TOSHIBA

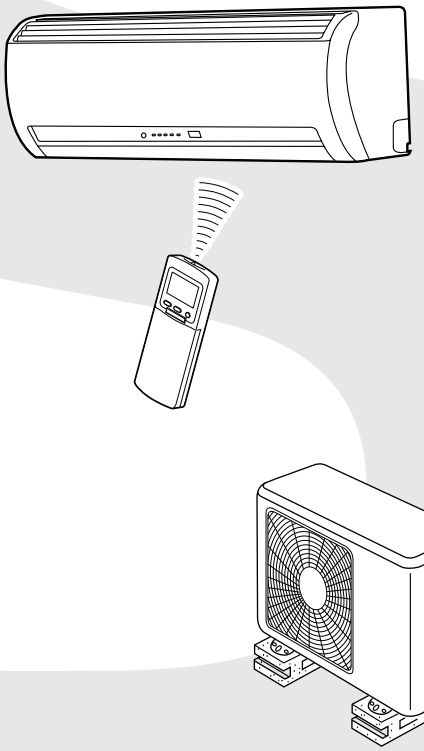
FILE NO. SVM-05027-1

SERVICE MANUAL

AIR CONDITIONER

SPLIT WALL TYPE

RAS-13NKV-E / RAS-13NAV-E
RAS-13NKV-A / RAS-13NAV-A
RAS-16NKV-E / RAS-16NAV-E
RAS-16NKV-A / RAS-16NAV-A



HFC
R410A

June, 2005

CONTENTS

1. SPECIFICATIONS

1-1. Specifications

Unit model	**Indoor**			**RAS-13NKV-E (A)**	
	Outdoor			**RAS-13NAV-E (A)**	
Cooling capacity			(kW)	3.5	
Cooling capacity range			(kW)	1.1–4.0	
Heating capacity			(kW)	4.2	
Heating capacity range			(kW)	1.1–5.8	
Power supply				220–240V–1Ph–50/60Hz	
Electric characteristics	Indoor	Operation mode		**Cooling**	**Heating**
		Running current	(A)	0.15	0.15
		Power consumption	(W)	30	30
	Outdoor	Power factor	(%)	87	87
		Operation mode		**Cooling**	**Heating**
		Running current	(A)	4.70	4.97
		Power consumption	(W)	1040	1100
		Power factor	(%)	96	96
COP (Cooling / Heating)				3.27/3.72	
Operation noise	Indoor	High (Cooling / Heating)	(dB•A)	39/39	
		Medium (Cooling / Heating)	(dB•A)	33/34	
		Low (Cooling / Heating)	(dB•A)	26/28	
	Outdoor (Cooling / Heating)		(dB•A)	48/50	
Indoor unit	Unit model			**RAS-13NKV-E (A)**	
	Dimension	Height	(mm)	275	
		Width	(mm)	790	
		Depth	(mm)	218	
	Net weight		(kg)	10	
	Fan motor output		(W)	20	
	Air flow rate	(Cooling / Heating)	(m^3/h)	590/620	
Outdoor unit	Unit model			**RAS-13NAV-E (A)**	
	Dimension	Height	(mm)	550	
		Width	(mm)	780	
		Depth	(mm)	270	
	Net weight		(kg)	36	
	Compressor	Motor output	(W)	750	
		Type		Single rotary type with DC-inverter variable speed control	
		Model		DA89X1F-23F	
	Fan motor output		(W)	43	
	Air flow rate	(Cooling / Heating)	(m^3/h)	2410/2410	
Piping connection	Type			Flare connection	
	Indoor unit	Liquid side		∅6.35	
		Gas side		∅9.52	
	Outdoor unit	Liquid side		∅6.35	
		Gas side		∅9.52	
	Maximum length (Per unit)		(m)	15	
	Maximum chargeless length		(m)	15	
	Maximum height difference		(m)	10	
Refrigerant	Name of refrigerant			R410A	
	Weight		(kg)	0.8	
Wiring connection		Power supply		3 Wires:includes earth (Outdoor)	
		Interconnection		4 Wires:includes earth	
Usable temperature range		Indoor (Cooling / Heating)	(°C)	21 – 32 / Up to 27 °C	
		Outdoor (Cooling / Heating)	(°C)	15 – 43 / – 10 – 24	

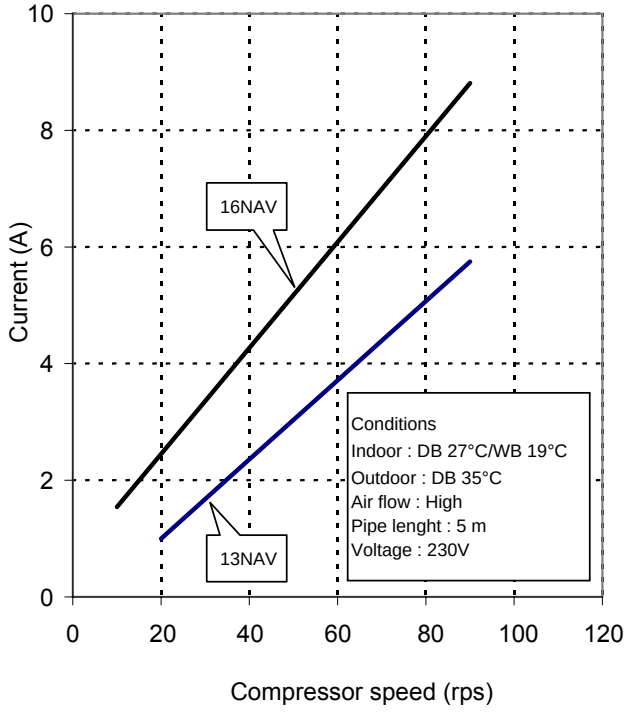
- The specification may be subject to change without notice for purpose of improvement.

Unit model	**Indoor**			**RAS-16NKV-E (A)**	
	Outdoor			**RAS-16NAV-E (A)**	
Cooling capacity			(kW)	4.62	
Cooling capacity range			(kW)	1.2–5.2	
Heating capacity			(kW)	5.9	
Heating capacity range			(kW)	1.3–7.4	
Power supply				1 Ph, 50Hz~ 220–240V / 60Hz~220V	
Electric characteristics	Indoor	Operation mode		**Cooling**	**Heating**
		Running current	(A)	0.2	0.2
		Power consumption	(W)	30	30
	Outdoor	Power factor	(%)	65	65
		Operation mode		**Cooling**	**Heating**
		Running current	(A)	7.20	7.60
		Power consumption	(W)	1590	1700
		Power factor	(%)	96	97
COP (Cooling / Heating)				2.85/3.41	
Operation noise	Indoor	High (Cooling / Heating)	(dB•A)	45/44	
		Medium (Cooling / Heating)	(dB•A)	40/40	
		Low (Cooling / Heating)	(dB•A)	34/34	
	Outdoor (Cooling / Heating)		(dB•A)	51/53	
Indoor unit	Unit model			**RAS-16NKV-E (A)**	
	Dimension	Height	(mm)	275	
		Width	(mm)	790	
		Depth	(mm)	218	
	Net weight		(kg)	10	
	Fan motor output		(W)	30	
	Air flow rate	(Cooling / Heating)	(m^3/h)	760/780	
Outdoor unit	Unit model			**RAS-16NAV-E (A)**	
	Dimension	Height	(mm)	550	
		Width	(mm)	780	
		Depth	(mm)	270	
	Net weight		(kg)	39	
	Compressor	Motor output	(W)	1100	
		Type		Twin rotary type with DC-inverter variable speed control	
		Model		DA130A1F-24F	
	Fan motor output		(W)	43	
	Air flow rate	(Cooling / Heating)	(m^3/h)	2410/2410	
Piping connection	Type			Flare connection	
	Indoor unit	Liquid side		∅6.35	
		Gas side		∅12.7	
	Outdoor unit	Liquid side		∅6.35	
		Gas side		∅12.7	
	Maximum length (Per unit)		(m)	15	
	Maximum chargeless length		(m)	15	
	Maximum height difference		(m)	10	
Refrigerant	Name of refrigerant			R410A	
	Weight		(kg)	0.95	
Wiring connection		Power supply		3 Wires:includes earth (Outdoor)	
		Interconnection		4 Wires:includes earth	
Usable temperature range		Indoor (Cooling / Heating)	(°C)	21 – 32 / Up to 27 °C	
		Outdoor (Cooling / Heating)	(°C)	15 – 43 / – 10 – 24	

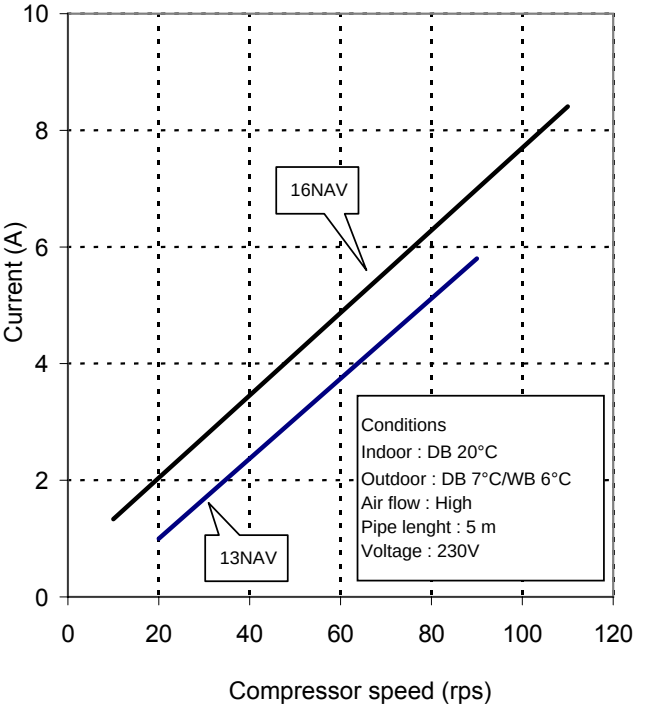
- The specification may be subject to change without notice for purpose of improvement.

1-2. Operation Characteristic Curve

<Cooling>

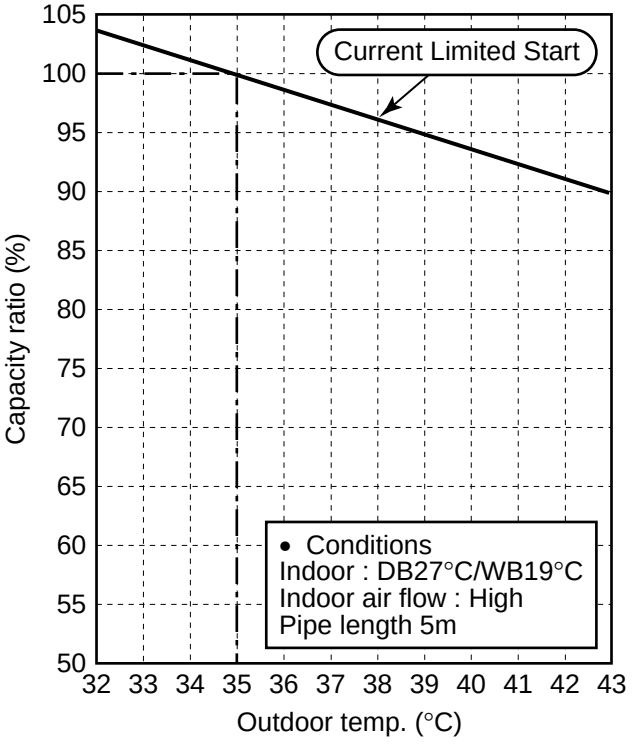


<Heating>

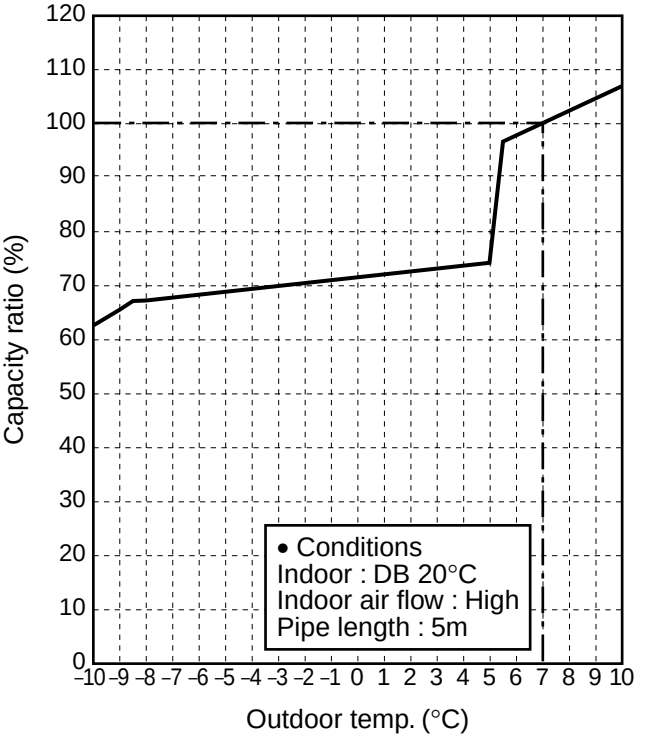


1-3. Capacity Variation Ratio According to Temperature

<Cooling>



<Heating>



* Capacity ratio : 100% = Nominal Capacity

2. REFRIGERANT R410A

This air conditioner adopts the new refrigerant HFC (R410A) which does not damage the ozone layer.

The working pressure of the new refrigerant R410A is 1.6 times higher than conventional refrigerant (R22). The refrigerating oil is also changed in accordance with change of refrigerant, so be careful that water, dust, and existing refrigerant or refrigerating oil are not entered in the refrigerant cycle of the air conditioner using the new refrigerant during installation work or servicing time.

The next section describes the precautions for air conditioner using the new refrigerant. Conforming to contents of the next section together with the general cautions included in this manual, perform the correct and safe work.

2-1. Safety During Installation/Servicing

As R410A's pressure is about 1.6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration.

(1) Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A.
If other refrigerant than R410A is mixed, pressure in the refrigeration cycle becomes abnormally high, and it may cause personal injury, etc. by a rupture.

(2) Confirm the used refrigerant name, and use tools and materials exclusive for the refrigerant R410A. The refrigerant name R410A is indicated on the visible place of the outdoor unit of the air conditioner using R410A as refrigerant. To prevent mischarging, the diameter of the service port differs from that of R22

(3) If a refrigeration gas leakage occurs during installation/servicing, be sure to ventilate fully.
If the refrigerant gas comes into contact with fire, a poisonous gas may occur.

(4) When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture of personal injury may be caused.

(5) After completion of installation work, check to make sure that there is no refrigeration gas leakage.
If the refrigerant gas leaks into the room, coming into contact with fire in the fan-driven heater, space heater, etc., a poisonous gas may occur.

(6) When an air conditioning system charged with a large volume of refrigerant is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level.
If the refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result.

(7) Be sure to carry out installation or removal according to the installation manual.
Improper installation may cause refrigeration trouble, water leakage, electric shock, fire, etc.

(8) Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician.
Improper repair's may result in water leakage, electric shock and fire, etc.

2-2. Refrigerant Piping Installation

2-2-1. Piping materials and joints used

For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants.

(1) Copper Pipes
It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10 m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface). Otherwise, the expansion valve or capillary tube may become blocked with contaminants.
As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.
Thicknesses of copper pipes used with R410A are as shown in Table 2-2-1. Never use copper pipes thinner than 0.8 mm even when it is available on the market.

Table 2-2-1 Thicknesses of annealed copper pipes

		Thickness (mm)	
Nominal diameter	**Outer diameter (mm)**	**R410A**	**R22**
1/4	6.35	0.80	0.80
3/8	9.52	0.80	0.80
1/2	12.70	0.80	0.80
5/8	15.88	1.00	1.00

(2) Joints
For copper pipes, flare joints or socket joints are used. Prior to use, be sure to remove all contaminants.

a) Flare Joints
Flare joints used to connect the copper pipes cannot be used for pipings whose outer diameter exceeds 20 mm. In such a case, socket joints can be used.
Sizes of flare pipe ends, flare joint ends and flare nuts are as shown in Tables 2-2-3 to 2-2-6 below.

b) Socket Joints
Socket joints are such that they are brazed for connections, and used mainly for thick pipings whose diameter is larger than 20 mm.
Thicknesses of socket joints are as shown in Table 2-2-2.

Table 2-2-2 Minimum thicknesses of socket joints

Nominal diameter	**Reference outer diameter of copper pipe jointed (mm)**	**Minimum joint thickness (mm)**
1/4	6.35	0.50
3/8	9.52	0.60
1/2	12.70	0.70
5/8	15.88	0.80

2-2-2. Processing of piping materials

When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil other than lubricating oils used in the installed air conditioner is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed. When stored, be sure to seal the container with an airtight cap or any other cover.

(1) Flare Processing Procedures and Precautions
a) Cutting the Pipe
By means of a pipe cutter, slowly cut the pipe so that it is not deformed.
b) Removing Burrs and Chips
If the flared section has chips or burrs, refrigerant leakage may occur. Carefully remove all burrs and clean the cut surface before installation.
c) Insertion of Flare Nut

d) Flare Processing
Make certain that a clamp bar and copper pipe have been cleaned.
By means of the clamp bar, perform the flare processing correctly.
Use either a flare tool for R410A or conventional flare tool.
Flare processing dimensions differ according to the type of flare tool. When using a conventional flare tool, be sure to secure “dimension A” by using a gauge for size adjustment.

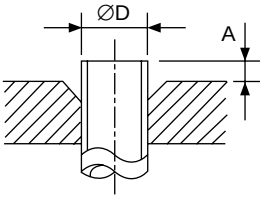


Fig. 2-2-1 Flare processing dimensions

Table 2-2-3 Dimensions related to flare processing for R410A

Nominal diameter	Outer diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 to 0.5	1.0 to 1.5	1.5 to 2.0
3/8	9.52	0.8	0 to 0.5	1.0 to 1.5	1.5 to 2.0
1/2	12.70	0.8	0 to 0.5	1.0 to 1.5	2.0 to 2.5
5/8	15.88	1.0	0 to 0.5	1.0 to 1.5	2.0 to 2.5

Table 2-2-4 Dimensions related to flare processing for R22

Nominal diameter	Outer diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool for R410A clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 to 0.5	0.5 to 1.0	1.0 to 1.5
3/8	9.52	0.8	0 to 0.5	0.5 to 1.0	1.0 to 1.5
1/2	12.70	0.8	0 to 0.5	0.5 to 1.0	1.0 to 2.0
5/8	15.88	1.0	0 to 0.5	0.5 to 1.0	1.0 to 2.0

Table 2-2-5 Flare and flare nut dimensions for R410A

Nominal diameter	Outer diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
1/4	6.35	0.8	9.1	9.2	6.5	13	17
3/8	9.52	0.8	13.2	13.5	9.7	20	22
1/2	12.70	0.8	16.6	16.0	12.9	23	26
5/8	15.88	1.0	19.7	19.0	16.0	25	29

Table 2-2-6 Flare and flare nut dimensions for R22

Nominal diameter	Outer diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width (mm)
			A	B	C	D	
1/4	6.35	0.8	9.0	9.2	6.5	13	17
3/8	9.52	0.8	13.0	13.5	9.7	20	22
1/2	12.70	0.8	16.2	16.0	12.9	20	24
5/8	15.88	1.0	19.7	19.0	16.0	23	27
3/4	19.05	1.0	23.3	24.0	19.2	34	36

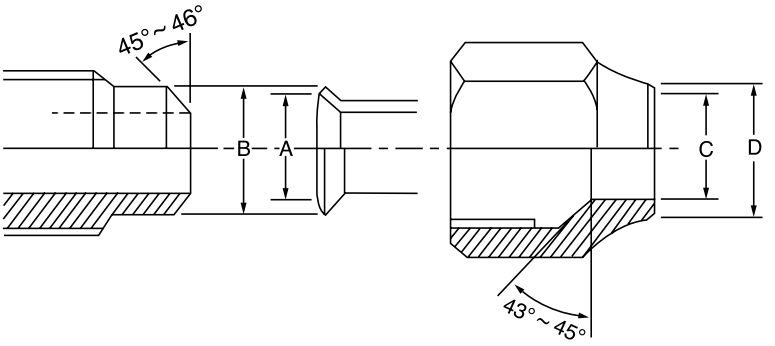


Fig. 2-2-2 Relations between flare nut and flare seal surface

(2) Flare Connecting Procedures and Precautions

a) Make sure that the flare and union portions do not have any scar or dust, etc.

b) Correctly align the processed flare surface with the union axis.

c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is the same as that for conventional R22. Incidentally, when the torque is weak, the gas leakage may occur. When it is strong, the flare nut may crack and may be made non-removable. When choosing the tightening torque, comply with values designated by manufacturers. Table 2-2-7 shows reference values.

Note:
When applying oil to the flare surface, be sure to use oil designated by the manufacturer. If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out.

Table 2-2-7 Tightening torque of flare for R410A [Reference values]

Nominal diameter	Outer diameter (mm)	Tightening torque N·m (kgf·m)	Tightening torque of torque wrenches available on the market N·m (kgf·m)
1/4	6.35	14 to 18 (140 to 180)	16 (160), 18 (180)
3/8	9.52	33 to 42 (330 to 420)	42 (420)
1/2	12.70	50 to 62 (500 to 620)	55 (550)
5/8	15.88	63 to 77 (630 to 770)	65 (650)

2-3. Tools

2-3-1. Required tools

The service port diameter of packed valve of the outdoor unit in the air conditioner using R410A is changed to prevent mixing of other refrigerant. To reinforce the pressure-resisting strength, flare processing dimensions and opposite side dimension of flare nut (For ∅12.70 copper pipe) of the refrigerant piping are lengthened.

The used refrigerating oil is changed, and mixing of oil may cause a trouble such as generation of sludge, clogging of capillary, etc. Accordingly, the tools to be used are classified into the following three types.

(1) Tools exclusive for R410A (Those which cannot be used for conventional refrigerant (R22))
(2) Tools exclusive for R410A, but can be also used for conventional refrigerant (R22)
(3) Tools commonly used for R410A and for conventional refrigerant (R22)

The table below shows the tools exclusive for R410A and their interchangeability.

Tools exclusive for R410A (The following tools for R410A are required.)

Tools whose specifications are changed for R410A and their interchangeability

No.	Used tool	Usage	R410A air conditioner installation		Conventional air conditioner installation
			Existence of new equipment for R410A	Whether conventional equipment can be used	Whether new equipment can be used with conventional refrigerant
①	Flare tool	Pipe flaring	Yes	*(Note 1)	○
②	Copper pipe gauge for adjusting projection margin	Flaring by conventional flare tool	Yes	*(Note 1)	*(Note 1)
③	Torque wrench (For ∅12.70)	Connection of flare nut	Yes	×	×
④	Gauge manifold	Evacuating, refrigerant charge, run check, etc.	Yes	×	×
⑤	Charge hose				
⑥	Vacuum pump adapter	Vacuum evacuating	Yes	×	○
⑦	Electronic balance for refrigerant charging	Refrigerant charge	Yes	×	○
⑧	Refrigerant cylinder	Refrigerant charge	Yes	×	×
⑨	Leakage detector	Gas leakage check	Yes	×	○
⑩	Charging cylinder	Refrigerant charge	(Note 2)	×	×

(Note 1) When flaring is carried out for R410A using the conventional flare tools, adjustment of projection margin is necessary. For this adjustment, a copper pipe gauge, etc. are necessary.
(Note 2) Charging cylinder for R410A is being currently developed.

General tools (Conventional tools can be used.)

In addition to the above exclusive tools, the following equipments which serve also for R22 are necessary as the general tools.

(1) Vacuum pump
Use vacuum pump by attaching vacuum pump adapter.
(2) Torque wrench (For ∅6.35)
(3) Pipe cutter
(4) Reamer
(5) Pipe bender
(6) Level vial
(7) Screwdriver (+, –)
(8) Spanner of Monkey wrench
(9) Hole core drill (∅65)
(10) Hexagon wrench (Opposite side 5 mm)
(11) Tape measure
(12) Metal saw

Also prepare the following equipments for other installation method and run check.

(1) Clamp meter
(2) Thermometer
(3) Insulation resistance tester
(4) Electroscope

2-4. Recharging of Refrigerant

When it is necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps.

Recover the refrigerant, and check no refrigerant remains in the equipment.

↓

Connect the charge hose to packed valve service port at the outdoor unit's gas side.

↓

Connect the charge hose to the vacuum pump adapter.

↓

Open fully both packed valves at liquid and gas sides.

↓

Place the handle of the gauge manifold Low in the fully opened position, and turn on the vacuum pump's power switch. Then, evacuating the refrigerant in the cycle.

↓

When the compound gauge's pointer has indicated -0.1 Mpa (-76 cmHg), place the handle Low in the fully closed position, and turn off the vacuum pump's power switch.

↓

Keep the status as it is for 1 to 2 minutes, and ensure that the compound gauge's pointer does not return.

↓

Set the refrigerant cylinder to the electronic balance, connect the connecting hose to the cylinder and the connecting port of the electronic balance, and charge **liquid refrigerant.**

(For refrigerant charging, see the figure below.)

① Never charge refrigerant exceeding the specified amount.

② If the specified amount of refrigerant cannot be charged, charge refrigerant **bit by bit** in COOL mode.

③ Do not carry out additional charging.

When additional charging is carried out if refrigerant leaks, the refrigerant composition changes in the refrigeration cycle, that is characteristics of the air conditioner changes, refrigerant exceeding the specified amount is charged, and working pressure in the refrigeration cycle becomes abnormally high pressure, and may cause a rupture or personal injury.

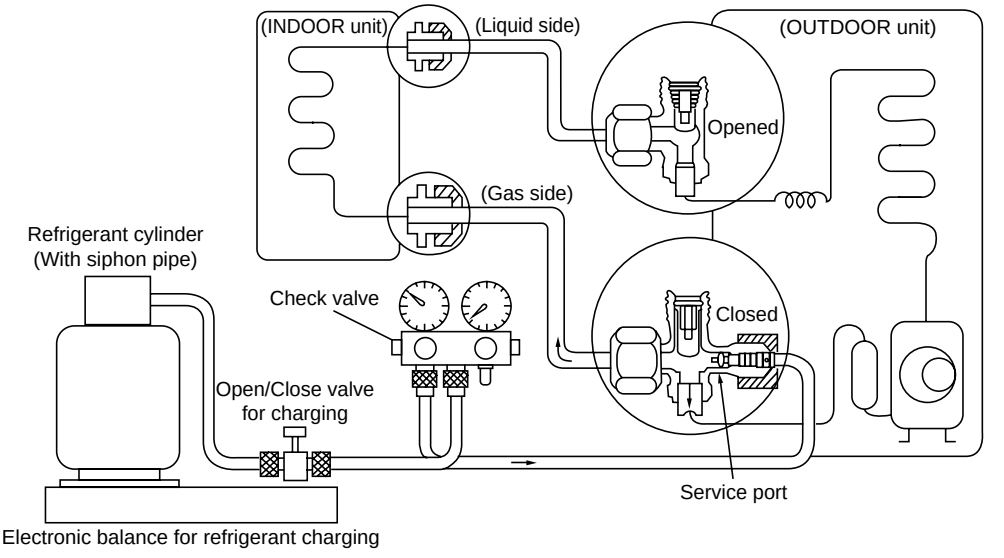


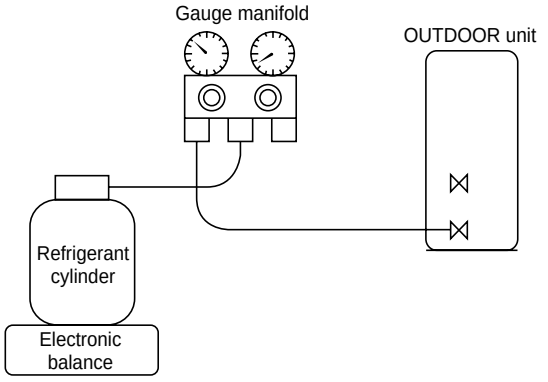
Fig. 2-4-1 Configuration of refrigerant charging

① Be sure to make setting so that **liquid** can be charged.

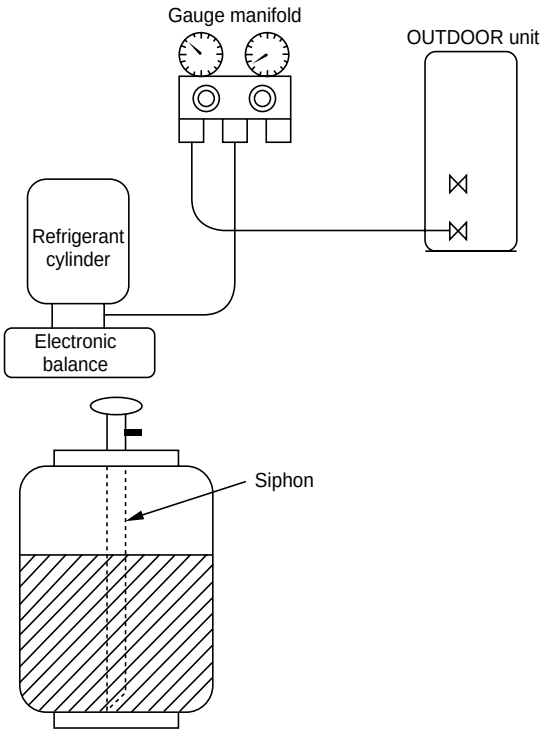
② When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down.

It is necessary for charging refrigerant under condition of liquid because R410A is mixed type of refrigerant. Accordingly, when charging refrigerant from the refrigerant cylinder to the equipment, charge it turning the cylinder upside down if cylinder is not equipped with siphon.

[Cylinder with siphon]



[Cylinder without siphon]



R410A refrigerant is HFC mixed refrigerant. Therefore, if it is charged with gas, the composition of the charged refrigerant changes and the characteristics of the equipment varies.

Fig. 2-4-2

2-5. Brazing of Pipes

2-5-1. Materials for brazing

(1) Silver brazing filler
Silver brazing filler is an alloy mainly composed of silver and copper. It is used to join iron, copper or copper alloy, and is relatively expensive though it excels in solderability.

(2) Phosphor bronze brazing filler
Phosphor bronze brazing filler is generally used to join copper or copper alloy.

(3) Low temperature brazing filler
Low temperature brazing filler is generally called solder, and is an alloy of tin and lead. Since it is weak in adhesive strength, do not use it for refrigerant pipes.

① Phosphor bronze brazing filler tends to react with sulfur and produce a fragile compound water solution, which may cause a gas leakage. Therefore, use any other type of brazing filler at a hot spring resort, etc., and coat the surface with a paint.

② When performing brazing again at time of servicing, use the same type of brazing filler.

2-5-2. Flux

(1) Reason why flux is necessary

- By removing the oxide film and any foreign matter on the metal surface, it assists the flow of brazing filler.
- In the brazing process, it prevents the metal surface from being oxidized.
- By reducing the brazing filler's surface tension, the brazing filler adheres better to the treated metal.

(2) Characteristics required for flux

- Activated temperature of flux coincides with the brazing temperature.
- Due to a wide effective temperature range, flux is hard to carbonize.
- It is easy to remove slag after brazing.
- The corrosive action to the treated metal and brazing filler is minimum.
- It excels in coating performance and is harmless to the human body.

As the flux works in a complicated manner as described above, it is necessary to select an adequate type of flux according to the type and shape of treated metal, type of brazing filler and brazing method, etc.

(3) Types of flux

- **Noncorrosive flux**
  Generally, it is a compound of borax and boric acid.
  It is effective in case where the brazing temperature is higher than 800°C.

- **Activated flux**
  Most of fluxes generally used for silver brazing are this type.
  It features an increased oxide film removing capability due to the addition of compounds such as potassium fluoride, potassium chloride and sodium fluoride to the borax-boric acid compound.

(4) Piping materials for brazing and used brazing filler/flux

Piping material	Used brazing filler	Used flux
Copper - Copper	Phosphor copper	Do not use
Copper - Iron	Silver	Paste flux
Iron - Iron	Silver	Vapor flux

① Do not enter flux into the refrigeration cycle.
② When chlorine contained in the flux remains within the pipe, the lubricating oil deteriorates. Therefore, use a flux which does not contain chlorine.
③ When adding water to the flux, use water which does not contain chlorine (e.g. distilled water or ion-exchange water).
④ Remove the flux after brazing.

2-5-3. Brazing

As brazing work requires sophisticated techniques, experiences based upon a theoretical knowledge, it must be performed by a person qualified.
In order to prevent the oxide film from occurring in the pipe interior during brazing, it is effective to proceed with brazing while letting dry Nitrogen gas (N_2) flow.

Never use gas other than Nitrogen gas.

(1) Brazing method to prevent oxidation

① Attach a reducing valve and a flow-meter to the Nitrogen gas cylinder.
② Use a copper pipe to direct the piping material, and attach a flow-meter to the cylinder.
③ Apply a seal into the clearance between the piping material and inserted copper pipe for Nitrogen in order to prevent backflow of the Nitrogen gas.
④ When the Nitrogen gas is flowing, be sure to keep the piping end open.
⑤ Adjust the flow rate of Nitrogen gas so that it is lower than 0.05 m^3/Hr or 0.02 Mpa (0.2 kgf/cm^2) by means of the reducing valve.
⑥ After performing the steps above, keep the Nitrogen gas flowing until the pipe cools down to a certain extent (temperature at which pipes are touchable with hands).
⑦ Remove the flux completely after brazing.

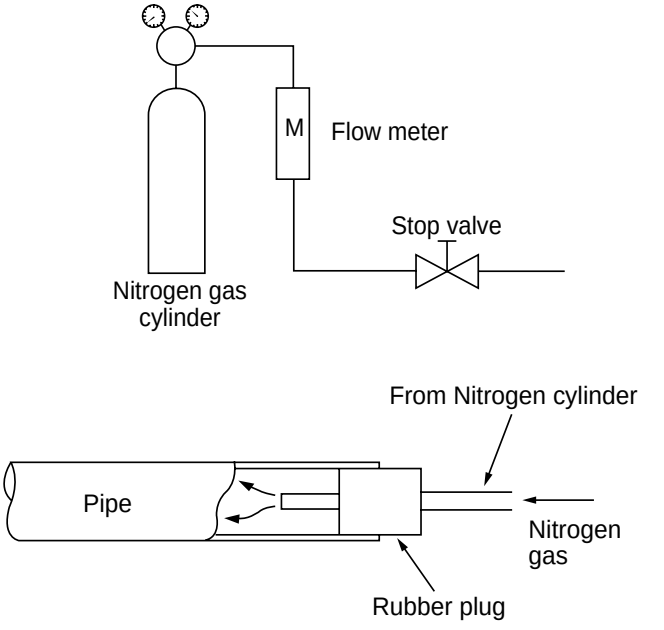
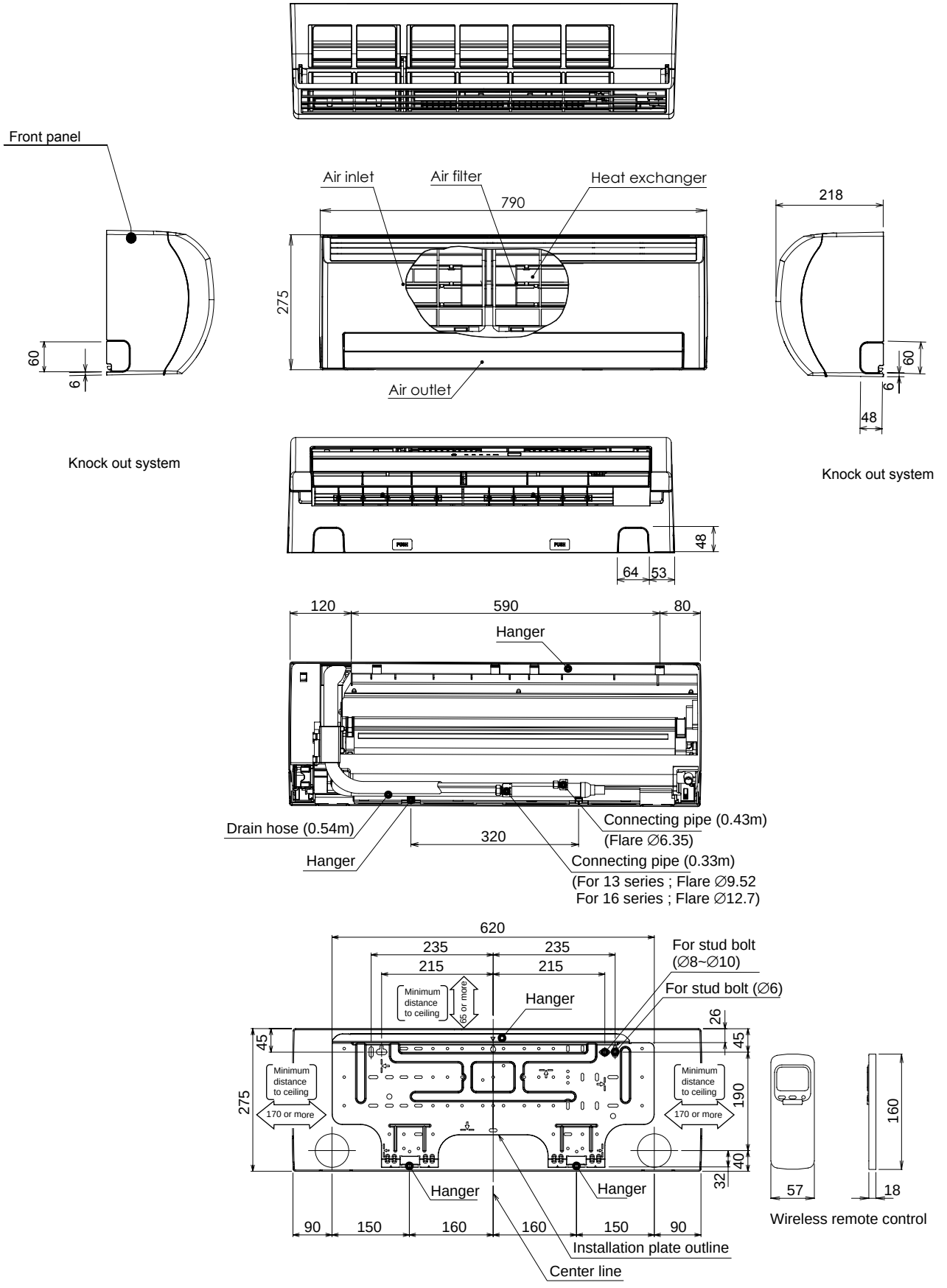


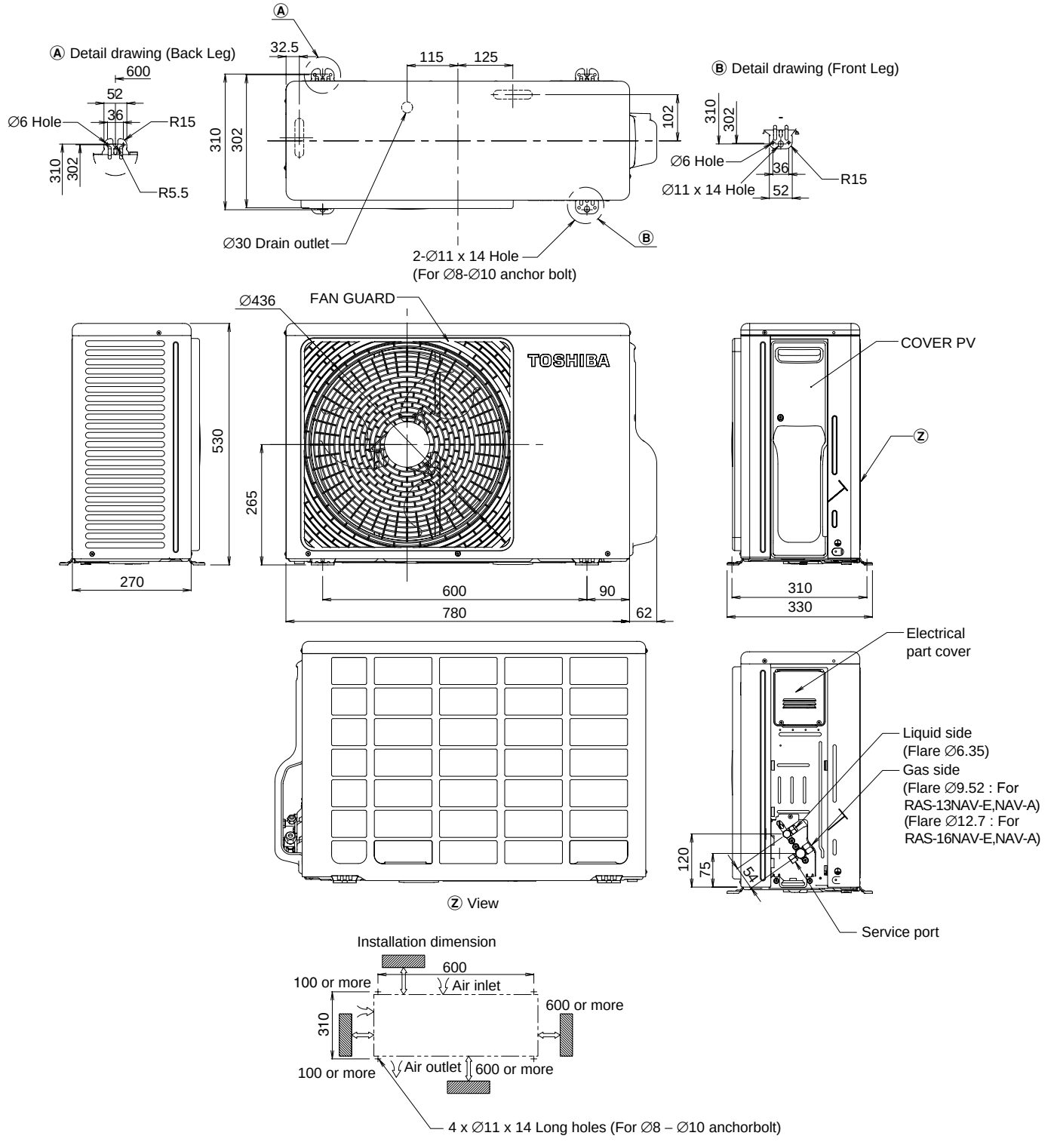
Fig. 2-5-1 Prevention of oxidation during brazing

3. CONSTRUCTION VIEWS

3-1. Indoor Unit

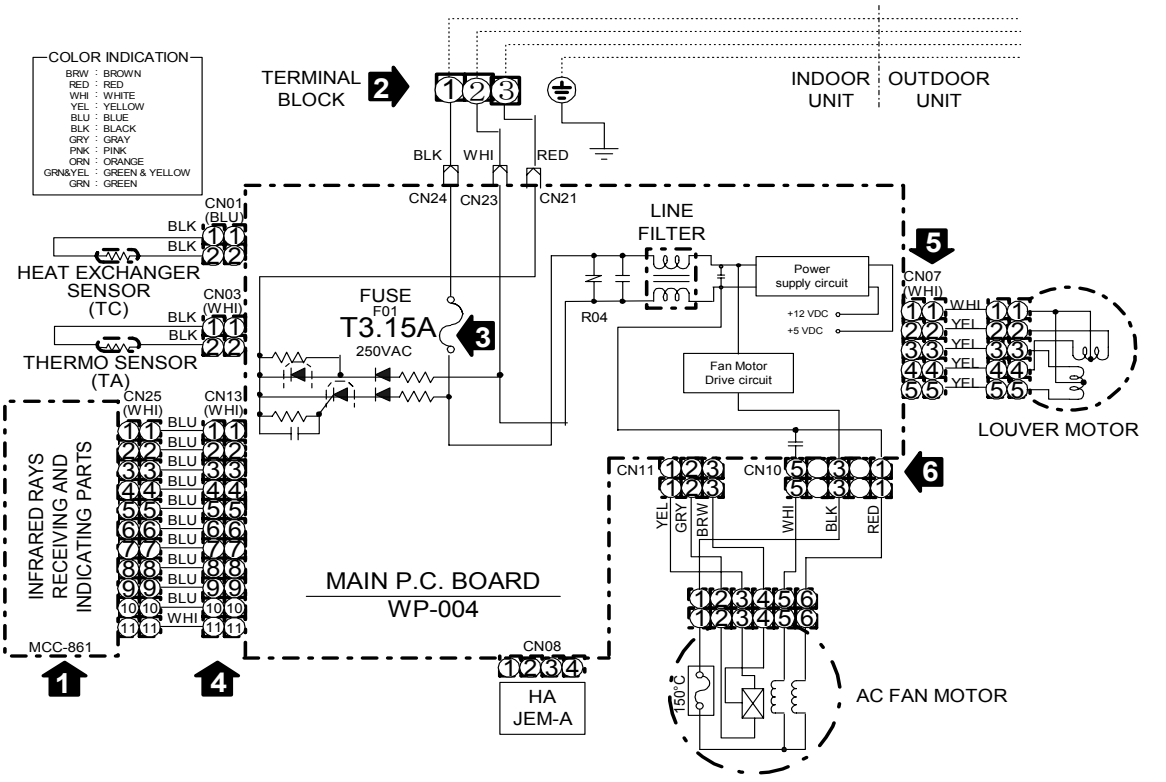


3-2. Outdoor Unit



4. WIRING DIAGRAM

4-1. Indoor Unit (For 13NKV)

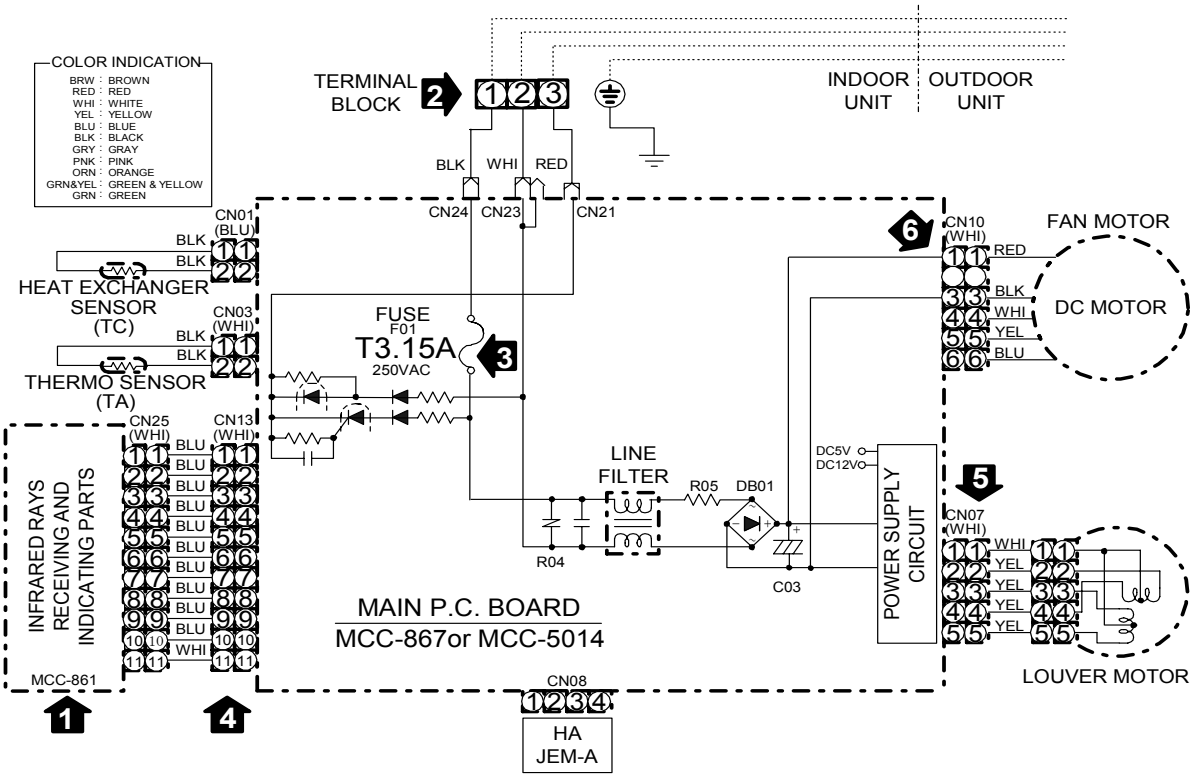


Simple Check for Failure Diagnosis

Check Item	Diagnosis Result
1 OPERATION INDICATOR	Check to see if the OPERATION indicator goes on and off when the main switch or breaker is turned on. (Check the primary and secondary voltage of the transformer.)
2 TERMINAL BLOCK	Check the power supply voltage between ① and ②. (Refer to the name plate.) (Check the primary and secondary voltage of the transformer.) Check the fluctuating voltage between ② and ③. (15~60VDC)
3 FUSE 3.15A	Check to see if the fuse blows out. (Check the R04 of the varistor.)
4 DC5V	Check the voltage at the No.4 pin on CN13 connector of the infrared receiver. (Check the transformer and the power supply circuit of the rated voltage.)
5 DC12V	Check the voltage at the white lead of the louver motor. (Check the transformer and the power supply circuit of the rated voltage.)
6 (AC 220~240V)	Check the voltage at the No.1 pin on CN10 connector and CN24. (Check the F01)

Refer to the service data for the detailed failure diagnosis.

4-2. Indoor Unit (For 16NKV)

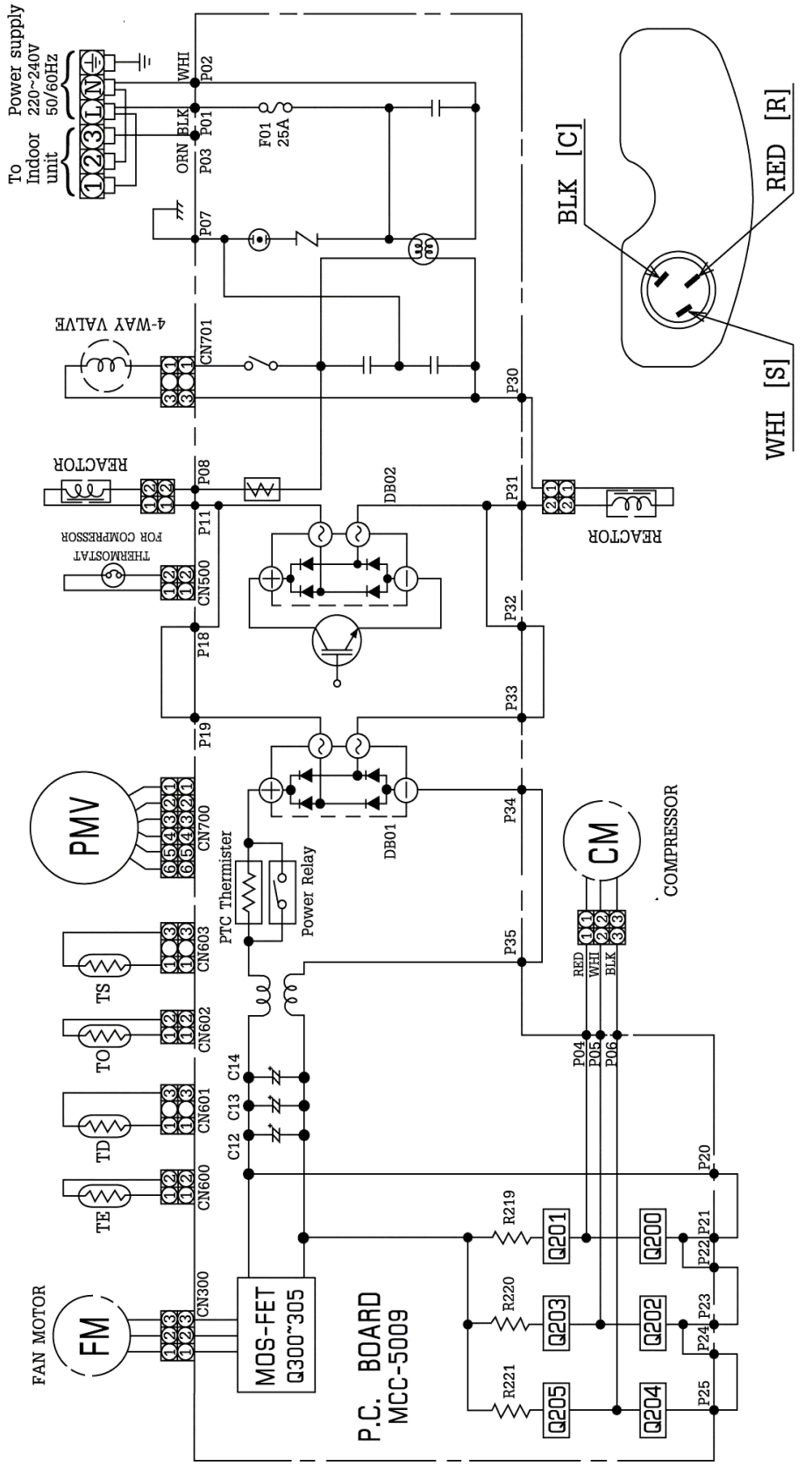


Simple Check for Failure Diagnosis

Check Item	Diagnosis Result
1 OPERATION INDICATOR	Check to see if the OPERATION indicator goes on and off when the main switch or breaker is turned on. (Check the primary and secondary voltage of the transformer.)
2 TERMINAL BLOCK	Check the power supply voltage between ① and ②. (Refer to the name plate.) (Check the primary and secondary voltage of the transformer.) Check the fluctuating voltage between ② and ③. (15～60VDC)
3 FUSE 3.15A	Check to see if the fuse blows out. (Check the R04 of the varistor.)
4 DC5V	Check the voltage at the No.4 pin on CN13 connector of the infrared receiver. (Check the transformer and the power supply circuit of the rated voltage.)
5 DC12V	Check the voltage at the white lead of the louver motor. (Check the transformer and the power supply circuit of the rated voltage.)
6 DC325V (DC310～340V)	Check the voltage at the No.1 pin on CN10 connector. (Check the DB01, R05 and C03.)

Refer to the service data for the detailed failure diagnosis.

4-2. Outdoor Unit



5. SPECIFICATION OF ELECTRICAL PARTS

5-1. Indoor Unit (For 13NKV)

No.	Parts name	Type	Specifications
1	Fan motor (for indoor)	SKF-220-20-4A-1	AC Motor with 150°C thermo fuse
2	Thermo. sensor (TA-sensor)	———	10 kΩ at 25°C
3	AC-AC transformer (T01)	TT-10	187 - 276V, 6VA
4	Microcomputer	μPD780024AGK	
5	Heat exchanger sensor (TC-sensor)	———	10 kΩ at 25°C
6	Line filter (L01)	SS11V-06270	27 μH, AC 0.64A
7	Diode (DB01)	KBP06M	1.5A, 420V
8	Capacitor (C50)	LXV35VB2200MJ20	2200μF, 35 V
9	Fuse (F01)	BET 3.15A, 250VAC	T3.15A, 250 V
10	Regulator IC (IC08)	NJM7812	12VDC, 1.5A max
11	Regulator IC (IC11)	NJM7805	5VDC, 1.5A max
12	Varistor (R21, R109)	15G561K	560V
13	Louver motor	24BYJ48	DC 12V

5-2. Incoor Unit (For 16NKV)

No.	Parts name	Type	Specifications
1	Fan motor (for indoor)	ICF-340-30-2	DC 340 V, 30 W
2	Thermo. sensor (TA-sensor)	———	10 kΩ at 25°C
3	DC-DC transformer (T01)	SWT-70	DC 390 V, Secondary DC 15 V, 12 V, 7 V
4	Microcomputer	μPD780024AGK	
5	Heat exchanger sensor (TC-sensor)	———	10 kΩ at 25°C
6	Line filter (L01	SS11V-06270	27mH, AC 0.6A
7	Diode (DB01)	D3SBA60	4A, 600 V
8	Capacitor (C03)	KMH450VSSN120M25C	120μF, 450 V
9	Fuse (F01)	FCU250V, 3.15A	T3.15A, 250 V
10	Power supply IC (IC01)	STR-L472	
11	Varistor (R21, R109)	15G561K	560 V
12	Resistor (R01)	RF-5TK4R7	4.7Ω, 5 W
13	Louver motor	24BYJ48	DC 12V

5-3. Outdoor Unit (For 13NAV)

No.	Parts name		Model name	Rating
1	SC coil	L01	ADR2516-0R6TB	15A, 0.6mH
	(Noise filter)	L03	ADR2510-020 T4B	20A, 0.15mH
2	DC-DC transformer		SWT-72	Primary side DC280V, Secondary side 7.0 V x 1, 12V x 1, 17V x 2
3	Reactor		CH-57-Z-T	L=10mH, 16A x 2
4	Outside fan motor		ICF-140-43-4	DC140V, 43W
5	Fan control relay (TS sensor)		(Inverter attached)	10 kΩ (25°C)
6	Discharge temp. sensor (TD sensor)		(Inverter attached)	62 kΩ (20°C)
7	Outside air temp. sensor (TO sensor)		(Inverter attached)	10 kΩ (25°C)
8	Heat exchanger temp. sensor (TE sensor)		(Inverter attached)	10 kΩ (25°C)
9	Terminal block (6P)		JXO-6B	30A, 600 VAC
10	Fuse		For protection of switching power source	3.15A, AC 250 V
			For protection of inverter input overcurrent	25A, AC 250 V
11	Electrolytic capacitor		LLQ2G761KHUBTF	760μF, DC 400 V x 3 pieces
12	IGBT		GT20J321	20A, 600 V
13	Compressor		DA89X1F-23F	3-phases 4-poles 1100 W
15	Rectifier		D25XB60-4001	20A, 600V

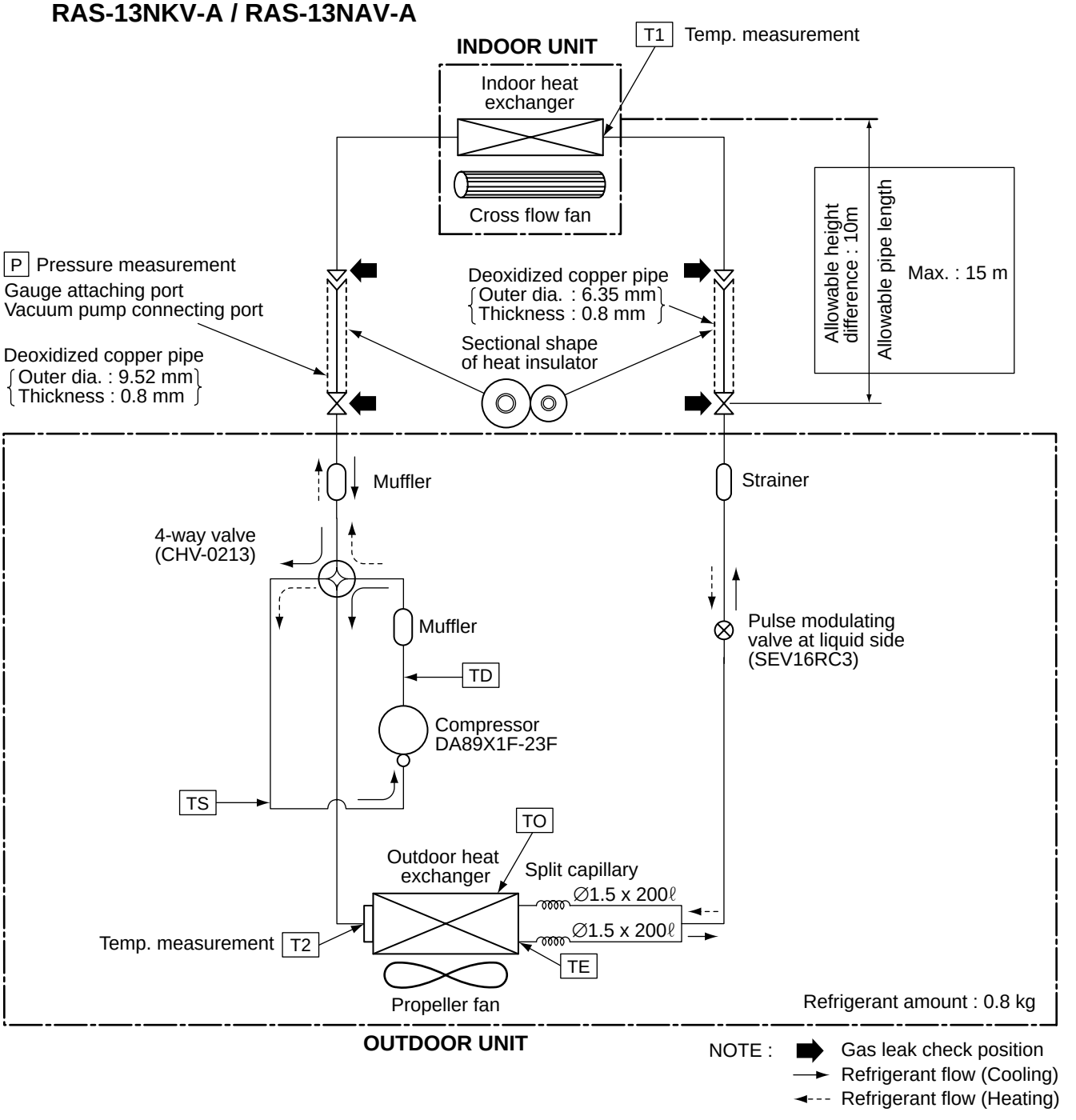
5-4. Outdoor Unit (For 16NAV)

No.	Parts name		Model name	Rating
1	SC coil	L01	ADR2516-0R6TB	15A, 0.6mH
	(Noise filter)	L03	ADR2520-R15TB	20A, 0.15mH
2	DC-DC transformer		SWT-72	Primary side DC280V, Secondary side 7.0 V x 1, 12 V x 1, 17V x 2
3	Reactor		CH-57-Z-T	L=10mH, 16A x 2
4	Outside fan motor		ICF-140-43-4	DC140 V, 43 W
5	Suction temp. sensor (TS sensor)		(Inverter attached)	10 kΩ (25°C)
6	Discharge temp. sensor (TD sensor)		(Inverter attached)	62 kΩ (20°C)
7	Outside air temp. sensor (TO sensor)		(Inverter attached)	10 kΩ (25°C)
8	Heat exchanger temp. sensor (TE sensor)		(Inverter attached)	10 kΩ (25°C)
9	Terminal block (6P)		JXO-6B	30A, 600 VAC
10	Fuse		For protection of switching power source	3.15A, AC 250 V
			For protection of inverter input overcurrent	25A, AC 250 V
11	Electrolytic capacitor		LLQ2G761KHUBTF	760μF, DC 400 V x 3 pieces
12	IGBT		GT20J321	20A, 600 V
13	Compressor		DA89X1F-23F	3-phases 4-poles 1100 W
14	Rectifier		D25XB60-4001	20A, 600 V,

6. REFRIGERANT CYCLE DIAGRAM

6-1. Refrigerant Cycle Diagram

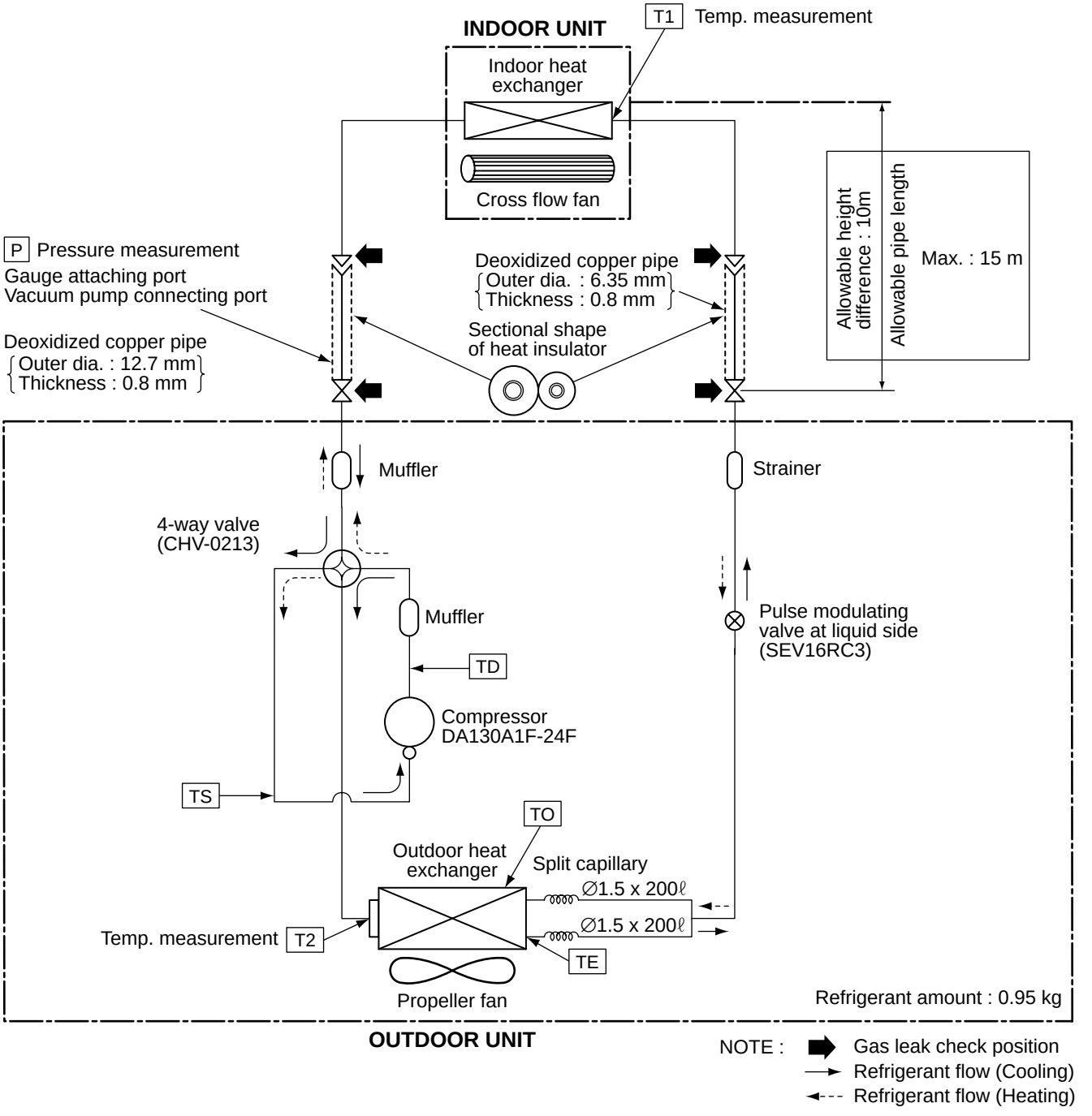
RAS-13NKV-E / RAS-13NAV-E
RAS-13NKV-A / RAS-13NAV-A



Note :

- The maximum length of the pipe for this air conditioner is 15 m. The additional charging of refrigerant is unnecessary because this air conditioner is designed with charge-less specification.

RAS-16NKV-E / RAS-16NAV-E
RAS-16NKV-A / RAS-16NAV-A



Note :

- The maximum length of the pipe for this air conditioner is 15 m. The additional charging of refrigerant is unnecessary because this air conditioner is designed with charge-less specification.

6-2. Operation Data

RAS-13NKV-E / RAS-13NAV-E
RAS-13NKV-A / RAS-13NAV-A

<Cooling>

Temperature condition (°C)		Standard pressure P (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		T1 (°C)	T2 (°C)			
27/19	35/–	0.8 to 1.0	9 to 11	49 to 45	High	High	77

<Heating>

Temperature condition (°C)		Standard pressure P (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		T1 (°C)	T2 (°C)			
20/–	7/6	2.5 to 2.7	42 to 44	0 to 3	High	High	80

RAS-16NKV-E / RAS-16NAV-E
RAS-16NKV-A / RAS-16NAV-A

<Cooling>

Temperature condition (°C)		Standard pressure P (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		T1 (°C)	T2 (°C)			
27/19	35/–	0.9 to 1.2	79 to 10	50 to 45	High	High	77

<Heating>

Temperature condition (°C)		Standard pressure P (MPa)	Heat exchanger pipe temp.		Indoor fan mode	Outdoor fan mode	Compressor revolution (rps)
Indoor	Outdoor		T1 (°C)	T2 (°C)			
20/–	7/6	2.7 to 2.9	42 to 46	0 to 3	High	High	82

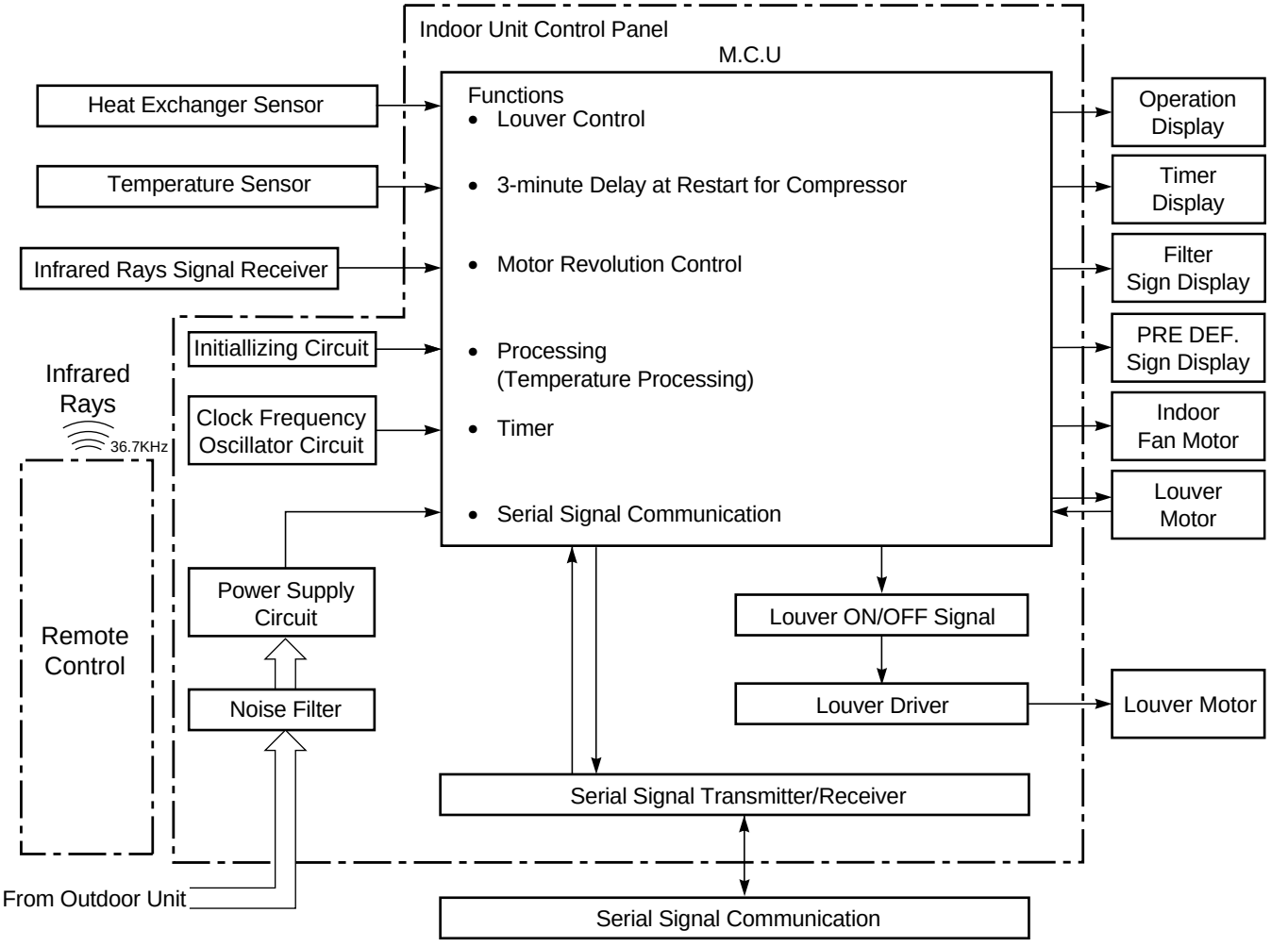
Note :

(1) Measure surface temperature of heat exchanger pipe around center of heat exchanger path U bent. (Thermistor themometer)

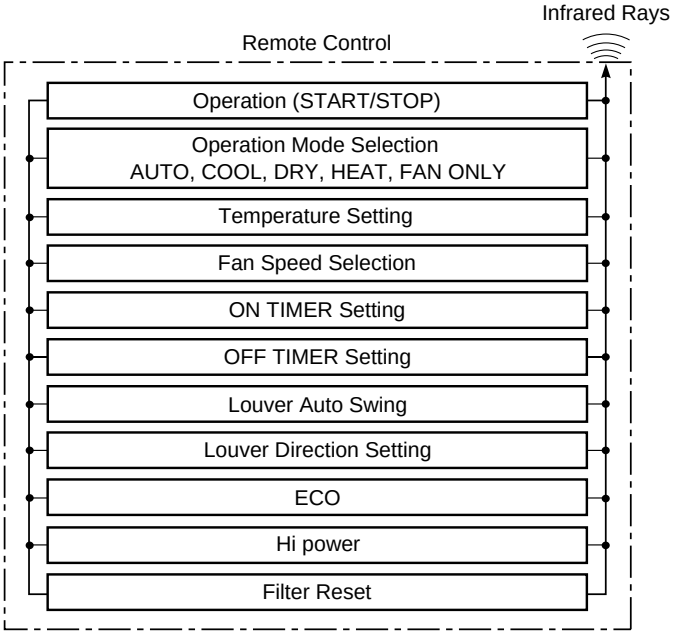
(2) Connecting piping condition : 5m

7. CONTROL BLOCK DIAGRAM

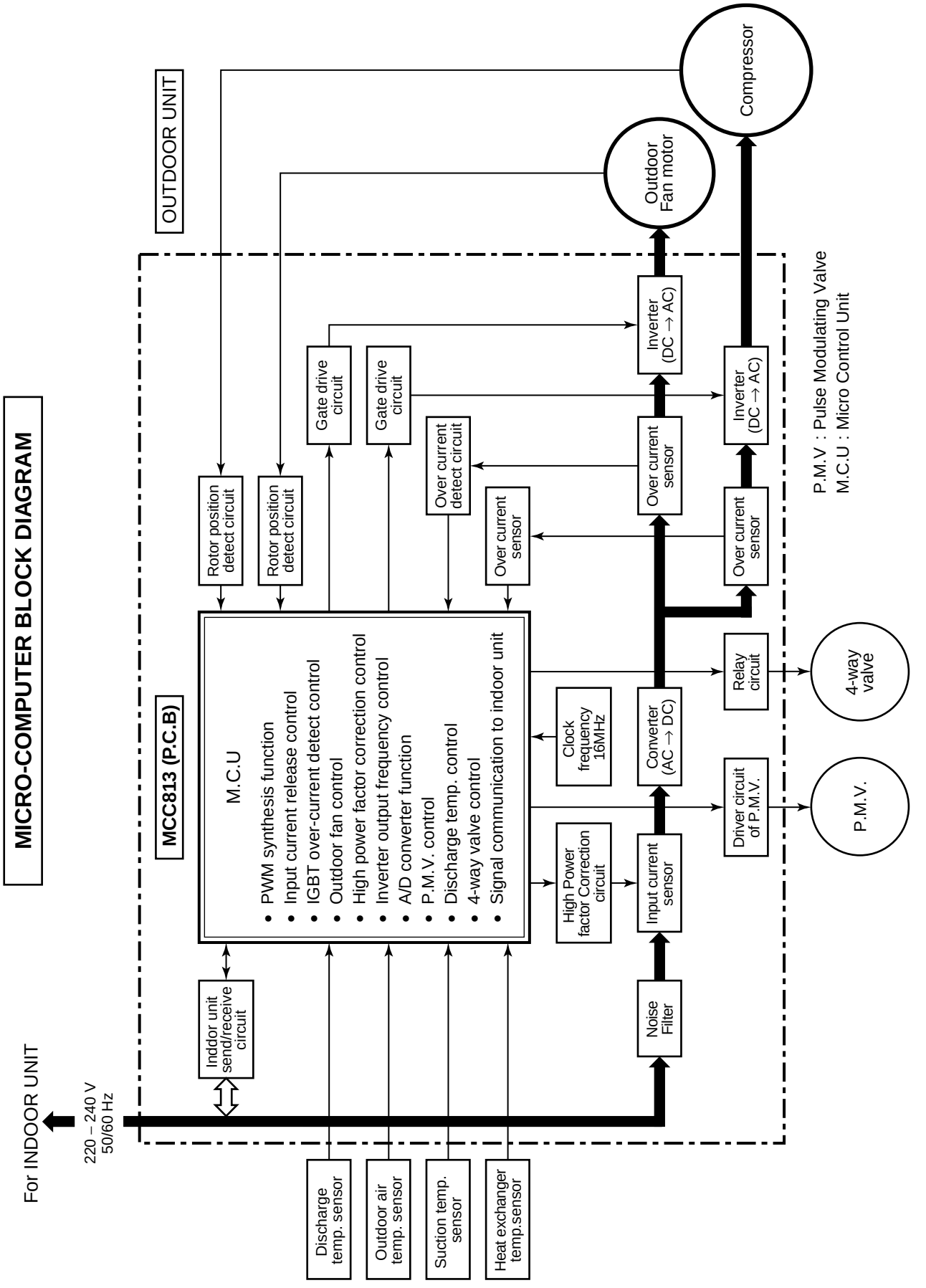
7-1. Indoor Unit



REMOTE CONTROL



7-2. Outdoor Unit (Inverter Assembly)



8. OPERATION DESCRIPTION

8-1. Outline of Air Conditioner Control

This air conditioner is a capacity-variable type air conditioner. The capacity proportional control compressor which can change the motor speed is mounted. The indoor unit motor drive circuit is mounted to the indoor unit. The compressor and the inverter to control outdoor unit motor are mounted to the outdoor unit.
The entire air conditioner is mainly controlled by the indoor unit controller.

The indoor unit controller drives the indoor fan motor based upon command sent from the remote control, and transfers the operation command to the outdoor unit controller.

The outdoor unit controller receives operation command from the indoor unit side, and controls the outdoor fan and the pulse modulating valve. (P.M.V) Besides, detecting revolution position of the compressor motor, the outdoor unit controller controls speed of the compressor motor by controlling output voltage of the inverter and switching timing of the supply power (current transfer timing) so that motors drive according to the operation command. And then, the outdoor unit controller transfers reversely the operating status information of the outdoor unit to control the indoor unit controller.

As the compressor adopts four-pole brushless DC motor, the frequency of the supply power from inverter to compressor is two-times cycles of the actual number of revolution.

(1) Role of indoor unit controller
The indoor unit controller judges the operation commands from the remote controller and assumes the following functions.

- Judgment of suction air temperature of the indoor heat exchanger by using the indoor temp. sensor (TA sensor)
- Temperature setting of the indoor heat exchanger by using heat exchanger sensor (TC sensor) (Prevent-freezing control)
- Louver motor control
- Indoor fan motor operation control
- LED (Light Emitting Diode) display control
- Transferring of operation command signal (Serial signal) to the outdoor unit
- Reception of information of operation status (Serial signal including outside temp. data) to the outdoor unit and judgment/display of error

(2) Role of outdoor unit controller
Receiving the operation command signal (Serial signal) from the indoor controller, the outdoor unit performs its role.

- Compressor operation control
- Operation control of outdoor fan motor
- P.M.V. control

} Operations followed to judgment of serial signal from indoor side.

- Detection of inverter input current and current release operation
- Over-current detection and prevention operation to IGBT module (Compressor stop function)
- Compressor and outdoor fan stop function when serial signal is off (when the serial signal does not reach the board assembly of outdoor control by trouble of the signal system).
- Transferring of operation information (Serial signal) from outdoor unit to indoor unit
- Detection of outdoor temperature and operation revolution control
- Defrost control in heating operation (Temp. measurement by outdoor heat exchanger and control for 4-way valve and outdoor fan)

(3) Contents of operation command signal (Serial signal) from indoor unit controller to outdoor unit controller
The following three types of signals are sent from the indoor unit controller.

- Operation mode set on the remote control
- Compressor revolution command signal defined by indoor temperature and set temperature (Correction along with variation of room
temperature and correction of indoor heat exchanger temperature are added.)
- For these two types of signals ([Operation mode] and [Compressor revolution]), the outdoor unit controller monitors the input current to the inverter, and performs the followed operation within the range that current does not exceed the allowable value.
- Temperature of indoor heat exchanger by indoor heat exchanger sensor
(Minimum revolution control)

(4) Contents of operation command signal (Serial signal) from outdoor unit controller to indoor unit controller
The following signals are sent from the outdoor unit controller.

- The current operation mode
- The current compressor revolution
- Outdoor temperature
- Existence of protective circuit operation
For transferring of these signals, the indoor unit controller monitors the contents of signals, and judges existence of trouble occurrence.
Contents of judgment are described below.
- Whether distinction of the current operation status meets to the operation command signal
- Whether protective circuit operates
When no signal is received from the outdoor unit controller, it is assumed as a trouble.

8-1-1. Capacity control

The cooling and heating capacity is varied by changing compressor motor speed. The inverter changes compressor motor speed by changing
AC 220-240 V power to DC once, and controls capacity by changing supply power status to the compressor with transistor module (includes 6 transistors). The outline of the control is as follows:

The revolution position and revolution speed of the motor are detected by detecting winding electromotive force of the compressor motor under operation, and the revolution speed is changed so that the motor drives based upon revolution speed of the operation command by changing timing (current transfer timing) to exchange inverter output voltage and supply power winding.

Detection of the revolution position for controlling is performed 12 times per 1 revolution of compressor.
The range of supply power frequency to the compressor differs according to the operation status (COOL, HEAT, DRY).

Table 8-1-1 Compressor revolution range

Operation mode	Model name	Compressor revolution (rps)
COOL	13NKV	20 to 88
HEAT		20 to 90
COOL	16NKV	13 to 91
HEAT		13 to 106

8-1-2. Current release control

The outdoor main circuit control section (Inverter assembly) detects the input current to the outdoor unit. If the current value with compressor motor speed instructed from indoor side exceeds the specified value, the outdoor main circuit control section controls compressor motor speed by reducing motor speed so that value becomes closest to the command within the limited value.

8-1-3. Power factor improvement control

Power factor improvement control is performed mainly aiming to reduce the current on much power consumption of cooling/heating operation. Controlling starts from the time when input power has reached at a certain point. To be concrete, IGBT of the power factor improvement circuit is used, and the power factor is improved by keeping IGBT on for an arbitrary period to widen electro-angle of the input current.

8-1-4. Prevent-freezing control

The indoor heat exchanger sensor detects refrigerant vapor temperature in COOL/DRY operation. If the temperature is below the specified value, compressor motor speed is reduced so that operation is performed in temperature below the specified value to prevent-freezing of indoor heat exchanger.

8-1-5. P.M.V. (Pulse Modulating Valve)

Using P.M.V., refrigerant flow of refrigeration cycle is varied for the optimum temperature.

After the power has been turned on, when a serial operation signal is received from indoor at the first time, or when PMV alarm is detected and the equipment is reactivated, move the valve once until it hits on the stopper for positioning of the valve. In this case, ticktack sound may be heard.

8-1-6. Louver control

(1) Vertical air flow louvers
Positions of vertical air flow louvers are automatically controlled according to the operation status (AUTO (A), COOL (☼), DRY (💧), HEAT(☼) and FAN ONLY (🌀). Besides, positions of vertical air flow louvers can be arbitrarily set by pushing the [FIX] button.

(2) Swing
If the [SWING] button is pressed during running operation, vertical air flow louvers start swinging. When the [SWING] button is pushed, swinging stops.

8-1-7. Indoor fan control

(1) The indoor fan is operated by the stepless speed change motor.

(2) For air flow level, speed of the indoor fan motor is controlled in five steps (LOW, LOW$^+$, MED, MED$^+$ and HIGH). If AUTO mode is selected, the fan motor speed is automatically controlled by the difference between the preset temperature and the room temperature.

$$LOW^+ = \frac{LOW+MED}{2}$$

$$MED^+ = \frac{MED+HIGH}{2}$$

Table 8-1-2

Operation mode	Fan mode	Remote Control	13NKV Speed (rpm)	13NKV Air flow (m^3/h)	16NKV Speed (rpm)	16NKV Air flow (m^3/h)
Cooling and Fan only	H	HIGH	1210	590	1560	760
	M+		1130	530	1430	700
		MED+	1110	520	1440	710
	M	MED	1010	460	1330	640
		LOW+	910	410	1230	600
	L+		880	390	1230	600
	L	LOW	810	350	1130	530
	L-		780	330	1030	470
Dry	L+		880	390	1230	600
	L		810	350	1130	530
	L-		780	330	1030	470
	UL		720	290	920	410
	SUL		660	260	860	380
Heating	H	HIGH	1290	620	1600	780
	M+		1290	620	1560	760
		MED+	1200	570	1510	740
	M	MED	1110	520	1430	700
		LOW+	1020	470	1330	640
	L+		1010	460	1330	640
	L	LOW	930	420	1230	600
	L-		880	390	1230	600
	UL		780	330	1030	470
	SUL		550	180	750	310

8-1-8. Outdoor fan control

Although the outdoor fan motor drives the outdoor fan by non-step variable system of the revolution speed, the revolution speed is restricted to three steps on the convenience of controlling. If a strong wind is lashing outside of the room, the operation may be continued as the outdoor fan stops in order to protect the outdoor fan motor.

If a fan lock occurred due to entering of foreign matter, the air conditioner stops and an alarm is displayed.

<COOL, DRY>

Table 8-1-3

Model name		**13NAV and 16NAV**		
Compressor revolution (rps)		**To 13.8**	**To 34.7**	**From 35.3**
Outdoor temp. sensor TO	TO ≥ 38°C	390	840	840
	TO < 38°C	390	700	840
	TO < 15°C	390		
ECONO. operation	TO ≥ 38°C	390	700	840
	TO < 38°C	390	390	700
	TO < 15°C	390		
TO is abnormal		700	700	840

<HEAT>

Table 8-1-4

Model name		**13NAV and 16NAV**		
Compressor revolution (rps)		**To 16.8**	**To 57.4**	**From 58.0**
Outdoor temp. sensor TO	TO ≥ 5°C	390	650	840
	TO < 5°C	650	650	840
ECONO. operation	TO ≥ 5°C	390	390	650
	TO < 5°C	390	650	650
TO is abnormal		390	650	840

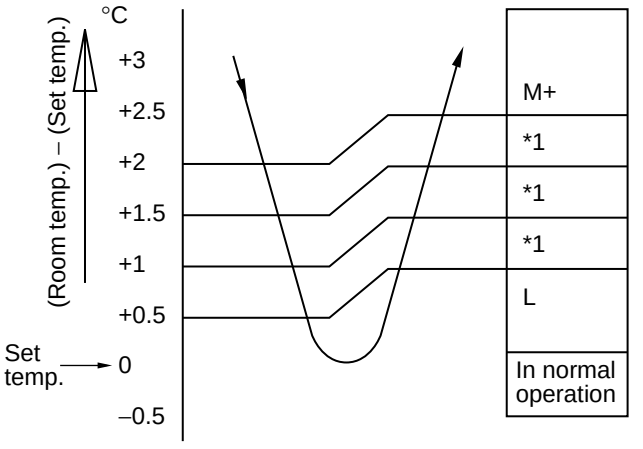
8-2. Description of Operation Circuit

- Turning [ON] the breaker flashes the operation lamp. (1Hz)
  This is the display of power-ON (or notification of power failure).
- When pushing [⏻] button of the remote control, receive sound is issued from the main unit, and the next operations are performed together with opening the vertical air flow louvers.

8-2-1. Cooling operation

(The Remote Control [MODE] Button is Set to the COOL ☼ Position)

- Once the setting is made, the operation mode is memorized in the microcomputer so that the same operation can be effected thereafter simply by pushing [⏻] button.
- A cooling operation signal is transmitted to outdoor unit.
- The outdoor unit controls the outdoor fan relay R01, R02 and R03, and the compressor motor speed according to the operation command signal sent from the indoor unit.
- When [FAN] button is set to AUTO, the indoor fan motor operates as shown in Fig. 8-2-1. When [FAN] button is set to LOW ▂, LOW⁺ ▂▃, MED ▂▃▅, MED⁺ ▂▃▅▆, HIGH ▂▃▅▆▇, the motor operates with a constant air flow.



NOTE :

*1: Calculated from difference in motor speed of M+ and L, and controlled.

Fig. 8-2-1 Setting of air flow [Fan AUTO]

(1) Cooling capacity control

- The cooling capacity and room temperature are controller by changing the compressor motor speed according to both the difference between the temperature detected by the room temperature sensor and the temperature set by [TEMP] button and also any change in room temperature.
- When compressor has been activated or reactivated, it operates with Max.41 rps for 2 minutes, with Max.90 rps from 2 minutes to 3 minutes, and with Max.88 rps after 3 minutes passed.
- When room temperature is lower than set temperature, indoor fan motor is operated at fan speed L as shown in Fig. 8-2-1 while the outdoor unit stops.

(2) Prevent-freezing control

If temperature of indoor heat exchanger detected by the indoor heat exchanger sensor is 5°C lower, compressor motor speed is gradually lowered to prevent freezing of the indoor heat exchanger. If temperature is 7°C or higher, return the operation to the above item (1).

(3) Current release control

The input current of compressor and outdoor fan motor (Precisely inverter main circuit control section) which occupy most of air conditioner input is detected by the outdoor current sensor, and compressor motor speed is gradually lowered so that current value does not exceed 9.0A if current value exceeds 9.0A. When the current value lowers to 8.5A, return the operation to the above item (1).

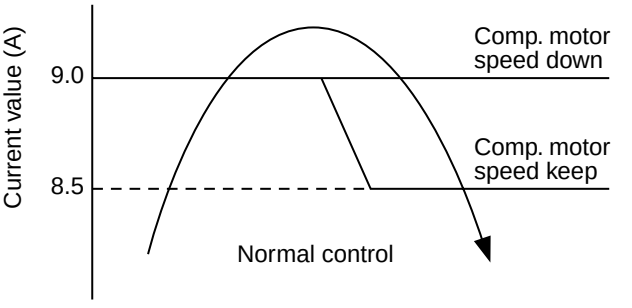


Fig. 8-2-2

(4) Limit for maximum compressor motor speed by indoor fan speed

When outdoor temperature sensor detected 32°C or lower, and indoor heat exchanger sensor detected 17°C or lower, the maximum compressor motor speed is limited by the indoor fan speed. For example, the compressor motor speed is limited as described in the table below.

Table 8-2-1

Air flow rate	RAS-13NKV / RAS-16NKV (rps)
HIGH	77
M+	65
MED.	53
L–, L	30
UL, SUL	30

rps : round per second

(5) Louver control

The vertical air flow louvers are automatically set to horizontal or cool memory position.
When temperature of indoor heat exchanger becomes 5°C or lower by the prevent-freezing control and the compressor is turned off, the vertical air flow louvers close once and then return to the position of previous time.

(6) Discharge temperature control (Common control to cooling and heating)

The discharge temperature of refrigerant gas from the compressor is detected by the discharge temperature sensor, and controls operating compressor motor speed.

1) Control 1 (A zone) : Normal operation zone
When TD detect value is 98°C or lower, the operation is performed with operating motor speed instructed by the serial signal.
2) Control 2 (B zone) : Slow-up zone of motor speed
When TD detect value is 98°C or higher, operating motor speed is slowly up.
3) Control 3 (C zone) : Keep zone
When TD detect value is 105°C or higher, operating motor speed is not changed if raising operation speed.
4) Control 4 (D zone) : Slow down zone of motor speed.
When TD detect value is 108°C or higher, operating motor speed is slowly down.
temperature is changed also.
5) Control 5 (E zone) : Nornal down of motor speed.
When TD detect value is 112°C or higher, operating motor speed is down.
6) Control 6 (F zone) : Operation stop zone
If TD detect value exceeds 117°C during operation, stop the operation immediately. Then, restart the operation when TD detect value becomes 105°C or lower.

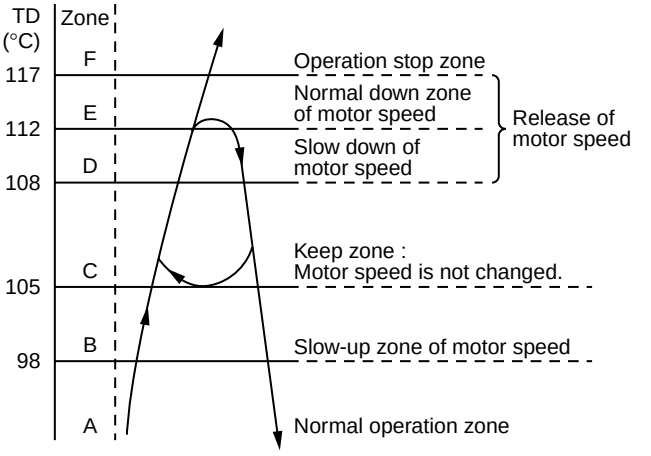


Fig. 8-2-3 Compressor motor speed control

(7) ECONO operation control

When the [ECO] button is pushed, ECONO operation is performed by restraining air flow and compressor motor speed. The set temperature is changed also.

1) The set temperature increased 0.5°C per hour up to 2°C starting from the set temperature when ECONO has been received.
2) Indoor air flow is controlled between L^+ and UL. The compressor motor speed in control as shown in Fig. 8-2-4

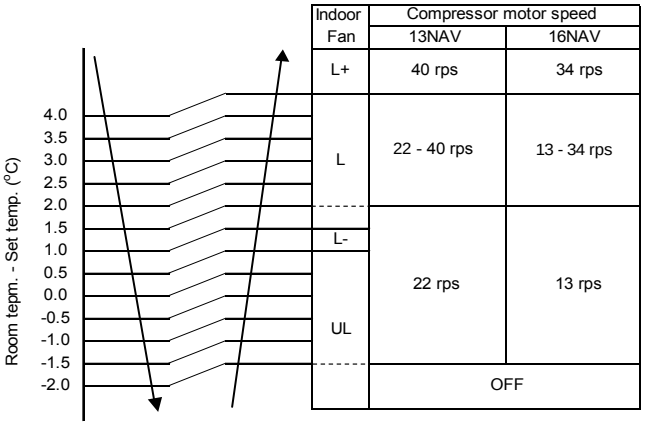


Fig. 8-2-4

(8) COMFORT SLEET operation control.

When the [COMFORT SLEEP] button is pushed, the ECONO operation activate together with the timer OFF function. Each time of pressing [COMFORT SLEEP] button the off timer setting changes in the sequence of 1, 3, 5 or 9 hours.

(9) Hi POWER operation control.

When the [Hi POWER] button is pushed Hi Power operation is performed by change set temperature and air flow (display on the remote control does not change).

1) Changing of set temperature.

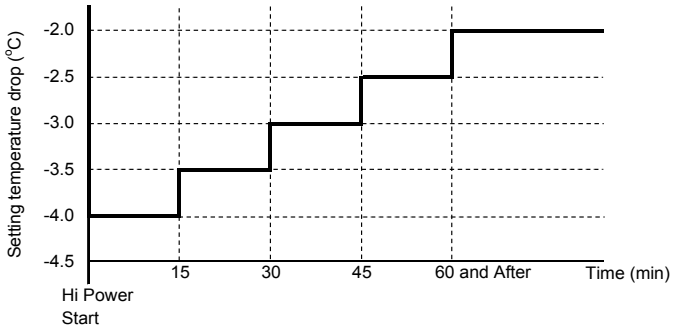


Fig. 8-2-5

2) Changing of air flow (Fan setting : AUTO)
When the Hi POWER is started, the fan of the indoor unit operates at higher air flow level than normal air flow AUTO (normal air flow AUTO is shown in Fig. 8-2-1). Because of the difference between room temperature and set temperature are increased automatically.

3) Changing of air flow (Fan setting : One of 5 levels)
When the Hi POWER is started, the fan of the indoor unit operates at higher consecutive air flow level. (Fan speed on the display of remote control does not change)

4) Changing of louver positing
If the room temperature is higher than setting temperature by 3.5 °C or more, the louver is automatically set to the maximum air flow position. If it is not, position of louver is not change. When room temperature is reach to setting temperature. The louver moves back to set position.

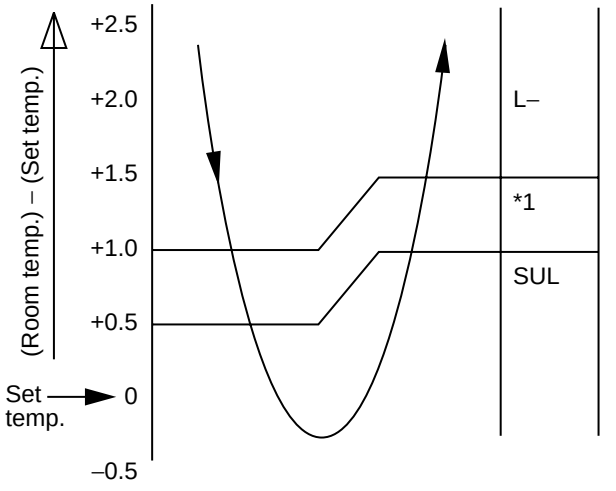
(10) QUIET operation control.

When the [QUIET] button is pushed, the fan is restricted the revolution speed at L- level until the [QUIET] button is pushed once again (cancel QUIET operation).

Remarks :
QUIET operation is appropriate to work with less cooling load condition. Because of the fan speed L- may cause not enough the cooling capacity.

8-2-2. DRY operation
(The Remote Control [MODE] Button is Set to the DRY ♨ Position)

- Once the setting is made, the operation mode is memorized in the microcomputer so that the same operation can be effected thereafter simply by pushing [⏻] button.
- Dry operation signal is transmitted to outdoor unit.
- The Cooling operation giving priority to dehumidifying, which restrains the indoor fan speed and compressor motor speed, is performed.
- The indoor fan motor operates as shown in Fig. 8-2-6. (Fan speed is AUTO only.)
- The outdoor fan motor operates as described in Table 8-1-3, and the compressor motor speed according to the operation command signal sent from the indoor unit.



NOTE :

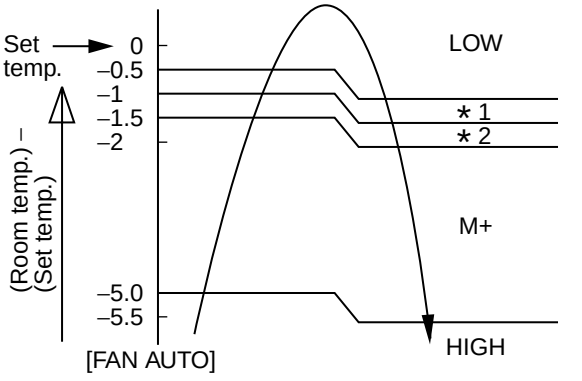
*1 : Middle motor speed between L– and SUL

Fig. 8-2-6 Setting of air flow

8-2-3. Heating operation

Transferring of heat operation signal from indoor unit to outdoor unit starts.
The indoor fan motor operates by the room temperature when selecting “AUTO” of “FAN” as shown in Fig. 8-2-7, and operates with a set air flow when selecting “LOW ▂” to “HIGH ▂▃▅▇”.
However, to prevent cold draft, revolution speed of the fan is restricted by indoor heat exchanger when air flow is AUTO (Fig. 8-2-8) and starting of FAN Manual.

[Basic control]



*1,*2 : Approximate revolution speed of M^+ and L to linear accordingly to temperature.

Fig. 8-2-7 Setting of air flow

[Cold draft preventing control]

The upper limit of fan revolution speed is shown below.

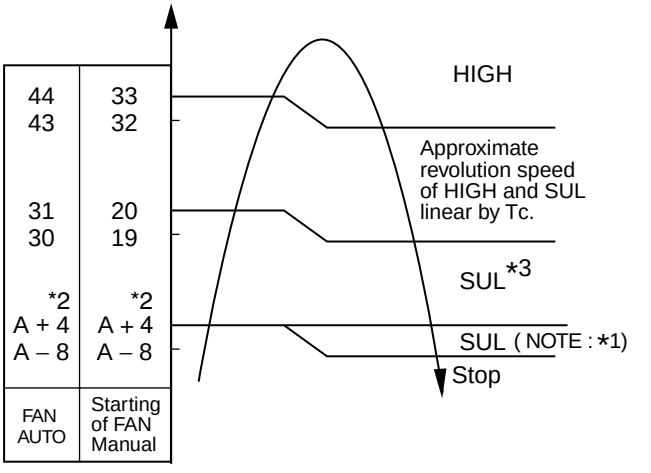


Fig. 8-2-8 Cold draft preventing control

NOTES :

*1 : Stops for 2 minutes after thermostat-OFF.
*2 : 24°C when the set temp. is 24°C or more
Set temp. when the set temp. is below 24°C
*3 : SUL : Super ultra low

[In starting and in stability]

	In starting	In stability
FAN AUTO	• Until 12 minutes passed after operation start • When 12 to 25 minutes passed after operation start and room temp. is 3°C or lower than set temp.	• When 12 to 25 minutes passed after operation start and room temp. is higher than (set temp. –3°C) • When 25 minutes or more passed after operation start
FAN Manual	• Room temp. < Set temp. –4°C	• Room temp. Set temp. –3.5°C

The outdoor unit controls the outdoor fan based upon the operation signal sent from the indoor unit, and also controls revolution speed of the compressor motor.

The power coupler (IC20) for 4-way valve is turned on, and turned off in defrost operation.

(1) Heating capacity control

Calculate the difference between temperature detected by room temp. sensor every minute and the set temp. set on "Temp. indicator" and variation amount of room temp.
Then, obtain the correction amount of the command signal, and correct the current frequency command signal.

(2) High-temp. release control

If temperature of the indoor heat exchanger detected by the indoor heat exchanger sensor is 55°C or higher, compressor motor speed is gradually lowered to prevent over-temp. rising of compressed pressure.
If temperature becomes below 48°C, return to above item (1).

(3) Current release control

The input current of compressor and outdoor fan motor (Precisely inverter main circuit control section) which occupies most of air conditioner input is detected by the outdoor current sensor. The compressor motor speed is lowered gradually according to the range of TO (outside air temp.) if the input current exceeds the current value determined in each zone as shown in Fig. 8-2-9 so that the input current does not exceed the set value.
In case that the current lowered by approx. 0.5A than each set value, return to above item (1).

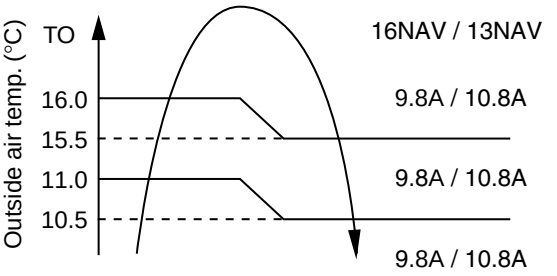


Fig. 8-2-9

(4) Defrost control

1) Detection of frost
In heating operation, time duration while the compressor operates is counted, and defrost operation starts by any condition described below.

a. The counted time is 28 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is –20°C or lower continued for 2 minutes or more.
b. The counted time is 28 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is –7°C or lower and temperature lowered by 2.5°C than the minimum value of the outdoor heat exchanger during 10 to 15 minutes count time continued for 2 minutes or more.
c. The counted time is 34 minutes or more, and status that temperature of the outdoor heat exchanger detected by the outdoor heat exchanger is -5°C or lower and temperature lowered by 3.0°C than the minimum value of the outdoor heat exchanger during 10 to 15 minutes count time continued for 2 minutes or more.
d. If the following three conditions are satisfied, defrost operation (Timer defrost) starts after heating operation for 37 minutes.
   ① Setting on remote control, HEAT ☼ (mode), HIGH ▂▃▅▇ (Fan), 30°C (temp.).
   ② Room temp. is 19°C to 24°C, and outside air temp. is 5°C or lower.
   ③ Defrost operation has been already performed once.

2) Defrost operation
Operation of the compressor is stopped once, turn off power coupler for 4-way valves after 10 seconds, and then exchange the 4-way valves.
After 20 seconds, restart operation of the compressor. Turn off the outdoor fan just when the compressor stopped.
If temperature of the indoor heat exchanger lowered than 38°C, stop the indoor fan.

3) Defrost reset
Resetting operation from defrost to heating is performed when anyone of the following conditions is satisfied.
a. Temperature of the outdoor heat exchanger rose to +8 °C or higher.
b. A status that temperature of the outdoor heat exchanger is +5°C or higher continued for 80 seconds.
c. Defrost operation continued for 15 minutes.

In resetting defrost operation, the compressor stops for 50 seconds if defrost has started under condition a. to c. in item1), but the compressor is reset to heating operation keeping operated if defrost has started under condition d. in item 1).

(5) Louver control
When the compressor is turned off by high-temp. release control, the vertical air flow louvers close once and then return to the position of previous time.

(6) ECONO operation control.
When the [ECO] button is pushed, ECONO operation is performed by restraining air flow and compressor moter speed.

1) The indoor fan speed is controlled within L- as maximum speed.
2) Compressor motor speed is controlled by the difference value of room temperature and set temperature as shown in Fig. 8-2-10
The different value of room temperature and set temperature are separated to A, B and C zone. Then compressor motor speed in each zone are controlled by different speed.
After 30 minutes passed, the different value of room temperature and set temperature is separated zone again by more different value than before. Then compressor motor speed after 30 minute passed is lower than before by the same different value of room temperature and set temperature.

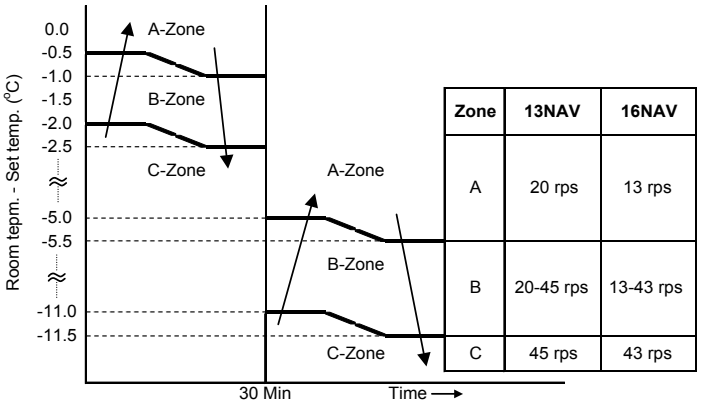


Fig. 8-2-10

(7) COMFORT SLEEP operation control.
When the [COMFORT SLEEP] button is pushed, the ECONO operation actrvate together with the timer OFF function. Each time of pressing [COMFORT SLEEP] button the off timer setting changes in the sequence of 1, 3, 5 or 9 hours.

(8) Hi POWER operation control.
When the [Hi POWER] button is pushed Hi Power operation is performed by changing setting temperature and air flow (display on the remote control does not change).

1) Changing of setting temperature.

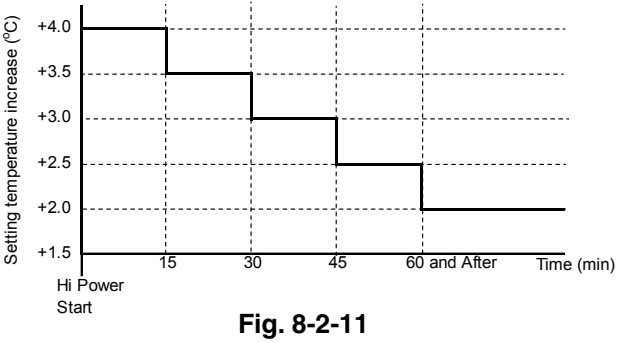


Fig. 8-2-11

2) Changing of air flow (Fan setting : AUTO)
When the Hi POWER is started, the fan of the indoor unit operates at higher air flow level than normal air flow AUTO (normal air flow AUTO is shown in Fig. 8-2-7). Because of the difference between room temperature and setting temperature are increased automatically.

3) Changing of air flow (Fan setting : One of 5 levels)
When the Hi POWER is started, the fan of the indoor unit operates at higher consecutive air flow level. (Fan speed on the display of remote control does not change)

(9) QUIET operation control.

When the [QUIET] button is pushed, the fan is restricted the revolution speed at L- level until the [QUIET] button is pushed once again (cancel QUIET operation).

Remarks :
QUIET operation is appropriate to work with less heating load condition. Because of the fan speed L- may cause not enough the heating capacity.

8-2-4. Automatic operation

(1) As shown in Fig. 8-2-12, the operation mode (COOL, DRY, HEAT) is selected according to the Preset temperature and room temperature when the operation has started.

- If room temperature is higher than 1°C of perset temperature. "Cooling" operation is performed.
- If room temperture is within 1°C of perset temperature. "Fan only" operation is performed. (at UL speed).
- If room temperture is lower than 1°C of perset temperture. "Heating operation is performed.

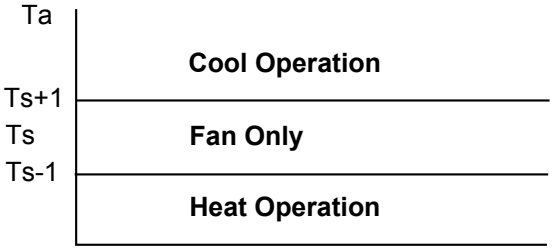


Fig. 8-2-12

8-3. Temporary Operation

- Temporary Auto operation, existence of Auto Restart, and Temporary Cooling operation can be set by the [RESET] button of the indoor controller.

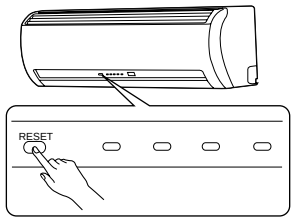


Fig. 8-3-1

Table 8-3-1

TEMPORARY button	Control
OFF → ON	Temporary Auto operation start
After pushing button for 3 seconds	Auto Restart control select
After pushing button for 10 seconds	Temporary Cooling operation start

8-3-1. Temporary auto operation

- When the [RESET] button is pushed, the Auto operation with set temperature fixed at 25°C starts. Controlling is same as that of Auto operation by the remote controller.
- When the [RESET] button is pushed again, the operation stops.
- During Temporary Auto operation, operation by the remote controller is accepted.
- Using the Auto Restart function, the Temporary Auto operation starts when power failure is reset.

8-3-2. Temporary cooling operation

- When the [RESET] operation button keeps pushed for 10 seconds, Cooling operation of which compressor motor speed and the indoor fan speed are fixed starts.

Compressor motor speed :
30 rps
Indoor fan speed : Low

- When the [RESET] operation button is pushed again, the operation stops.
- Auto Restart function is unavailable.

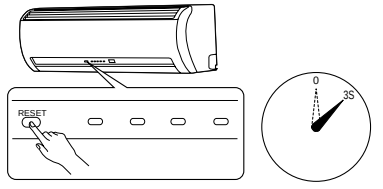
8-4. Auto Restart Function

The indoor unit is equipped with an automatic restarting function which allows the unit to restart operating with the set operating conditions in the event of power supply being accidentally shut down. The operation will resume without warning three minutes after power is restored.
This function is not set to work when shipped from the factory. Therefore it is necessary to set it to work.

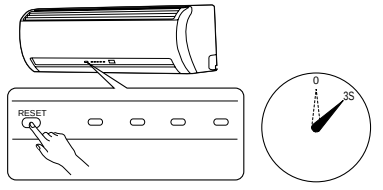
8-4-1. How to set auto restart function

To set the auto restart function, proceed as follows:
The power supply to the unit must be on; the function will not set if the power is off.
Push the [RESET] button located in the center of the front panel continuously for three seconds.
The unit receives the signal and beeps three times.
The unit then restarts operating automatically in the event of power supply being accidentally shut down.

When the unit is on standby (Not operating)

Operation	Motions
Push [RESET] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The green lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from green to orange. If the unit is not required to operate at this time, push [RESET] button once more or use the remote control to turn it off.

When the unit is in operation

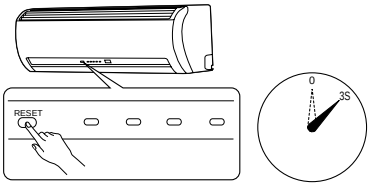
Operation	Motions
Push [RESET] button for more than three seconds. 	The unit is in operation. The green lamp is on. ↓ The unit stops operating. The green lamp is turned off. ↓ After approx. three seconds, The unit beeps three times If the unit is required to operate at this time, push [RESET] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.
- This function can not be set if the timer operation has been selected.
- When the unit is turned on by this function, the louver will not swing even though it was swinging automatically before shutting down.
- While the filter check lamp is on, the [RESET] button has the function of filter reset button.

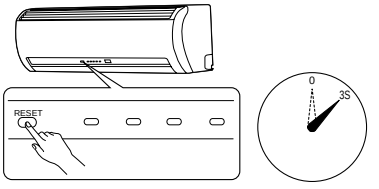
8-4-2. How to cancel auto restart function

To cancel auto restart function, proceed as follows:
Repeat the setting prodedure: the unit receives the signal and beeps three times.
The unit will be required to be turned on with the remote control after the main power supply is turned off.

When the unit is on standby (Not operating)

Operation	Motions
Push [RESET] button for more than three seconds. 	The unit is on standby. ↓ The unit starts to operate. The orange lamp is on. ↓ After approx. three seconds, The unit beeps three times and continues to operate. The lamp changes from orange to green. If the unit is not required to operate at this time, push [RESET] button once more or use the remote control to turn it off.

When the unit is in operation

Operation	Motions
Push [RESET] button for more than three seconds. 	The unit is in operation. The orange lamp is on. ↓ The unit stops operating. The orange lamp is turned off. ↓ After approx. three seconds, The unit beeps three times If the unit is required to operate at this time, push [RESET] button once more or use the remote control to turn it on.

- While this function is being set, if the unit is in operation, the orange lamp is on.

8-4-3. Power failure during timer operation

When the unit is in Timer operation, if it is turned off because of power failure, the timer operation is cancelled. Therefore, set the timer operation again.

8-5. Filter Check Lamp

When the elapsed time reaches 1000 hours, the filter check lamp indicates. After cleaning the filters, turn off the filter check lamp.

8-5-1. How to turn off filter check lamp

Push [RESET] button on the indoor unit.

Note:
If [RESET] button is pushed while the filter check lamp is not indicating, the indoor unit will start the Automatic Operation.

8-6. Remote control

8-6-1. Remote control and its functions

① **Infrared signal emitter**
Transmits a signal to the indoor unit.

② **START/STOP button** [⏻]
Push the button to start operation.
(A receiving beep is heard.)
Push the button again to stop operation.
(A receiving beep is heard.)
If no receiving sound is heard from the indoor unit, push the button twice.

③ **Mode select button [MODE]**
Push this button to select a mode.
Each time you push the button, a mode is selected in a sequence that goes from A : Auto changeover control, ☼ : Cool, 💧 : Dry, ☼ : Heat, ✣ : Fan only, and back to A.
(A receiving beep is heard.)

④ **Temperature button [TEMP.]**
▲.....The set temperature is increased up to 30°C.
▼.....The set temperature is dropped down to 17°C.
(A receiving beep is heard.)

⑤ **Fan speed button [FAN]**
Push this button to select fan speed. When you select AUTO, the fan speed is automatically adjusted according to the room temperature.
You can also manually select the desired fan speed from among five settings.
(LOW ▂ , LOW+ ▂▃ , MED ▂▃▅ , MED+ ▂▃▅▆ , HIGH ▂▃▅▆▇)
(A receiving beep is heard.)

⑥ **Auto louver button [SWING]**
Push this button to swing the louver.
(A receiving beep is heard.)
Push the button again to stop the louver swinging.
(A receiving beep is heard.)

⑦ **Set louver button [FIX]**
Push this button to adjust the air flow direction.
(A receiving beep is heard.)

⑧ **On timer button [ON]**
Push this button to set the ON timer.

⑨ **Off timer button [OFF]**
Push this button to set the OFF timer.

⑩ **Reserve button [SET]**
Push this button to reserve setting of time, ON timer or OFF timer. (A receiving beep is heard.)

⑪ **Cancel button [CLR]**
Push this button to cancel ON timer and OFF timer. (A receiving beep is heard.)

⑫ **Sleep timer button [SLEEP]**
Push this button to set the OFF timer.
(1, 3, 5 or 9 hours) (A receiving beep is heard)

⑬ **High power button [Hi POWER]**
Push this button to start the high power operation. (A receiving beep is heard.)

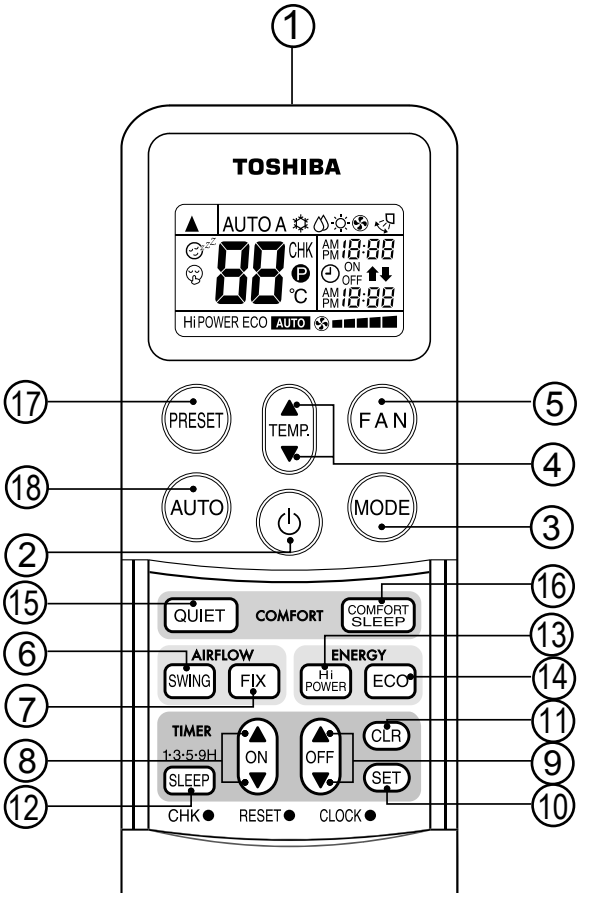
⑭ **ECO timer button [ECO]**
Push this button to start the ECO operation.
(A receiving been is heard)

⑮ **Quiet button [QUIET]**
Push this button to start the quiet operation.
(A receiving been is heard)

⑯ **Comfort sleep button [COMFORT SLEET]**
Push this button to start the comfort sleep operation. OFF timer neccessary to set together (1, 3, 5 or 9 hours). (A receiving been is heard)

⑰ **PRESET button**
Push this button to operate the air conditioner according to settings memorized. (A receiving been is heard)
Or push the button for more than 4 seconds to memorize the setting indicated on the remote control and Ⓟ mark is indicated.

⑱ **Automatic operation button [AUTO]**
Push this button to operate the air conditioner automatically.
(A receiving beep is heard.)



8-6-2. Names and functions of indications on remote control

Display

All indications, except for clock time indication, are indicated by push the [⏻] button.

① **Transmission mark**
This transmission mark (▲) indicates when the remote control transmits signals to the indoor unit.

② **Mode display**
Indicates the current operation mode.
(AUTO : Automatic control, A : Auto changeover control, ☼ : Cool, 💧 : Dry, ☀ : Heat, 🌀 : Fan only)

③ **Temperature display**
Indicates the temperature setting (17°C to 30°C).
When you set the operating mode to 🌀 : Fan only, no temperature setting is indicated.

④ **Louver operation display**
Indicates the louver operation. (: Fix, : Swing).

⑤ **FAN speed display**
Indicates the selected fan speed. AUTO or one of five fan speed levels (LOW , LOW+ , MED , MED+ , HIGH) can be indicated.
Indicates AUTO when the operating mode is either AUTO or 💧 : Dry.

⑥ **TIMER and clock time display**
The time set for timer operation or clock time is indicated.
The present time is always indicated except for TIMER operation.

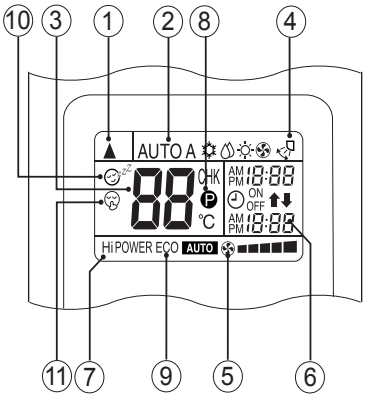
⑦ **Hi POWER display**
Indicates when the Hi POWER operation starts.
Push the [Hi POWER] button to start and push it again to stop the operation.

⑧ **PRESET display**
Flashes for 4 seconds when the [PRESET] button is pushed and hold to memorize.
Ⓟ mark is indicated when [PRESET] button is pushed than 4 seconds.
Push another button to turn off the mark.

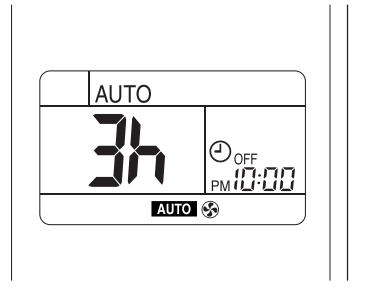
⑨ **ECO display**
Indicates when the ECO is in operation.

⑩ **COMFORT SLEEP display**
Indicates when the COMFORT SLEEP is in operation.
Each time you push the [COMFORT SLEEP] button, the display changes in the sequence of 1, 3, 5 or 9h.

⑪ **QUIET display**
Indicates when the QUIET is in operation.



- In the illustration, all indications are indicated for explanation. During operation, only the relevant indications will be indicated on the remote control.



9. INSTALLATION PROCEDURE

9-1. Safety Cautions

For general public use

Power supply cord of parts of appliance for outdoor use shall be at least polychloroprene sheathed flexible cord (design H07RN-F), or cord designation 245 IEC66. (1.5 mm^2 or more)

CAUTION **New Refrigerant Air conditioner Installation**

- **THIS AIR CONDITIONER USES THE NEW HFC REFRGERANT (R410A), WHICH DOES NOT DESTROY THE OZONE LAYER.**

R410A refrigerant is apt to be affected by impurity such as water, oxidizing membranes, and oils because the pressure of R410A refrigerant is approx. 1.6 times of refrigerant R22. As well as the adoption of this new refrigerant, refrigerating machine oil has also been changed. Therefore, during installation work, be sure that water, dust, former refrigerant, or refrigerating machine oil does not enter into the refrigerating cycle of a new-refrigerant air conditioner.

To avoid mixing refrigerant and refrigerating machine oil, the sizes of charging port connecting sections on the main unit are different from those for the conventional refrigerant, and different size tools are also required. Accordingly, special tools are required for the new refrigerant (R410A) as shown below. For connecting pipes, use new and clean piping materials with high-pressure withstand capabilities, designed for R410A only, and ensure that water or dust does not enter. Moreover, do not use any existing piping as its pressure withstand may be insufficient, and may contain impurities.

CAUTION **To Disconnect the Appliance from the Main Power Supply**

This appliance must be connected to the main power supply by means of a circuit breaker or a switch with a contact separation of at least 3 mm.

The installation fuse (25A) must be used for the power supply line of this air conditioner.

DANGER

- FOR USE BY QUALIFIED PERSONS ONLY.
- TURN OFF MAIN POWER SUPPLY BEFORE ATTEMPTING ANY ELECTRICAL WORK. MAKE SURE ALL POWER SWITCHES ARE OFF. FAILURE TO DO SO MAY CAUSE ELECTRIC SHOCK.
- CONNECT THE CONNECTING CABLE CORRECTLY. IF THE CONNECTING CABLE IS CONNECTED WRONGLY, ELECTRIC PARTS MAY BE DAMAGED.
- CHECK THE EARTH WIRE THAT IT IS NOT BROKEN OR DISCONNECTED BEFORE INSTALLATION.
- DO NOT INSTALL NEAR CONCENTRATIONS OF COMBUSTIBLE GAS OR GAS VAPORS. FAILURE TO FOLLOW THIS INSTRUCTION CAN RESULT IN FIRE OR EXPLOSION.
- TO PREVENT OVERHEATING THE INDOOR UNIT AND CAUSING A FIRE HAZARD, PLACE THE UNIT WELL AWAY (MORE THAN 2 M) FROM HEAT SOURCES SUCH AS RADIATORS, HEATERS, FURNACE, STOVES, ETC.
- WHEN MOVING THE AIR-CONDITIONER FOR INSTALLING IT IN ANOTHER PLACE AGAIN, BE VERY CAREFUL NOT TO GET THE SPECIFIED REFRIGERANT WITH ANY OTHER GASEOUS BODY INTO THE REFRIGERATION CYCLE. IF AIR OR ANY OTHER GAS IS MIXED IN THE REFRIGERANT, THE GAS PRESSURE IN THE REFRIGERATION CYCLE BECOMES ABNORMALLY HIGH AND IT RESULTINGLY CAUSES BURST OF THE PIPE AND INJURIES ON PERSONS.
- IN THE EVENT THAT THE REFRIGERANT GAS LEAKS OUT OF THE PIPE DURING THE INSTALLATION WORK, IMMEDIATELY LET FRESH AIR INTO THE ROOM. IF THE REFRIGERANT GAS IS HEATED BY FIRE OR SOMETHING ELSE, IT CAUSES GENERATION OF POISONOUS GAS.

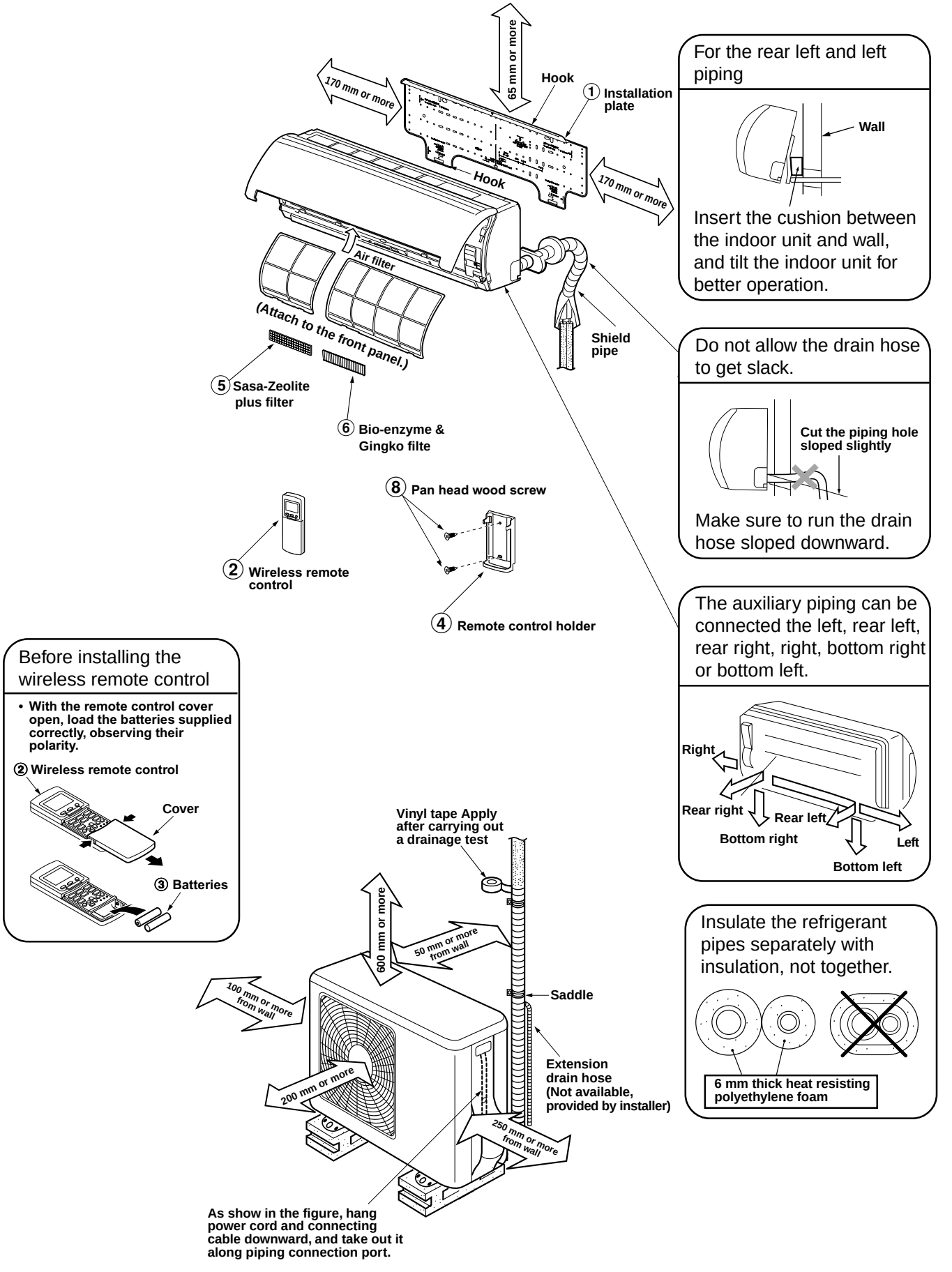
WARNING

- Never modify this unit by removing any of the safety guards or bypassing any of the safety interlock switches.
- Do not install in a place which cannot bear the weight of the unit.
  Personal injury and property damage can result if the unit falls.
- Before doing the electrical work, attach an approved plug to the power supply cord.
  Also, make sure the equipment is properly earthed.
- Appliance shall be installed in accordance with national wiring regulations.
  If you detect any damage, do not install the unit. Contact your TOSHIBA dealer immediately.

CAUTION

- Exposure of unit to water or other moisture before installation could result in electric shock.
  Do not store it in a wet basement or expose to rain or water.
- After unpacking the unit, examine it carefully for possible damage.
- Do not install in a place that can increase the vibration of the unit. Do not install in a place that can amplify the noise level of the unit or where noise and discharged air might disturb neighbors.
- To avoid personal injury, be careful when handling parts with sharp edges.
- Please read this installation manual carefully before installing the unit. It contains further important instructions for proper installation.

9-1-1. Installation Diagram of Indoor and Outdoor Units



9-1-2. Optional installation parts

Part Code	Parts name	Q'ty
Ⓐ	Refrigerant piping Liquid side : ∅6.35 mm Gas side : ∅9.52 mm (13 Series) Gas side : ∅12.7 mm (16 Series)	One each
Ⓑ	Pipe insulating material (polyethylene foam, 6 mm thick)	1
Ⓒ	Putty, PVC tapes	One each

<Fixing bolt arrangement of outdoor unit>

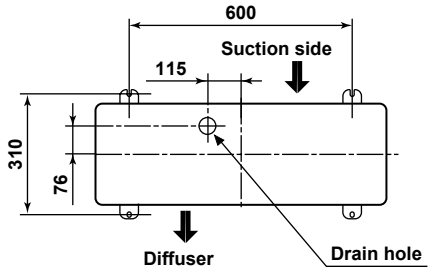
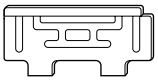
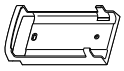
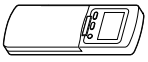
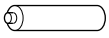
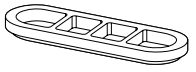


Fig. 9-1-2

- Secure the outdoor unit with the fixing bolts and nuts if the unit is likely to be exposed to a strong wind.
- Use ∅8 mm or ∅10 mm anchor bolts and nuts.
- If it is necessary to drain the defrost water, attach drain nipple ⑨ and cap water proof ⑩ to the bottom plate of the outdoor unit before installing it.

9-1-3. Accessory and installation parts

Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)	Part No.	Part name (Q'ty)
①	 Installation plate x 1	④	 Remote control holder x 1	⑦	 Mounting screw ∅4 x 25 ℓ x 6
②	 Wireless remote control x 1	⑤	 Sasa-Zeolite Plus filter x 1	⑧	 Flat head wood screw ∅3.1 x 16 ℓ x 2
③	 Battery x 2	⑥	 Bio-enzyme & Ginko filter x 1	⑨	 Drain nipple* x 1
				⑩	 Cap water proof* x 2 (For Heat pump model only)

Others

Name
Owner's manual
Installation manual

The part marked with asterisk (*) is packaged with the outdoor unit.

9-1-4. Installation/Servicing Tools

<Changes in the product and components>

In the case of an air conditioner using R410A, in order to prevent any other refrigerant from being charged accidentally, the service port diameter of the outdoor unit control valve (3 way valve) has been changed. (1/2 UNF 20 threads per inch)

- In order to increase the pressure resisting strength of the refrigerant piping, flare processing diameter and size of opposite side of flare nuts has been changed. (for copper pipes with nominal dimensions 1/2 and 5/8)

New tools for R410A

New tools for R410A	Applicable to R22 model		Changes
Gauge manifold	×		As pressure is high, it is impossible to measure by means of conventional gauge. In order to prevent any other refrigerant from being charged, each port diameter has been changed.
Charge hose	×		In order to increase pressure resisting strength, hose materials and port size have been changed (to 1/2 UNF 20 threads per inch). When purchasing a charge hose, be sure to confirm the port size.
Electronic balance for refrigerant charging	○		As pressure is hight and gasification speed is fast, it is difficult to read the indicated value by means of charging cylinder, as air bubbles occur.
Torque wrench (nominal diam. 1/2, 5/8)	×		The size of opposite sides of flare nuts have been increased. Incidentally, a common wrench is used for nominal diameters 1/4 and 3/8.
Flare tool (clutch type)	○		By increasing the clamp bar's receiving hole, strength of spring in the tool has been improved.
Gauge for projection adjustment	—		Used when flare is made by using conventional flare tool.
Vacuum pump adapter	○		Connected to conventional vacuum pump. It is necessary to use an adapter to prevent vacuum pump oil from flowing back to the charge hose. The charge hose connecting part has two ports-one for conventional refrigerant (7/16 UNF 20 threads per inch) and one for R410A. If the vacuum pump oil (mineral) mixes with R410A a sludge may occur and damage the equipment.
Gas leakage detector	×		Exclusive for HFC refrigerant.

- Incidentally, the "refrigerant cylinder" comes with the refrigerant designation (R410A) and protector coating in the U. S's ARI specified rose color (ARI color code: PMS 507).
- Also, the "charge port and packing for refrigerant cylinder" require 1/2 UNF 20 threads per inch corresponding to the charge hose's port size.

9-2. Indoor Unit

9-2-1. Installation place

- A place which provides the spaces around the indoor unit as shown in the above diagram.
- A place where there is no obstacle near the air inlet and outlet.
- A place that allows easy installation of the piping to the outdoor unit.
- A place which allows the front panel to be opened.
- The indoor unit shall be installed as top of the indoor unit comes to at least 2 m height.
  Also it must be avoided to put anything on the top of the indoor unit.

CAUTION

- Direct sunlight to the indoor unit's wireless receiver should be avoided.
- The microprocessor in the indoor unit should not be too close to RF noise sources.
  (For details, see the owner's manual.)

<Remote controller>

- A place where there are no obstacles such as a curtain that may block the signal from the indoor unit.
- Do not install the remote control in a place exposed to direct sunlight or close to a heating source, such as a stove.
- Keep the remote control at least 1 m apart from the nearest TV set or stereo equipment. (This is necessary to prevent image disturbances or noise interference.)
- The location of the remote control should be determined as shown below.

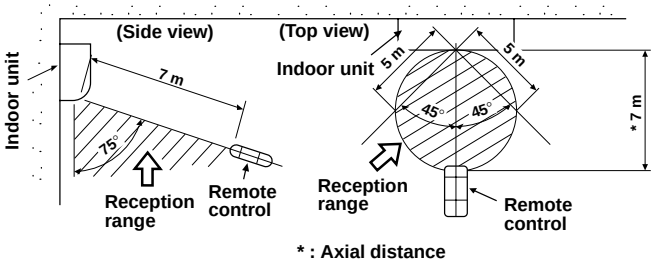


Fig. 9-2-1

9-2-2. Cutting a hole and mounting installation plate

<Cutting a hole>

When installing the refrigerant pipes from the rear.

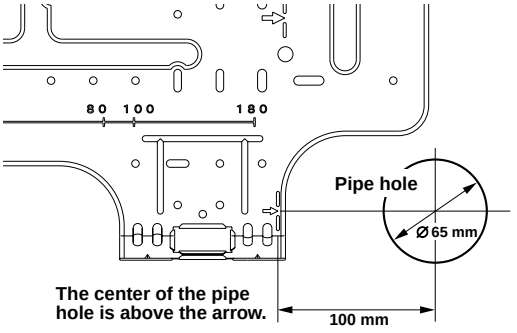


Fig. 9-2-2

1. After determining the pipe hole position on the mounting plate (➡), drill the pipe hole (∅65 mm) at a slight downward slant to the outdoor side.

NOTE:

- When drilling a wall that contains a metal lath, wire lath or metal plate, be sure to use a pipe hole brim ring sold separately.

<Mounting the installation plate>

For installation of the indoor unit, use the paper pattern on the back.

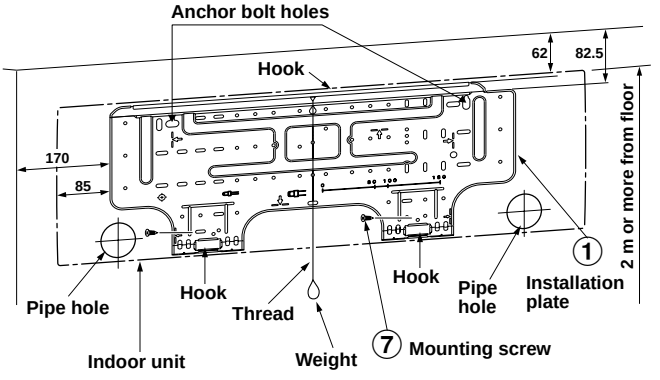


Fig. 9-2-3

<When the installation plate is directly mounted on the wall>

1. Securely fit the installation plate onto the wall by screwing it in the upper and lower parts to hook up the indoor unit.
2. To mount the installation plate on a concrete wall with anchor bolts, utilize the anchor bolt holes as illustrated in the above figure.
3. Install the installation plate horizontally in the wall.

CAUTION

When installing the installation plate with a mounting screw, do not use the anchor bolt hole. Otherwise the unit may fall down and result in personal injury and property damage.

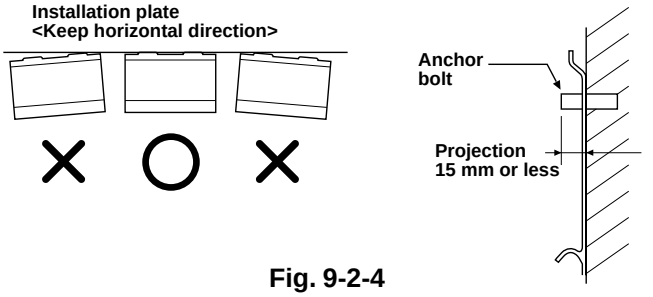


Fig. 9-2-4

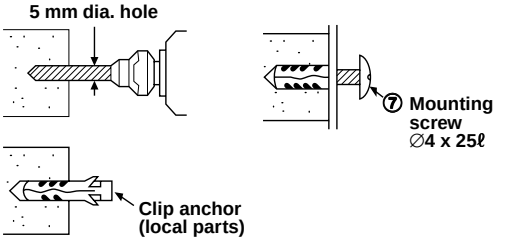


Fig. 9-2-5

CAUTION

Failure to firmly install the unit may result in personal injury and property damage if the unit falls.

- In case of block, brick, concrete or similar type walls, make 5 mm dia. holes in the wall.
- Insert clip anchors for appropriate mounting screws ⑦.

NOTE:

- Secure four corners and lower parts of the installation plate with 4 to 6 mounting screws to install it.

9-2-3. Electrical work

1. The supply voltage must be the same as the rated voltage of the air conditioner.
2. Prepare the power source for exclusive use with the air conditioner.

NOTE:

- Wire type : More than H07RN-F or 245 IEC66 (1.0 mm^2 or more)

CAUTION

- This appliance can be connected to the mains in either of the following two ways.
  (1) Connection to fixed wiring :
  A switch or circuit breake which disconnects all poles and has a contact separation of at least 3 mm must be incorporate in the fixed wiring. An approved circuit breaker or switches must used.
  (2) Connection with power supply plug :
  Attach power supply plug with power cord and plug it into wall outlet. An approved power supply cord and plug must be used.

NOTE:

- Perform wiring works so as to allow a generous wiring capacity.

9-2-4. Wiring connection

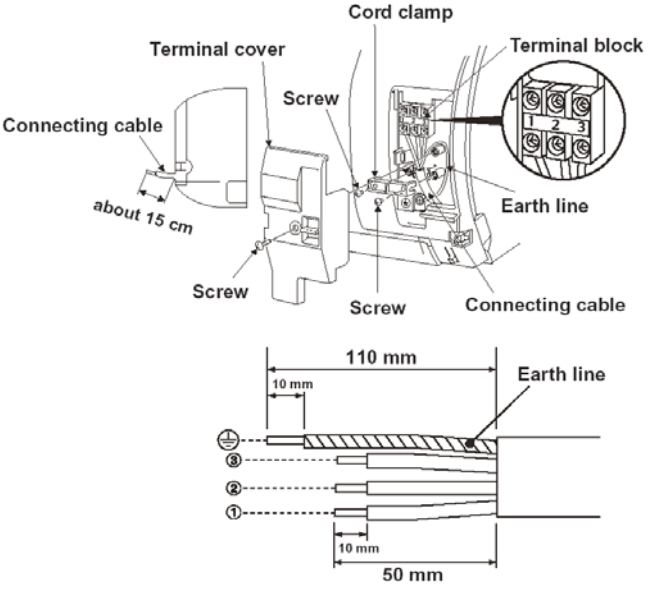
<How to connect the connecting cable>

Wiring of the connecting cable can be carried out without removing of the front panel.

1. Remove the air inlet grille.
   Open the air inlet grille upward and pull it toward you.
2. Remove the terminal cover and cord clamp.
3. Insert the connecting cable (according to the local cords) into the pipe hole on the wall.
4. Take out the connecting cable through the cable slot on the rear panel so that it protrudes about 15 cm from the front.
5. Insert the connecting cable fully into the terminal block and secure it tightly with screws.
6. Tightening torque : 1.2 N·m (0.12 kgf·m)
7. Secure the connecting cable with the cord clamp.
8. Fix the terminal cover, rear plate bushing and air inlet grille on the indoor unit.

CAUTION

- Be sure to refer to the wiring system diagram labeled inside the front panel.
- Check local electrical cords and also any specific wiring instructions or limitations.



NOTE :

- Use stranded wire only.
- Wire type : H07R N-F or more.

Fig. 9-2-7 Stripping length of connecting cable

9-2-5. Piping and drain hose installation

<Piping and Drain Hose Forming>

* Since dewing results in a machine trouble, make sure to insulate both the connecting pipes. (Use polyethylene foam as insulating material.)

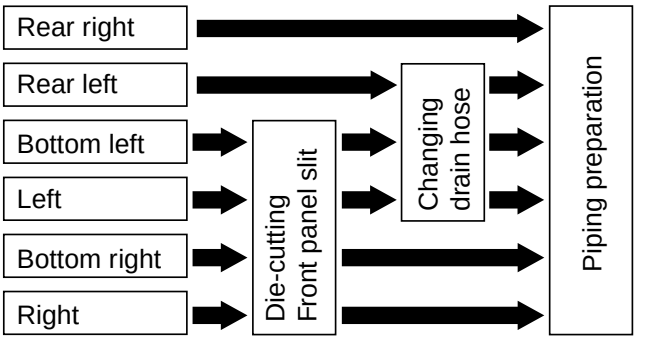


Fig. 9-2-8

1. Die-cutting Front panel slit

Cut out the slit on the left or right side of the front panel for the left or right connection and the slit on the bottom left or right side of the front panel for the bottom left or right connection with a pair of nippers.

2. Changing drain hose

For left connection, bottom-leftward connection and rear-leftward connection's piping, it is necessary to change the drain hose and drain cap.

<How to remove the Drains Cap>

Clip drain cap by needle-nose pliers, and pull out.

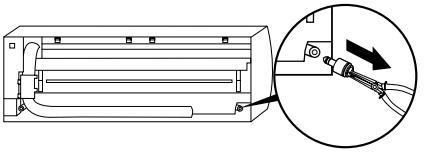


Fig. 9-2-9

<How to install the Drain Hose>

Firmly insert drain hose connecting part until hitting on a heat insulator.

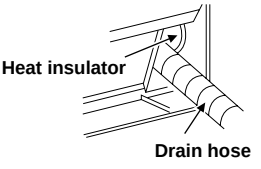


Fig. 9-2-10

<How to fix the Drains Cap>

1) Insert hexagonal wrench (∅4 mm) in a center head.

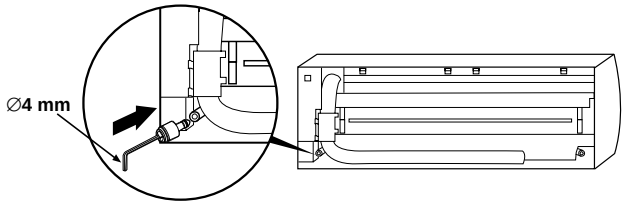


Fig. 9-2-11

2) Firmly insert drains cap.

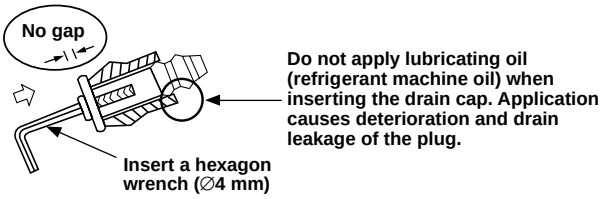


Fig. 9-2-12

CAUTION

Firmly insert the drain hose and drain cap; otherwise, water may leak.

<In case of right or left piping>

- After scribing slits of the front panel with a knife or a making-off pin, cut them with a pair of nippers or an equivalent tool.

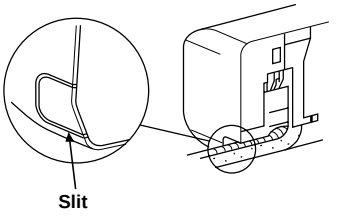


Fig. 9-2-13

<In case of bottom right or bottom left piping>

- After scribing slits of the front panel with a knife or a making-off pin, cut them with a pair of nippers or an equivalent tool.

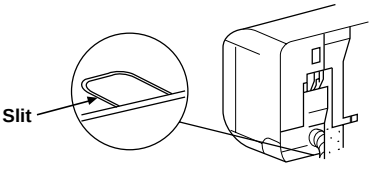


Fig. 9-2-14

<Left-hand connection with piping>

Bend the connecting pipe so that it is laid within 43 mm above the wall surface. If the connecting pipe is laid exceeding 43 mm above the wall surface, the indoor unit may unstably be set on the wall. When bending the connecting pipe, make sure to use a spring bender so as not to crush the pipe.

Bend the connection pipe within a radius of 30 mm (∅6.35) 40 mm (∅9.52).

To connect the pipe after installation of the unit (figure)

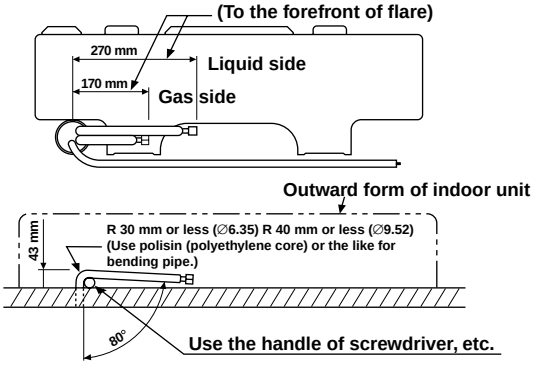


Fig. 9-2-15

NOTE:

If the pipe is bent incorrectly, the indoor unit may unstably be set on the wall.
After passing the connecting pipe through the pipe hole, connect the connecting pipe to the auxiliary pipes and wrap the facing tape around them.

CAUTION

- Bind the auxiliary pipes (two) and connecting cable with facing tape tightly. In case of leftward piping and rear-leftward piping, bind the auxiliary pipes (two) only with facing tape.

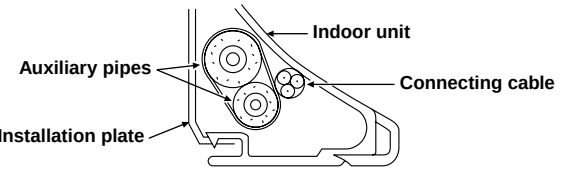


Fig. 9-2-16

- Carefully arrange pipes so that any pipe does not stick out of the rear plate of the indoor unit.
- Carefully connect the auxiliary pipes and connecting pipes to each other and cut off the insulating tape wound on the connecting pipe to avoid double-taping at the joint, moreover, seal the joint with the vinyl tape, etc.
- Since dewing results in a machine trouble, make sure to insulate both the connecting pipes. (Use polyethylene foam as insulating material.)
- When bending a pipe, carefully do it not to crush it.

9-2-6. Indoor unit fixing

1. Pass the pipe through the hole in the wall, and hook the indoor unit on the installation plate at the upper hooks.
2. Swing the indoor unit to right and left to confirm that it is firmly hooked up on the installation plate.
3. While pressing the indoor unit onto the wall, hook it at the lower part on the installation plate. Pull the indoor unit toward you to confirm that it is firmly hooked up on the installation plate.

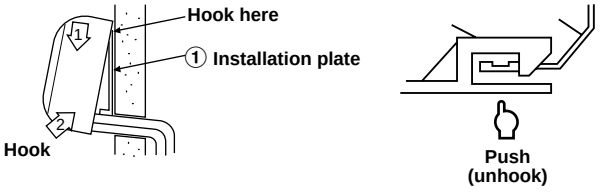


Fig. 9-2-17

- For detaching the indoor unit from the installation plate pull the indoor unit toward you while pushing its bottom up at the specified parts.

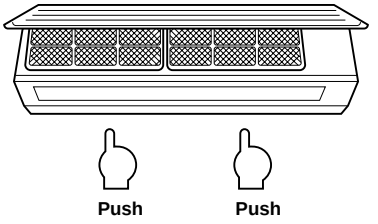


Fig. 9-2-18

9-2-7. Drainage

1. Run the drain hose sloped downwards.

NOTE:

- Hole should be made at a slight downward slant on the outdoor side.

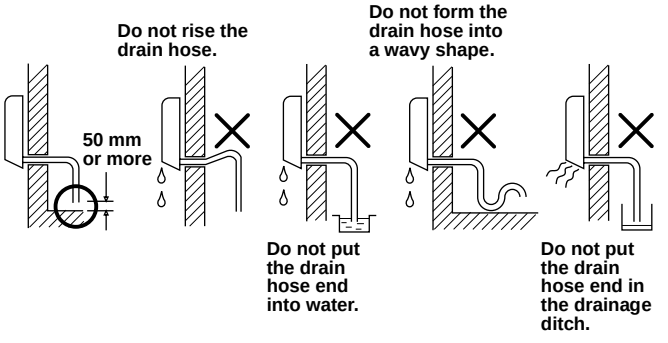


Fig. 9-2-19

2. Put water in the drain pan and make sure that the water is drained out of doors.
3. When connecting extension drain hose, insulate the connecting part of extension drain hose with shield pipe.

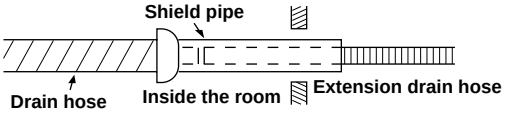


Fig. 9-2-20

CAUTION

Arrange the drain pipe for proper drainage from the unit.
Improper drainage can result in dew-dropping.

This air conditioner has the structure designed to drain water collected from dew, which forms on the back of the indoor unit, to the drain pan.
Therefore, do not store the power cord and other parts at a height above the drain guide.

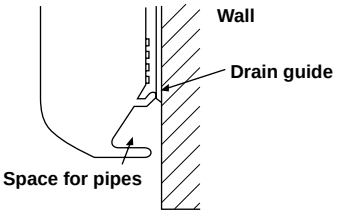


Fig. 9-2-21

9-3. Outdoor Unit

9-3-1. Installation place

- A place which provides the spaces around the outdoor unit as shown in the left diagram.
- A place which can bear the weight of the outdoor unit and does not allow an increase in noise level and vibration.
- A place where the operation noise and discharged air do not disturb users neighbors.
- A place which is not exposed to a strong wind.
- A place free of a leakage of combustible gases.
- A place which does not block a passage.
- When the outdoor unit is to be installed in an elevated position, be sure to secure its feet.
- An allowable length of the connecting pipe is up 15 m.
- An allowable height level is up to 10 m.
- A place where the drain water does not raise any problem.

CAUTION

1. Install the outdoor unit without anything blocking the air discharging.
2. When the outdoor unit is installed in a place exposed always exposed to strong wind like a coast or on a high storey of a building, secure the normal fan operation using a duct or a wind shield.
3. In particularly windy areas, install the unit such as to avoid admission of wind.
4. Installation in the following places may result in trouble.
   Do not install the unit in such places.
   - A place full of machine oil.
   - A saline-place such as the coast.
   - A place full of sulfide gas.
   - A place where high-frequency waves are likely to be generated as from audio equipment, welders, and medical equipment.

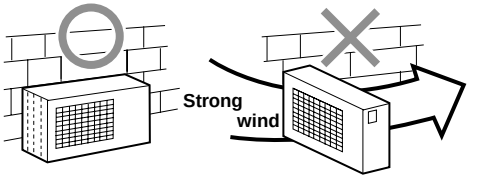


Fig. 9-3-1

9-3-2. Refrigerant piping connection

<Flaring>

1. Cut the pipe with a pipe cutter.

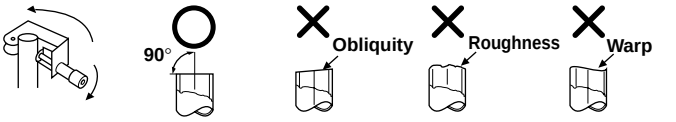


Fig. 9-3-2

2. Insert a flare nut into the pipe, and flare the pipe.
   Projection margin in flaring : A (Unit : mm)

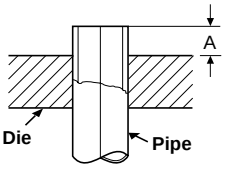


Fig. 9-3-3

Rigid (Clutch type)

Outer dia. of copper pipe	R410A tool used	Conventional tool used
6.35	0 to 0.5	1.0 to 1.5
9.52	0 to 0.5	1.0 to 1.5
12.70	0 to 0.5	1.0 to 1.5

Imperial (wing nut type)

Outer dia. of copper pipe	R410A
6.35	1.5 to 2.0
9.52	1.5 to 2.0
12.70	2.0 to 2.5

<Tightening connection>

Align the centers of the connecting pipes and tighten the flare nut as far as possible with your fingers. Then tighten the nut with a spanner and torque wrench as shown in the figure.

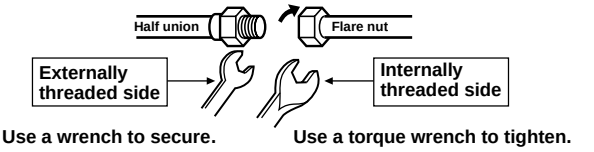


Fig. 9-3-4

CAUTION

- Do not apply excess torque.
- Otherwise, the nut may crack depending on the conditions.

(Unit : Nám) 9-3-3. Evacuating

Outer dia. of copper pipe	Tightening torque
∅6.35 mm	16 to 18 (1.6 to 1.8 kgf·m)
∅9.52 mm	30 to 42 (3.0 to 4.2 kgf·m)
∅12.70 mm	50 to 62 (5.0 to 6.2 kgf·m)

Tightening torque of flare pipe connections

The operating pressure of R410A is higher than that of R22. (Approx. 1.6 times).
It is therefore necessary to firmly tighten the flare pipe connecting sections (which connect the indoor and outdoor units) up to the specified tightening torque. Incorrect connections may cause not only a gas leakage, but also damage to the refrigerant cycle.

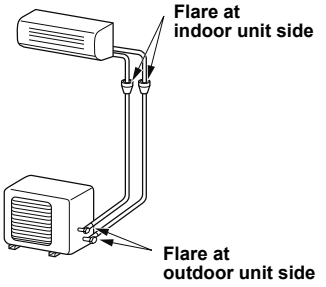


Fig. 9-3-5

<Shaping pipes>

1. How to shape the pipes
   Shape the pipes along the incused line on the outdoor unit.
2. How to fit position of the pipes
   Put the edges of the pipes to the place with a distance of 85 mm from the incused line.

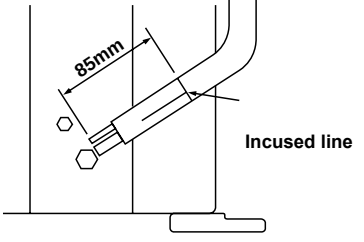


Fig. 9-3-6

After the piping has been connected to the indoor unit, you can perform the air purge together at once.

AIR PURGE
Evacuate the air in the connecting pipes and in the indoor unit using a vacuum pump. Do not use the refrigerant in the outdoor unit. For details, see the manual of the vacuum pump.

<Using a vacuum pump>

Be sure to use a vacuum pump with counter-flow prevention function so that inside oil of the pump does not flow backward into pipes of the air conditioner when the pump stops. (If oil inside of the vacuum pump enters into the air conditioner, which use R410A, refrigeration cycle trouble may result.)

1. Connect the charge hose from the manifold valve to the service port of the gas side packed valve.
2. Connect the charge hose to the port of the vacuum pump.
3. Open fully the low pressure side handle of the gauge manifold valve.
4. Operate the vacuum pump to start evacuating. Perform evacuating for about 15 minutes if the piping length is 20 meters. (15 minutes for 20 meters) (assuming a pump capacity of 27 liters per minute. Then confirm that the compound pressure gauge reading is Ð101 kPa (Ð76 cmHg).
5. Close the low pressure side valve handle of gauge manifold.
6. Open fully the valve stem of the packed valves (both side of Gas and Liquid).
7. Remove the charging hose from the service port.
8. Securely tighten the caps on the packed valves.

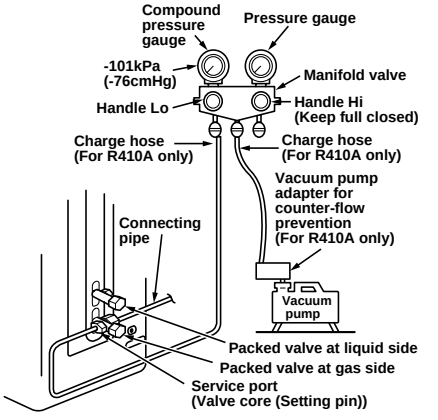


Fig. 9-3-7

CAUTION

- **KEEP IMPORTANT 4 POINTS FOR PIPING WORK**

(1) Take away dust and moisture (Inside of the connecting pipes.)
(2) Tight connection (between pipes and unit)
(3) Evacuate the air in the connecting pipes using VACUUM PUMP.
(4) Check gas leak (connected points)

<Packed valve handling precautions>

- Open the valve stem all the way out; but do not try to open it beyond the stopper.
- Securely tighten the valve stem cap with torque in the following table:

Gas side (∅9.52 mm)	30 to 42 N·m (3.0 to 4.2 kgf·m)
Liquid side (∅6.35 mm)	16 to 18 N·m (1.6 to 1.8 kgf·m)
Liquid side (∅12.70 mm)	50 to 62 N·m (5.0 to 6.2 kgf·m)
Service port	9 to 10 N·m (0.9 to 1.0 kgf·m)

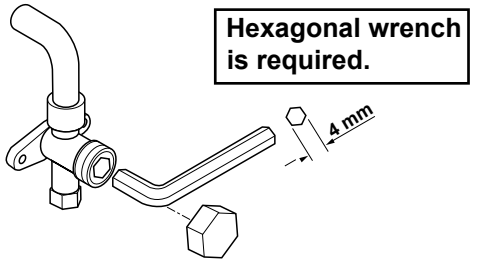


Fig. 9-3-8

9-3-4. Wiring connection

1. Remove the valve cover from the outdoor unit.
2. Connect the connecting cable to the terminal as identified with their respective matched numbers on the terminal block of indoor and outdoor unit.
3. When connecting the connecting cable to the outdoor unit terminal, make a loop as shown in the installation diagram of indoor and outdoor unit, to prevent water coming in the outdoor unit.
4. Insulate the unused cords (conductors) from any water coming in the outdoor unit. Proceed them so that they do not touch any electrical or metal parts.

<Stripping length of connection cable>

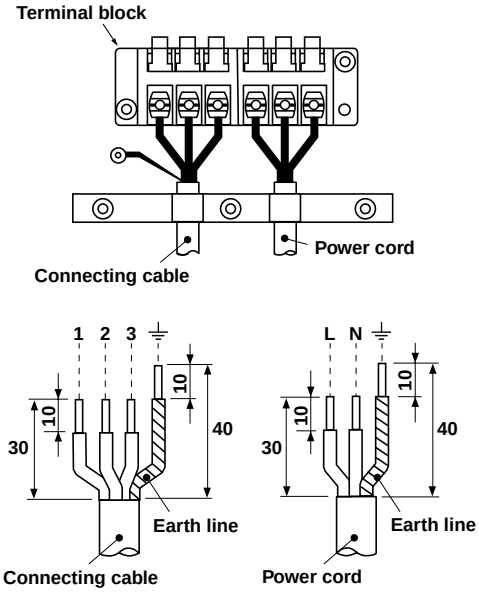


Fig. 9-3-9

Model	13NKV / 16NKV
Power source	50/60 Hz, 220 – 240 V Single phase
Maximum running current	11A
Installation fuse rating	25A
Power cord	H07RN-F or 245 IEC66 (1.5 mm^2 or more)

CAUTION

- Wrong wiring connection may cause some electrical parts burn out.
- Be sure to comply with local codes on running the wire from indoor unit to outdoor unit (size of wire and wiring method etc).
- Every wire must be connected firmly.
- This installation fuse (25A) must be used for the power supply line of this air conditioner.
- If incorrect or incomplete wiring is carried out, it will cause an ignition or smoke.
- Prepare the power supply for exclusive use with the air conditioner.
- This product can be connected to the mains. Connection to fixed wiring: A switch which disconnects all poles and has a contact separation of at least 3 mm must be incorporated in the fixed wiring.

NOTE: Connecting cable

- Wire type: More than H07RN-F or 245 IEC66 (1.0 mm^2 or more)

9-3-5. Gas leak test

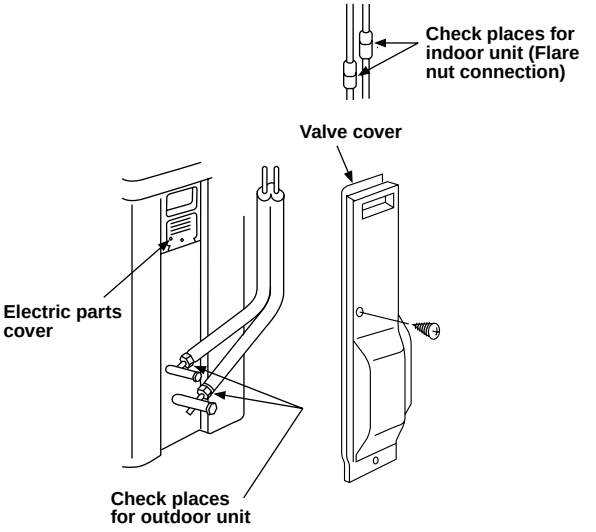


Fig. 9-3-10

- Check the flare nut connections for the gas leak with a gas leak detector or soap water.

9-3-6. Test operation

To switch the TEST RUN (COOL) mode, push [RESET] button for 10 sec.
(The beeper will make a short beep.)

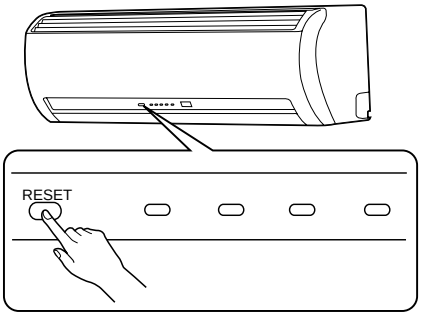


Fig. 9-3-11

9-3-7. Auto restart setting

This product is designed so that, after a power failure, it can restart automatically in the same operating mode as before the power failure.

Information

The product was shipped with Auto Restart function in the off position. Turn it on as required.

<How to set the auto restart>

- Press and hold down the [RESET] button for about 3 seconds. After 3 seconds, the electronic beeper makes three short beeps to tell you the Auto Restart has been selected.
- To cancel the Auto Restart, follow the steps described in the section Auto Restart Function of the Owner's Manual.

10. HOW TO DIAGNOSE THE TROUBLE

The pulse modulating circuits are mounted to both indoor and outdoor units. Therefore, diagnose troubles according to the diagnosis procedure as described below. (Refer to the check points in servicing written on the wiring diagrams attached to the indoor/outdoor units.)

Table 10-1

No.	Troubleshooting Procedure	Page
1	First Confirmation	52
2	Primary Judgment	53
3	Judgment by Flashing LED of Indoor Unit	54
4	Self-Diagnosis by Remote Control	55
5	Judgment of Trouble by Every Symptom	58
6	How to Check Simply the Main Parts	66

NOTE:

A large-capacity electrolytic capacitor is used in the outdoor unit control (inverter). Therefore, if the power supply is turned off, charge (charging voltage DC280V) remains and discharging takes a lot of time. After turning off the power source, if touching the charging section before discharging, an electrical shock may be caused. Discharge the electrolytic capacitor completely by using soldering iron, etc.

<Discharging method>

(1) Remove the inverter cover (plating) by opening four mounting claws.
(2) As shown below, connect the discharge resistance (approx. 100Ω40W) or plug of the soldering iron to voltage between + – terminals of the C14 (“CAUTION HIGH VOLTAGE 380 V” is indicated.) electrolytic capacitor (760μF/400 V) on P.C. board, and then perform discharging.

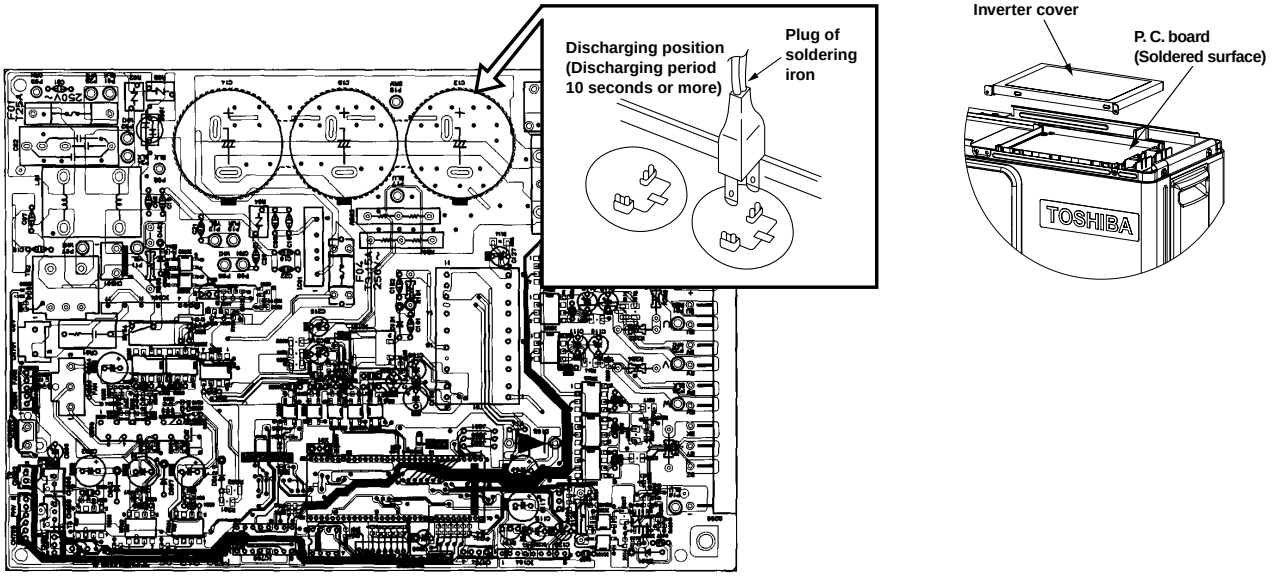


Fig. 10-1

10-1. First Confirmation

10-1-1. Confirmation of power supply

Confirm that the power breaker operates (ON) normally.

10-1-2. Confirmation of power voltage

Confirm that power voltage is AC 220-240 V ± 10%. If power voltage is not in this range, the unit may not operate normally.

10-1-3. Operation which is not a trouble (Program operation)

For controlling the air conditioner, the program operations are built in the microcomputer as described in the following table. If a claim is made for running operation, check whether or not it meets to the contents in the following table. When it does, we inform you that it is not trouble of equipment, but it is indispensable for controlling and maintaining of air conditioner.

Table 10-1-1

No.	Operation of air conditioner	Description
1	When power breaker is turned “ON”, the operation lamp (Green) of the indoor unit flashes.	The OPERATION lamp of the indoor unit flashes when power source is turned on. If [START/STOP] button is operated once, flashing stops. (Flashes also in power failure)
2	Compressor may not operate even if the room temperature is within range of compressor-ON.	The compressor does not operate while compressor restart delay timer (3-minutes timer) operates. The same phenomenon is found after power source has been turned on because 3-minutes timer operates.
3	In Dry and ECO. mode, FAN (air flow) display does not change even though FAN (air flow select) button is operated.	The air flow indication is fixed to [AUTO].
4	Increasing of compressor motor speed stops approx. 30 seconds after operation started, and then compressor motor speed increases again approx. 30 seconds after.	For smooth operation of the compressor, the compressor motor speed is restricted to Max. 41 rps for 2 minutes, and Max.91 rps for 2 minutes to 3 minutes, respectively after the operation has started.
5	The set value of the remote control should be below the room temperature.	If the set value is above the room temperature, Cooling operation is not performed. And check whether battery of the remote control is consumed or not.
6	In AUTO mode, the operation mode is changed.	After selecting Cool or Heat mode, select an operation mode again if the compressor keeps stop status for 15 minutes.
7	In HEAT mode, the compressor motor speed does not increase up to the maximum speed or decreases before the temperature arrives at the set temperature.	The compressor motor speed may decrease by high-temp. release control (Release protective operation by temp.-up of the indoor heat exchanger) or current release control.

10-2. Primary Judgment

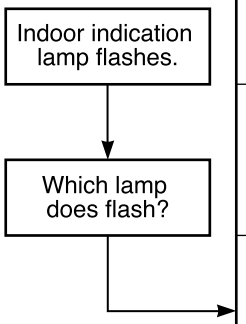
To diagnose the troubles, use the following methods.
(1) Judgment by flashing LED of indoor unit
(2) Self-diagnosis by service check remote control
(3) Judgment of trouble by every symptom

Firstly, use the method (1) for diagnosis. Then, use the method (2) and (3) to diagnose the details of troubles.

10-3. Judgment by Flashing LED of Indoor Unit

While the indoor unit monitors the operation status of the air conditioner, if the protective circuit operates, the contents of self-diagnosis are displayed with block on the indoor unit indication section.

Table 10-3-1



Item	Check code	Block display	Description for self-diagnosis
A	—	OPERATION (Green) Flashing display (1 Hz)	Power failure (when power is ON)
B	00	OPERATION (Green) Flashing display (5 Hz)	Protective circuit operation for indoor P.C. board
C	01	OPERATION (Green) TIMER (Yellow) Flashing display (5 Hz)	Protective circuit operation for connecting cable and serial signal system
D	02	OPERATION (Green) PRE DEF. (Orange) Flashing display (5 Hz)	Protective circuit operation for outdoor P.C. board
E	03	OPERATION (Green) TIMER (Yellow) PRE DEF. (Orange) Flashing display (5 Hz)	Protective circuit operation for others (including compressor)

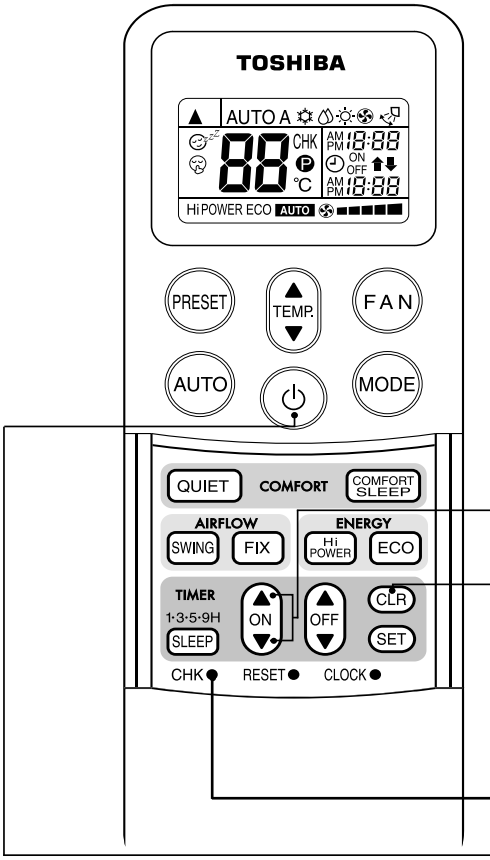
NOTES:

(1) The contents of items B and C and a part of item E are displayed when air conditioner operates.
(2) When item B and C, and item B and a part of item E occur concurrently, priority is given to the block of item B.
(3) The check codes can be confirmed on the remote control for servicing.

10-4. Self-Diagnosis by Remote Control (Check Code)

(1) If the lamps are indicated as shown B to G in Table 9-3-1, exchanger the self-diagnosis by the remote control.
(2) When the remote control is set to the service mode, the indoor controller diagnoses the operation condition and indicate the information of the self-diagnosis on the display of the remote control with the check codes. If a fault is detected, all lamps on the indoor unit will blink at 5Hz and it will beep for 10 seconds (Pi, Pi, Pi....). The timer lamp usually blinks (5Hz) during the self-diagnosis.

10-4-1. How to use remote control in service mode



(1) Press [CHK] button with a tip of pencil to set the remote control to the service mode.
- "00" is indicated on the display of the remote control.
- The timer lamp on the indoor unit blinks continuously. (5 times per 1 sec.)

(2) Press [TIMER ▲] button.
If there is no fault with a code, the indoor unit will beep once (Pi) and the display of the remote control will change as follows:

→ 00 → 01 → 02 ··· 1d → 1E → 22 →

- Check the unit with all 35 check codes (00 to 22). as shown in Table 9-4-1.
- Press [TIMER ▼] button to change the check code backwards.

If there is a fault, the indoor unit will beep for 10 seconds (Pi, Pi, Pi...).
Note the check code on the display of the remote control.
- 2-digits alphanumeric will be indicated on the display.
- All lamps on the indoor unit will blink. (5 times per 1 sec.)

(3) Press [CLR] button. After service finish for clear service code in memory.
- "7F" is indicated on the display of the remote control.

(4) Press [⏻] button to release the service mode.
- The display of the remote control returns to as it was before service mode was engaged.

- Alphanumeric characters are used for the check code.

5	is 5.	6	is 6.
A	is A.	b	is B.
C	is C.	d	is D.

* This illustration in only for Heat pump model.
For Cooling only model, there is not the (☼) symbol.

10-4-2. Caution at servicing

(1) After servicing, push the START/STOP button to return to the normal mode.
(2) After servicing by the check code, turn off breaker of the power supply, and turn on breaker of the power supply again so that memory in the microcomputer returns the initial status. However, the check codes are not deleted even if the power supply is turned off because they are stored in the fixed memory.

Table 10-4-1

Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
00	Indoor P.C. board etc.	0C	Short-circuit or disconnection of the room temperature sensor (TA sensor).	Operation continues.	Displayed when error is detected.	1. Check the room temp. sensor. 2. When the room temp. sensor is normal, check P.C. board.
		0d	Being out of place, disconnection, short-circuit, or migration of heat exchanger sensor (TC sensor)	Operation continues.	Displayed when error is detected.	1. Check heat exchanger sensor. 2. When heat exchanger sensor is normal, check P.C. board.
		11	Lock of indoor fan or trouble on the indoor fan circuit	All off	Displayed when error is detected.	1. Check P.C. board. 2. When P.C. board is normal, check the motor.
	Not displayed	12	Trouble on other indoor P.C. boards	Operation continues.	Displayed when error is detected.	Replace P.C. board.
01	Connecting cable and serial signal	04	Return serial signal is not sent to indoor side from operation started. (1) Defective wiring of connecting cable (2) Operation of compressor thermo. Gas shortage Gas leak	Operation continues.	Flashes when trouble is detected on return serial signal, and normal status when signal is reset.	1. When the outdoor unit never operate: (1) Check connecting cable, and correct if defective wiring. (2) Check 25A fuse of inverter P.C. board (3) Check 3.15A of inverter P.C. board. 2. To display [Other] block during operation, check compressor thermo. operation and supply gas (check gas leak also). 3. Unit operates normally during check. If Return serial signal does not stop between ② and ③ of the indoor terminal block, replace inverter P.C. board. If signal stops between indoor terminal block ② and ③, replace indoor P.C. board.
		05	Operation command signal is not sent to outdoor side.	Operation continues.	Flashes when trouble is detected on operation command signal, and normal status when signal is reset.	If return serial signal does not stop between indoor terminal block ② and ③, replace inverter P.C. board. If signal stops between indoor terminal block ② and ③, replace indoor P.C. board.

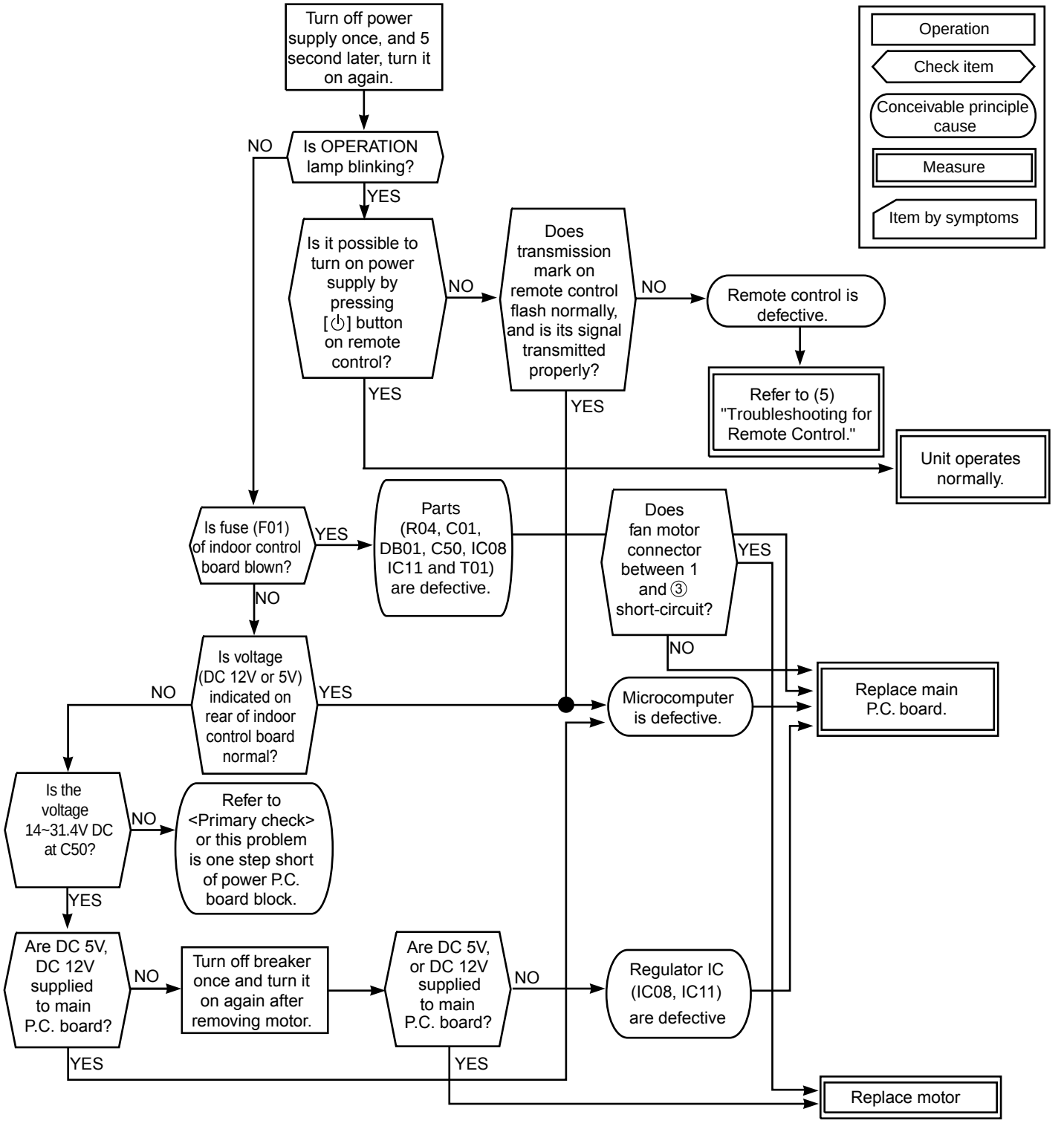
Block distinction		Operation of diagnosis function				Judgment and action
Check code	Block	Check code	Cause of operation	Air conditioner status	Remarks	
02	Ondoor P.C. board	14	Inverter over-current protective circuit operates. (Short time)	All off	Displayed when error is detected.	Even if trying operation again, all operations stop immediately. : Replace P.C. board.
		16	Position-detect circuit error or short-circuit between windings of compressor	All off	Displayed when error is detected.	1. Even if connecting lead wire of compressor is removed, position-detect circuit error occurred. : Replace P.C. board. 2. Measure resistance between wires of compressor, and perform short circuit. : Replace compressor.
		17	Current-detect circuit error	All off	Displayed when error is detected.	Even if trying operation again, all operations stop immediately. : Replace P.C. board.
		18	Being out of place, disconnection or short-circuit of outdoor temp. sensor	All off	Displayed when error is detected.	1. Check outdoor temp. sensors (TE, TS). 2. Check P.C. board.
		19	Disconnection or short-circuit of discharge temp. sensor	All off	Displayed when error is detected.	1. Check discharge temp. sensor (TD). 2. Check P.C. board.
		1A	Outdoor fan drive system error	All off	Displayed when error is detected.	Position-detect error, over-current protective operation of outdoor fan drive system, fan lock, etc. : Replace P.C. board or fan motor.
	Not displayed	1b	Outdoor heat exchanger temp. sensor error	Operation continues.	—	1. Check outdoor heat exchanger temp. sensor (TE). 2. Check P.C. board.
	Ondoor P.C. board	1C	Compressor drive output error, Compressor error (lock, missing, etc.), Break down	All off	Displayed when error is detected.	When 20 seconds passed after startup, position-detect circuit error occurred. : Replace compressor.
03	Others (including compres-sor)	07	Return serial signal has been sent when operation started, but it is not sent from halfway. (1) Compressor thermo. operation Gas shortage Gas leak (2) Instantaneous power failure	Operation continues.	Flashes when trouble is detected on return serial signal, and normal status when signal is reset.	1. Repeat Start and Stop with interval of approx. 10 to 40 minutes. (Code is not displayed during operation.) Supply gas. (Check also gas leak.) 2. Unit operates normally during check. If return serial signal does not stop between indoor terminal block, ② and ③ replace inverter P.C. board. If signal stops between indoor terminal block, ② and ③ replace indoor P.C. board.
		1d	Compressor does not rotate. (Current protective circuit does not operate when a specified time passed after compressor had been activated.)	All off	Displayed when error is detected.	1. Trouble on compressor 2. Trouble on wiring of compressor (Missed phase)
		1E	Discharge temp. exceeded 117°C	All off	Displayed when error is detected.	1. Check discharge temp. sensor (TD). 2. Degassing 3. Trouble on P.M.V.
		1F	Break down of compressor	All off	Displayed when error is detected.	1. Check power voltage. (220-240 V +10%) 2. Overload operation of refrigeration cycle Check installation condition (Short-circuit of outdoor diffuser.)
		08	Four-way valve inverse error (TC sensor value lowered during heating operation.)	Operation continues.	—	1. Check 4-way valve operation.

10-5. Judgement of Trouble by Every Symptom

10-5-1. Indoor unit (Including remote controller)

(1) Power is not turned on (Does not operate entirely)

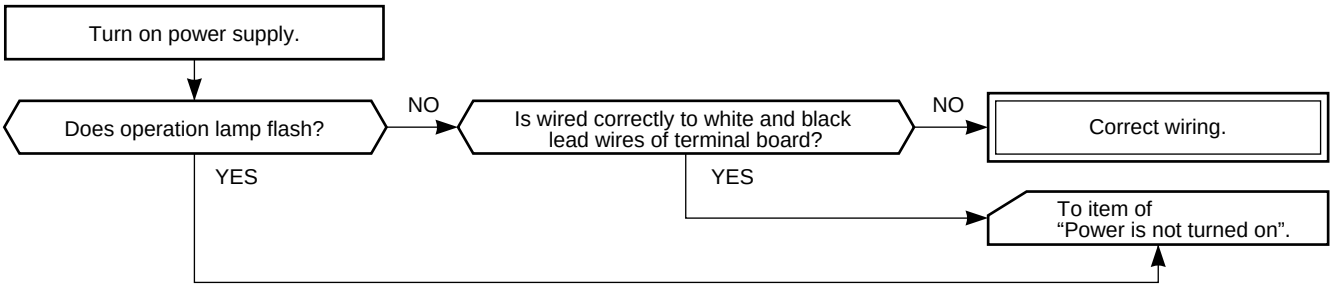
For 13NKV



- Be sure to disconnect the motor connector CN10 after shut off the power supply, or it will be a cause of damage of the motor.

(2) Power is not turned on though Indoor P.C. board is replaced

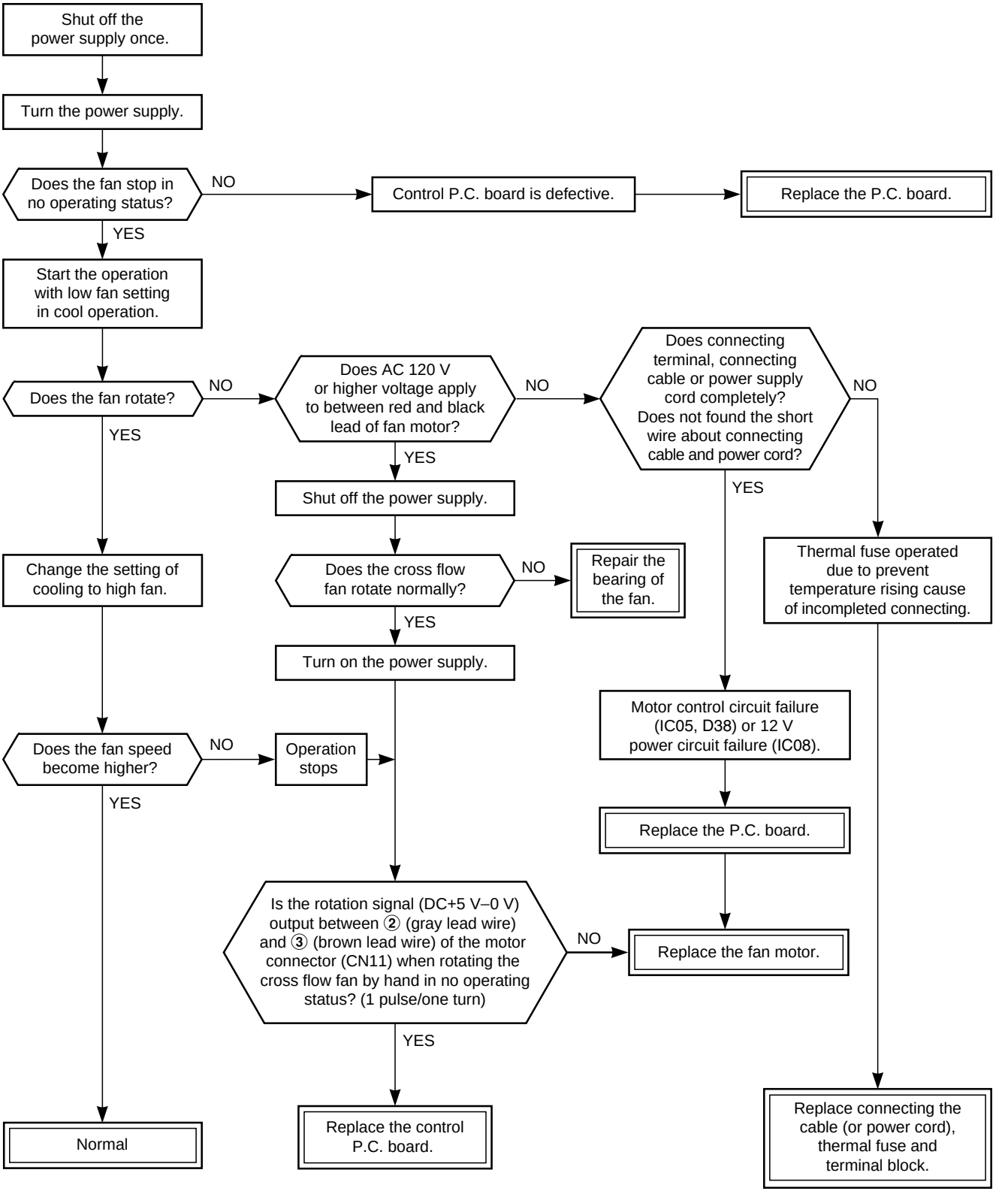
<Confirmation procedure>



(3) Only the indoor fan does not operate.

For 13NKV

<Check procedure>

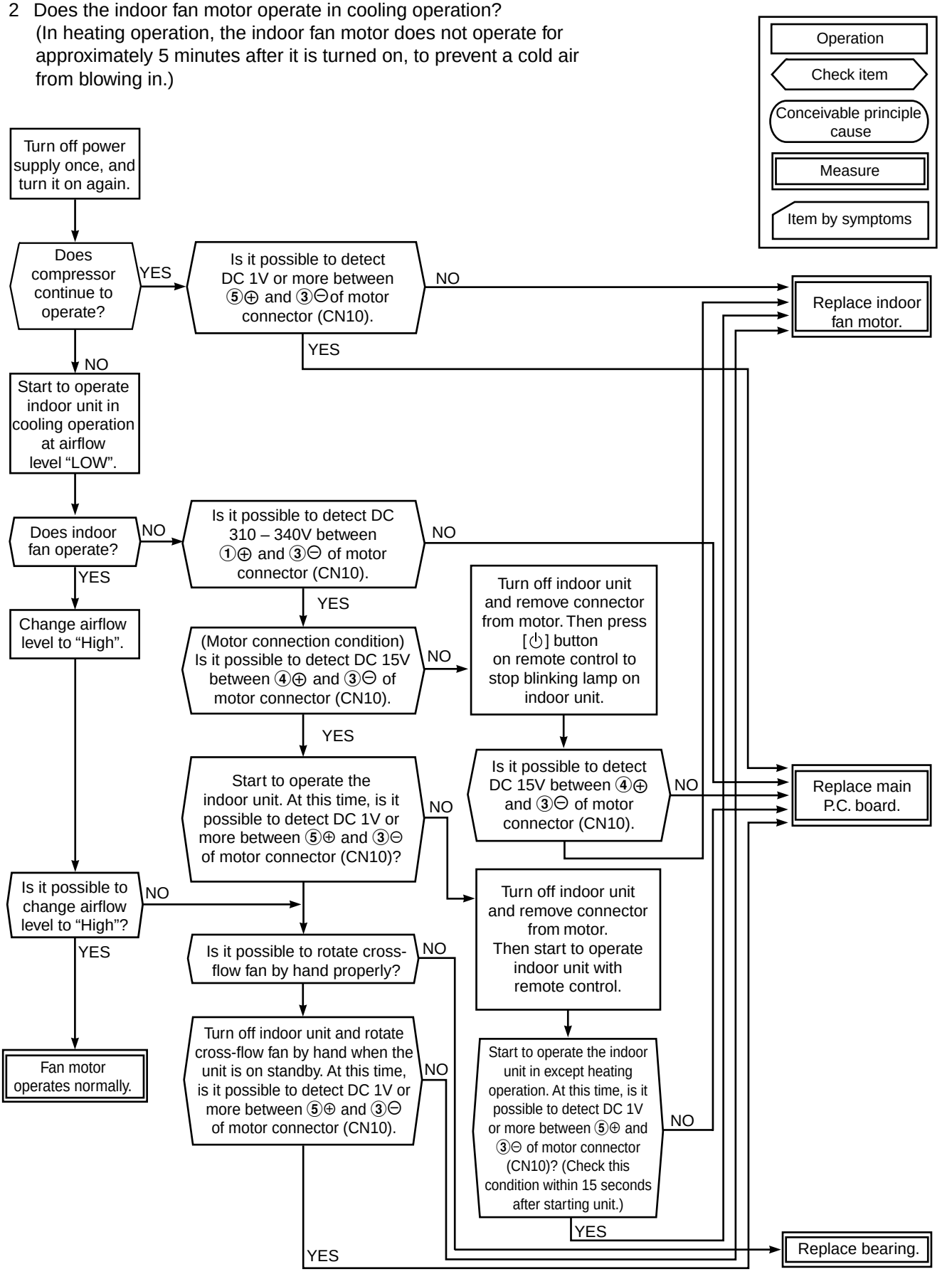


For 16NKV

<Preliminary check>

1 Is it possible to detect the power supply voltage (200 – 240V) between ① and ② on the terminal block?

2 Does the indoor fan motor operate in cooling operation?
(In heating operation, the indoor fan motor does not operate for approximately 5 minutes after it is turned on, to prevent a cold air from blowing in.)



(4) Indoor fan motor starts rotating by turning on power supply alone. (For 16k)

<Cause>

The IC is built in the indoor fan motor. Therefore the P.C. board is also mounted to the inside of the motor.

If the P.C. board is soldered imperfectly or the IC is defective, the fan motor may automatically rotate by turning on power supply.

<Confirmation procedure>

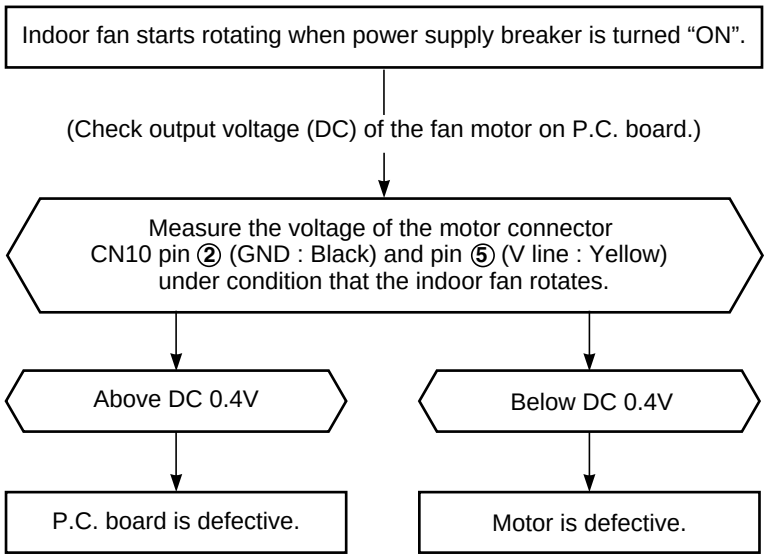
(1) Remove the front panel.(Remove 4 screws.)

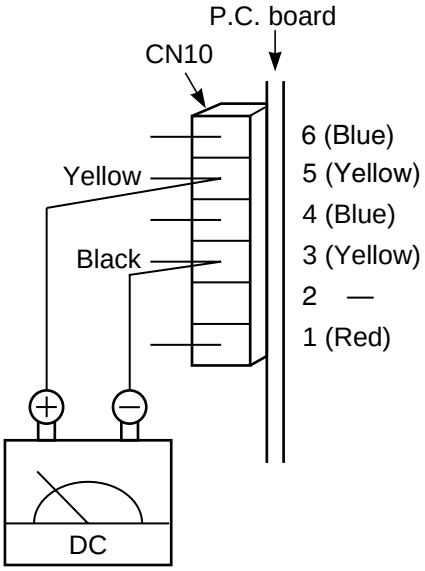
(2) Remove cover of the fan motor lead wires.

(3) Check DC voltage with CN10 connector while the fan rotating.

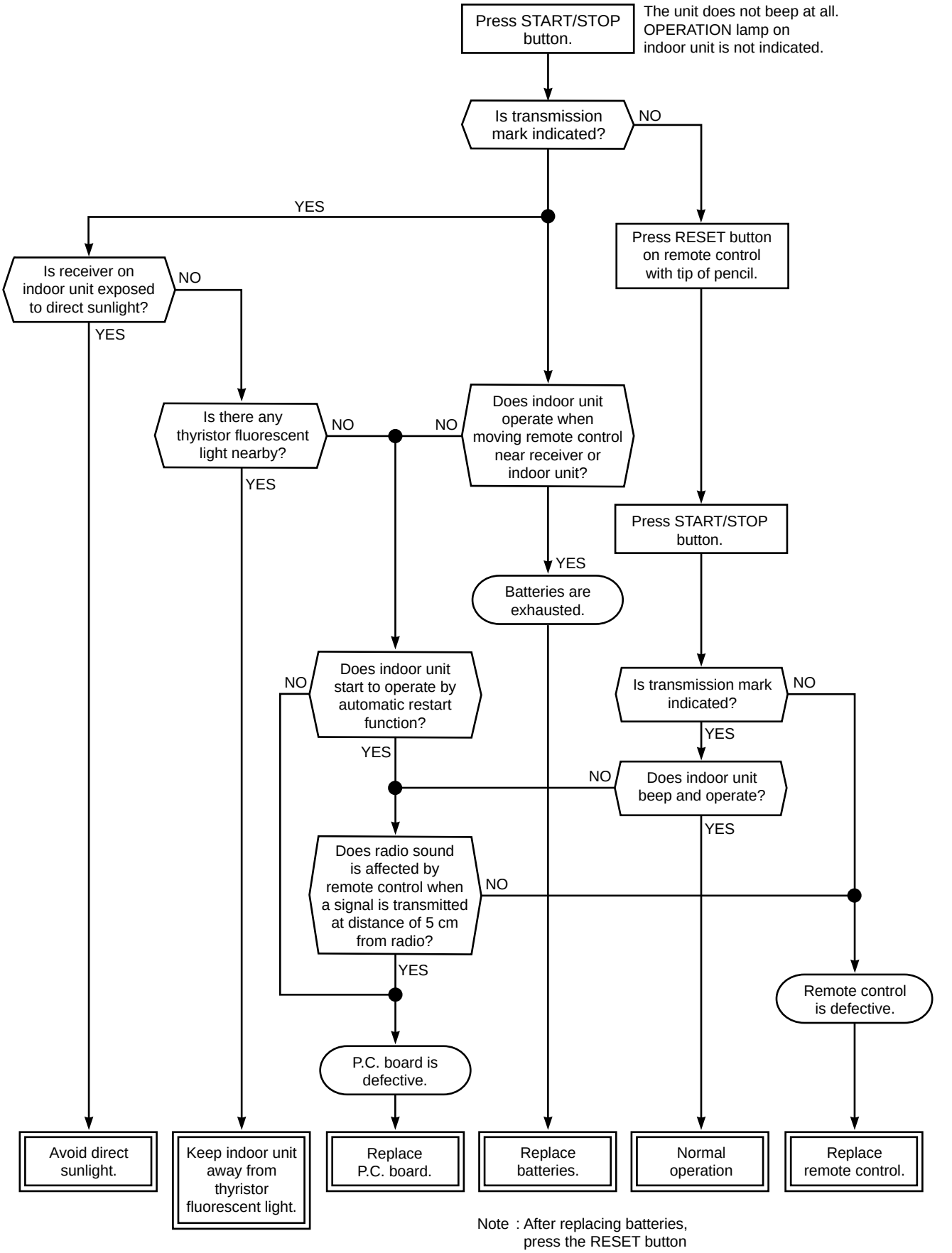
NOTE :

- Do not disconnect the connector while the fan rotates.
- Use a thin tester rod.





(5) Troubleshooting for remote control



Note : After replacing batteries, press the RESET button with a tip of a pencil.

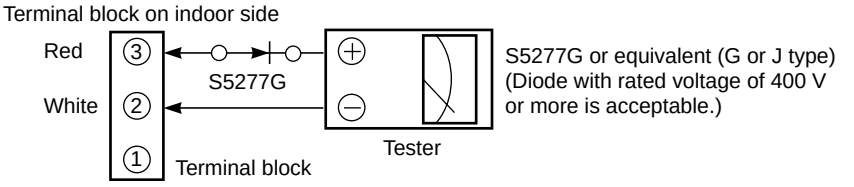
10-5-2. Wiring Failure (Interconnecting and serial signal wire)

(1) Outdoor unit does not operate.

1) Is the voltage between indoor terminal block ② and ③ varied?
   Confirm that transmission from indoor to outdoor is correctly performed based on the following diagram.

NOTE:

- Measurement should be performed 2 minutes and 30 seconds after starting of the operation.
- Be sure to prepare a diode for judgment.

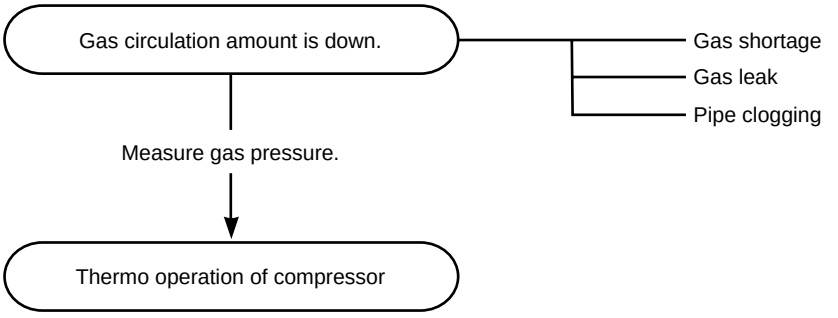


Normal time : Voltage swings between DC15 V and 60 V.
Abnormal time : Voltage does not vary.

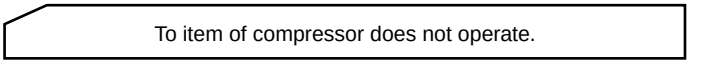
(2) Outdoor unit stops in a little while after operation started.

<Check procedure> Select phenomena described below.

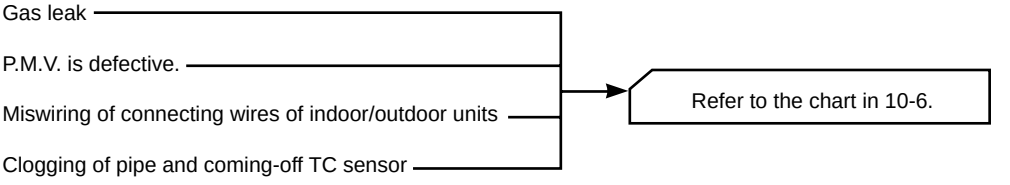
1) The outdoor unit stops 10 to 20 minutes after operation started, and 10 minutes or more are required to restart the unit.



2) If the unit stops once, it dose not operate until the power will be turned on again.

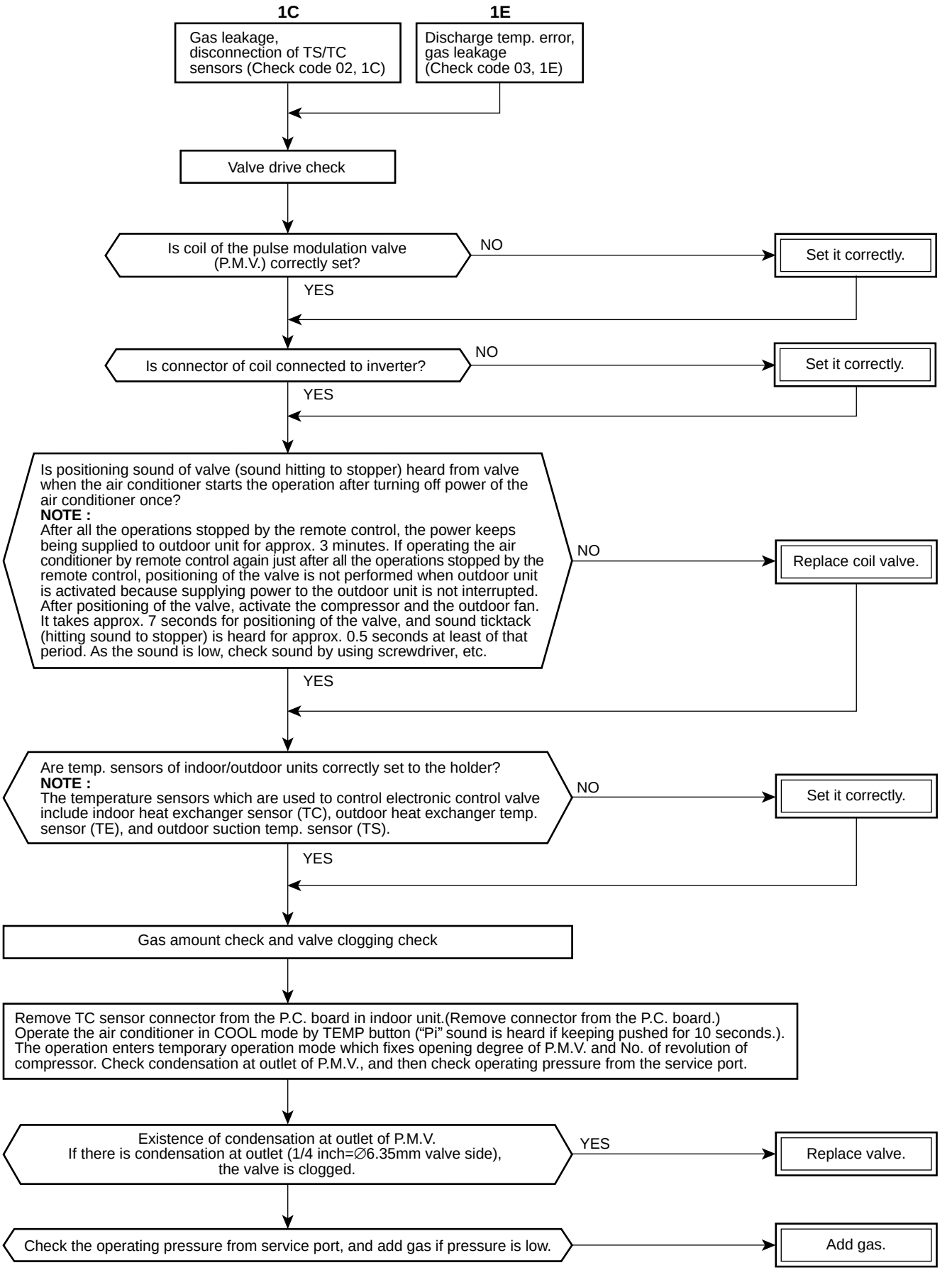


3) The outdoor unit stops 10 minutes to 1 hour after operation started, and an alarm is displayed.
   (Discharge temp. error check code 03, 1E Sensor temp. error check code 02, 1C)



10-6. Check Code 1C (Miswiring in indoor/outdoor units) and 1E

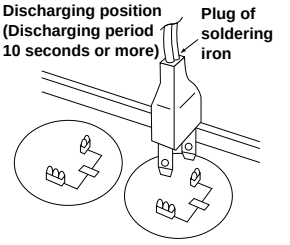
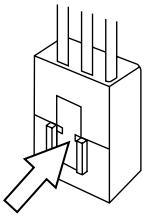
<Check procedure>

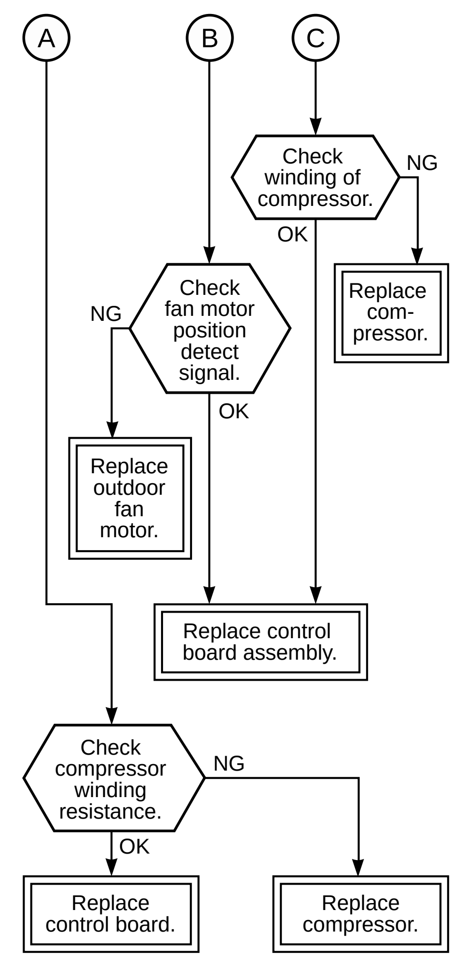


10-7. How to Diagnose Trouble in Outdoor Unit

10-7-1. Summarized inner diagnosis of inverter assembly

Table 10-7-1

Diagnosis/Process flowchart	Item	Contents	Summary
Remove connector of compressor.	Preparation	Turn "OFF" the power breaker, and remove 3P connector which connects inverter and compressor.	
Check 25 A fuse (Part No.F01). NG → Replace fuse. OK	Check	• Check whether 25 A fuse on the control board assembly is blown or not. (F01)	If fuse was blown, be sure to check the electrolytic capacitor and diode block. (DB01)
Check electrolytic capacitor, diode block (DB01), etc.	Check		• Connect discharge resistance (approx. 100Ω40W) or soldering iron (plug) between +, – terminals of the electrolytic capacitor (760μF) of C14 (with printed CAUTION HIGH VOLTAGE) on P.C. board.
Check terminal voltage of electrolytic capacitor. NG → Check electrolytic capacitor, diode (DB01), etc. OK			
Does outdoor fan rotate? NO → A. YES	Operation	Turn on power breaker, and operate the air conditioner in COOL mode by short-circuit of the timer.	
Does LED on control board flash or go on? YES → C. NO	Measurement	Measure terminal voltage of electrolytic capacity. 760μF: 400WV x 3	OK if 760μF → DC280 to 380 V
Remove connector CN300 of outdoor fan motor, and using a tester, check resistance value between every phase at motor side. NG → Replace outdoor fan motor. OK → B.	Check Stop Check Measurement	After operation, turn off the power breaker after 2 minutes 20 seconds passed, and discharge the electrolytic capacity by soldering iron. Check voltage between motor phases. • Is not winding between ①-②, ②-③, or ①-③ opened or short-circuited? • Is not frame grounded with ①, ② or ③?	Remove CN300 by pushing the part an arrow because CN01 is a connector with lock.  → Resistance between phases should be approx. 55 to 77Ω. → Should be 10MΩ or more.

Diagnosis/Process flowchart	Item	Contents	Summary
	Check	Check winding resistance between phases of compressor, and resistance between outdoor frames by using a tester. • Is not grounded. • Is not short-circuited between windings. • Winding is not opened.	→ OK if 10MΩ or more → OK if 0.51Ω → 0.57Ω (Check by a digital tester.)
	Operation	Remove connector CN300 of the outdoor fan motor, turn on the power breaker, and perform the operation. (Stops though activation is prompted.) Check operation within 2 minutes 20 seconds after activation stopped.	
		<Output check of fan motor position detect signal> While connecting connector 5P (CN301) for position detection, using a tester, measure voltage between ①-⑤. Between ⑤-④ : 5 V	a) One or two of three voltages should be 5 V, and others should be 0V. (When all are 0V or 5 V, it is not accepted.) b) When rotating the fan slowly with hands, the voltage between pins should move from 0V to 5 V. (Check it with an analog tester.)

10-8. How to Check Simply the Main Parts

10-8-1. How to check the P.C. board (Indoor unit)

(1) Operating precautions

1) When removing the front panel or the P.C. board, be sure to shut off the power supply breaker.
2) When removing the P.C. board, hold the edge of the P.C. board and do not apply force to the parts.
3) When connecting or disconnecting the connectors on the P.C. board, hold the whole housing. Do not pull at the lead wire.

(2) Inspection procedures

1) When a P.C. board is judged to be defective, check for disconnection, burning, or discoloration of the copper foil pattern or this P.C. board.
2) The P.C. board consists of the following 2 parts

a. Main P.C. board part:
DC power supply circuit (5 V, 12 V, 15 V), Indoor fan motor control circuit, CPU and peripheral circuits, buzzer, and Driving circuit of louver.

b. Indication unit of infrared ray receiving Infrared ray receiving circuit, LED:
To check defect of the P.C. board, follow the procedure described below.

(3) Checking procedure.

For 13NKV

Table 10-6-1

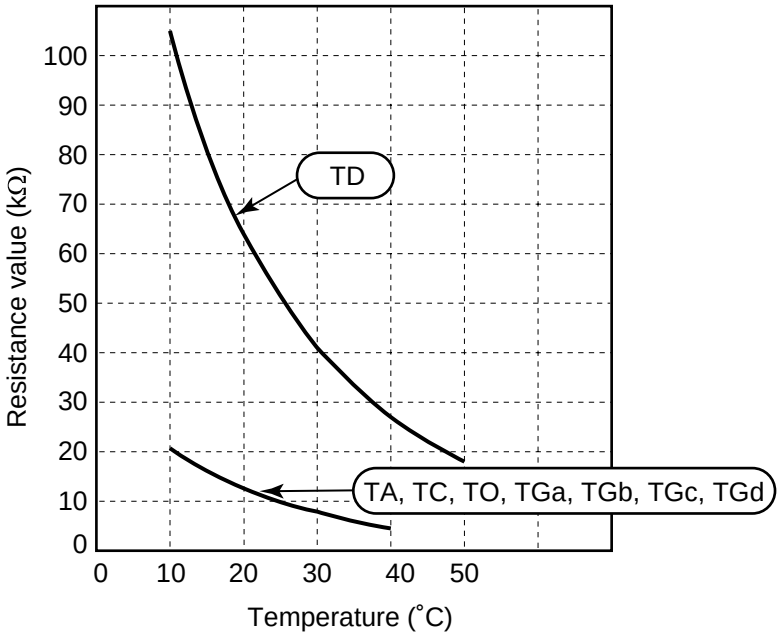
No.	Procedure	Check Point (Symptom)	Causes
1	Shut off the power supply and remove the P.C. board assembly from the electronic parts base. Remove the connecting cable from the terminal block.	1. Is the fuse blown?	1. Application of shock voltage. Overload by short-circuit of the parts.
2	Remove the connector for the motor, and turn the power on. If the OPERATION lamp blinks (0.5 sec. : ON, 0.5 sec. : OFF) when the power turning on, the checking points described as 1-4 of right column are not necessary to perform.	Voltage check 1. Between F01 and CN23 (AC 220 ~ 240 V) 2. Between + and – of C50 (DC14 ~ 31V) 3. Between 5V and GND 4. Between 12V and GND	1. AC power cord is defective. Poor contact of the terminal plate. 2. Capacitor (C01, C15) is defective. Line filter (L01) is defective. Capacitor (C50) is defective. Diode (DB01) is defective. 3. T01, IC08, IC11 are defective.
3	Start the operation with the system which the time of the restart delay timer is shortened.	1. All indicators light for 3 sec.. 2. Indicators do not indicate normally after approximate 3 sec..	} Defective indicator, or poor housing assembly. (CN13)
4	Make the operation status by pressing once the [⏻] button. 1. The time of the restart delay timer is shortened. 2. Cool operation 3. Air volume [AUTO] 4. Make the setting temperature lower enough than room temperature. 5. Continuous operation.	1. Compressor does not operate. 2. OPERATION lamp blinks.	1. The temperature of the indoor heat exchanger is abnormally lower. 2. Poor contact of the heat exchanger sensor. (The connector is disconnected.) (CN01) 3. Heat exchanger sensor, main P.C. board are defective. (Refer to 4. Main P.C. board is defective.
5	The status of No. 4 is continued, and make the following condition. 1. Heat operation 2. Make the setting temperature higher enough than room temperature.	1. Compressor does not operate. 2. OPERATION lamp blinks.	1. The temperature of the heat exchanger is abnormally high. 2. The heat exchanger sensor connector has short-circuit. (CN01) 3. The heat exchanger sensor is defective. 4. P.C. board is defective.
6	Turn the power on after connecting the motor connector. Start the operation with the following condition. 1. Operation [Cooling] 2. Airflow [High fan] 3. Continuous operation	1. Motor does not rotate. (The key operation is accepted.) 2. The Motor rotates, but it vibrates too much.	1. Poor contact of the motor connector. 2. Fan motor is defective

For 16NKV

Table 10-8-1

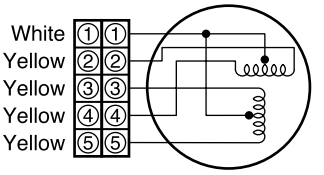
No.	Procedure	Check point (Symptom)	Causes
1	Shut off the power supply and remove the P.C. board assembly from the electronic parts base. Remove the connecting cable from the terminal block.	1. Is the fuse blown?	1. * Application of shock voltage. * Overload by short-circuit of the parts.
2	Remove the connector for the motor, and turn the power on. If the OPERATION lamp flashes (0.5 sec. : ON, 0.5 sec. : OFF) when the power turning on, the checking points described as 1-3 of right column are not necessary to perform.	Voltage check 1. Between [TP1] and [TP2] (220–240V AC) 2. Between + and - of C03 (310 to 340V DC) 3. Between [15V] and [GND] 4. Between [12V] and [GND] 5. Between [5 V] and [GND]	1. * AC power cord is defective. * Poor contact of the terminal plate. * Miss wiring of the power relay. 2. * Capacitor (C01) is defective. * Line filter (L01) is defective. * Resistor (R05) is defective. * Diode (DB01) is defective. 3. Q14, IC08, T01 are defective. 4. IC01, D16, T01, F02 are defective. 5. IC01, IC11, T01, F03 are defective.
3	Start the operation with the system which the time of the restart delay timer is shortened.	1. All indicators light for 3 sec. 2. Indicators do not indicate normally after approximate 3 sec.	} Defective indicator, or poor housing assembly. (CN13)
4	Make the operation status by pressing once the [⏻] button. 1. The time of the restart delay timer is shortened. 2. Cool operation 3. Air volume [AUTO] 4. Make the setting temperature lower enough than room temperature. 5. Continuous operation.	1. Compressor does not operate. 2. OPERATION lamp flashes.	1. The temperature of the indoor heat exchanger is abnormally low. 2. Poor contact of the heat exchanger sensor. (The connector is disconnected.) (CN01) 3. Heat exchanger sensor, main P.C. board are defective. 4. Main P.C. board is defective.
5	Turn the power on after connecting the motor connector. Start the operation with the following condition. 1. Operation [Cooling] 2. Airflow [High fan] 3. Continuous operation	1. Motor does not rotate. (The key operation is accepted.) 2. The motor rotates, but it vibrates too much.	1. Poor contact of the motor connector. 2. Indoor fan motor is defective.

<Sensor characteristic table>

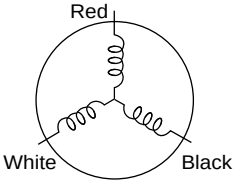
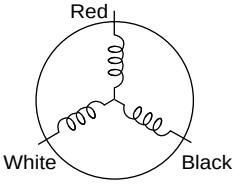
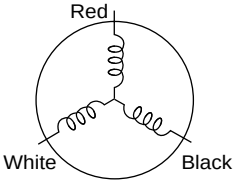


TD : Discharge temp. sensor
TA : Room temp. sensor
TC : Heat exchanger temp. sensor
TO : Outdoor temp. sensor
TGa : Gas side temp. sensor
TGb : Gas side temp. sensor
TGc : Gas side temp. sensor
TGd : Gas side temp. sensor

10-8-3. Indoor unit (Other parts)

No.	Part name	Checking procedure
1	Room temp. (TA) sensor Heat exchanger (TC) sensor	Disconnect the connector and measure the resistance value with tester. (Normal temp.) Temperature / Sensor: 10°C: TA, TC (kΩ) 20.7; 20°C: 12.6; 25°C: 10.0; 30°C: 7.9; 40°C: 4.5
2	Remote control	To item of How to judge whether remote control is good or bad of the Judgment of trouble by symptom.
3	Louver motor 24BYJ48	Measure the resistance value of each winding coil by using the tester. (Under normal temp. 25°C)  Position: 1 to 2, 1 to 3, 1 to 4, 1 to 5 — Resistance value: 380±40Ω
4	Indoor fan motor	Since judgment of DC motor is difficult on the single motor, refer to 10-5-1. (3)

10-8-4. Outdoor unit

No.	Part name	Checking procedure
1	Compressor (Model : DA89X1F-23F) (For 13NAV)	Measure the resistance value of each winding by using the tester.  Position: Red - White, White - Black, Black - Red — Resistance value: 0.51 to 0.57Ω Under 20°C
	Compressor (Model : DA89X1F-23F) (For 16NAV)	Measure the resistance value of each winding by using the tester.  Position: Red - White, White - Black, Black - Red — Resistance value: 0.59Ω Under 20°C
2	Outdoor fan motor (Model : ICF-140-43-4)	Measure the resistance value of winding by using the tester.  Position: Red - White, White - Black, Black - Red — Resistance value: 21Ω For details, refer to Section 10-9.

<table>
<tr><td>3</td><td>Outdoor temperature sensor (TO), discharge temperature sensor (TD), suction temperature sensor (TS), outdoor heat exchanger temperature sensor (TE)</td><td>Disconnect the connector, and measure resistance value with the tester.
(Normal temperature)

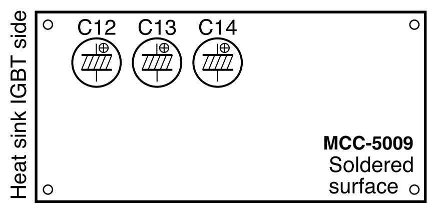
<table>
<tr><th>Sensor \ Temperature</th><th>10°C</th><th>20°C</th><th>30°C</th><th>40°C</th><th>50°C</th></tr>
<tr><td>TA, TC (k)</td><td>105</td><td>64</td><td>41</td><td>27</td><td>18</td></tr>
</table>

TGa : Heat pump model only.

TO, TS, TE : Refer to the TA, TC characteristic table in Indoor
(Refer to Table 10-8-3, No.1).</td></tr>
</table>

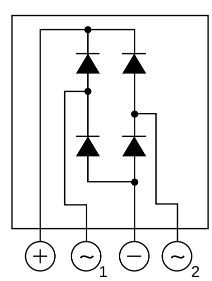
10-8-5. Checking Method for Each Part

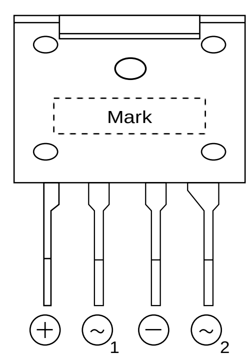
<table>
<tr><th>No.</th><th>Part name</th><th>Checking procedure</th></tr>
<tr><td>1</td><td>Electrolytic capacitor
(For raising pressure, smoothing)</td><td>1. Turn OFF the power supply breaker.
2. Discharge all three capacitors completely.
3. Check that safety valve at the bottom of capacitor is not broken.
4. Check that vessel is not swollen or exploded.
5. Check that electrolytic liquid does not blow off.
6. Check that the normal charging characteristics are show in continuity test by the tester.



<table>
<tr><th>sjCase that product is good</th></tr>
<tr><td>Pointer swings once, and returns slowly. When performing test once again under another polarity, the pointer should return.</td></tr>
</table>

C12, C13, C14 → 760µF/400V</td></tr>
<tr><td>2</td><td>Converter module</td><td>1. Turn OFF the power supply breaker.
2. Discharge all four capacitors completely.
3 Check that the normal rectification characteristics are shown in continuity test by the tester.





Diode check
<table>
<tr><th colspan="2">Tester rod</th><th rowspan="2">Resistance value in good product</th></tr>
<tr><th>⊕</th><th>⊖</th></tr>
<tr><td>~1</td><td rowspan="2">⊖</td><td rowspan="4">50kΩ or more
(0Ω in trouble)</td></tr>
<tr><td>~2</td></tr>
<tr><td rowspan="2">⊕</td><td>~1</td></tr>
<tr><td>~2</td></tr>
</table>
</td></tr>
</table>

10-9. How to Simply Judge Whether Outdoor Fan Motor is Good or Bad

1. Symptom

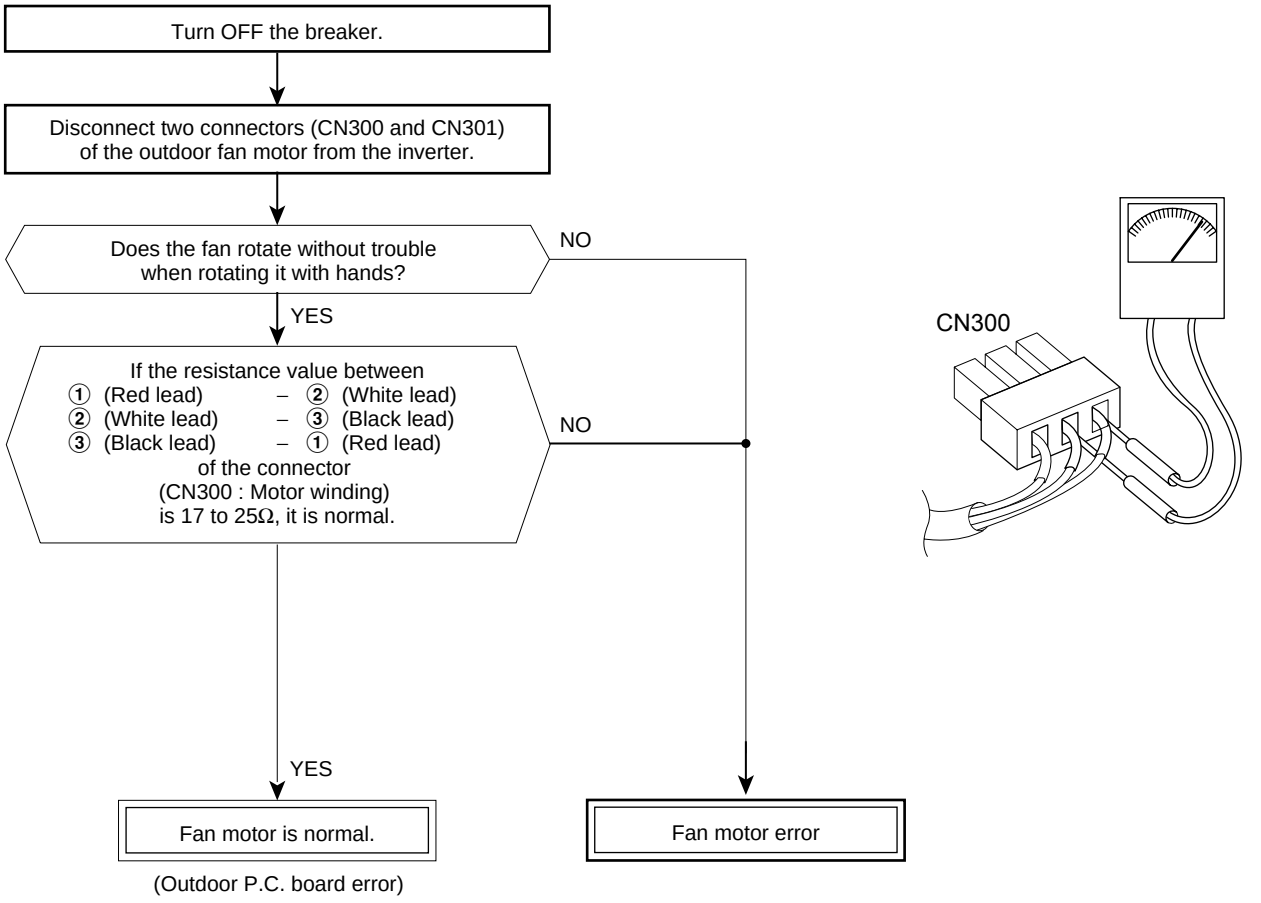
- Outdoor fan motor does not rotate.
- Outdoor fan motor stops within several ten seconds though it starts rotating.
- Outdoor fan motor rotates or does not rotate according to the position where the fan stopped., etc.

Remote controller check code “02 : Outdoor block, 1A : Outdoor fan drive system error”

2. Cause

The following causes are considered when the outdoor fan motor does not normally rotate.
1) Mechanical lock of the outdoor fan motor
2) Winding failure of the outdoor fan motor
3) Position-detect circuit failure inside of the outdoor fan motor
or
4) Motor drive circuit failure of the outdoor P.C. board

3. How to simply judge whether outdoor fan motor is good or bad

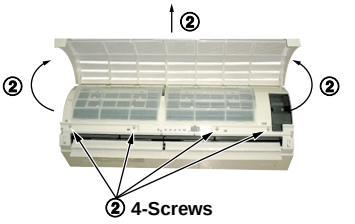
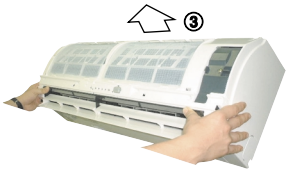
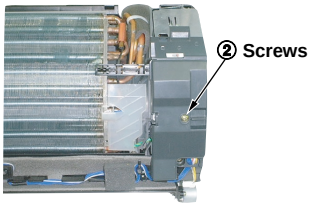
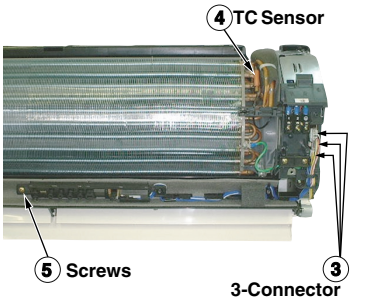
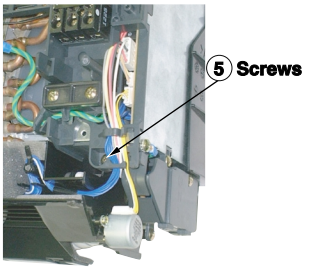
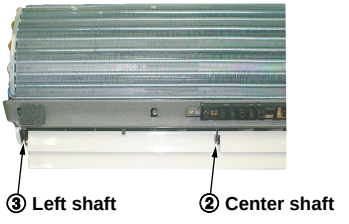


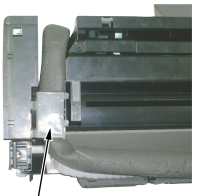
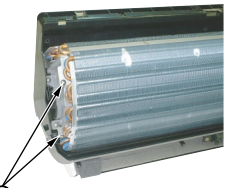
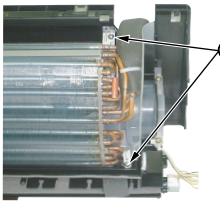
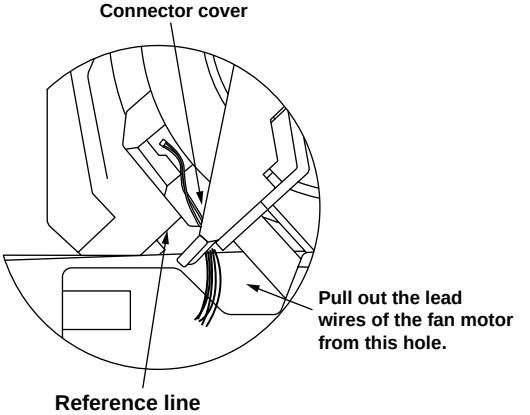
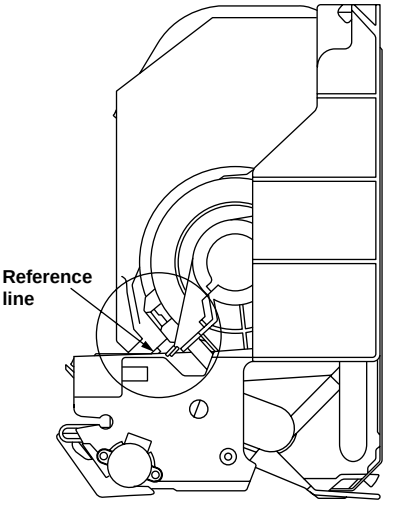
NOTE :

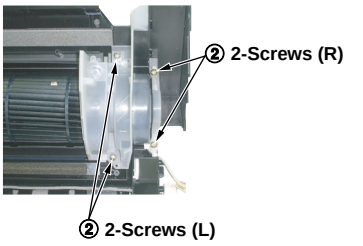
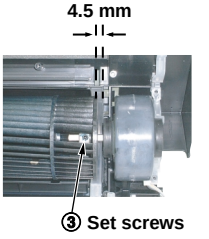
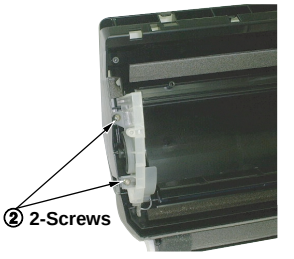
However, GND circuit error inside of the motor may be accepted in some cases when the above check is performed.
When the fan motor does not become normal even if P.C. board is replaced, replace the outdoor fan motor.

11. HOW TO REPLACE THE MAIN PARTS

11-1. Indoor Unit

No.	Part name	Procedures	Remarks
①	Front panel	**How to remove the front panel** 1) Stop operation of the air conditioner and turn off its main power supply. 2) Pull the air inlet grille toward you to open it and remove the air inlet grille. Then remove the 4 screws fixing the front panel. 3) Open the horizontal louver, and then remove the front panel from the back body by pulling it toward you. **How to mount the front panel** Mount the front panel in position and make sure all hooks are locked.	 
②	Electrical part	How to remove the electrical part. 1) Remove the front panel with procedure ①. 2) Remove the screw holding the electrical part cover. 3) Disconnect the 2 connectors (3P) for the fan motor and the connector (5P) for the louver motor from the P.C. board assembly. 4) Pull out the TC sensor from the sensor holder. 5) Remove the screw for the ground connection, remove the screw for the electrical part box and remove the screw from the LED unit. Then remove the LED unit and the electrical part box from the main unit. How to mount the electrical part. 1) To put back the electrical part box, lock it to the upper hook of the back body. 2) Tighten the screw on the electrical part box. 3) Connect the 3 connectors and arrange the wiring same as original condition and then tighten the screw from the LED unit to the back body. 4) Attach the TC sensor to the holder. 5) Tighten the screw for the ground connection. 6) Assemble the drain guide (the TC sensor wire should be covered by the drain guide). 7) Tighten the screw on the electrical part cover	  
③	Horizontal louver	1) Remove the front panel and the electrical part with the procedure ②. 2) Remove the center shaft of the horizontal louver from the back body. 3) Remove the left shaft from the back body. 4) Remove the horizontal louver from the back body.	

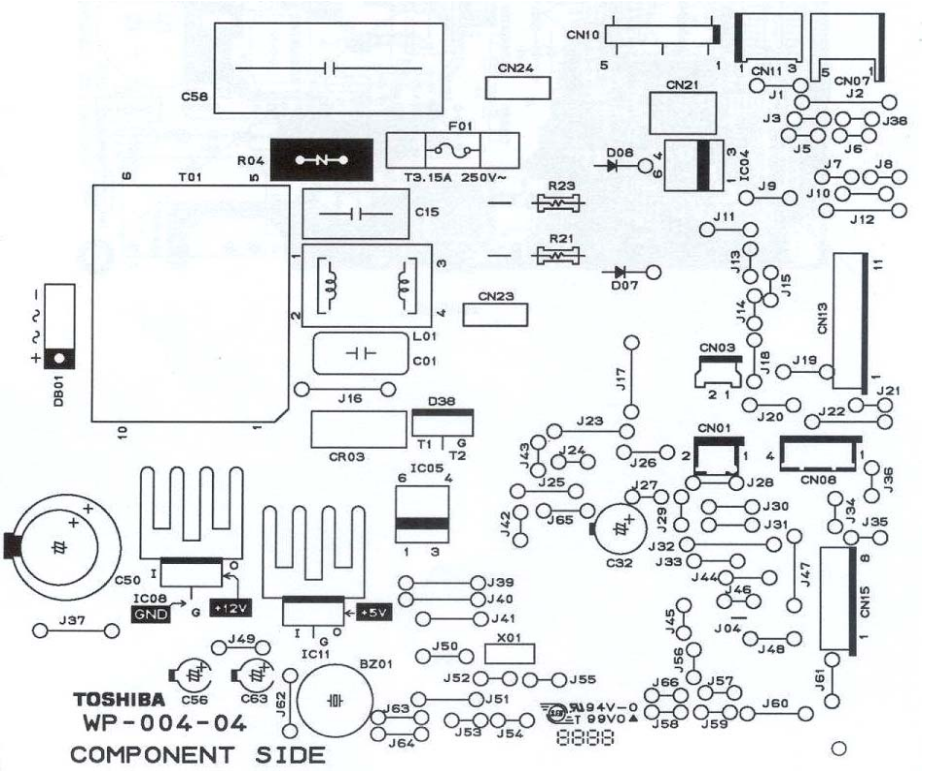
No.	Part name	Procedures	Remarks
④	Heat exchanger	1) Remove the front panel, electrical part and the horizontal louver with the procedure ③. 2) Remove the pipe holder on the rear side of the main unit. 3) Remove 2 screws of the heat exchanger on the base bearing side. 4) Remove 2 screws of the heat exchanger on the left side (upper and lower) from the back body, and then pull out the upper side of the heat exchanger slowly.	 ② Pipe holder  ③ 2-Screws  ④ 2-Screws
⑤	Fan motor	1) Remove the front panel and the electrical part with the procedure ②. 2) Loosen the set screw of the cross flow fan. 3) Remove 2 screws fixing the motor band (R). 4) Pull out the fan motor.  Connector cover Pull out the lead wires of the fan motor from this hole. **Reference line** **When mouting the fan motor, put the R end of the connector cover this reference line.**	Mounting the fan motor as shown in figure below.  Reference line

No.	Part name	Procedures	Remarks
⑥	Cross flow fan	1) Remove the front panel, electrical part, horizontal louver and the heat exchanger with the procedure ④. 2) Remove 2 screws of the band motor (L) and other 2 screws of the band motor (R) and then remove the cross flow fan. 3) Loosen the set screw of the cross flow fan then disconnect the fan and the fan motor. **Notice** For position of the fan motor connector and drawing out of the lead cables, refer to the procedure ⑤. Fix the cross flow fan with the set screw at the position where the gap between the back body and the right surface of the cross flow fan is 4.5 mm.	 
⑦	Base bearing	1) Remove the front panel, electrical part, horizontal louver, heat exchanger and the cross flow fan with the procedure ⑤ and ⑥ . 2) Remove the 2 screws fixing the base bearing. 3) Remove the bearing from the base bearing. If the housing protrudes from the base bearing, put the housing in position and attach the bearing to the base bearing.	

11-2. Microcomputer

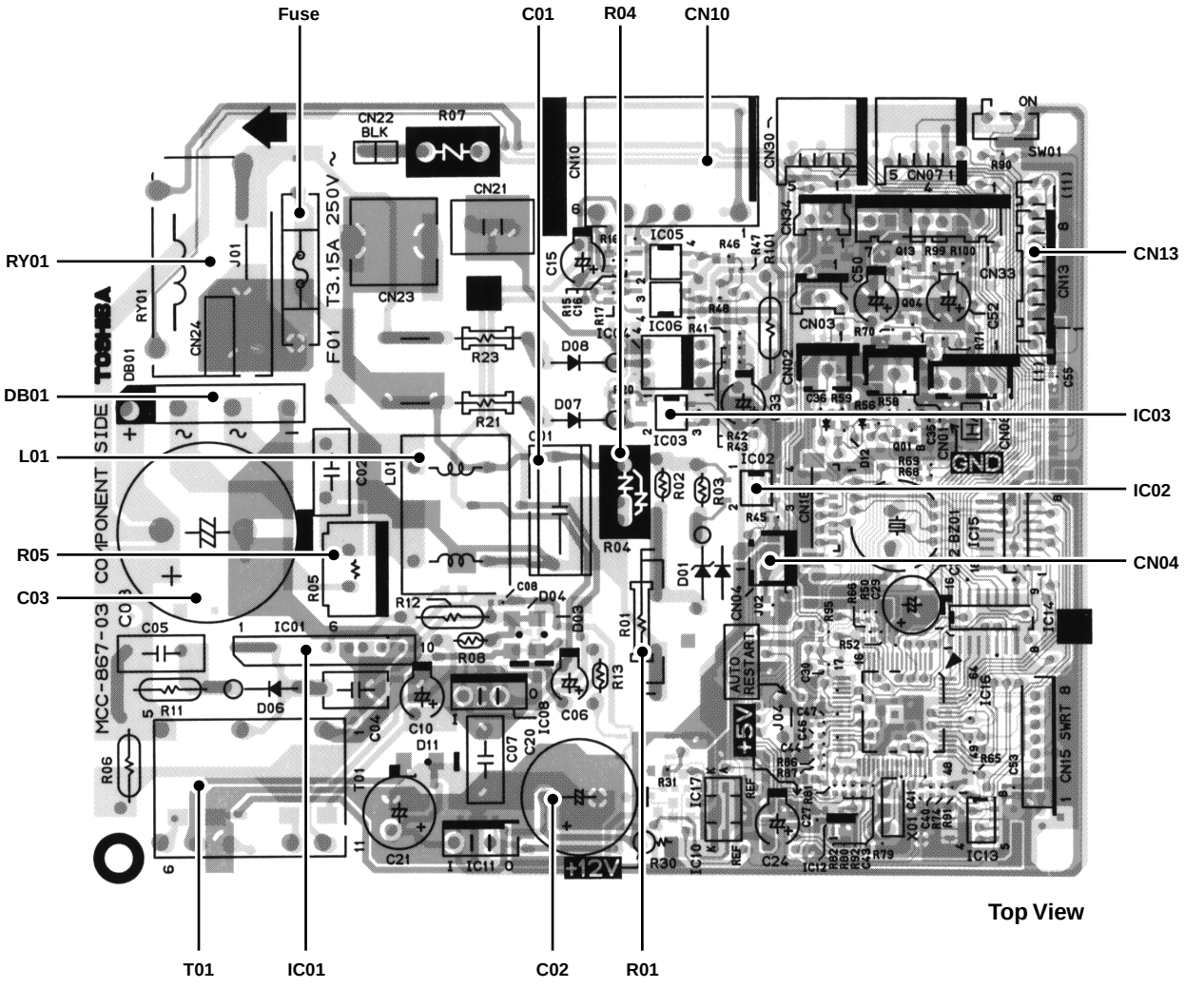
No.	Part name	Procedures	Remarks
①	Common procedure	1) Turn the power supply off to stop the operation of air conditioner. 2) Remove the front panel. • Remove the 4 fixing screws. 3) Remove the electrical part base.	Replace the thermal fuse, terminal block, microcomputer ass'y and the P.C. board ass'y

<P.C. board layout> (For 13NKV)



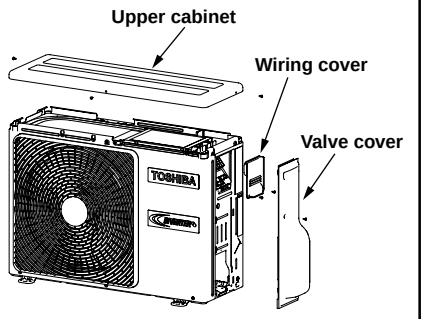
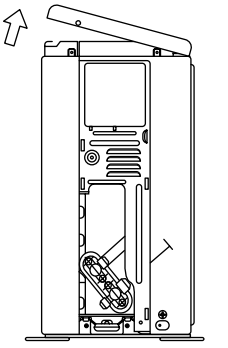
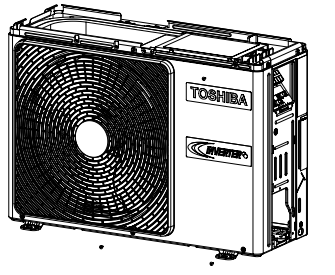
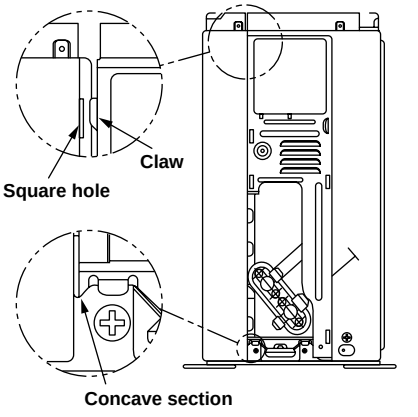
Top View

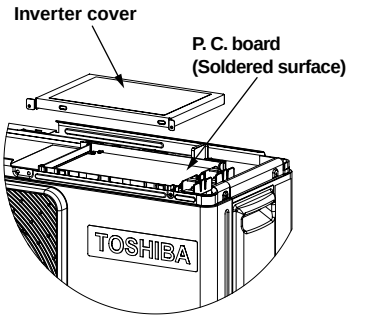
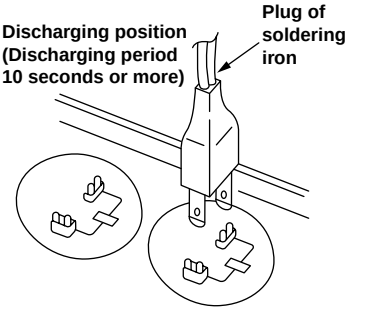
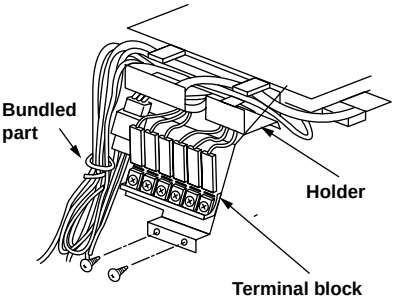
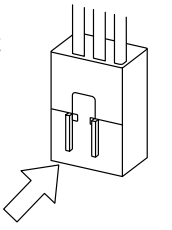
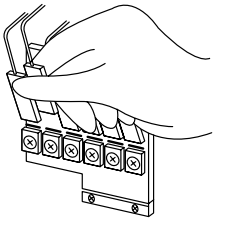
<P.C. board layout> (For 16NKV)

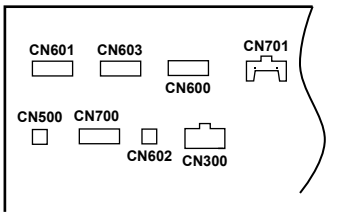
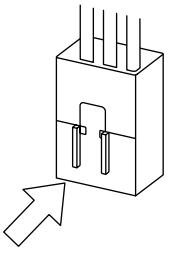
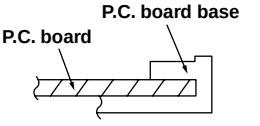
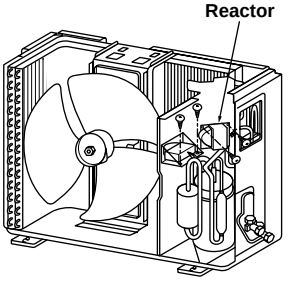


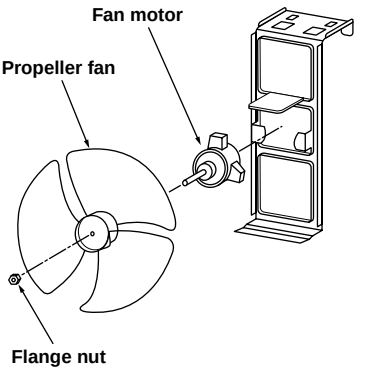
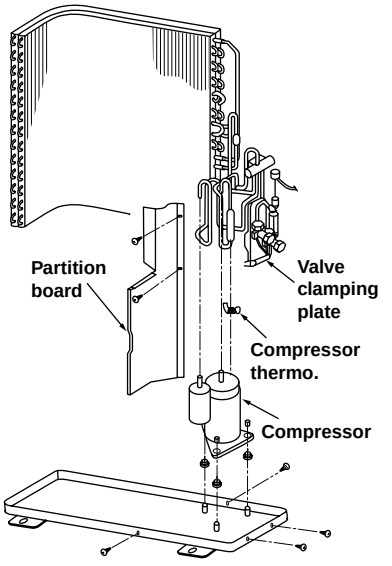
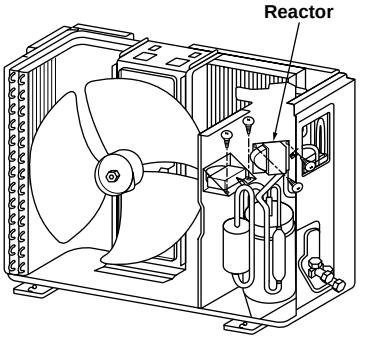
Top View

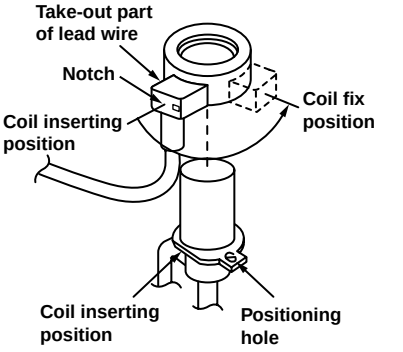
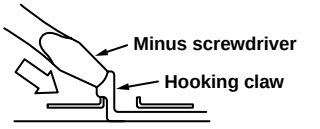
11-3. Outdoor Unit

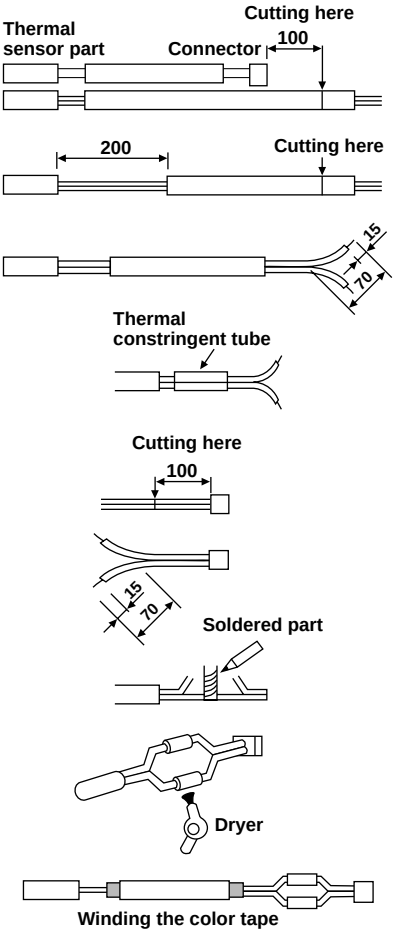
No.	Part name	Procedures	Remarks
①	Common procedure	**1. Detachment** 1) Stop operation of the air conditioner, and turn off the main switch of the breaker for the air conditioner. 2) Remove the valve cover. (ST1TØ4 x 10ℓ 1 pc.) • After removing screw, remove the valve cover pulling it downward. 3) Remove wiring cover (ST1TØ4 x 10ℓ 2 pcs.), and then remove connecting cable. 4) Remove the upper cabinet. (ST1TØ4 x 10ℓ 2 pcs.) • After removing screws, remove the upper cabinet pulling it upward. **2. Attachment** 1) Attach the upper cabinet. (ST1TØ4 x 10ℓ 2 pcs.) • Hook the rear side of the upper cabinet to claw of the rear cabinet, and then put it on the front cabinet. 2) Perform cabling of connecting cable, and attach the wiring cover. • Insert the upper part into the upper cabinet, insert claw which has been hooked to the lower part into the square hole, and then fix it with screw. (ST1TØ4 x 10ℓ 1 pc.) 3) Attach the valve cover. (ST1TØ4 x 10ℓ 1 pc.) • Insert the upper part to the upper cabinet, set hook claw of the valve cover to square holes (at three positions) of the main unit, and attach it pushing upward.	  
②	Front cabinet	**1. Detachment** 1) Perform work of item 1 of ①. 2) Remove screw (ST1TØ4 x 10ℓ 2 pc.) of the front cabinet and inverter cover and screws (ST1TØ4 x 10ℓ 3 pcs.) of the front cabinet and lower part. • The left side of the front is made to insert to the rear cabinet, so remove it pulling upward. **2. Attachment** 1) Insert claw at the left side of the front into the rear cabinet. 2) Hook the lower part at the right side of the front to concave part of the bottom plate. Insert claw of the rear cabinet into square hole of the front cabinet. 3) Attach the removed screws to the original positions.	

No.	Part name	Procedures	Remarks
③	Inverter assembly	1) Perform work of item 1 of ①. 2) Remove screw (ST1T∅4 x 10ℓ 2 pc.) of the upper part of the front cabinet. • If removing the inverter cover in this condition, P.C. board can be checked. • If there is no space in the upper part of the upper cabinet, perform work of ②. **Be careful to check the inverter because high-voltage circuit is incorporated in it.** 3) Perform discharging by connecting ⊕, ⊖ polarity by discharging resistance (approx. 100Ω40W) or plug of soldering iron to ⊕, ⊖ terminals of the C14 (printed "CAUTION HIGH VOLTAGE" is attached.) electrolytic capacitor (760 µF) on P.C. board. **Be careful to discharge the capacitor because the electrolytic capacitor cannot naturally discharge and voltage remains according to trouble type in some cases.** **NOTE :** **This capacitor is one with mass capacity. Therefore, it is dangerous that a large spark generates if short-circuiting between the ⊕,⊖ polarity with screw-driver, etc. for discharging.** 4) Remove screw (ST1T∅4 x 10ℓ 2 pc.) fixing the main body and the inverter box. 5) Remove various lead wires from the holder at upper part of the inverter box and wiring holder at right side of the terminal block. 6) Remove the lead wire from the bundled part at left side of the terminal block. 7) Pull the inverter box upward. 8) Disconnect connectors of various lead wires. **Requirement :** **As each connector has a lock mechanism, avoid to remove the connector by holding the lead wire, but by holding the connector.**	   The connector is one with lock, so remove it while pushing the part indicated by an arrow.   Be sure to remove the connector by holding the connector, not by pulling the lead wire.

No.	Part name	Procedures	Remarks
④	Control board assembly	1) Disconnect lead wires and connectors connected from the control board assembly to other parts. 1. Lead wires □ Connection with terminal block : 3 wires (Black, White, Orange) □ Connection with compressor : Remove the connector (3P) □ Connection with reactor : 2. Connectors CN300 : Outdoor fan (3P, White) CN701 : 4-way valve (3P, Yellow) CN600 : TE sensor (2P, White) CN601 : TD sensor (3P, White) CN603 : TS sensor (3P, White) CN602 : TO sensor (2P, White) CN700 : Pulse modulating valve (6P, White) 2) Remove the control board assembly from P.C. board base. 1. Main control board assembly side □ Remove two claws of P.C. board base, and remove upward the heat sink with hands. □ Remove three screws fixing the heat sink and main control board assembly side, and replace the board with a new one.	 CN300, CN301 and CN701, etc. at the control board assembly side are connectors with locks. Therefore, remove the connector while pushing the part indicated by an arrow.   When mounting a new board, check that the board is correctly set in the groove of base holder of P.C. board base.
⑤	Rear cabinet	1) Perform work of item 1 of 1, ① and ②, ③. 2) Remove fixed screws fixing to the bottom plate. (ST1T∅4 x 10ℓ 3 pcs.) 3) Remove fixed screws fixing to the heat exchanger. (ST1T∅4 x 10ℓ 2 pcs.) 4) Remove fixed screw fixing to the valve mounting plate. (ST1T∅4 x 10ℓ 1 pc.)	

No.	Part name	Procedures	Remarks
⑥	Fan motor	1) Perform work of item 1 of ① and ②. 2) Remove the flange nut fixing the fan motor and the propeller fan. • Flange nut is loosened by turning clockwise. (To tighten the flange nut, turn counterclockwise.) 3) Remove the propeller fan. 4) Disconnect the connector for fan motor from the inverter. 5) Remove the fixing screws (3 pcs.) holding by hand so that the fan motor does not fall.	
⑦	Compressor	1) Perform work of item 1 of ① and ②, ③, ④, ⑤. 2) Extract refrigerant gas. 3) Remove the partition board. (ST1TØ4 x 10ℓ 2 pcs.) 4) Remove the sound-insulation material. 5) Remove the terminal cover of the compressor, and disconnect lead wire of the compressor thermo. and the compressor from the terminal. 6) Remove pipe connected to the compressor with a burner. 7) Remove the fixing screw of the bottom plate and heat exchanger. (ST1TØ4 x 10ℓ 2 pc.) 8) Remove the fixing screw of the bottom plate and valve clamping plate. (ST1TØ4 x 10ℓ 2 pcs.) 9) Pull upward the refrigeration cycle. 10) Remove the nut fixing the compressor to the bottom plate.	
⑧	Reactor	1) Perform work of item 1 of ① and ③. 2) Remove lead wires clung in holder on the partition board. 3) Remove the screw fixing the reactor. (ST1TØ4 x 10ℓ 2 pcs.)	

No.	Part name	Procedures	Remarks
⑨	Pulse modulating valve coil	**1. Detachment** 1) Perform work of item 1 of ①, and ②, ③, ⑤. 2) Turn the coil clockwise (counterclockwise) by 90 degrees, and remove coil from the pulse modulating valve. **2. Attachment** 1) Set take-out part of the lead wire of coil to the coil inserting position of the pulse modulating valve, and attach the coil. 2) Turn the coil by 90 degrees, set surely the concave part at lower part of the coil to the positioning hole of the pulse modulating valve, and then fix the coil. **The pulse modulating valve has A room side and B room side. After mounting it, check that coil at B room side (Red marking is marked on the pulse modulating valve.) is connected to CN13 of the control board assembly.**	
⑩	Fan guard	**1. Detachment** 1) Perform work of item 1 of ①, and ②. 2) Remove the front cabinet, and put it down so that fan guard side directs downward. **Perform work on a corrugated cardboard, cloth, etc. to prevent flaw to the product.** 3) Remove the hooking claws by pushing minus screwdriver according to the arrow mark in the right figure, and remove the fan guard. **2. Attachment** 1) Insert claw of the fan guard in the hole of the front cabinet. Push the hooking claws (10 positions) by hands and fix the claws. **All the attaching works have completed. Check that all the hooking claws are fixed to the specified positions.**	

No.	Part name	Procedures	Remarks
⑪	Replacement of temperature sensor for servicing only Common service parts of sensor TO, TS, TE, TD	1) Cut the sensor 100 mm longer than old one. 2) Cut the protective tube after pulling out it (200 mm). 3) Move the protective tube toward the thermal sensor side and tear the tip of lead wire in two, then strip the covering part. 4) Pass the stripped part through the thermal constringent tube. 5) Cut the old sensor 100 mm length on the connector side, and recycle that connector. 6) Tear the lead wire in two on the connector side and strip and covering part. 7) Twist the leads on the connector and sensor sides, and solder them. 8) Move the thermal constringent tubes toward the soldered parts and heat them with the dryer and constring them. 9) Wind the attached color tape round the both terminals of the protective tube when colored protective tube is used. 10) Fix the sensor again. **NOTES:** 1) Store the joint part of the sensor and the connector in the electric parts box. 2) Never joint them near the thermal sensor part. Otherwise, it would cause insulation inferiority because of dew drops. 3) When replacing the sensor using the colored protective tube, wind the color tape matching the color of that tube.	

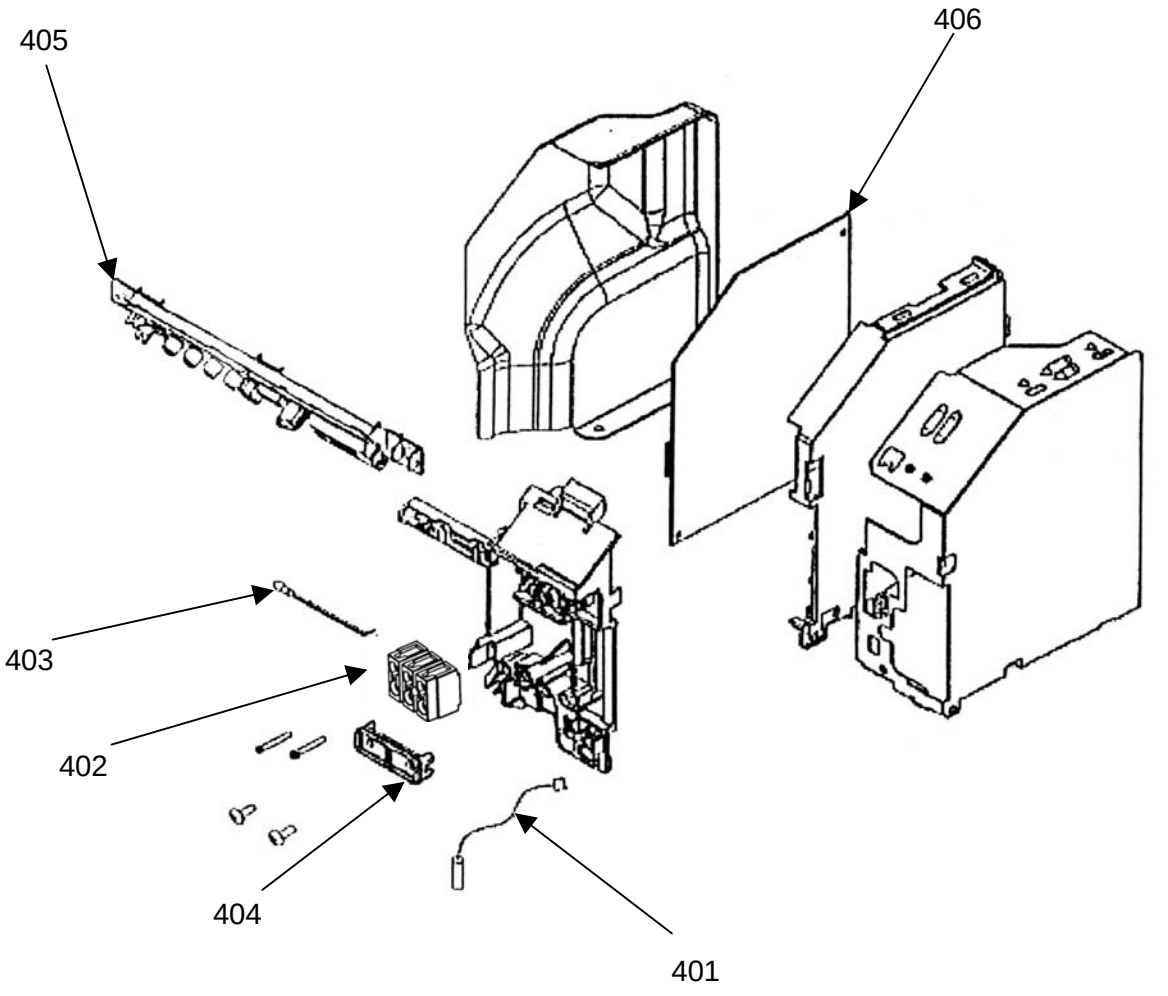
These are parts for servicing sensors.

Please check that the accessories shown in the right table are packed.

	Part name	Q'ty	Remarks
1	Sensor	1	Length: 3 m
2	Sensor Spring (A)	1	For spare
3	Sensor Spring (B)	1	For spare
4	Thermal constringent tube	3	Including one spare
5	Color tape	1	9 colors
6	Terminal	3	

12. EXPLODED VIEWS AND PARTS LIST

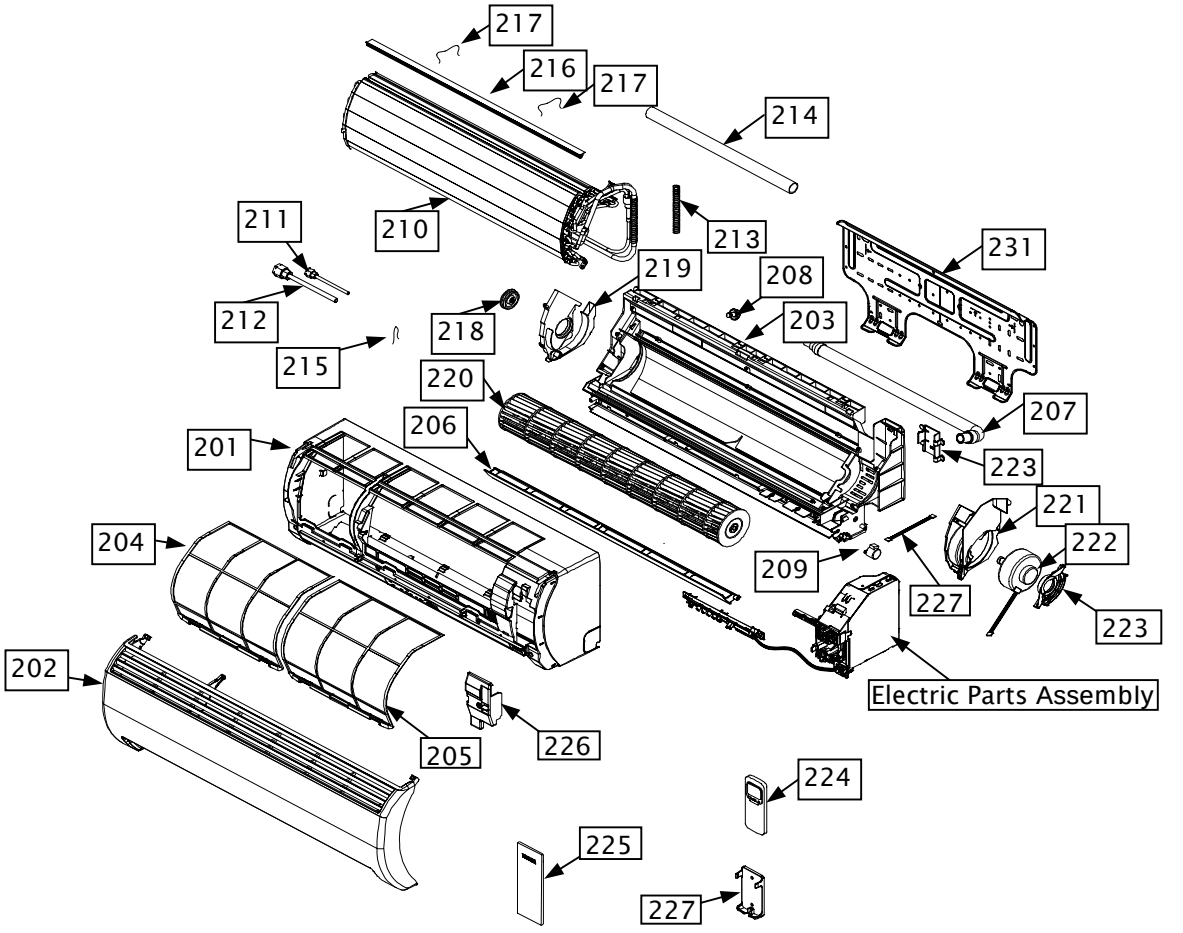
12-1. Indoor Unit (E-Parts Assy)



Location No.	Part No.	Description
401	43T69319	TEMPERATURE SENSOR
402	43T60002	TERMINAL BLOCK; 3P
403	43T69320	TEMPERATURE SENSOR
404	43T62003	CORD CLAMP

Location No.	Part No.	Description
405	43T69079	PC BOARD ASSY;WRS-LED
406	43T69399	PC BOARD (FOR 16NKV)
406	43T69473	PC BOARD (FOR 13NKV)

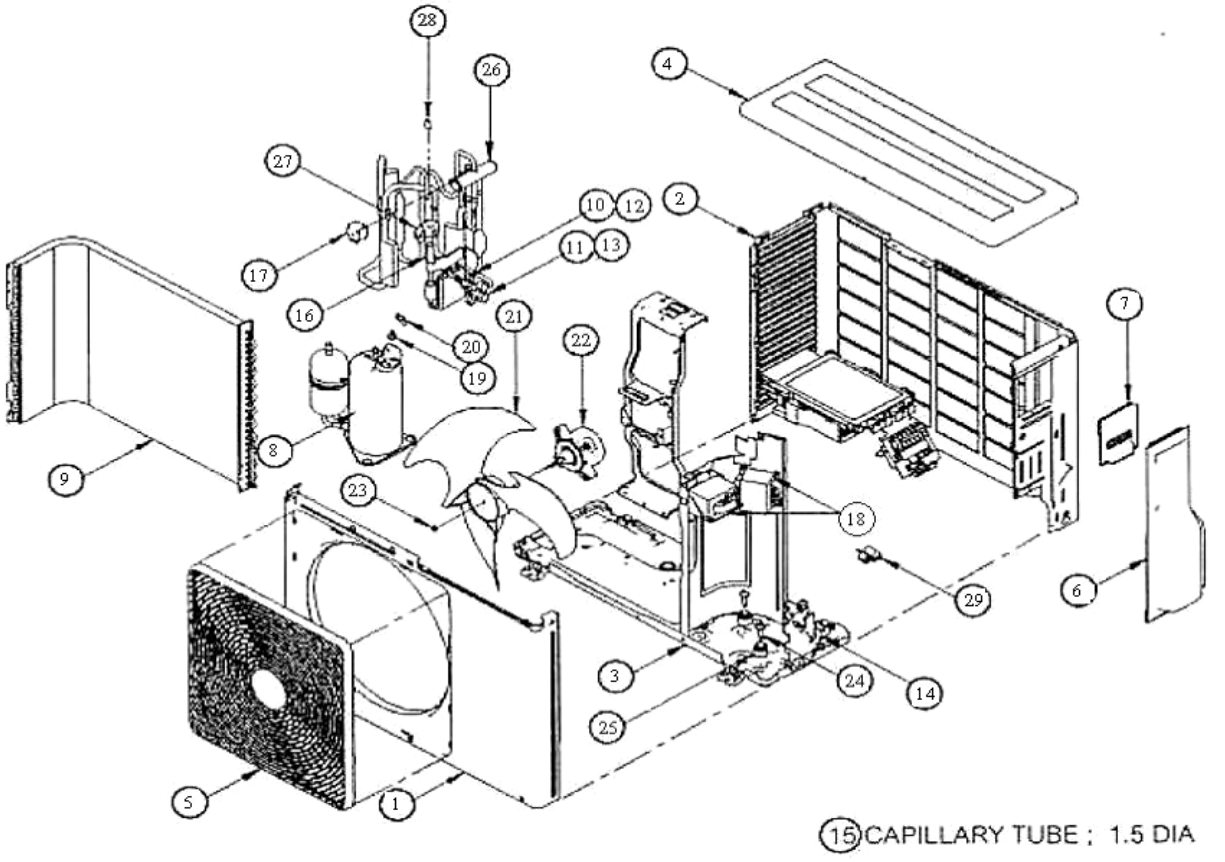
12-2. Indoor Unit



Location No.	Part No.	Description
201	43T00414	FRONT PANEL ASSY
202	43T09342	INLET GRILLE ASSY
203	43T03316	BACK BODY ASSY
204	43T80311	AIR-FILTER(R)
205	43T80310	AIR FILTER (L)
206	43T09328	HORIZONTAL LOUVER
207	43T70002	DRAIN-HOSE
208	43T79301	CAP-DRAIN
209	43T21321	MOTOR; STEPPING
210	43T44366	REFRIGERATION CYCLE ASSY
		(FOR RAS-13NKV-E, NKV-A)
210	43T44367	REFRIGERATION CYCLE ASSY
		(FOR RAS-16NKV-E, NKV-A)
211	43T47006	PIPE; DELIVERY
212	43T47016	PIPE; SUCTION
213	43T49009	SPRING
		(FOR RAS-16NKV-E, NKV-A)
214	43T11301	PIPE SHIELD
215	43T19302	HOLDER SENSOR
216	43T49302	PLATE OF EVA SEAL
217	43T49006	HOLDER FOR PLATE
218	43T22002	ASM-M-BEARING
219	43T39301	BASE; BEARING
220	43T20302	FAN; CROSS FLOW

Location No.	Part No.	Description
221	43T39302	BAND MOTOR-L
222	43T21327	MOTOR FAN
		(FOR RAS-16NKV-E, NKV-A)
222	43T21338	MOTOR FAN
		(FOR RAS-13NKV-E, NKV-A)
223	43T39303	BAND MOTOR-R
224	43T69421	WIRELESS-REMOCO
225	43T85468	OWNER'S MANUAL
225	43T85469	OWNER'S MANUAL
		(FOR RAS-13,16NKV-E)
225	43T85470	OWNER'S MANUAL
		(FOR RAS-13,16NKV-E)
225	43T85471	OWNER'S MANUAL
		(FOR RAS-13,16NKV-E)
225	43T85472	OWNER'S MANUAL
		(FOR RAS-13,16NKV-E)
225	43T85475	OWNER'S MANUAL
		(FOR RAS-13,16NKV-E)
226	43T62302	TERMINAL COVER
227	43T60317	CORD MOTOR LOUVER
228	43T07303	HOLDER PIPE
231	43T82301	PLATE; INSTALLATION
232	43T60316	CORD MOTOR FAN
		(FOR RAS-16NKV-E, NKV-A)

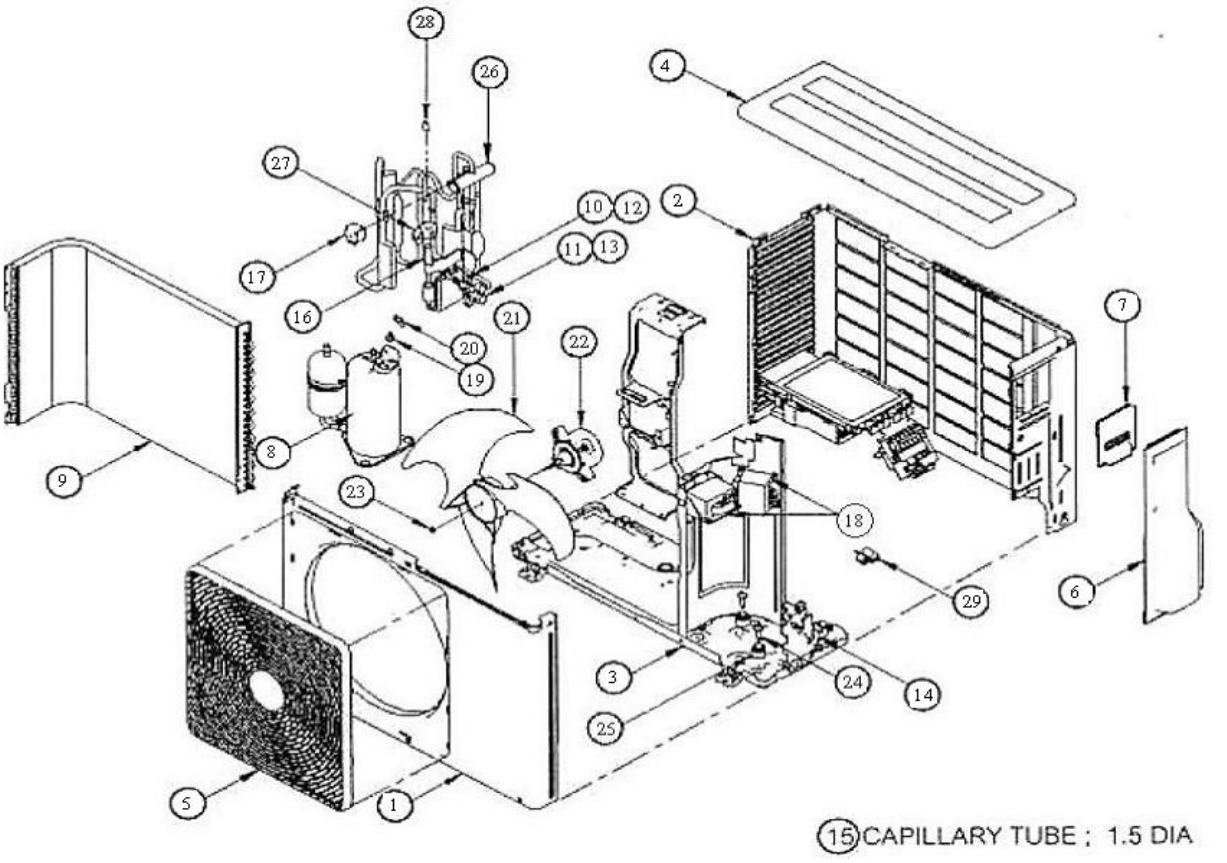
12-3. Outdoor Unit (For 13NAV)



Location No.	Part No.	Description
01	43T00427	FRONT CABINET ASSEMBLY
02	43T00381	BACK CABINET ASSEMBLY
03	43T03329	BASE
04	43T00380	UPPER CABINET ASSEMBLY
05	43T09318	GUARD FAN
06	43T52310	PACKED VALVE COVER ASSEMBLY
07	43T62311	ELECTRIC PART COVER
08	43T41381	COMPRESSOR (DA89X1F-23F)
09	43T43355	CONDENSER ASSEMBLY
10	43T46308	VALVE;PACKED 6.35 DIA
11	43T46011	VALVE;PACKED 9.52 DIA
12	43T47331	BONNET, 6.35 DIA
13	43T47332	BONNET, 9.52 DIA
14	43T63303	FIXING PLATE VALVE
15	43T47008	CAPILLARY TUBE; 1.5 DIA

Location No.	Part No.	Description
16	43T46326	BODY-PMV
17	43T63305	COIL-PMV
18	43T58303	REACTOR
19	43T54304	BIMETAL THERMO
20	43T63005	HOLDER;THERMOSTAT;BIMETAL
21	43T20307	FAN PROPELLER
22	43T21355	MOTOR,FAN
23	43T47001	NUT FLANGE
24	43T47325	BOLT COMPRESSOR (M6)
25	43T49308	RUBBEER CUSHION
26	43T46319	4-WAY VALVE
27	43T63304	4WAY VALVE COIL ASSEMBLY
28	43T63306	HOLDER,SENSOR
29	43T79305	DRAIN NIPPLE

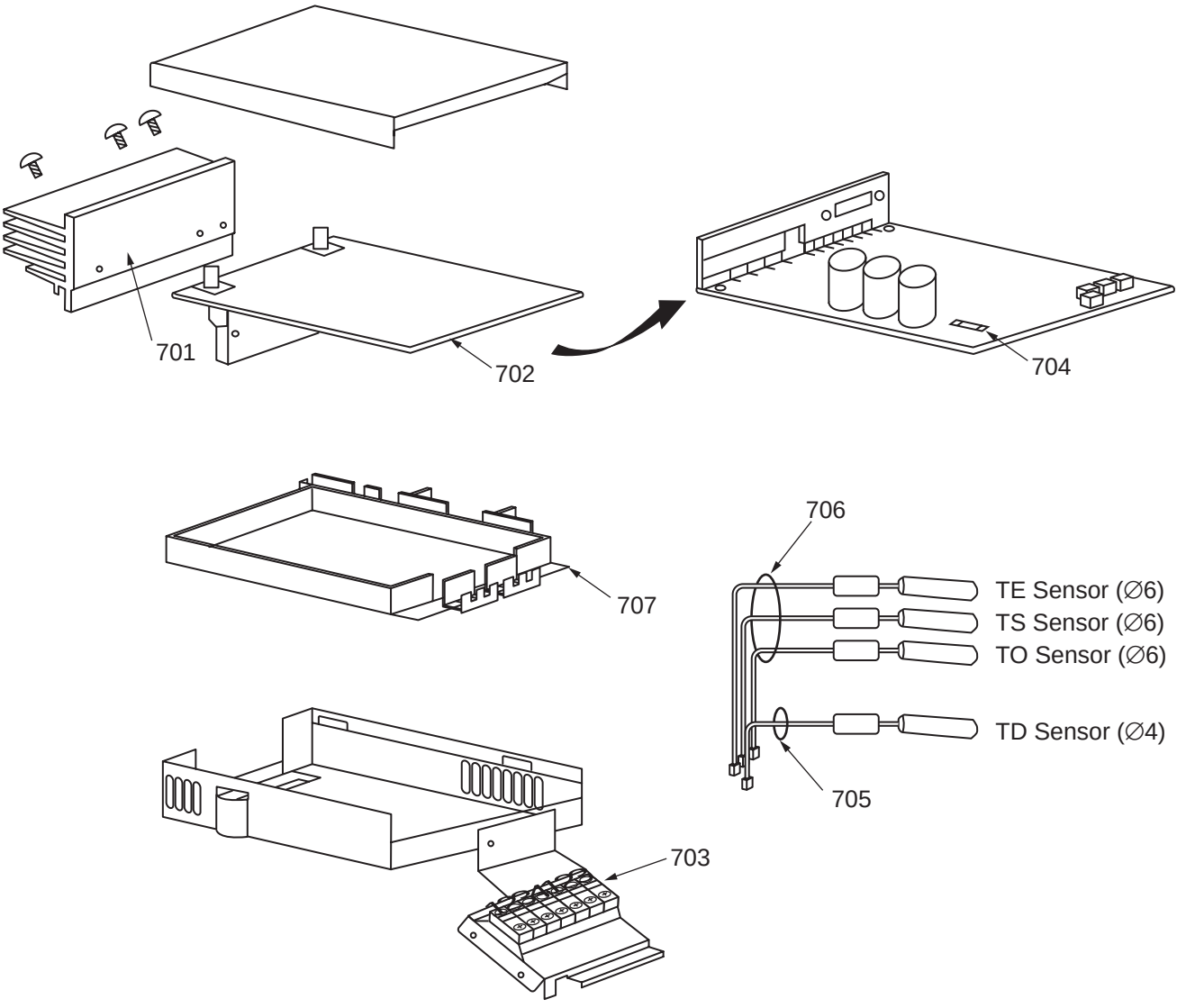
12-4. Outdoor Unit (For 16NAV)



Location No.	Part No.	Description
01	43T00427	FRONT CABINET ASSEMBLY
02	43T00381	BACK CABINET ASSEMBLY
03	43T03329	BASE
04	43T00380	UPPER CABINET ASSEMBLY
05	43T09318	GUARD FAN
06	43T52310	PACKED VALVE COVER ASSEMBLY
07	43T62311	ELECTRIC PART COVER
08	43T41359	COMPRESSOR (DA130A1F-24F)
09	43T43354	CONDENSER ASSEMBLY
10	43T46308	VALVE;PACKED 6.35 DIA
11	43T46307	VALVE; PACKED 12.7 DIA(H4)
12	43T47331	BONNET, 6.35 DIA
13	43T47333	BONNET, 12.70 DIA
14	43T63303	FIXING PLATE VALVE
15	43T47008	CAPILLARY TUBE; 1.5 DIA

Location No.	Part No.	Description
16	43T46326	BODY-PMV
17	43T63305	COIL-PMV
18	43T58303	REACTOR
19	43T54304	BIMETAL THERMO
20	43T63005	HOLDER;THERMOSTAT;BIMETAL
21	43T20307	FAN PROPELLER
22	43T21355	MOTOR,FAN
23	43T47001	NUT FLANGE
24	43T47325	BOLT COMPRESSOR (M6)
25	43T49308	RUBBEER CUSHION
26	43T46319	4-WAY VALVE
27	43T63304	4WAY VALVE COIL ASSEMBLY
28	43T63306	HOLDER,SENSOR
29	43T79305	DRAIN NIPPLE

12-5. Outdoor Unit (E-Parts Assy)



Location No.	Part No.	Description
701	43T62320	HEATSINK (FOR 13NAV)
701	43T62321	HEATSINK (FOR 16NAV)
702	43T69484	PC BOARD (FOR 13NAV)
702	43T69485	PC BOARD (FOR 16NAV)
703	43T60352	TERMINAL BLOCK; 6P

Location No.	Part No.	Description
704	43T60326	FUSE
705	43T50305	TEMPERATURE SENSOR
706	43T50304	TEMPERATURE SENSOR
707	43T62313	BASE-PLATE-PC

TOSHIBA CARRIER CORPORATION