

15-1. Inspection display

Table of inspection displays on remote controller and circuit board in errors with the indoor unit

Inspection display					Location of breakdown	Description of breakdown
Remote controller		Indoor circuit board		Outdoor circuit board		
Error signal	LED red	LED red	LED green	LED red		
No display	OFF	OFF	Flashes continuously	OFF	–	● Normal operation
		OFF	On continuously	OFF	Indoor unit circuit board	● There is a unit on the same network with an indoor circuit board or CPU that has crashed.
		OFF	OFF	OFF	Indoor unit power supply	● Power supply is off, broken wire, fuse is burned out, broken transformer wire.
		I Flashes 3 times	Flashes continuously	OFF	Remote controller wiring	● Defective remote controller wire connection, broken wire (power supply: red, ground: black) I OFF when power supply is on and when the wire is broken.
E1	Flashes continuously	OFF	Flashes continuously	OFF	Indoor unit power supply	● The power supply to the indoor unit is off when one remote controller is controlling multiple units.
		I Flashes 3 times	Flashes continuously	OFF	Remote controller wiring (Electrical noise)	● Defective connection or broken wire for remote controller signal wire (white). I OFF when power supply is on and when the wire is broken. ● Electrical noise enters remote controller wire.
		Unfixed	Unfixed	OFF	Indoor unit circuit board	● Indoor unit circuit board or CPU crashed. ● Indoor unit circuit board defective (CPU defective).
E2		Flashes 1 time	Flashes continuously	OFF	Indoor unit number setting	● Duplicate indoor unit numbers (U0 to U47), 49 units or more connected.
E3		Flashes 2 times	Flashes continuously	OFF	Outdoor unit power supply	● Outdoor unit power supply is off or outdoor unit circuit board CPU has crashed.
		Flashes 2 times	Flashes continuously	OFF	Outdoor unit signal wire Outdoor unit number setting	● Defective connection or broken wire for signal wire for outdoor unit network. ● Wrong outdoor unit number setting. (There is no outdoor unit with the same number as the indoor unit).
		Flashes 2 times	Flashes continuously	Unfixed	Outdoor unit circuit board	● Outdoor unit circuit board. ● CPU crash or outdoor unit power supply off.
		Flashes 2 times	Flashes continuously	Flashes	Outdoor unit number setting	● Wrong outdoor unit number setting. (set U48, U49)
E5		Flashes 2 times	Flashes continuously	Flashes	Signal wire between indoor and outdoor units	● Bad outdoor signal connection has occurred during operation. (Come off or loose.) ● Defective communication between indoor/outdoor units due to electrical noise, etc.
		Flashes 2 times	Flashes continuously	OFF	Outdoor unit power supply	● When there are separate indoor/outdoor power supply, the outdoor power supply goes off during operation. (Power outage, wrong phase) ● Power supply wire to outdoor unit circuit board has come off. (R phase or S phase.)
		Flashes 2 times	Flashes continuously	Unfixed	(Electrical noise)	● Outdoor unit circuit board or CPU crash when power is on.
		Flashes 2 times	Flashes continuously	OFF	Indoor unit circuit board	● Defective communication circuit. (Defective reading of self-sent data.)
E6		Flashes 1 time	Flashes continuously	OFF	Indoor/Heat exchanger thermistor	● Defective indoor heat exchanger thermistor. (Defective element, broken wire.) ● Defective connector connection for thermistor.
E7		Flashes 1 time	Flashes continuously	OFF	Indoor/intake thermistor	● Defective indoor intake thermistor. (Defective element, broken wire.) ● Defective connector connection for thermistor.
E9		Flashes 1 time	Flashes continuously	OFF	Poor drainage	● Defective drain pump (DM). Broken wire for drain pump. Connector has come loose.
					Float switch	● Defective float switch operation (misoperation).
					Option	● Defective option parts (when setting option error input)
E10		OFF	Flashes continuously	OFF	Number of connected indoor units	● Number of indoor units connected exceeds maximum when one remote controller is controlling multiple units. (17 units or more)
E12		Flashes 1 time	Flashes continuously	OFF	Indoor/outdoor circuit board address setting	● Wrong address setting.
E16		OFF	On continuously	OFF	Indoor fan moter	● Indoor fan motor error ● Indoor fan motor connector disconnected
E28		OFF	On continuously	OFF	Remote contoroller thermistor	● Remote control sensor disconnected
E30		Flashes 2 times	Flashes continuously	Flashes	Outdoor unit number setting	● Unmatched indoor/outdoor unit connections. (The capacity of indoor units for single type is over regulated capacity.)
E43		OFF	Flashes continuously	Flashes	Exceeding the number of units that can be connected	● Too many indoor units connected to one outdoor unit (single type: 5 units or more, multi-type: 25 units or more) ● Indoor unit connection capacity exceeded (single type)
E46		OFF	Flashes continuously	Flashes	Address setting method mixed	● Wrong outdoor unit number setting. (Set U48 or U49) Indoor unit circuit board address setting (Same indoor unit number and outdoor unit number 0 to 47.)
E85		OFF	On continuously	Flashes	Installed	● Indoor units for single type are installed in the multi-type outdoor unit. (multi type)

Table of inspection displays on remote controller and circuit board in errors with the outdoor unit

Inspection display					Location of breakdown	Description of breakdown
Remote controller		Indoor circuit board		Outdoor circuit board		
Error signal	LED red	LED red	LED green	LED red		
E31	Flashes continuously	OFF	Flashes continuously	Flashes	Unit number setting	● Duplicate outdoor unit numbers (U0 to U47).
E34		OFF	Flashes continuously	Flashes	One phrase broken	● One phase in three-phases is broken
E36		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Discharge temperature high (120 °C or more).
					Discharge piping thermistor	● Defective discharge piping thermistor or short circuit.
E38		OFF	Flashes continuously	Flashes	Outdoor temperature thermistor	● Defective outdoor temperature thermistor, broken wire, defective connector connection or short circuit.
E39		OFF	Flashes continuously	Flashes	Discharge piping thermistor	● Defective discharge piping thermistor, broken wire or defective connector connection or short circuit.
E40		OFF	Flashes continuously	Flashes	Installation/operation conditions	● High pressure rises.
					High pressure switch	● Defective high pressure switch, broken wire or defective connector connection.
E52		OFF	Flashes continuously	Flashes	Engine room temperature thermistor Exhaust air temp. sensor	● Defective engine room temperature thermistor or broken wire or defective connector contact or short circuit. ● Exhaust air temperature sensor disconnection with the deodorizer attached.
E53		OFF	Flashes continuously	Flashes	Compressor intake/port temperature thermistor	● Defective compressor intake/outlet port temperature thermistor, broken wire, short circuit or defective connector connection.
E57		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Insufficient refrigerant.
					Low pressure switch	● Defective low pressure switch, broken wire or defective connector connection.
					Installation/operation conditions	● Empty refrigerant.
E58		OFF	Flashes continuously	Flashes	Emergency Stop	● Emergency stop command issued from indoor unit
E63		OFF	Flashes continuously	Flashes	Mounting/Operational Status	● Exhaust temperature excessive when deodorizer attached
E80		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Rise in engine coolant temperature. (105 °C)
					Engine coolant	● Insufficient engine coolant. (Empty operation)
					Water pump	● Defective waterpump
E81		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Insufficient engine oil.
E82		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Abnormal rise in engine rpm.
E83		OFF	Flashes continuously	Flashes	Stator, etc.	● Defective startor, broken cord or defective engine speed. ● Gas valve output error
E84		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Engine start failure. ● Bad engine gas fuel supply. ● Engine stop.
E86		OFF	Flashes continuously	Flashes	Engine oil pressure switch	● Defective engine oil pressure switch, broken cord or defective connector connection.
E87		OFF	Flashes continuously	Flashes	Engine water temperature sensor	● Defective engine water temperature sensor, broken cord or defective connector connection.
E89		OFF	Flashes continuously	Flashes	Installation/operation conditions	● Excessive refrigerant charge (too much refrigerant charge). ● Abnormal overheating.
					Installation/operation conditions	● Insufficient or deteriorated compressor oil for compressor.
					Oil return electromagnetic valve	● Defective oil return electromagnetic valve.
					Oil return capillary	● Defective oil return capillary (blocked).
					Temperature sensor	● The temperature sensor is malfunctioning, disconnected, or short-circuited, or the connector contacts are bad.
					Sub heat exchanger output	● The temperature sensor is malfunctioning, disconnected, or short-circuited, or the connector contacts are bad.
					External pipes	● The temperature sensor is malfunctioning, disconnected, or short-circuited, or the connector contacts are bad.
					Outdoor unit heat exchanger liquid side temperature sensor	● Defective outdoor heat exchanger liquid side temperature sensor, broken wire, short circuit or defective connector connection.
					Pressure sensor	● Defective pressure sensor (High pressure 3.8 MPa or more). ● Defective pressure sensor (High pressure 0.3 MPa or less).
					Electronic expansion valve	● Defective electronic expansion valve operation.
OFF				Flashes	Setting for power supply	● Defective power supply setting on sub-circuit board. ● Defective connection in the connector.

16. Installation Check List

Installation — Outdoor unit

- Are there any problems with the exterior and interior of the outdoor unit?
- Is there any possibilities that short circuit operation could occur due to outdoor unit exhaust heat?
- Is there enough space for air flow and servicing?
- Could blower air from the outdoor unit or engine exhaust gas accumulate inside or flow into the room?
- Is there proper drainage from the outdoor unit?
- Does exhaust gas from the outdoor unit come in direct contact with plants, etc?

Installation — Indoor unit

- Are there any problems with the exterior and interior of the indoor unit?
- Is the downward grade for drain pipe 1/100 or more?
- Is there enough space for air flow and servicing?

Refrigerant piping installation

- Is the number of indoor units connected less than 20 sets? (for multi-type for buildings)
- Is the total capacity for the number of connected indoor units within the following ranges for multi-type for buildings: In case of P450 type, P224 to P585, in case of P560 type, P280 to P728, in case of P710, P355 to P923
- Are the differences in length and height of the refrigerant piping within the permissible ranges?
- Are the branch sections properly installed?
- Is the piping properly insulated?
- Has the proper amount of additional refrigerant been added?

Drain piping installation

- Did you install exhaust drain piping in accordance with the specifications?
- Do the exhaust drain for the outdoor unit and drain for the indoor unit drain into the same recepticle?
- Have you performed a water drainage test? (For both the cooling and heating seasons)
- Is the drain properly insulated?

Gas piping

- Are there any fuel gas leaks?
- Does the type of the gas supplied match the type indicated on the name plate?

Electric wiring installation

- Are there any errors in the connections for the electrical and signal wires?
- When the outdoor unit power supply is AC 200V, has the connector on the sub-circuit board been /and connected to the terminal block R-S and reinserted?
- Have your performed the check for finding mixed electrical/signal wiring?
- Does the indoor unit have Class D grounding?
- Are 2-core cables used for the signal wire and not multi-core cable?
- Is the wiring within the permissible length? Is the routing proper?

Addresses and others settings

- Are the address switches for the indoor unit and outdoor unit properly set?
- Has the remote controller address switch been properly set? (When using multiple remote controllers.)
- Were the addresses set with the power (breaker) off?
  (If the setting of the addresses was done with the power (breaker) on, turn it off, wait approx. five seconds and re-enter the addresses.)
- Has the fan motor of the indoor unit been set to 50 or 60 Hz accordingly? (Reinsert the connector.)
  (Factory setting is 60 Hz for one-way cassette type, floor low boy and ceiling suspended types.)

Options

[Check the following items if installed in regions that are cold or have much snowfall.]

- Has the snow hood been mounted?
- Has the drain heater been installed?
- Is the harness of the drain heater connected to the terminal correcly?
- Is a hose clip installed?

[Check the following item if the vibration of the outdoor unit can cause problems]

- Has the antivibrant stand been installed?

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