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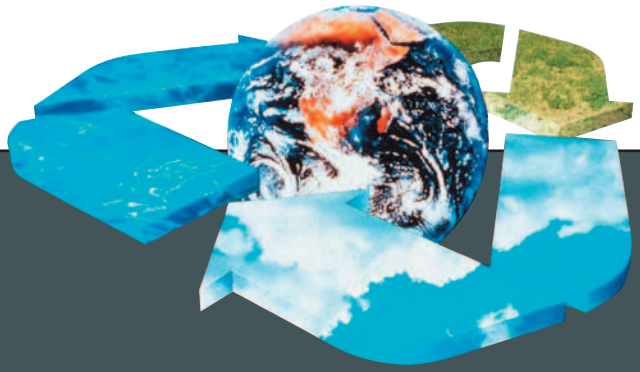
AquaFREE System



Service Manual

Outdoor units:
RAS-(3~5)HVRNE
RAS-(4/5)HRNE

Indoor units:
RWM-(3~5)FSN1E
RWM-(3~5)FSN1E-(4.5/6)H(1/3)
RWM-(3~5)FSN1E-S1
RWM-(3~5)FSN1E-(4.5/6)SH(1/3)

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Contents

Models coding

List of indooor units, outdoor units and accessories available in this service manual

Indoor units					
Wall type					
RWM - AquaFREE (Basic models)		AquaFREE (Models with electric heater)			
Unit	Code	Unit	Code	Unit	Code
RWM-3FSN1E	70900000 NEW	RWM-3FSN1E-4.5H1	70900005 NEW		
RWM-4FSN1E	70900001 NEW	RWM-4FSN1E-6H1	70900008 NEW	RWM-4FSN1E-6H3	70900013 NEW
RWM-5FSN1E	70900002 NEW	RWM-5FSN1E-6H1	70900010 NEW	RWM-5FSN1E-6H3	70900016 NEW
					
RWM					
1~		1~		3~	

Indoor units					
Wall type					
AquaFREE (Basic models for swimming pools)		AquaFREE (Models with electrical heater for swimming pools)			
Unit	Code	Unit	Code	Unit	Code
RWM-3FSN1E-S1	70900022 NEW	RWM-3FSN1E-S1-4.5H1	70900027 NEW		
RWM-4FSN1E-S1	70900023 NEW	RWM-4FSN1E-S1-6H1	70900030 NEW	RWM-4FSN1E-S1-6H3	70900032 NEW
RWM-5FSN1E-S1	70900024 NEW	RWM-5FSN1E-S1-6H1	70900035 NEW	RWM-5FSN1E-S1-6H3	70900038 NEW
					
RWM					
1~		1~		3~	

Meaning of model codification:

RWM 5 FS N 1 E S1 6H 1

- Unit Type (Indoor Unit): RWM
- Capacity (HP): 3.0-4.0-5.0
- System: Sistem Free
- Refrigerant: R410A
- Series
- E : Made in Europe
  – : Made in Japan
- Type: swimming pool
- Model with electric heater: 4.0-6.0
- Power supply:
  1~230V/50Hz
  3~400V/50Hz

Outdoor units					
Utopia DC Inverter					
Unit	Code	Unit	Code	Unit	Code
RAS-3HVRNE	7E878651				
		RAS-4HVRNE	7E878652	RAS-4HRNE	7E875657
		RAS-5HVRNE	7E878653	RAS-5HRNE	7E878658
					
RAS-					
❄ ☀ 1~				❄ ☀ 3~	

Meaning of model codification:

RAS 5 H V R N E

- Unit Type (Outdoor Unit)
- Capacity (HP): 3.0-4.0-5.0
- System: Utopia (Heat/Cool)
- V: Single phase unit (1~230V/50Hz)
  - : Three phases unit (3~400V/50Hz)
- Compresor type: DC Inverter
- R410A Refrigerant
- E : Made in Europe
  – : Made in Japan

Accessories code list

Accesory	Name	Code	Figure
DBS-26	Drain discharging boss	60299192 NEW	
TT-FSN1E	Thermostatic Tank	70900004 NEW	

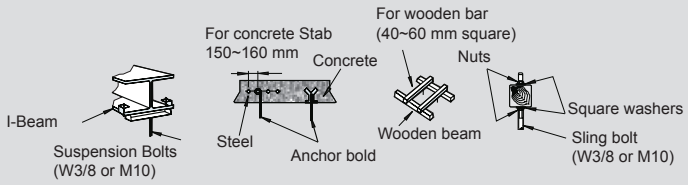
1. Units installation

This chapter provides information about the procedure you must follow to install the UTOPIA DC Inverter outdoor units and the AquaFREE range of Hitachi indoor units.

Contents

Warning

- Check to ensure that the accessories are packed with the indoor unit.
- Do not install the indoor units outdoors. If installed outdoors, an electric hazard or electric leakage will occur.
- It is recommended that the indoor units be installed 1.3 meters from the floor level.
- Pay attention to the following points when the indoor units are installed in a hospital or other places where there are electronic waves from medical equipment, etc.
- Install the indoor units and components as far as practical or at least 3 meters from the electromagnetic wave radiator.
- Prepare a steel box and install the remote control switch in it. Prepare a steel conduit tube and wire the remote control cable in it. Then connect the ground wire with the box and tube.
- Install a noise filter when the power supply emits harmful noises.
- AquaFREE must be installed by a technical service
- AquaFREE installation must comply with local and European regulations
- Mount suspension bolts using M10 (W3/8) as size, as shown below:



Caution

- Outdoor units must be installed in places not accessible to the general public. Install the outdoor unit in an area where people except services engineers cannot touch the unit.
- Do not install the indoor units in a flammable environment to avoid a fire or an explosion.
- Check to ensure that the ceiling slab is strong enough. If it is not strong enough, the indoor unit may fall down on you.
- Do not install the indoor units in a machinery shop or kitchen where vapor from oil or mist flows to the indoor units. The oil will deposit on the heat exchanger, thereby reducing the indoor unit performance, and it may deform. In the worst case, the oil damages the plastic parts of the indoor unit.
- To avoid any corrosive action to the heat exchangers, do not install the indoor units in an acid or alkaline environment.
- The control of temperature is only available through the ambient thermostat.
- Do not use the remote control switch of the indoor unit, otherwise the warranty will be void.

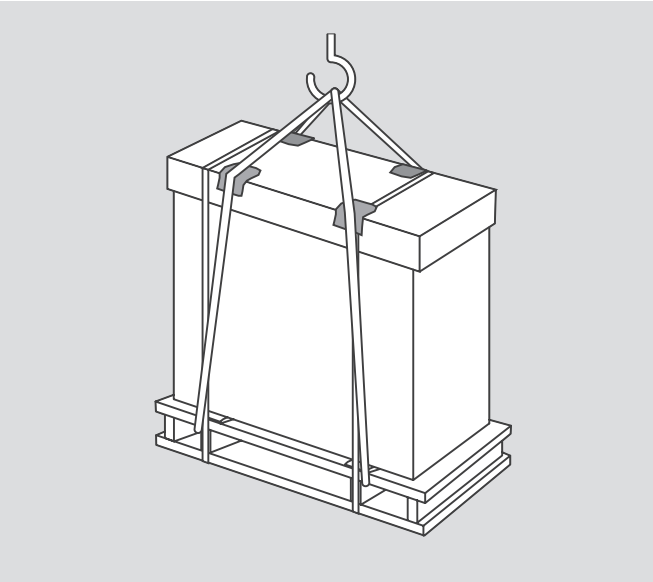
1.1. Transportation of Outdoor Units

Caution
Do not put any material on the product.

Transport the product as close to installation location as practical before unpacking.

Hanging method
When hanging the unit, ensure a balance of the unit, check safety and lift up smoothly.

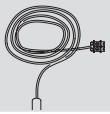
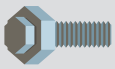
♦ For transportation:
- Do not remove any packing materials.
- Hang the unit with ropes through the wooden base without removing the packaging and apply splints or corrugated paper for unit protection.



1.2. RWM Units

1.2.1. Factory supplied accessories

Make sure that the following accessories are packed with the unit.

Accessory		Qty.	Purpose
Outdoor Thermistor (with cover)		1	Outside ambient temperature
Room's Thermostat (and reciver)		1	Temperature setting
Bracket clip		5	For fixing plastic front cover
Screw		5	For fixing plastic front cover

NOTE:

If any of these accessories are not packed with the unit, please contact your dealer.

Install the unit in area that does not affect other elements if the drain valve blow-off.

It's recommended to install the unit in frost free location.

The space around the unit allows for suficient air circulation.

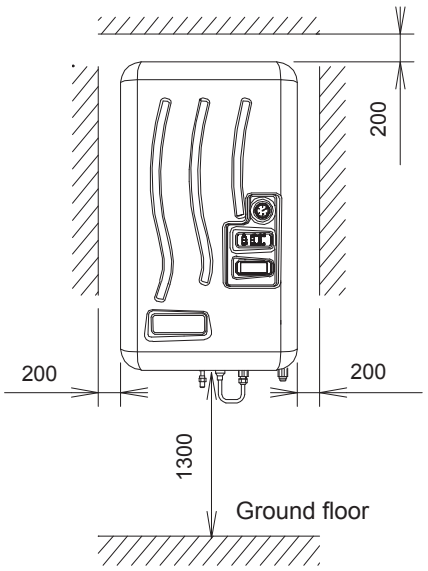
Two people are required to mount the unit.

1.2.2. Initial check

■ Service Space

Install the indoor unit with sufficient clearance around it to provide good conditions for electrical and refrigerant piping connections and for maintenance.

Minimum recommended space:



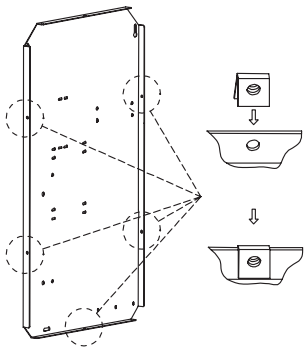
1.2.3. Installation

■ Fixing the module

NOTE:
These clips are necessary in order to attach correctly the plastic front cover to the fixing support plate.

Warning:
The installation surface must be flat, vertical and non combustible.

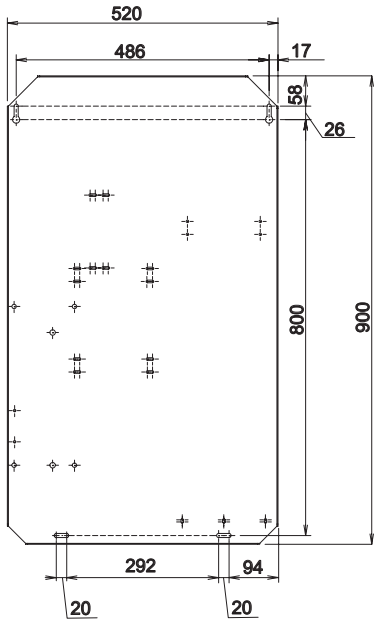
Before installing the fixing support plate, you must put the accessory bracket clip at the indicated locations as shown in the figure:



Use the dimensions of the support plate specified above to select the final location of the module; respect the spaces reserved for piping, wiring and maintenance.

Check that the bolts are well secured before placing the hood on the indoor unit.

Fixing support plate:
(units: mm)



Use the accessory screws to attach the Plastic front cover to the Fixing support plate. Do it at the bracket clips location.

■ Outdoor Thermistor Installation

The outdoor thermistor installation must be located in the external area. The thermistor will be connected in PCB AquaFREE Module.

Notes: ☛

- It is recommended to install the outdoor thermistor in a shadowed area, to avoid sun exposition and prefering north or west installation.
- The outdoor thermistor is supplied with the unit.
- The outdoor thermistor is supplied with a cover.
- Large cable is 1.5 m. It can be extended up using the same cable section.

1.3. HVRNE Units

WARNING:

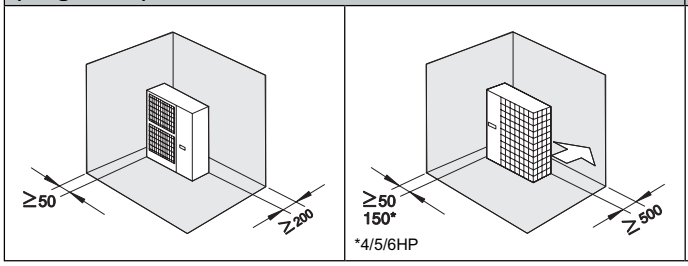
- *Install the outdoor unit with sufficient clearance around it for operation and maintenance as shown in the next figures.*
- *Install the outdoor unit where good ventilation is available*
- *Do not install the outdoor unit where is a high level of oil mist, salty air or sulphurous atmosphere.*
- *Install the outdoor unit as far as practical (being at least 3 meters) from electromagnetic wave radiator (such as medical equipment).*
- *Keep clearance between the units of more than 50 mm, and avoid obstacles that may hamper air intake, when installing more than one units together.*
- *Install the outdoor unit in the shade or not exposed to direct sunshine or direct radiation from high temperature heat source.*

CAUTION::

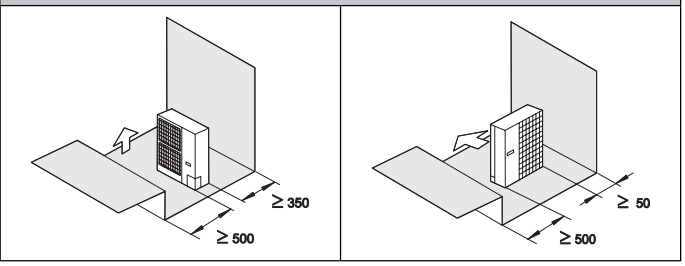
- *Check to ensure that the foundation is flat, level and sufficiently strong.*
- *Install the unit in a restricted area not accessible by the general public*
- *Aluminum fins have very sharp edges. Pay attention to the fins to avoid injury.*
- *Do not modify the factory settings of PC-P1HE or PC-P2HTE.*

1.3.1. Installation space

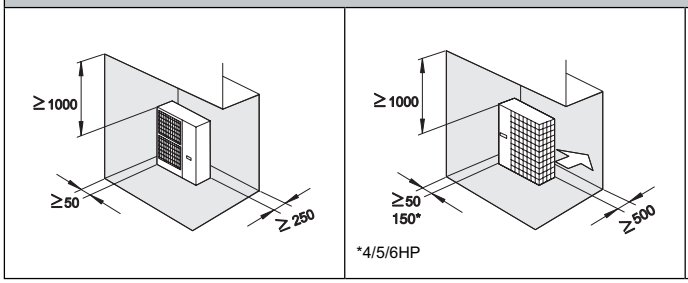
a) In case of front side and either of the sides are open (single unit)

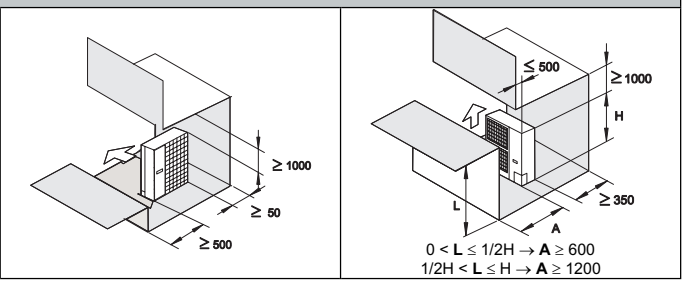


b) In case that surrounding wall exist (single unit)

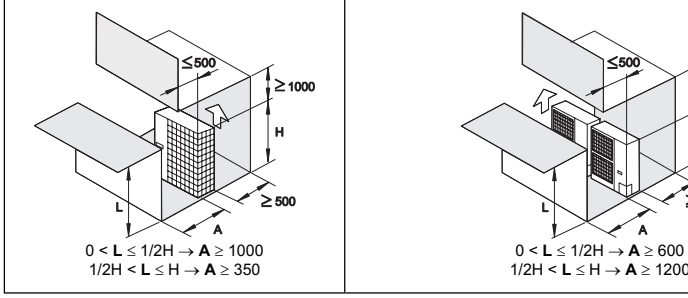


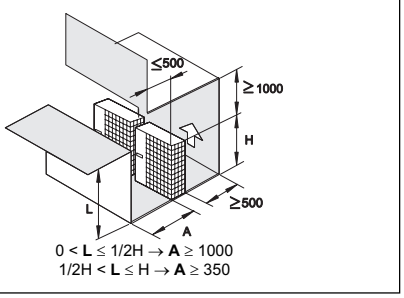
c) In case that upper side obstacles exist (single unit)





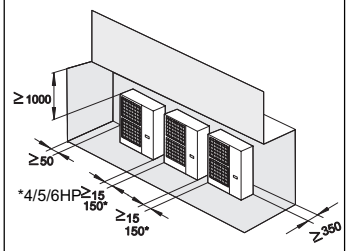
d) In case that upper side obstacles exist (serial units)

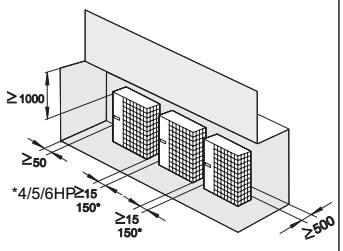


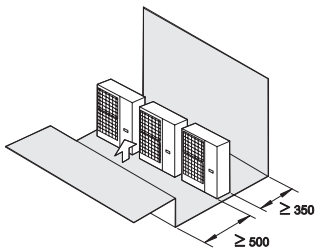


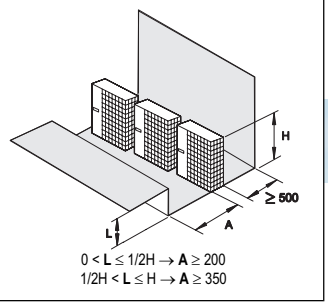
(mm)

e) In case of front side and either of the sides are open (serial units)	f) In case that surrounding wall exist (serial units)



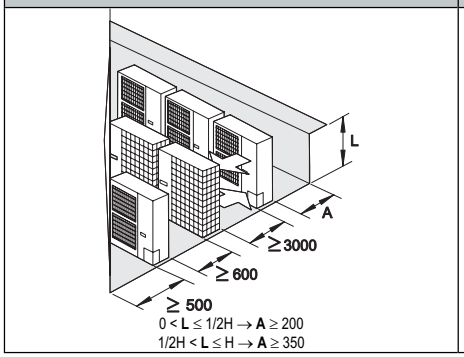


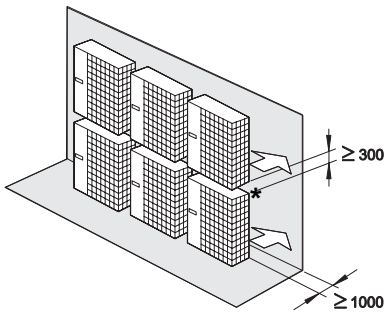


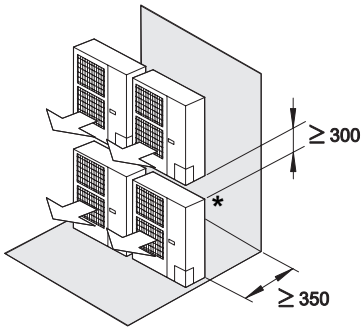


(mm)

g) Horizontal (multiple units)	h) Vertical (multiple units)





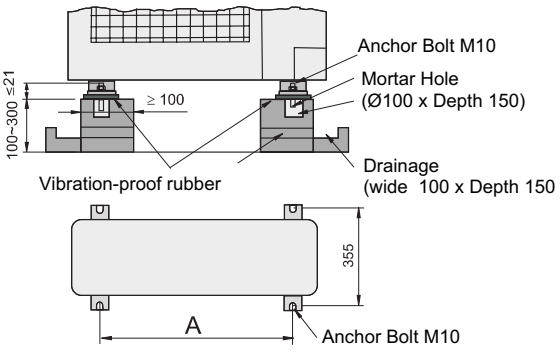


– Do not stack more than two units in height
– Close gap (*) to avoid recirculating discharge air flow

1.3.2. Installation place provision

■ Concrete Foundation

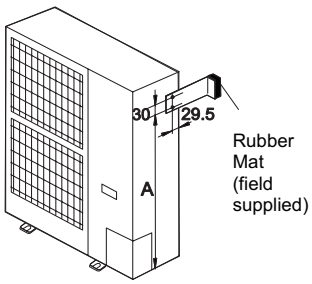
– Foundation could be on flat and is recommended be 100-300 mm higher than ground level.
– Install a drainage around foundation for smooth drain.
– When installing the outdoor unit fix the unit by anchor bolts of M10.
– When installing the unit on a roof or a veranda, drain water sometimes turns to ice on a cold morning. Therefore, avoid draining in an area that people often use because it is slippery.



Outdoor Unit (HP)	A (mm)
3	530
4/5	600

■ Fix Unit to the wall

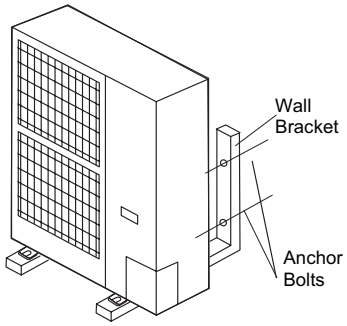
– Fix the Unit onto the wall as the figure indicates. (field supplied stay)
– Ensure the foundation so that avoid the deforming and noise.
– In case of prevention from vibration transfer to the building, use rubber Mat.



For 3HP, A = 511 mm
For 4/5HP, A = 796 mm

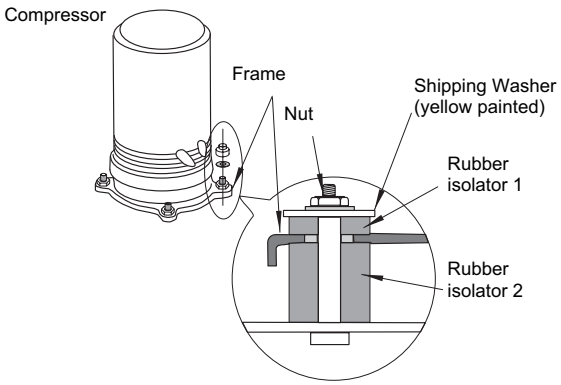
■ Suspended unit

– Suspended the unit as the following drawing indicate.
– Ensure that wall can resist the Outdoor unit weight indicated in specification label plate.
– It is recommended to select each foot support to bear the full weight of the unit (in order to consider stress fatigue applied when unit is working too).



1.3.3. Remove shipping washer

Remove the two shipping washer (yellow-painted)
Securely tighten the nuts again



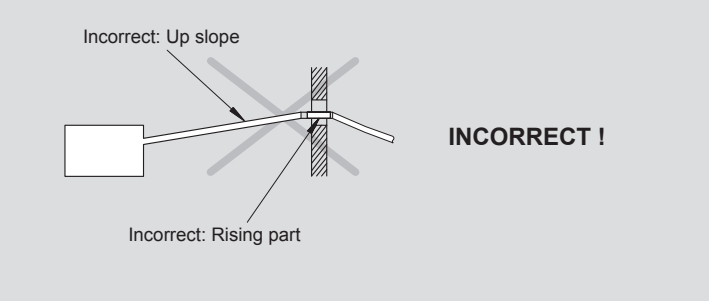
2. Piping installation

This chapter describes the procedure that you must follow to create the electrical wiring connection for the UTOPIA DC Inverter outdoor units and the AquaFREE range of Hitachi indoor units.

Contents

Caution

– *Do not create an up-slope for the drain pipe. If you do so, the drain water will flow back to the unit. Then, leakage to the room will occur when the unit operation is stopped.*



– *Do not connect the drain pipe with the sanitary piping, the sewage piping or any other drainage piping.*
– *The drain pipe will require insulation if it is installed in a location where condensation may form on the outside of drain pipe. This condensation may drop and cause damage.*

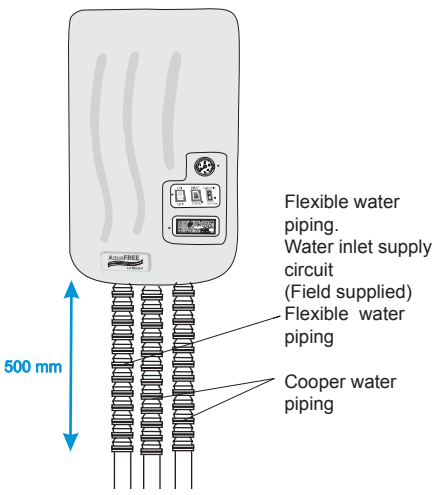
  The insulation for the drain pipe must be selected in order to ensure that the vapor is sealed and in order to prevent the condensation from forming.
– *Do not tie or clamp the drain pipe and the refrigerant pipe toghether.*
– *Pay attention to the thickness of the insulation material when the left-side piping is installed. If the insulation material is too thick, you cannot install the piping in the unit.*
– *Use refrigerant R410A in the refrigerant cycle. Do not charge oxigen, acetylene or other flammable or poisonous gases into the refrigerant cycle when performing a leakage test or an air-tight test.*
– *This type of gases are extremely dangerous and can cause an explosion. It is recommended that compressed air, nitrogen or refrigerant be used for this types of test.*
– *Check to ensure that no pressure exists inside the stop valve before removing the flange.*

The quality of the water that you need is the standard water without any material that can cause damage inside the piping system.

Example:

Item	Water System	
	Supply Water	
Standard Quality pH	(25 °C)	6.8 ~ 8.0
Electrical Conductivity	(mS/m) (25°C)	Less than 30
	{µS/cm} (25°C) (2)	Less than 300
Chlorine Ion	(mg Cl^-/l)	Less than 50
Sulphur Acid Ion	(mg $SO42^-$/l)	Less than 50
The Amount of Acid Consumption	(pH 4.8) (mg CaCO3/l)	Less than 50
Total Hardness	(mg CaCO3 /l)	Less than 70
Calcium Hardness	(mg CaCO3 /l)	Less than 50
Silica L	(mg SIO2 /l)	Less than 30
Reference QualityTotal Iron	(mg Fe/l)	Less than 0.3
Total Copper	(mg Cu/l)	Less than 0.1
Sulphur Ion	(mg $S2^-$/l)	It shall not be detected.
Ammonium Ion	(mg NH4+/l)	Less than 0.1
Remaining Chlorine	(mg Cl/l)	Less than 0.3
Floating Carbonic Acid	(mg CO2/l)	Less than 4.0
Index of Stability		-

When connecting the water piping to the indoor unit, it is necessary to install 500 mm of flexible water piping from the indoor unit, in order to avoid metal expansion problems due to temperature. After these 500 mm, install cooper piping.



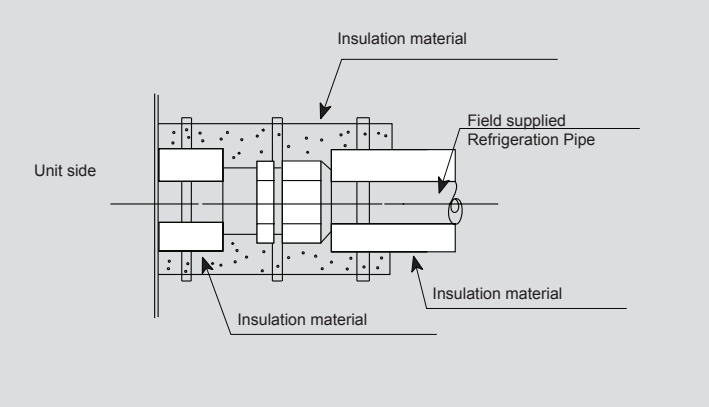
2.2. Piping work connection considerations

2.2.1. Piping materials

1. Prepare locally-supplied copper pipes.
2. Select the piping size with the correct thickness and correct material which can have sufficient pressure strength, considering that R410A pressure is higher than R407C. Use the table below to select the required pipe.

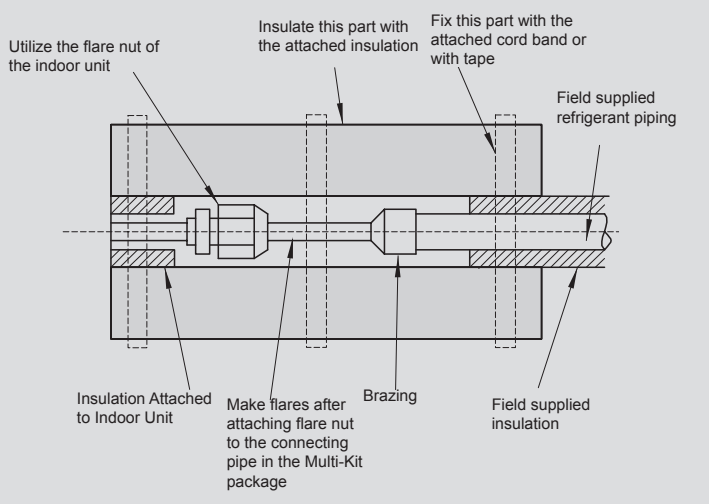
Nominal Diameter (mm)	(in)	Thickness (mm)	Cooper type
6.35	1/4	0.80	Roll
9.53	3/8	0.80	Roll
12.70	1/2	0.80	Pipe/Roll
15.88	5/8	1.00	Roll

3. Select clean copper pipes. Make sure there is not dust and moisture inside. Blow the inside of the pipes with oxygen free nitrogen to remove any dust and foreign materials before connecting pipes.
4. After connecting the refrigerant piping, seal the open space between Knockout hole and refrigerant pipes by using insulation material as shown bellow:



■ Piping Connection

Fix the connecting pipe as shown in the following figure. Utilize the insulation attached to the Indoor Unit.

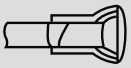


Caution:

- Utilize clean copper pipes without any moisture or foreign material on the internal surface of pipes. When connecting refrigerant piping, cut copper pipes with a pipe cutter and blow the pipes with nitrogen.
- Do not use a saw and a grindstone or others which cause copper powder.
- When cutting pipes, secure the part for brazing in accordance with the national and local regulations

Note:

A system with no moisture or oil contamination will give maximum performance and lifecycle compared to that of a poorly prepared system. Take particular care to ensure all copper piping is clean and dry internally.

Correct	Incorrect
	

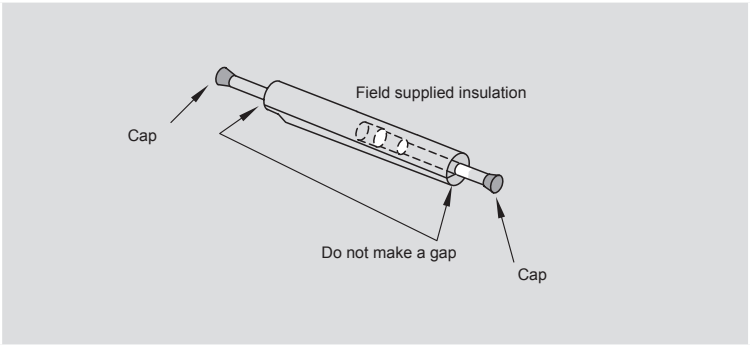
Caution:

- Cap the end of the pipe when pipe is to be inserted through a hole
- Do not put pipes on the ground directly without a cap or vinyl tape at the end of the pipe
- If piping installation is not completed until next day or over a longer period of time, braze off the ends of the piping and charge with oxygen free nitrogen through a Schrader valve type access fitting to prevent moisture and particle contamination.
- Do not use insulation material that contents NH3 because can damage cooper pipe material and can be a source of future leakage

■ Insulation

Attach insulation to field supplied piping for prevention of the capacity decrease according to the ambient air conditions and dewing on the pipe surface by the low pressure.

For Line Branch:



Note:

When polyethylene foam is applied, a thickness of 10 mm for the liquid piping and 15 mm to 20 mm for the gas piping is recommended.

Caution:

– Perform insulation work after the surface temperature decreases to the room temperature, If not, insulation material may melt.

– If the ends of the piping system are open after accomplishing piping work, securely attach caps or vinyl bags to the ends of the piping, avoiding the invasion of moisture and dust.

2.2.2. Three principles on refrigerant piping work

In case of the refrigeration cycle with refrigerant R410A, refrigeration oil should be of synthetic type. Therefore, the oil absorbs moisture quickly when compared with R407C systems and it will cause sludge and oxidation of the oil.

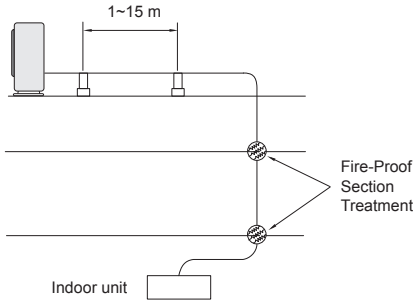
Due to this reason, pay much careful attention to basic piping work control to avoid infiltration of moisture or dusts during refrigerant piping work.

Three Principles	Cause of failure	Presumable Failure	Preventive Action
1. Dry Keep good dryness	Water Infiltration due to insufficient protection at pipe ends. Dewing inside of Pipes Insufficient Vacuum Pumping Time	Icing Inside Tube at Ex. Valve (Water Choking) + Generation of Hydration and Oxidation of Oil ⇩ Clogged Strainer, etc., Insulation Failure and Compressor Failure	Pipe Protection ⇩ 1 Pinching ⇩ 2 Taping Flushing ⇩ Vacuum Drying One gram of water turns into gas (approx. 1000 lrs) at 1 Torr.Therefore, it takes long time to vacuum-pump by a small vacuum pump
2. Clean No dust Inside of Pipes	Infiltration of Dusts, etc. from Tube Ends Oxidation Film during Brazing without Blowing Nitrogen Insufficient Flushing by Nitrogen after Brazing	Clogging of Ex. Valve, Capillary Tube and Filter ■ Oxidation of Oil ■ Compressor Failure ⇩ Insufficient Cooling or Heating Compressor Failure	Pipe Protection ⇩ 1 Mounting Caps ⇩ 2. Taping ⇩ 3. Pinching Flushing
3. No leakage No leakage shall exist	Brazing Failure Failed Flaring Work and Insufficient Torque of Squeezing Flare Insufficient Torque of Squeezing Flanges	Refrigerant Composition Change, Refrigerant Shortage ■ Performance Decrease ■ Oxidation of Oil ■ Overheating of Compressor ⇩ Insufficient Cooling or Heating Compressor Failure	Careful Basic Brazing Work ⇩ Basic Flaring Work ⇩ Basic Flange Connecting Work ⇩ Air Tight Test ⇩ Holding of Vacuum

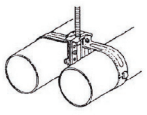
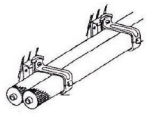
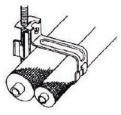
2.2.3. Suspension of refrigerant piping

Suspend the refrigerant piping at certain points and prevent the refrigerant piping from touching the weak part of the building such as wall, ceiling, etc…

If touched, abnormal sound may occur due to the vibration of the piping. Pay special attention in case of short piping length.



Some examples for suspension method are shown below

For suspendig heavies	For piping along the wall	For instant installation work
		

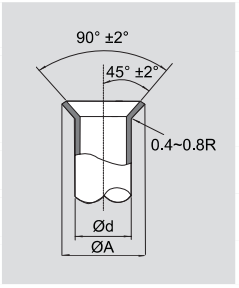
Caution

Do not fix the refrigerant piping directly with the metal fittings (The refrigerant piping may expand and contract).

2.2.4. Tightening torque

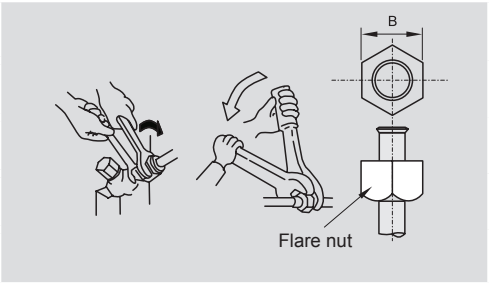
1. Flaring connections (smaller than a diameter of Ø19.05) are generally used. However, if incorrect flaring is performed, it will cause serious refrigerant leakage.
2. Shape after flaring, it should be rectangular and flat, and no uneven thickness, cracks and scratches should exist.

Nominal diameter Ød		Dimension ØA
(inches)	(mm)	(mm)
1/4	6.35	9.1
3/8	9.53	13.2
1/2	12.70	16.6
5/8	15.88	19.7



When tightening the flare nuts, use two spanners, as shown in the figure.

Pipe diameter (mm)	Size B (mm) (R410A)
Ø6.35	17
Ø9.53	22
Ø12.70	26
Ø15.88	29



The required tightening torque is as follows:

■ Indoor Units

Pipe size (mm)	Tightening Torque (Nm
Ø6.35	20
Ø9.53	40
Ø12.70	60
Ø15.88	80

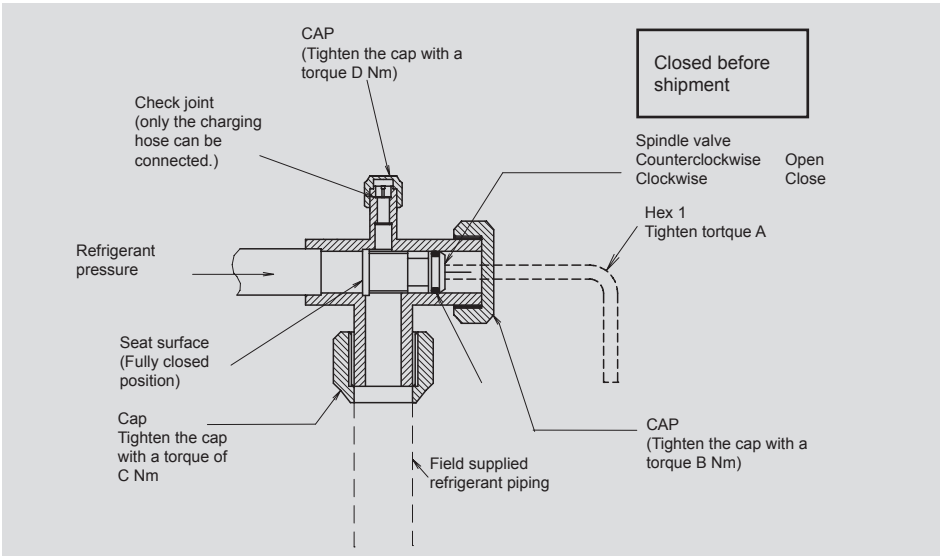
■ Outdoor Units

Operation of the stop valve should be performed according to the figure below.

	Tighten torque (N·m)				Size (mm)
	A	B	C	D	Hex 1
Liquid	7~9	33~42	33~42	14~18	4
Gas	11~12	14~18	68~82	8~12	4

Caution:

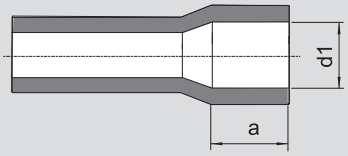
- Do not apply force to the spindle valve at the end of opening (5 N·m or smaller). The back seat construction is not provided.
- During the test run, fully open the spindle. If it is not fully opened, the devices will be damaged.



2.2.5. Brazing work

1. The most important work in the refrigerant piping work is brazing work. If leakage due to careless mistakes hydration generation accidentally occurs, it will cause clogged capillary pipes or serious compressor failure.
2. Pipe dimensions after expanding:
   It is important to control the clearance of the pipe fitting portion as shown below. In the case that a cooper tube expansion jig is used, the following dimensions should be secured.

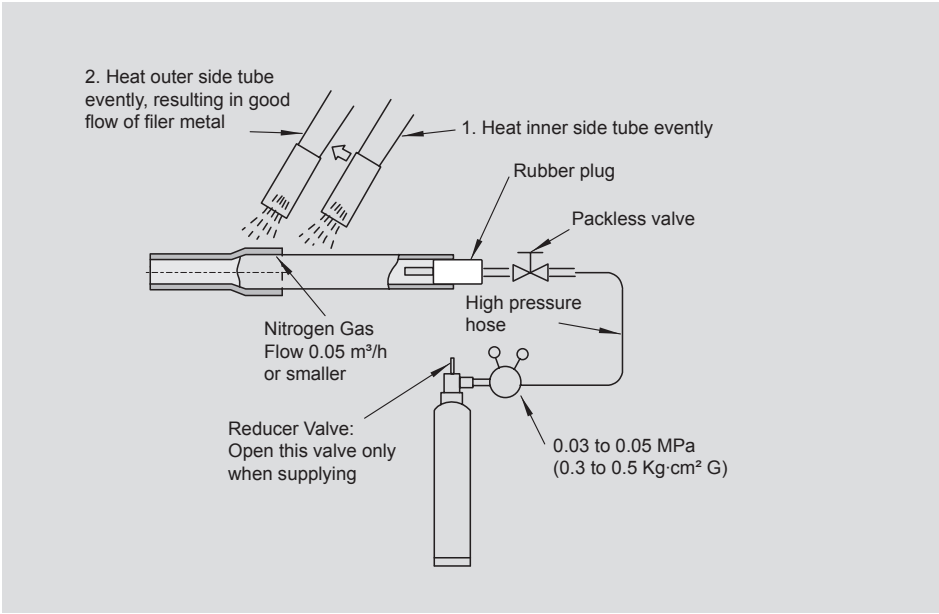
Pipe size	Ød1	Gap	a
Ø6.35 ±0.08	Ø6.35 +0.1	+0.33 +0.07	6
Ø9.53 ±0.08	Ø9.70 +0.1	+0.35 +0.09	8
Ø12.70 ±0.08	Ø12.9 +0.1	+0.38 +0.19	8
Ø15.88 ±0.09	Ø16.1 +0.1	+0.41 +0.13	8



Attention:

- Use nitrogen gas for blowing during pipe brazing. If oxygen, acetylene or fluorocarbon gas is used, it will cause an explosion or poisonous gas.
- A lot of oxidation film will occur inside of tubes if no nitrogen gas blowing is performed during brazing work. This film will be flecked off after operation and will circulate in the cycle, resulting in clogged expansion valves, etc. This will cause bad influence to the compressor.
- Use a reducer valve when nitrogen gas blowing is performed during brazing. The gas pressure should be maintained within 0.03 to 0.05 MPa. If a excessively high pressure is applied to a pipe, it will cause an explosion

A basic brazing method is shown below.

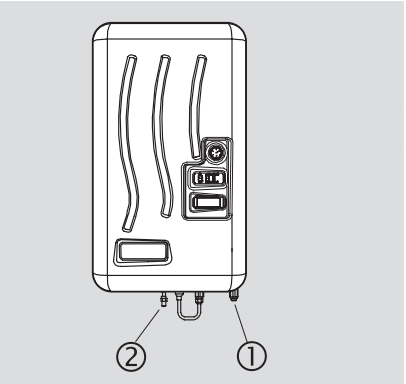


2.3. RWM Unit

■ Refrigerant piping

The position of the piping connection is the following:

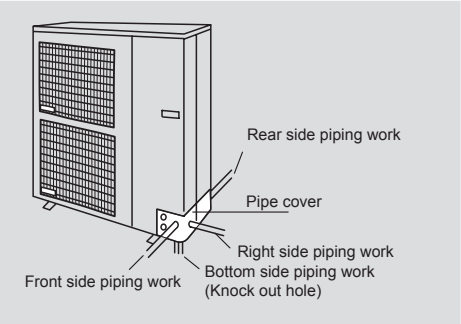
Indoor unit	① Gas piping mm (in)	② Liquid Piping mm (in)
RWM-3~5	Ø15.88 (5/8”)	Ø9.53 (3/8”)



2.4. H(V)RNE Unit

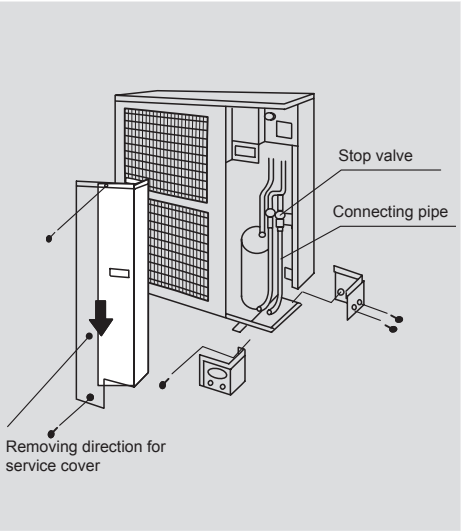
2.4.1. Refrigerant piping position

Pipes can be connected from four directions as shown. Make a hole at the front pipe cover or rear pipe cover to pass through the hole



Remove the service cover as shown in figure before piping connection.

– Remove fixing screws.
– Slightly open the upper side and lift the service cover upward, then slowly pull it forward to the front side.

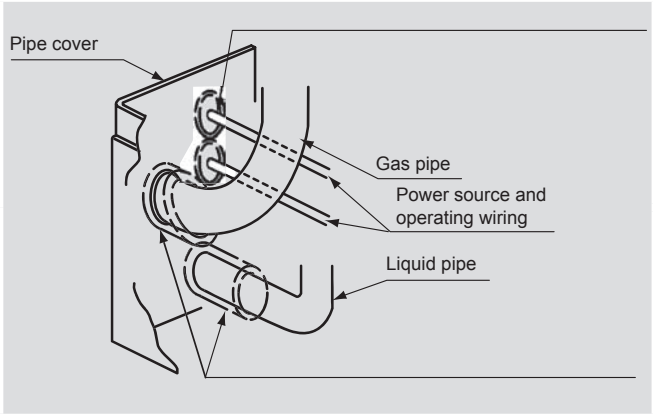


2.4.2 Piping connection

– Select the most suitable piping direction.

– Remove the pipe cover and the service cover from the unit, cut off the part of the holes along the guideline (on the rear side of the pipe cover) and cut the edge of the holes.

– Attach the rubber bush (Factory-Supplied) and insulation before connecting the pipe in the flare nut. Later, it would be impossible to pass the insulation or the rubber bush through the pipe and it would remain an undesired gap for where water or animals could enter inside the unit.



Rubber Bush (Accessory)
Add cross cutting to the center of the rubber bushing.Attach rubber bushing to the hole for wiring.In case that conduit tube is used, rubber bush is not necessary

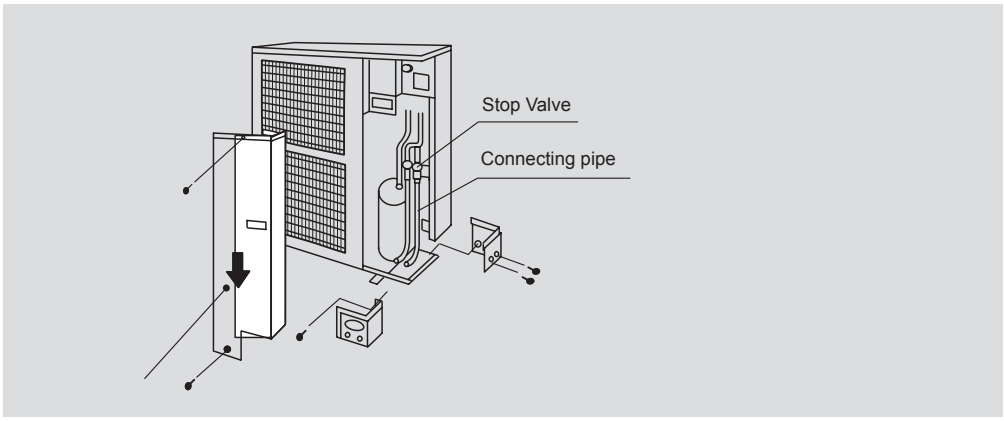
Attach insulation to the pipe as shown in the figure and space shall not exist at the piping hole.Cut insulation as shown in the figure when attaching work is difficult

– Connect the Pipes and the Wiring to the unit.

– If the field-supplied piping is connected with stop valves directly, it is recommended to use a tube bender.

– Fix the Service Cover and the Pipe Cover.

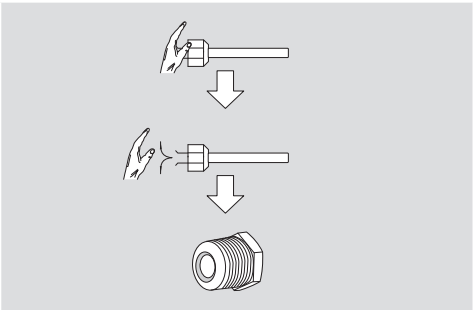
– Finally, seal the open space between knockout hole and refrigerant pipes by using insulation material. If not, animals or water will enter inside the unit and electrical parts will be damaged.



2.4.3. Flushing refrigerant pipes

It is required to remove oxidation film, moisture or dusts in case of insufficient nitrogen blow during brazing, or careless handling of tubes.

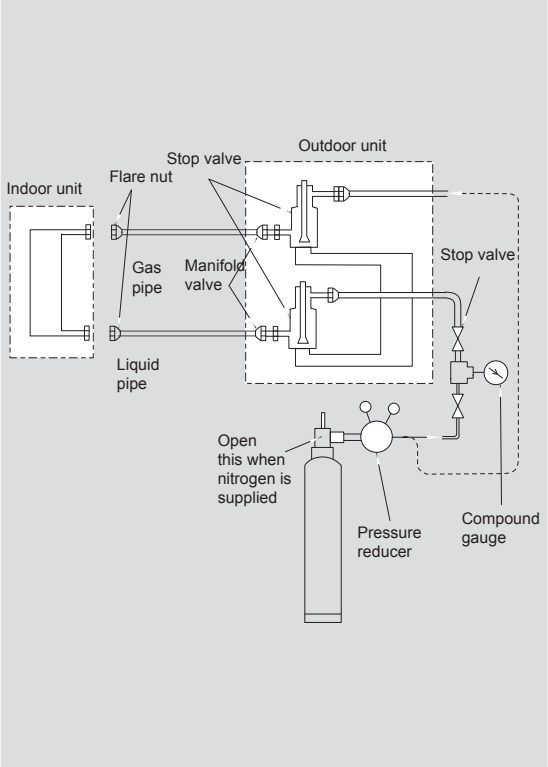
Release the pressure at a time after the hand can not close due to the pipe and pressure.
Attach a flare plug and close the end until flushing work is completely performed.



– Open the stop valve of a nitrogen cylinder and increase the pressure up to 5 bar through a reducer valve.
– Check to ensure that nitrogen gas is discharged from de service port in the outdoor unit.

Flushing:

– Perform flushing work for the pipes to the indoor units one by one
– Close the outlet of the pipe by hand. Release the pressure at a time after the hand can not close the pipe end due to pressure. (first flushing).
– Release the pressure at a time after the hand can not close the pipe end due to pressure. (second flushing).
– Check the contents and quantity of dusts by applying cloth at the end of the pipe at flushing. If slight water is detected, perform a vacuum drying to remove moisture completely.
– Perform the same work for gas piping after liquid piping.



2.4.4. Air tight pessure test

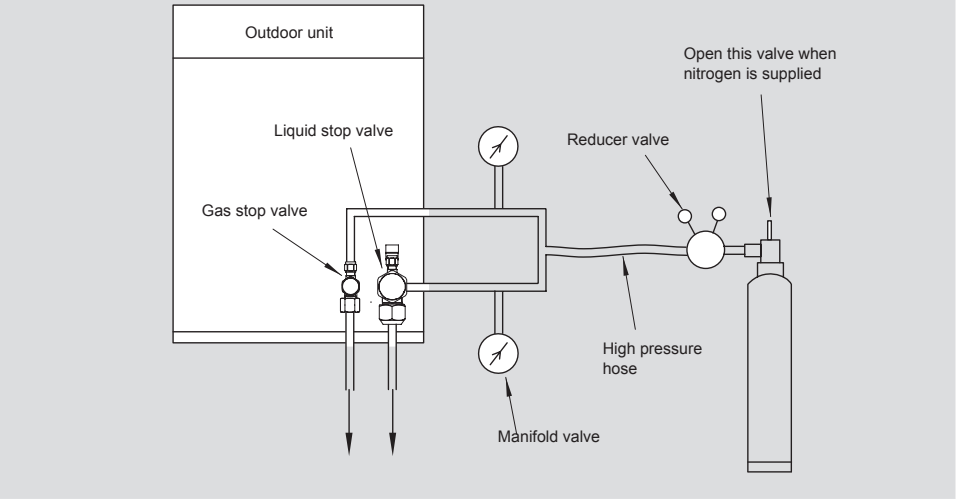
After perform the piping work, brazing work and before to change new refrigerant R410A, it is required to check that brazing is completely performed without any leakage after refrigerant pipe brazing. In particular, the new refrigerant R410A, operates in a higher pressures than R407C. Therefore, it needs more careful brazing work.

1. Connect a manifold gauge to the check joint an the liquid side and gas side stop valves. Gradually increase the pressure step by step without opening the stop valves.

Step 1	0.5 MPa (~ 5 kg· cm²)	5 minutes or over	⇨ able to find small small leakage
Step 2	1.5 MPa (~ 15 kg· cm²)		
⇩			
Step 3	4.15 MPa (~ 41.5 kg· cm²)	24 hours or over	⇨ able to find fine leakage

Caution:

- Nitrogen gas should be used for an air tight test. If accidentally oxygen or acetylene or fluorocarbon gas is used, it will cause an explosion or poisonous gas.



2. Perform an air tight test with a pressure of 4.15 MPa (= 41.5 kg·cm²) for R410A holding for 24 hours. If no pressure decrease is observed, it is judged that no leakage exist. If a pressure decrease is observed, check for leakage. However, in the case that there is ambient temperature difference between the pressure applying time and the final check time, perform the following temperature correction, since pressure are different according to an ambient temperature by approx. 0.01 MPa (=0.1 kg·cm²) per 1°C.

   Correction:

   Temp at Pressure Applying Time – (Temp. at Checking Time) x 0.01 MPa (or 0.1 kg·cm²)

Example	Pressure	Temperature
When pressure is applied	4.15 MPa (41.5 kg·cm²) R410A	28°C
After 24 hours	4.10 MPa (41.0 kg·cm²) R410A	23°C
Correction	(28-23) x { 0.01=0.05 MPa / 0.1=0.5 kg·cm²	5°C

3. If any leakage is detected locate it as follows:
   – Check by Listening: Listen to sound from a leakage portion
   – Check by touching: Check for a leakage portion by touching
   – Check by foaming agent: Apply foaming agent

2.4.5. Vacuum drying

The purpose of vacuum drying is to dry inside of the refrigeration cycle by decreasing pressures, evaporating moisture and discharging moisture and air from the refrigeration cycle. It is requires to strictly perform vacuum pumping work, due to its characteristics of the refrigerant R410A and lubrication oil. If moisture remains inside of the refrigerating cycle, will cause hydration, resulting in abnormal pressure due to clogging in the refrigeration cycle, also oxidation reaction with synthetic oil will cause insulation deterioration of the compressor motor.

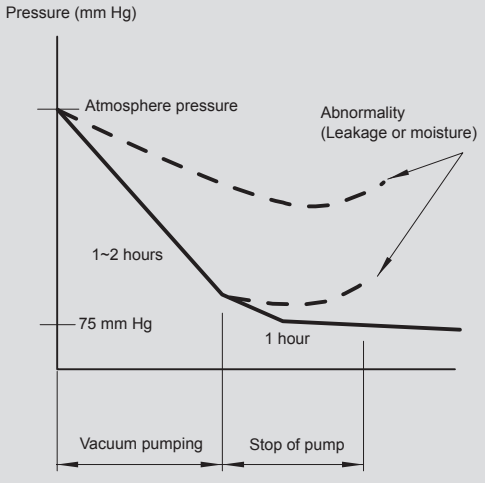
Perform vacuum pumping until an appropriate vacuum degree is obtained due to its high absorption.

Use a good vacuum pump, which provides a high vacuum degree performance

Use a new manifold valve and a charging hose only for the new refrigerant.

Perform vacuum pumping work according to the following procedures.

1. Check to ensure that the liquid and gas stop valves are completely closed.
2. Connect a manifold valve, a vacuum pump, a vacuum gauge for the new refrigerant to stop valves.
3. Operate the vacuum pump for more than 2 hours until.



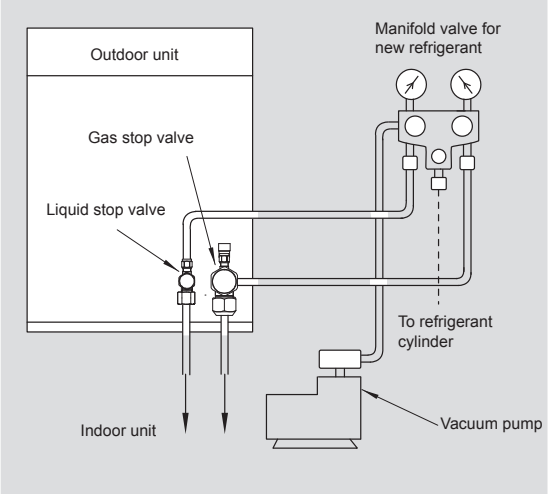
In the case that the vacuum degree of –755 mmHg is not available, check for any leakage, since a leakage or existence of moisture is suspected.

After the check, operate the vacuum pump more than one hour.

■ Evaporation of water

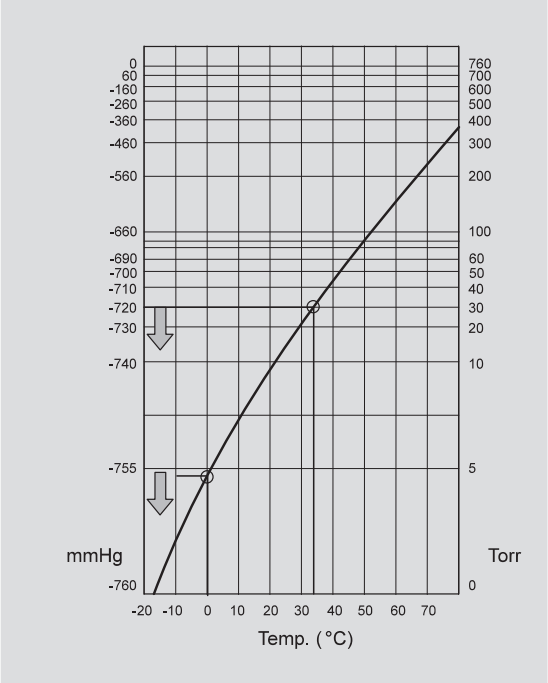
Water boiling temperature is 100 °C under atmosphere. However, boiling point decreases when vacuum degree is increased.
Therefore, the higher vacuum degree is, the higher vacuum drying is available.

In the case that dewing inside piping is suspected, it is not easy to obtain the high vacuum degree due to dew evaporation and it requires to control the degree strictly. It is preferable to obtain a vacuum degree of –755mmHg (5 to 2 Torr).



■ Check of vacuum degree

The vacuum degree should be checked by a vacuum gauge. However, vacuum degree reading is not available by the gauge connected to the manifold valve. It is recommended that a digital type vacuum gauge be used.



2.4.6. Refrigerant charge procedure

After finish the sumarized evacuation procedure, refrigerant charging procedure should be performed according to the next instructions:

1. The stop valves have been closed before shipment, however, ensure that the stop valves are closed completely.
2. Connect the indoor unit and the outdoor unit with field-supplied refrigerant tubes.
3. Connect the gauge manifold using charging hoses to a vacuum pump, a refrigerant charging cylinder and a nitrogen cylinder to the check joint of the liquid line stop valve.
4. Check for any gas leakage at the flare nut connection, by using oxygen free nitrogen gas to increase the pressure inside of the field-supplied tubes.
5. Operate the vacuum pump until the pressure decreases lower than a pressure of -756 mm Hg in vacuum.
6. Charge refrigerant (only if necessary according to data in chapter 7 of Technical Catalog) by opening the gauge manifold valve. If the required quantity cannot be charged, follow procedures (7) to (9). Otherwise proceed step (10).
7. Fully open the gas line stop valve
8. Slightly open the liquid line stop valve
9. Charge the required refrigerant by operating the system (Setting the remote control switch at cool)
10. Fully open the liquid line stop valve after completing refrigerant charge.

Note:

An excess or a shortage of refrigerant is the main cause of trouble to the units. Charge the correct refrigerant quantity as indicated in chapter 7 of Technical Catalog.

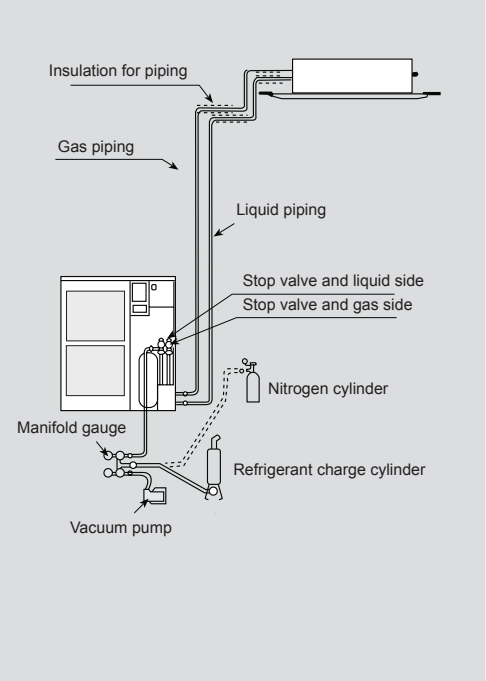
Caution

- Do not charge OXYGEN, ACETYLENE, or other flammable and poisonous gases into the refrigerant cycle when performing a leakage test or an airtight test. These types of gases are extremely dangerous, because an explosion can occur. It is recommended that oxygen free nitrogen be charged for these types of tests.
- Insulate the unions and flare-nuts at the piping connection part completely.
- Insulate the liquid piping completely to avoid a decrease of performance; if not, it will cause sweating on the surface of the pipe.
- Charge refrigerant correctly. Overcharging or insufficient charging could cause a compressor failure.
- Check for refrigerant leakage in detail. If a large refrigerant leakage occurred, it would cause difficulty with breathing or harmful gases would occu if a fire were being used in the room.

Insulation for Piping:
Insulate the gas piping and the liquid piping separately and wrap the piping from the outside

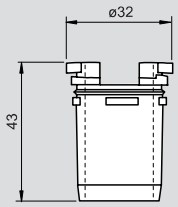
Insulation for Connection Parts:
The connection part must be insulated by the field supplied insulation materials.

Nitrogen:
For leakage test and brazing



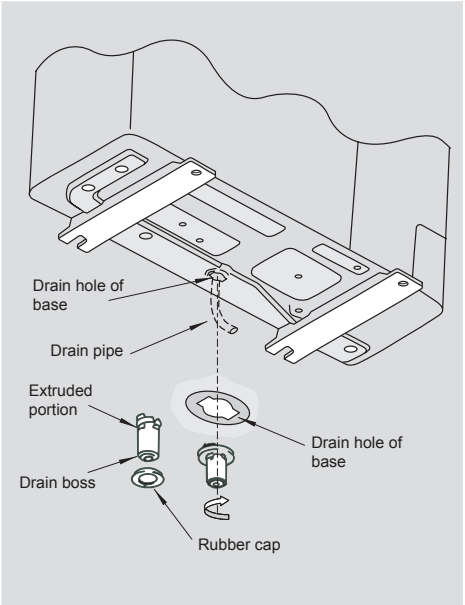
2.4.7. Drain Discharging Boss

When the base of the outdoor unit is temporarily utilized as a drain receiver and the drain water in it is discharged, this drain boss is utilized to connect the drain piping.

Outdoor unit model	Drain kit quantity (units)	Applicable Model: DBS-26
RAS-3HVRNE	1	
RAS-4H(V)RNE	1	
RAS-5H(V)RNE	1	

Connecting the drain discharging boss:

- Insert the rubber cap into the drain boss up to the extruded portions
- Insert the boss into the unit base and turn approximately 40 degree counterclockwise.
- Size of the drain boss is 32 mm (O.D.)
- A drain pipe should be field-supplied



Notes:

- Do not use this drain boss set in a cold area, because the drain water may freeze.
- This drain boss is not sufficient to collect all the drain water. If collecting drain water is completely required, provide a drain-pan that is bigger than the unit base and install it under the unit with drainage.
- In order to guarantee the proper condensate draining, the siphon installation is very important.

2.5. Water piping consideration

2.5.1. Piping materials

Caution:

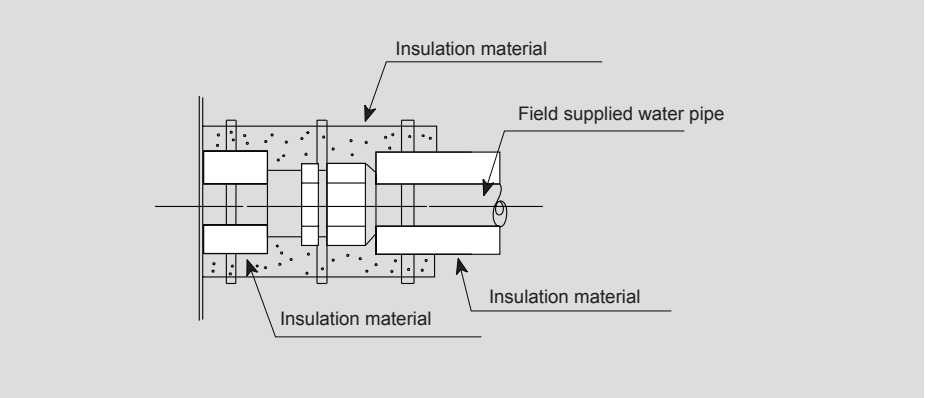
- Used clean pipes without any moisture or foreign material on the internal surface of pipes.
- When connecting water piping, cut copper pipes with a pipe cutter
- Do not use a saw and a grindstone or others which cause copper powder.
- The water circuit must be insulated to prevent the condensation during cooling operation the dew, and reduction of the capacity.
- Cap the end of the pipe when pipe is to be inserted through a hole

1. Prepare locally-supplied copper or steel pipes.
2. Select the piping size with the correct thickness and correct material which can have sufficient pressure strength Use the tables below to select the required pipe.

Unit	Steel piping diameter mm (inch)		
AquaFREE	Water inlet	Water outlet	Security Pipe
RWM	26-34 (1”)	26-34 (1”)	20-27 (3/4”)

Unit	Copper piping diameter mm (inch)		
AquaFREE	Water inlet	Water outlet	Security Pipe
RWM	26-28 (1”)	26-28 (1”)	20-22 (3/4”)

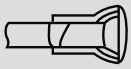
3. Select clean copper pipes. Make sure there is not dust and moisture inside.
4. After connecting the water piping, seal the open space between knockout hole and water pipes by using insulation material as shown bellow:



When using non-brass metallic piping, make sure to insulate both materials from each other to prevent galvanic corrosion.

Caution:

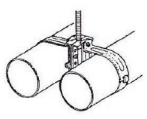
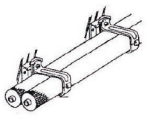
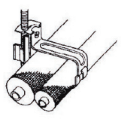
- Do not put pipes on the ground directly without a cap or vinyl tape at the end of the pipe
- Do not use insulation material that contents NH3 because can damage cooper pipe material and can be a source of future leakage

Correct	Incorrect
	

2.5.2. Suspension of water piping

- Suspend the water piping at certain points and prevent the water piping from touching the weak part of the building such as wall, ceiling, etc. (If touched, abnormal sound may occur due to the vibration of the piping. Pay special attention in case of short piping length).
- Do not fix the refrigerant piping directly with the metal fittings (The refrigerant piping may expand and contract).

Some examples for suspension method are shown below

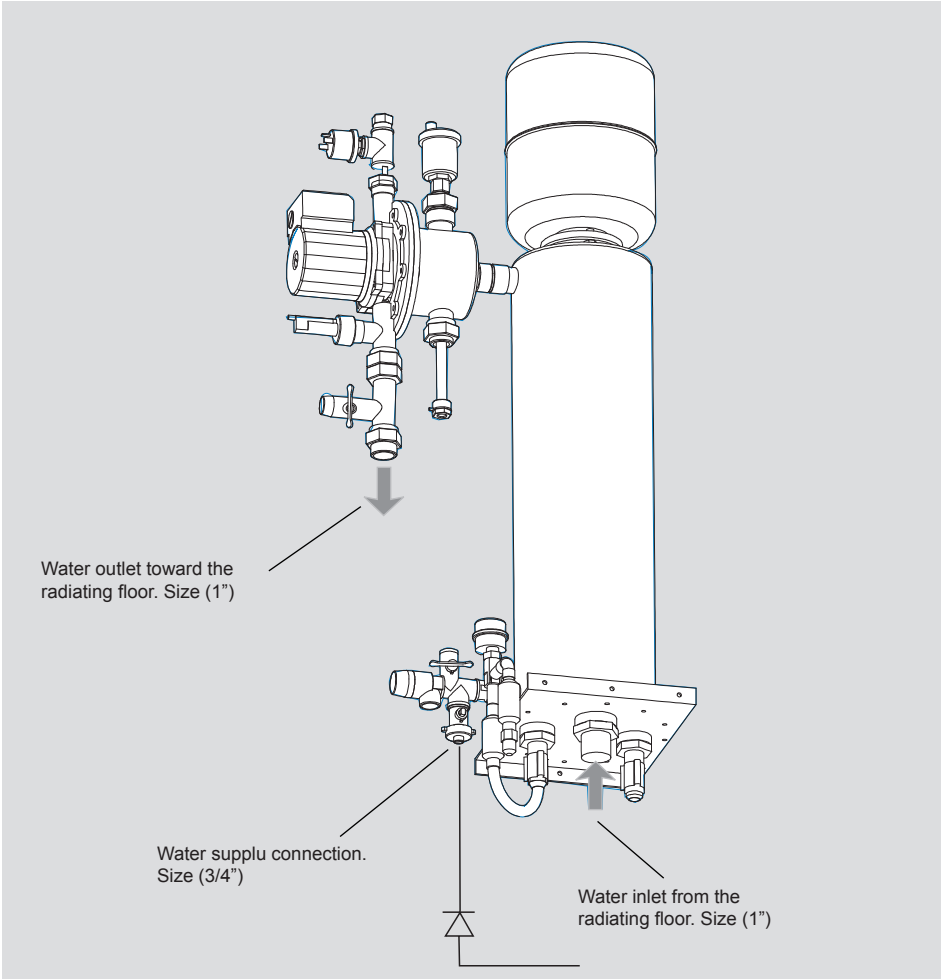
For suspendig heavies	For piping along the wall	For instant installation work
		

2.5.3. Charging water

Note

- Selected enough space to connect the pipes in some space that there is enough operation space.
- It is recomended to use the flexible joints for the piping inlet and outlet, to avoid the transmission vibrations.
- It is recomended cover the water pipes with insolutacion for dew problems.
- Before the comissioning is necessary to clean the hydralic pipes using water. After cleaning the hydraulic system fill in the circuit.
- It is recommended install a filter of 1000mm before water inlet connection pipe.
- In case that the Water piping would be located in a higher position than AquaFREE air purger, it is necessary to add an auxiliary purger system in the highest position of water piping installation.
- During the system water filling, it must be not purgue air system, at the same time.
- When a system refilling is performed, please check that general water pressure is higher than main water pressure.

1- Connect the water supply to the water supply connection.

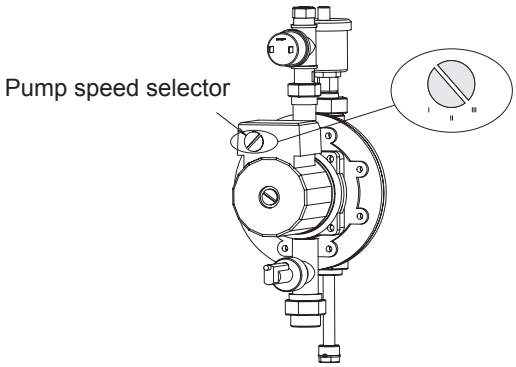


2. Place the two valves, first in the water oulet pipe and second in inlet AquaFREE pipe.
3. Charge the water system introducing the water trough the filling valve. The nominal water pressure in the system must be between 1.7~2.0 bar (recommended 1.8 bar).
4. Put the drain pipe from the automatic drain valve until the general drain system. This securety drain valve will be activated when water pressure arrives to 3 bars.

2.5.4. Adjusting the water flow

The pump that is integrated in the hydraulic module has 3 speeds (2 of these can be used).The maximum speed is factory setting.

NOTE:
Never use the Low speed level.



Speed indications:

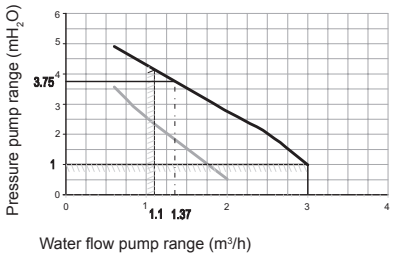
I Low Speed

II Medium Speed

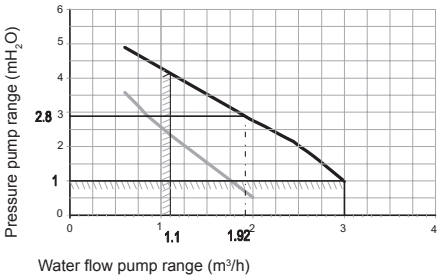
III High Speed

2.5.5. Pump curves

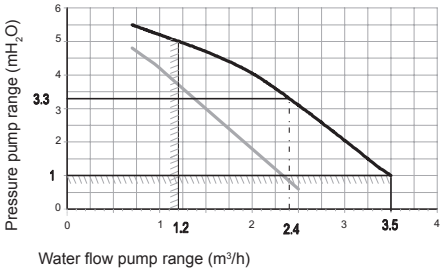
RWM-3FSN1E - (S1)



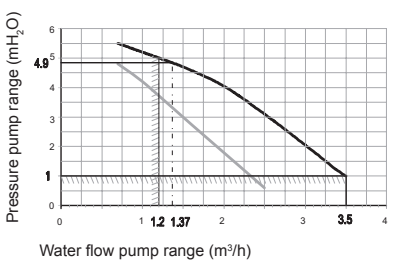
RWM-4FSN1E - (S1)



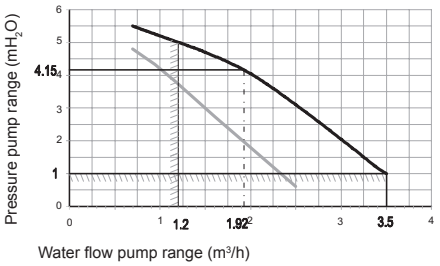
RWM-5FSN1E - (S1)



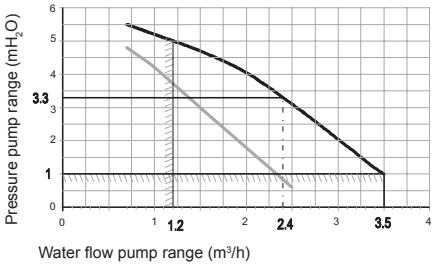
RWM-3FSN1E - (S1) - 4.5H1



RWM-4FSN1E - (S1) - 6H3



RWM-5FSN1E - (S1) - 6H3



Max speed

Medium speed

Nominal Heating water flow

NOTE:
The second manometer is only necessary for comissioning. After this you can turn it off.

■ Pump control range procedure

In order to control the water flow rate you must lower the water pressure. The value of this pressure is calculated from the difference between the value of the inlet and outlet water pressure.

Two pressure gauges must be installed in order to obtain this value:

1. Located after the pump (at the water outlet toward the radiating fl oor circuit)
2. Located over the water inlet port (as shown in the following figure).

The value of the water's pressure drop must be between the minimal and maximal values of the range of the waters flow ratio curve.

3. Electrical wiring and working mode

Contents

3.1. General check

Attention

Before installing the electrical wiring or before performing a periodical check, turn OFF the main switch to the indoor unit and the outdoor unit.

– Protect the wires, the drain pipe, the electrical components and any other parts from rats or other small animals. If all these parts are not protected, rats or other small animals may gnaw at these parts. In the worst case, a fire may occur.

– Prevent the wires from touching the refrigerant pipes, the plate edges and the electrical components inside the unit. Otherwise, the wires will be damaged. In the worst case, a fire may occur.

Caution:

Tightly secure the wires with the cord clamp inside the indoor unit.

Note:

Fix the rubber bushes with adhesive when the conduit tubes to the outdoor unit are not used.

1. Make sure that the field-selected electrical components (main switches, circuit breakers, wires, conduit connectors and wire terminals) have been properly selected according to the electrical specifications in this service manual. Make sure that the electrical components comply with the National Electrical Code (NEC).

Outdoor Unit model	Z_{max} (Ω)
RAS-3HVRNE	0.35
RAS-4HVRNE	0.27
RAS-5HVRNE	0.26
RAS-4HRNE	0.27
RAS-5HRNE	0.26

Indoor Unit model	Z_{max} (Ω)
RWM-3FSN1E-4.5H1	0.38
RWM-4FSN1E-6H1	0.29
RWM-5FSN1E-6H1	0.29

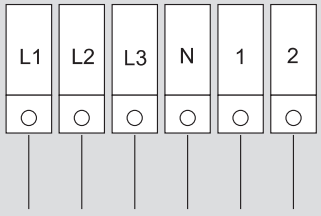
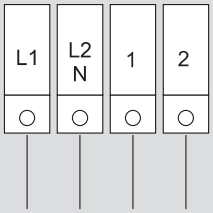
2. Following the Council Directive 89/336/EEC and its amendments 92/31/EEC and 93/68/EEC, relating to electromagnetic compatibility, next table indicates maximum permissible system impedance Zmax at the interface point of the user's supply, in accordance with EN61000-3-11
3. Make sure that the power supply voltage is within ±10% of the rated voltage.
4. Check the capacity of the electrical wires. If the power source capacity is too low, you cannot start the system due to the voltage drop.
5. Make sure that the ground wire is connected.
6. Main Switch
   Install a multi-pole main switch with a distance of 3.5mm or more between each phase.

3.2. Electrical wiring for the outdoor unit

3.2.1. Electrical wiring connection for outdoor unit

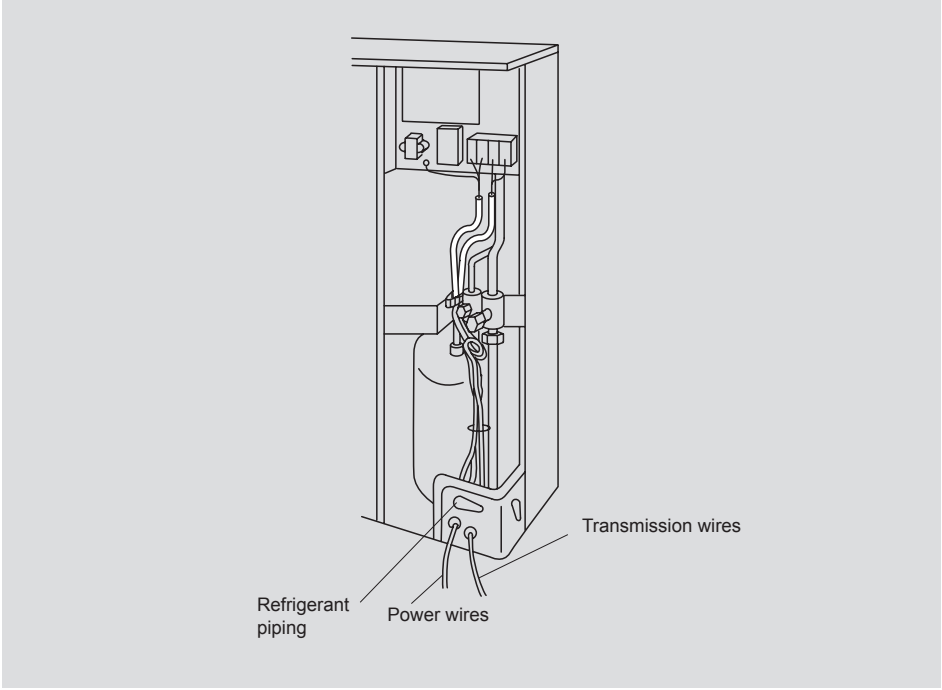
The electrical wiring connection for the outdoor unit is shown below.

1. Connect the power supply wires to L1, L2, L3 and N (for 400V/50Hz) or L1 and N (for 230V\50Hz) for single phase power source on the terminal board. Connect the ground wires to the terminals in the electrical box.
2. Connect the wires between the outdoor unit and the indoor units to the terminals

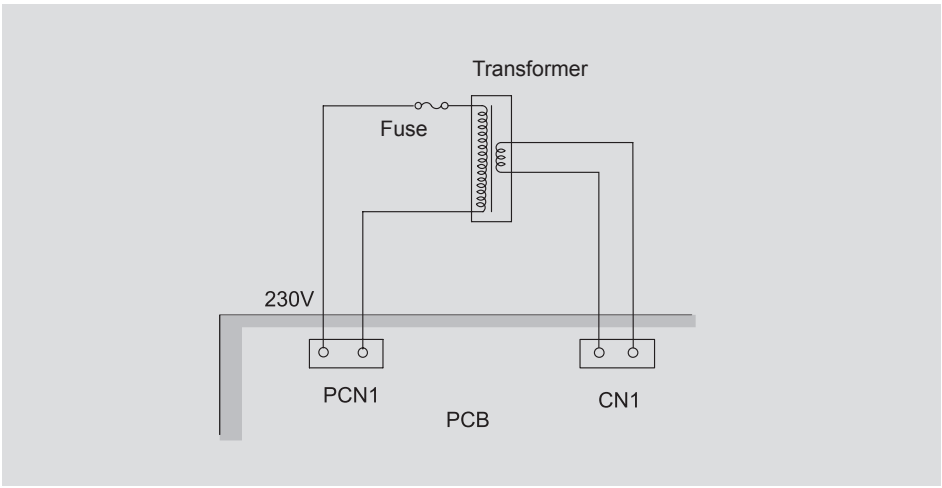
Three phase models		Single phase models	
			
Power supply 400V AC	Control cable (SV)	Power supply 230 V AC	Control cable (SV)

3. Do not run the wires in front of the fixing screw of the service access panel. If you do so, you cannot remove the fixing screw.

Position of wires and electrical board



4. Before turning ON the main switch, check the item below.

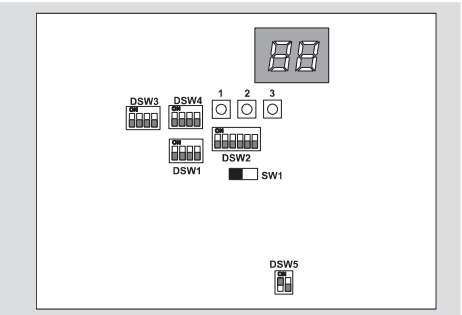


3.2.2. Setting the DIP switches for the outdoor unit

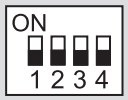
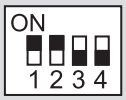
◆ Quantity and position of DIP switches

The PCB in the Outdoor Unit is operating with five types of DIP switches, and three types of push switches

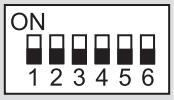
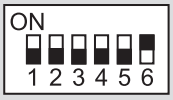
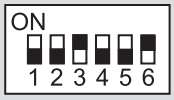
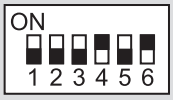
Position of DIP switches



DSW1:
Settings

Setting before shipment	Heating mode forced	Compressor forced stop
		

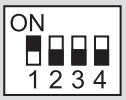
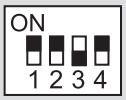
DSW2:
Optional function setting

Setting before shipment	Setting before installation	Night-Shift Mode (Low Sound) (2)	Cancellation of Outdoor Ambient Temp. limit (2)
			

(1) (ON:Set ; OFF: Cancel)

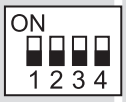
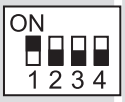
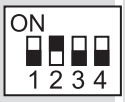
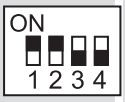
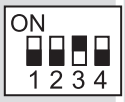
(2) (OFF: No set; ON:Set)

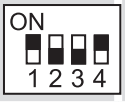
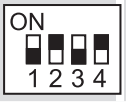
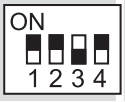
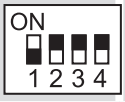
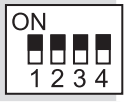
DSW3:
Capacity (Unit type)

Single phase			Three phases	
RAS-3HVRNE	RAS-4HVRNE	RAS-5HVRNE	RAS-4HRNE	RAS-5HRNE
				

DSW4:
Refrigerant cycle No. setting

- In the same refrigerant cycle, set the same refrigerant cycle No. for the outdoor unit and the indoor units as shown.
- Set each outdoor unit from No. 0, 1, 2, etc. at site. (factory set: No. 0)

Unit 0	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7
							

Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15
							

DSW5:
Setting for bridging the protection fuse

If a high voltage is applied by error to the terminals 1 and 2 of the TB1, the fuse on PCB will blown out. This fuse is soldered and can not be easily replaced.

To bridge the fuse, connect first the wiring correctly to the TB1 and then turn ON switch #2. In this case, the PCB is not protected by a fuse, however you are able to use it. Repair the fuse as soon as possible.

Setting before shipment	Bridging the fuse
	

3.3. Electrical wiring for AQUA FREE module

Aqua-Free units work with two different PCB's

3.3.1. Main PCB

The main PCBin the indoor unit is operating with four types of DIP switches, one rotary switch and one slide switch.

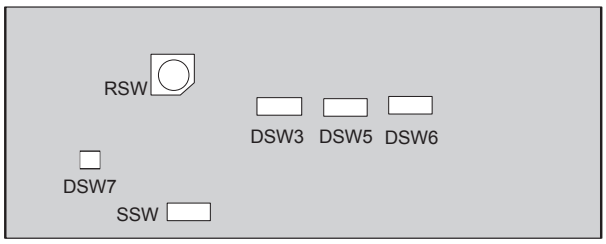
Note:

The mark "n" indicates position of dips switches. Figures show setting before shipment or after selection.

Not mark "n" indicates pin position is not affecting

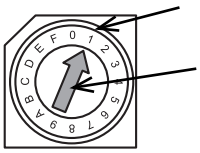
Caution:

Before setting dips switches, firstly turn off power source and set the position of the dips switches. If the switches are set without turning off the power source, the contents of the setting are invalid.



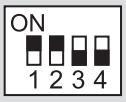
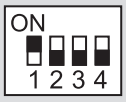
RSW: Unit number setting

Rotary switch for AquaFREE must be set to position No. 1

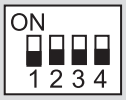


DWS3: Capacity code setting

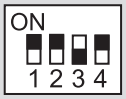
No setting is required because the DIP switch was set before shipment. Use this DIP switch for setting the capacity code that corresponds to the horsepower of the indoor unit.

Power	3HP	4HP	5HP
Setting position			

DSW5: Setting the refrigerant cycle number

	Unit No. 0
Setting position	

DSW6: Setting the indoor unit model

	RWM
Setting position	

DSW7: Setting the fuse recover and the remote control selection

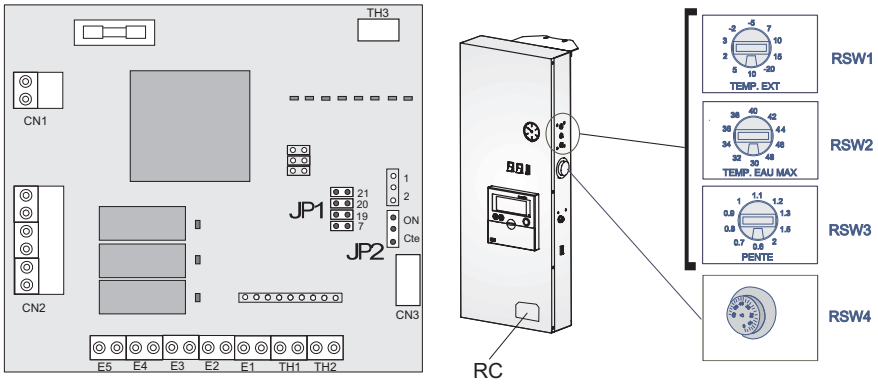
	RWM
No setting is required. Before the shipment, all setting positions are OFF. Remote control switch is selected	
If you apply high voltage to the terminals 1 and 2 of the TB, the fuse on the PCB will blow out- If that is the case, first correct the wiring to the TB. Then, set the pin ON as shown beside	

3.3.2. Control PCB

The control PCB has 4 rotational switches (RSW) and 2 groups of “jumpers” (JP) whose setting can be changed to perform unit maintenance and adapt the default confi guration for each specifi c installation or operating mode.
Layout of the switches and the “jumpers” in the PCB and in the electrical box:

Note

The rotating switches (RSW) on the RWM units are located on the outside left part of the electrical box.



RSW1: Outdoor Temperature (for electric Heater activation)Setting before shipment is -10ºCR

SW2: Water Temperature(for electric activation and control)Setting before shipment is 34ºC

RSW3: Water Rule(Water Temperature regulator)Setting before shipment is 0.8ºC

RSW4: Adjustable Water Temperature thermotatSetting before shipment is 48ºC

SW3: Electric Heater (ON/OFF)

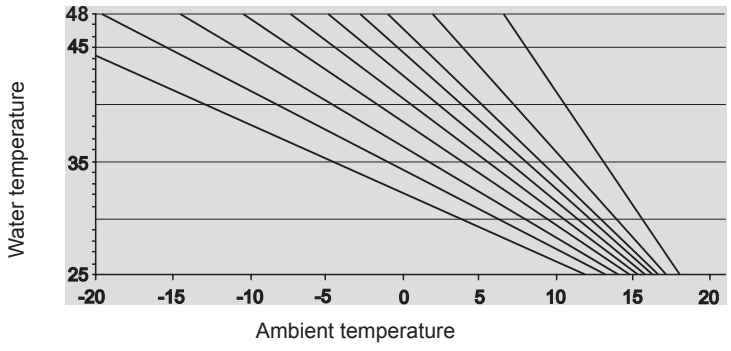
RC: Receiver

■ Water Rule

Note

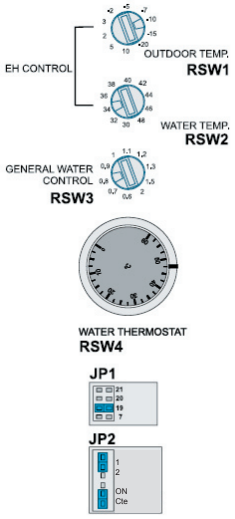
The SW3 switch only exists on the units with electric resistances.

The “Water rule” is the straight line representing outdoor temperatures which results from the value in RSW3 (value of the slope), plus a constant.
The possible “water rules” are represented graphically in the following way:



Note:

Factory settings of the switches and the “Jumpers”:



Notes

Use of the electric resistance:

In order to optimize the nverter function of the outdoor nit, it is recommended to not select the minimum temperature when in heating mode.

This temperature must be selected when performing the startup of the unit in order to adapt it to the usage mode.

Note:

With (JP1) the goal is to keep the water temperature between 19ºC and 21ºC.

The unit comes with a default setting of 19ºC.

The 7ºC position of JP1 is not available.

■ Settings: of the control PCB

Heating mode:

The control PCB has a rotating switch (RSW3) which is used to adjust the temperature of the water in the heating circuit (radiant floor / radiator).

In a radiant floor only heating system, it is recommended that this switch be set to one of the following positions: 0.6/0.7/0.8/0.9/1

In a heating system with radiators (or radiators combined with radiant floor), it is recommended that this switch be set to one of the following positions: 1.1/1.2/1.3/1.5/2

- Electric resistance: (Only in 4.5/6H1/3 units)

– Activation:

When outdoor temperature conditions are extreme, the system can be helped by activating the electric resistance.

The electric resistance starts up if both of the following premises occurs:

1. If the outdoor temperature is lower than the temperature selected on RSW1.
   Up to 10 different positions can be selected, with a temperature range that runs from 10ºC to -20ºC.
2. If the water temperature is lower than the temperature selected on RSW2.
   Up to 10 different positions can be selected, with a temperature range that runs from 48ºC to 30ºC.

- Setting the electric resistance:

– Turning OFF:

There are two ways to adjust the electric resistance, depending on how it is configured (JP2):

Option	Setting of JP2
A: The system adjusts the electric resistance depending on the unit’s “Water rule” (RSW3), and decides to turn the electric resistance off when the temperature of the water reaches the lower of the following values: – Value defined in (RSW1) - Water rule. – Value defined in (RSW2) - Water temperature for the electric resistance – Also electric heater turns OFF, when outdoor ambient temperature is higher than the value defined in RSW1.	
B: The system adjusts the electric resistance until it reaches the value defined in RSW2 (water temperature for the electric resistance) or outdoor ambient temperature is higher than the value defined in RSW1.	

Cooling Mode:

When in cooling mode, the desired water temperature must be selected by means of (JP1)

Select the temperature depending on the relative humidity of the air.

– For dry areas, select low temperatures. (19ºC)

– For humid areas, select high temperatures (21ºC)

3.3.3. Common wiring

Caution

All the field wiring and electrical components must comply with local codes.

Attention:

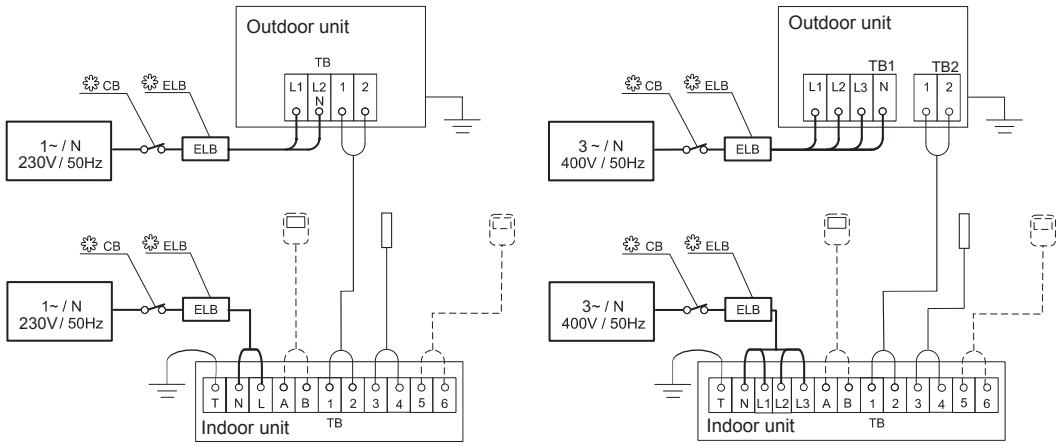
Pay attention to the connection of the operating line. Incorrect connection may cause the failure of PCB.

Attention

Power supply must be connected separately to the indoor unit and to the outdoor unit

Electrical wiring between indoor unit and outdoor unit:

- Connect the electrical wires between the indoor unit and the outdoor unit, as shown in the next diagram.
- Follow local codes and regulations when performing electrical wiring.
- If the refrigerant piping and the control wiring are connected to the units in the same refrigerant cycle.
- Use twist pair wire (more than 0.75 mm²) for operation wiring between outdoor unit and indoor unit, and operation wiring between indoor unit and indoor unit.
- Use 2-core wire for the operating line (Do not use wire with more than 3 cores).
- Use shielded wires for intermediate wiring to protect the units from noise obstacle at length of less than 300m and size complied with local code.
- Open a hole near the connection hole of power source wiring when multiple outdoor units are connected from one power source line.
- The recommended breaker sizes are shown in Table of electrical data and recommended Wiring, Breaker Size/1 O.U.
- In the case that a conduit tube for field-wiring is not used, fix rubber bushes with adhesive on the panel.
- All the field wiring and equipment must comply with local and international codes.



TB: Terminal board
CB: Circuit breaker
ELB: Earth Leakage Breaker
– – –: Internal wiring
——: Field wiring
: Field supplied
A, B: Remore control switch
3, 4: Outdoor Thermistor connection (non polarity)
5, 6: Room's thermostat connection

■ Recommended minimum size for field provided wires:

Model	Power source	Max. current [A]	Power source cable size [mm²]	Transmission cable size [mm²]
			EN60 335-1 ①	EN60 335-1 ①
RWM-3-4FSN1E	1N~ 230V 50Hz	1	0.75	0.75
RWM-5FSN1E		1		
RWM-3FSN1E-4.5H1		20	4	
RWM-4FSN1E-6H1		31	4	
RWM-5FSN1E-6H1		31		
RWM-4FSN1E-6H3	3N~400V 50Hz	11	2.5	
RWM-5FSN1E-6H3		11		
RAS-3HVRNE	1N~230V 50Hz	21	2.5	
RAS-4HVRNE		28	4	
RAS-5HVRNE		29		
RAS-4HRNE	3N~400V 50Hz	11	2.5	
RAS-5HRNE		15		

The above wire sizes marked with ① are selected at the maximum current of the unit according to the European Standard, EN60 335-1.

If the power cables are connected in series, add each unit maximum current and select according to the next table.

Selection according toEN60 335-1	
Current i (A)	Wire Size (mm²)
I ≤ 6	0.75
6 < i ≤ 10	1
10 < i ≤ 16	1.5
16 < i ≤ 25	2.5
25 < i ≤ 32	4
32 < i ≤ 40	6
40 < i ≤ 63	10
63 < i	③

③ In case that current exceeds 63 A do not connect cables in series

Note:

Follow local codes and regulations when selecting field wires, Circuit breakers and Earth Leakage breakers

Use wires that are not lighter than the ordinary polychloroprene sheathed flexible cord (code designation H05RN-F)

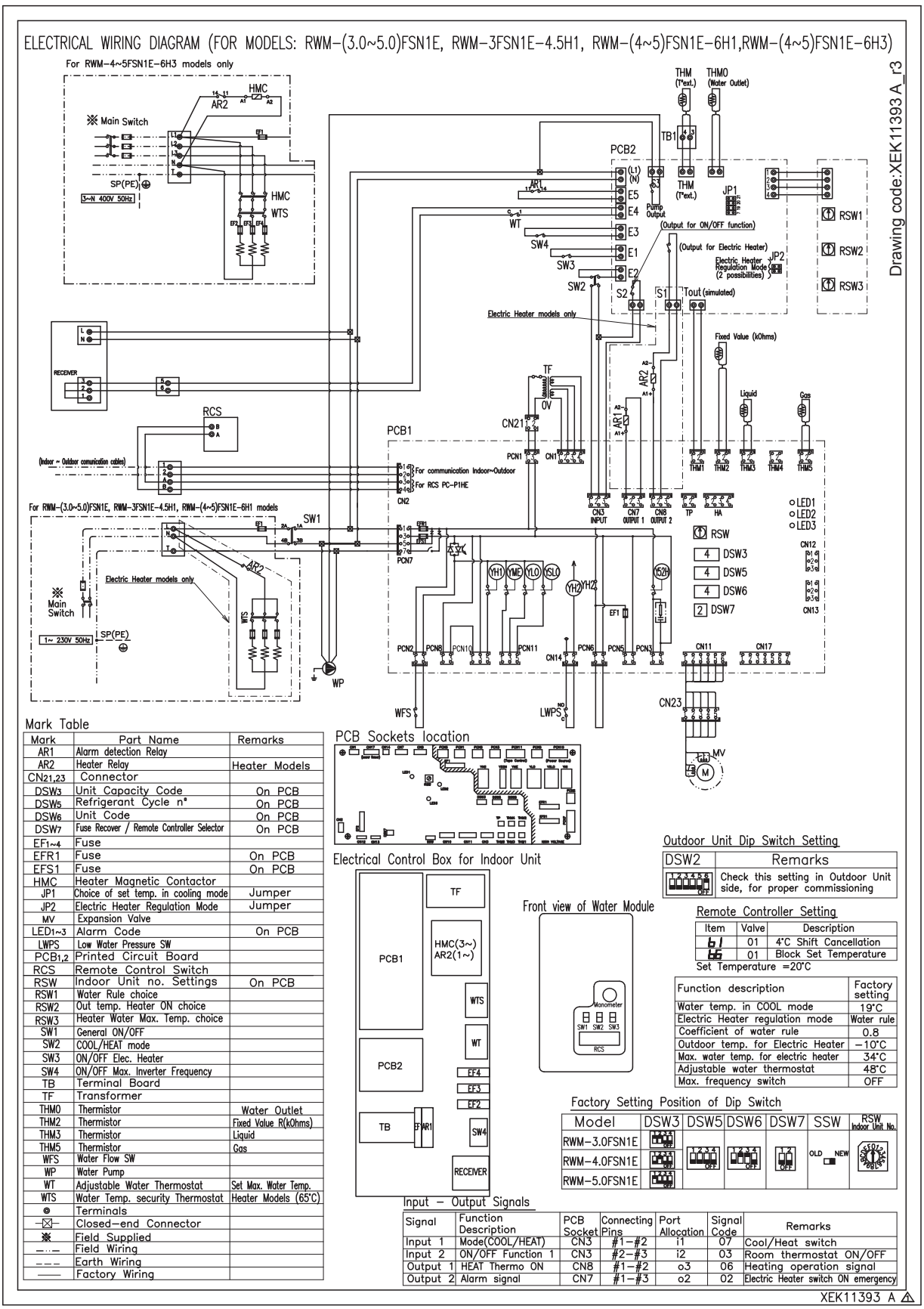
The earth cable size complied with local code: IEC 245, No. 571.

◆ Main switches protection

Select the main switches according to the next table

Model	Power source	Max. current [A]	CB [A]	ELB [no. of poles / A / mA]
RWM-3-4FSN1E	1N~ 230V 50Hz	1	6	2/40/30
RWM-5FSN1E		1		
RWM-3FSN1E-4.5H1		20	25	
RWM-4FSN1E-6H1		31	32	
RWM-5FSN1E-6H1		31		
RWM-4FSN1E-6H3	3N~400V 50Hz	11	16	4/40/30
RWM-5FSN1E-6H3		11		
RAS-3HVRNE	1N~230V 50Hz	21	25	2/40/30
RAS-4HVRNE		28	32	
RAS-5HVRNE		29		
RAS-4HRNE	3N~400V 50Hz	11	15	4/40/30
RAS-5HRNE		15	20	

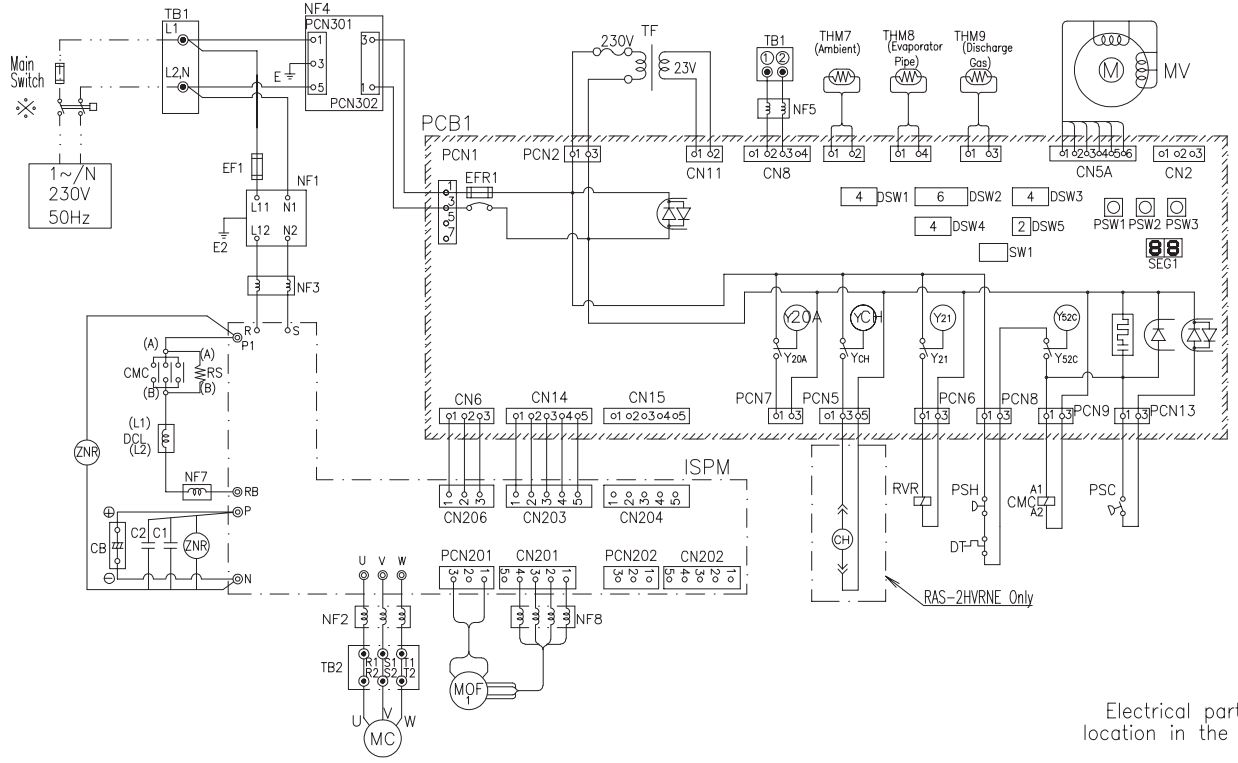
ELB: Earth leakage breaker
CB: Circuit breaker



Note: *All the field wiring equipment must comply with local codes. In subsection 3 there is more information about the Dip Switches configuration. See the legend for items appearing in the diagram at the end of this chapter.*

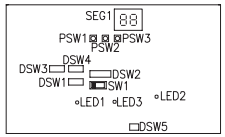
3.2. Outdoor units

3.2.1. Wiring diagram for models: RAS-3HVRNE



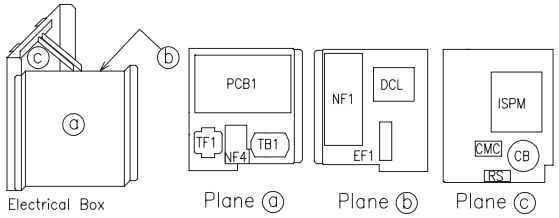
Mark	Name
NF1~5,7,8	Noise Filter
PCB1	Printed Circuit Board
PSC	Pressure Switch for Control
PSH	High Pressure Switch for Protection
PSW1~3	Push Switch on PCB1
RS	Resistor for Starting
RVR	Reversing Valve Relay
SW1	Switch
TB1,2	Terminal Board
TF1	Transformer
THM7~9	Thermistor
ZNR	Surge Absorber
CH	Crankcase Heater
C1,2	Capacitor
CB	Capacitor
CMC	Contactor for Compressor Motor
DCL	Reactor
DSW1~5	Dip Switch on PCB1
DT	Overload Relay
EF1	Fuse
ISPM	Inverter System Power Module
MC	Motor for Compressor
MOF1	Motor for Outdoor Fan
MV	Micro-Computer Control Expansion Valve

Main PCB



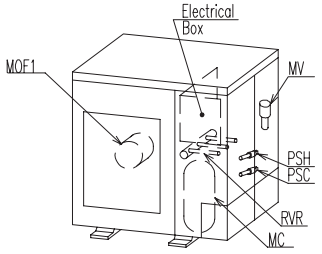
PCB1

Electrical box parts location



Electrical Box Plane ⓐ Plane ⓑ Plane ⓒ

Electrical parts location in the unit



NOTES:

- Turn OFF the main power switch of the indoor unit and the outdoor unit, and wait for more than 1 minute before electrical wiring work or a periodical check is performed.
- Do not connect the power source line to the terminals 1 and 2.
- These terminals are for the control line. If connected, the printed circuit board will be damaged.
- Indications about wining:
  Factory supplied: ——
  Earth wiring: - - - -
  Field wiring: —·—
  Field supplied: ※

Drawing code:
XEK11371 A

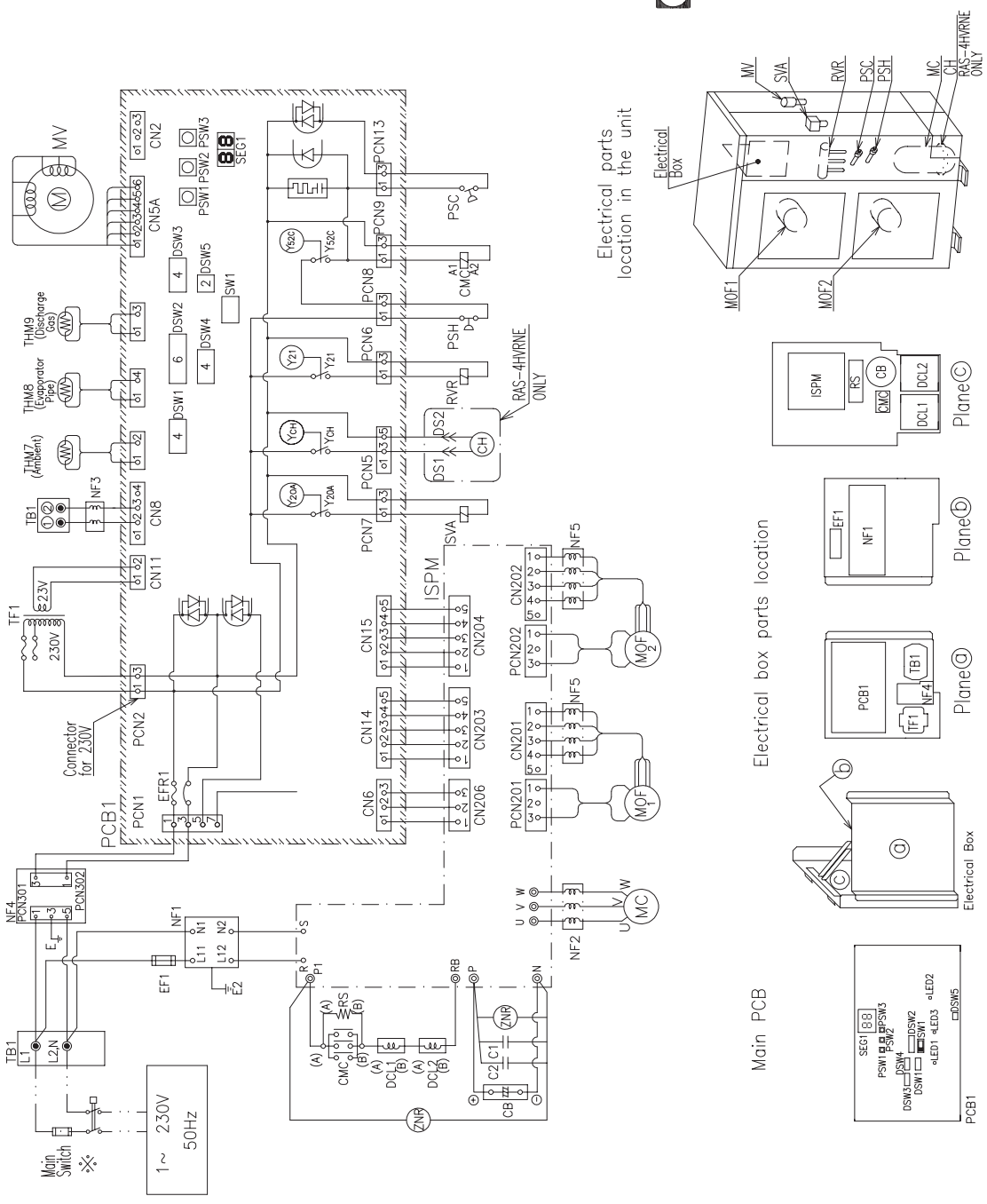
Note: *All the field wiring equipment must comply with local codes. In subsection 3 there is more information about the Dip Switches configuration. See the legend for items appearing in the diagram at the end of this chapter.*

3.2.2. Wiring diagram for models: RAS-(4/5)HVRNE

Mark	Name
C1,2	Capacitor
CB	Capacitor
CH	Crankcase Heater
CMC	Contactor for Compressor Motor
DCL1,2	Reactor
DSW1~5	Dip Switch on PCB1
EF1	Fuse
ISPM	Inverter System Power Module
MC	Motor for Compressor
MOF1,2	Motor for Outdoor Fan
MV	Micro-Computer Control Expansion Valve
NF1~5	Noise Filter
PCB1	Printed Circuit Board
PSC	Pressure Switch for Control
PSH	High Pressure Switch for Protection
PSW1~3	Push Switch on PCB1
RS	Resistor for Starting
RVR	Reversing Valve Relay
SVA	Solenoid Valve for Hot Gas Bypass
SW1	Switch
TB1	Terminal Board
TF1	Transformer
THM7~9	Thermistor
ZNR	Surge Absorber

NOTES:
- Turn OFF the main power switch of the indoor unit and the outdoor unit, and wait for more than 1 minute before electrical wiring work or a periodical check is performed.
- Do not connect the power source line to the terminals 1 and 2.
- These terminals are for the control line. If connected, the printed circuit board will be damaged.
- Indications about wiring:
  Factory supplied: ——
  Earth wiring: - - - -
  Field wiring: — · —
  Field supplied: ※

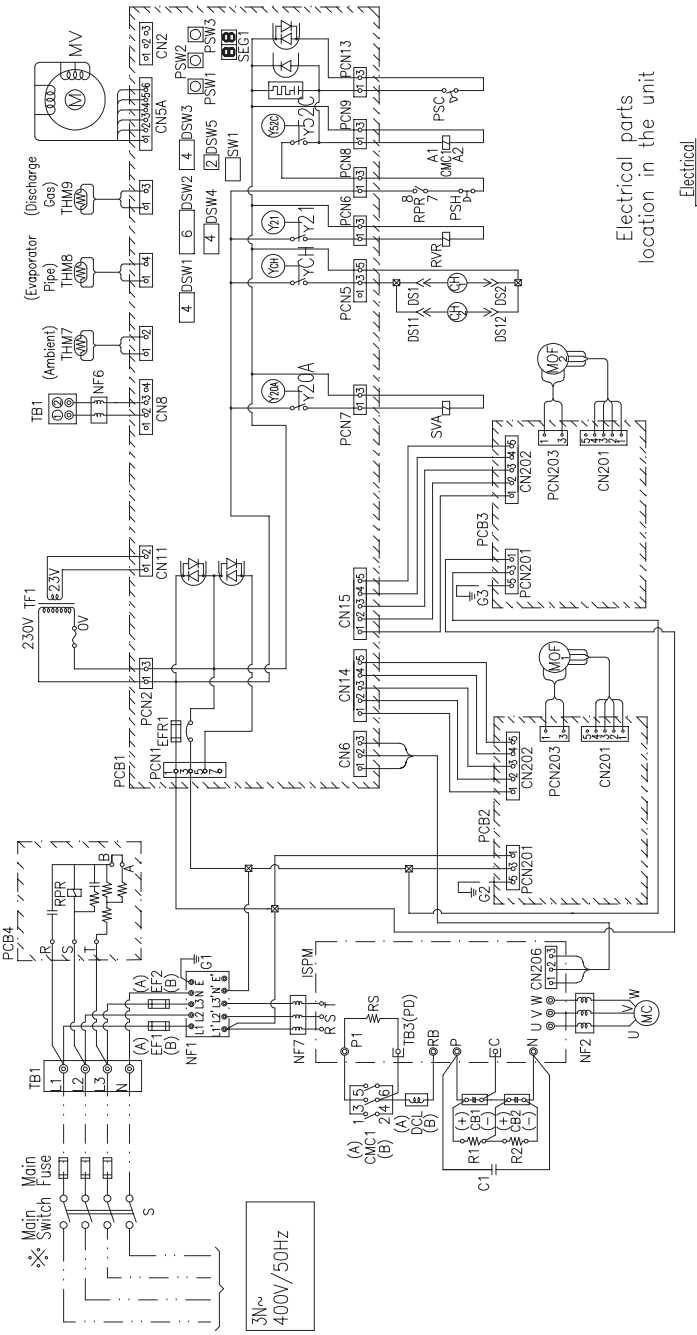
Drawing code:
XEK11142 A



Note: *All the field wiring equipment must comply with local codes. In subsection 3 there is more information about the Dip Switches configuration. See the legend for items appearing in the diagram at the end of this chapter.*

3.2.3. Wiring diagram for models: RAS-(4/5)HRNE

Mark	Name
C1	Capacitor
CB1,2	Capacitor
CH1,2	Crankcase Heater
CMC1	Contactor for Compressor Motor
DCL	Reactor
DSW1~5	Dip Switch on PCB1
EF1,2	Fuse
ISPM	Inverter System Power Module
MC	Motor for Compressor
MOF1,2	Motor for Outdoor Fan
MV	Micro-Computer Control Expansion Valve
NF1,2,6,7	Noise Filter
PCB1~4	Printed Circuit Board
PSC	Pressure Switch for Control
PSH	High Pressure Switch for Protection
PSW1~3	Push Switch on PCB1
R1,2	Resistor for Starting
RPR	Reverse Phase Protection Relay
RVR	Reversing Valve Relay
SVA	Solenoid Valve for Hot Gas Bypass
SW1	Switch
TB1	Terminal Board
TF1	Transformer
THM7~9	Thermistor



NOTES:
- Turn OFF the main power switch of the indoor unit and the outdoor unit, and wait for more than 3 minute before electrical wiring work or a periodical check is performed.
- Do not connect the power source line to the terminals 1 and 2.
- These terminals are for the control line. If connected, the printed circuit board will be damaged.
- Indications about wiring:
  - Factory supplied: ——
  - Earth wiring: - - - -
  - Field wiring: —·—·—
  - Field supplied: ※

Drawing code:
XEK11290 A

Note: *All the field wiring equipment must comply with local codes. In subsection 3 there is more information about the Dip Switches configuration. See the legend for items appearing in the diagram at the end of this chapter.*

3.3. Legend of wiring diagrams

Mark	Description
AR	Electric resistance relay
C / CA	Capacitor
CH	Crankcase heater
CMC	Contactor for compressor motor
CN	Connector
CT	Power transformer
DCL	Inductance
DS	Inserting type connector
DSW	Setting switch
DT	Overload relay
EF	Fuse
ES	Emergency switch
HMC	Magnetic contactor
JP	Bridge
ISPM	Power modulator of inverter system
ITO	Internal thermostat for outdoor fan motor
LD / LED	Alarm code
M(C)	Motor for compressor
M(OF)	Motor for outdoor fan
MV	Expansion valve
NF / ZNR	Noise filter
PCB	Printed circuit board
PS(L) / LWPS	Low-pressure switch
PS(H)	High pressure switch

Mark	Description
PS(C)	Pressure Switch (Control)
PSW	Push switch
RC	Running capa
RCS	Remote Controler
RS	Resistor
RSW	Rotary switch
RVR	Reversing valve relay
SVA	Solenoide valve
SW	Switch
TB	Terminal board
THM	Thermistor
TF	Tranformer
WFS	Water level sensor
WP	Water pump
WT	Adjustable water thermostat
Y	Relay

Symbol	Description
◎	Terminals
⊠	Closed-end Connector
⊗	Field-supplied
– ·· – ·· –	Field Wiring
– – – – –	Earth Wiring
———	Factory wired

4. Installation of the room thermostat

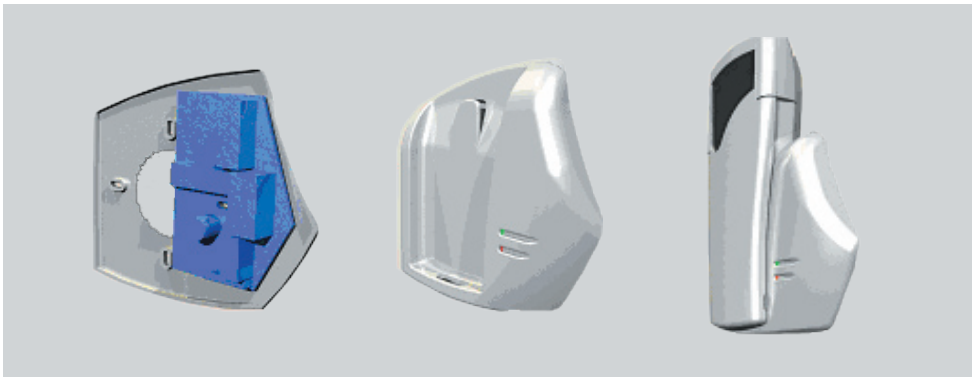
This chapter describes the procedure you must follow to install the room thermostat taht works with the UTOPIA DC Inverter outdoor units and the AquaFREE range of Hitachi indoor units.

Contents

4.1. Installation of the room thermostat

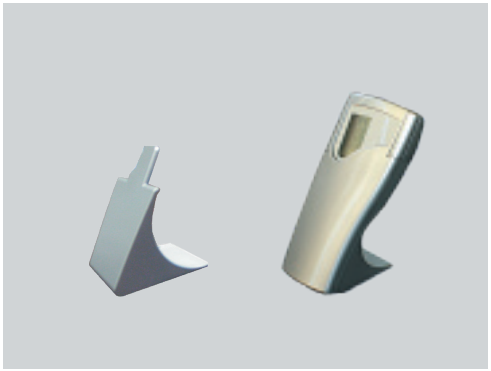
■ Contents

The wall bracket was designed to cover a flush box with a diameter of 60 cm, or directly to the wall with the set of screws and wall anchors that are supplied.

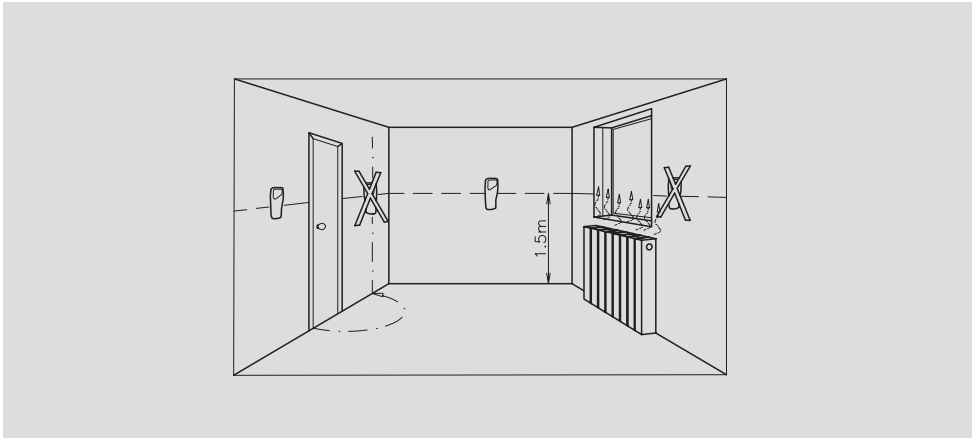


Also, an optional table support for the CTA RF MH A is fill supplied with the unit.

The PRT operates with 3 1,5V LR03 Batteries (supplied), that can easily be replaced by accessing the compartment through the panel at the back of the product.
Inverting the battery poles will only cause malfunction, but will not, however, damage the product



■ Location



4.1.1. General characteristics of the room thermostat

■ **Thermostat ambient configuration**

- Control: All or nothing, or proportional Chrono with optimizer
- Power: 3 alkaline 1.5 V type LR03 batteries
- Temperature range: 5°C to 30°C
- Transmission frequency: 868,3 MHz
- Range: 100 m outdoors and 30 meters indoors
- Protection index: IP 20
- Classe III
- Storage temperature: – 20°C to + 70°C
- Operating temperature: 0°C to 40°C

■ **Receiver**

– **Installation (2 types)**:

Wall mounting, in the IP 44 waterproof box provided, on the side or beneath the heater it controls.

Ensure that the connecting wires are adequately sustained by respecting the current installation standards.

Mounting in an IP20 embedded box close to the machine it controls, protected from water spray.

Receiver troubleshooting:

Problem	Cause
The reciver does not work	The receiver is not powered:Check the power circuit's fuse or circuit breaker.
	Learning has not been performed adequately:Perform the learning procedure again (refer to section 4).
	Check the associated thermostat's battery.
	A parasite transmitter may interfere with the link between the programmer and the receiver
The receiver is out of the transmitter's reach	Bring the transmitter closer to the receiver; for optimal operation the thermostat must be located in the center of the house, apartment or are covered.
Wave emissions (amateur radio, television screen, etc.) interfere with the receiver.	Identify, and then move the source of the interfering waves
There are interferences where the transmitter is located.	Move the position of the transmitter away from the area with interferences

If the problem persists, please contact your after sales service.

– **Technology features:**

Power supply: 230V AC +10/-20%, 50Hz.
Relay Output: 1 10A 230V AC 1 100000 cycles potential-free changeover contact.

– Standards:
  – Safety: EN 60730 - 1/2-9 class II.
  – Radio: EN 300220-3 / EN 301489-3.

– Environment:
  – Operation: 0°C to +40°C.
  – Storage: -10°C to +50°C.
  – Moisture: 80% at 25°C (Without condensation).
  – IP20 only for the module (EN 60529)
  – IP 44 after installing in the box provided (EN 60529).

Radio receiver, frequency of 868.3Mhz.
Can be used everywhere in Europe.

5. Control system

This chapter presents the control system flowcharts for the UTOPIA DC Inverter outdoor units operation.

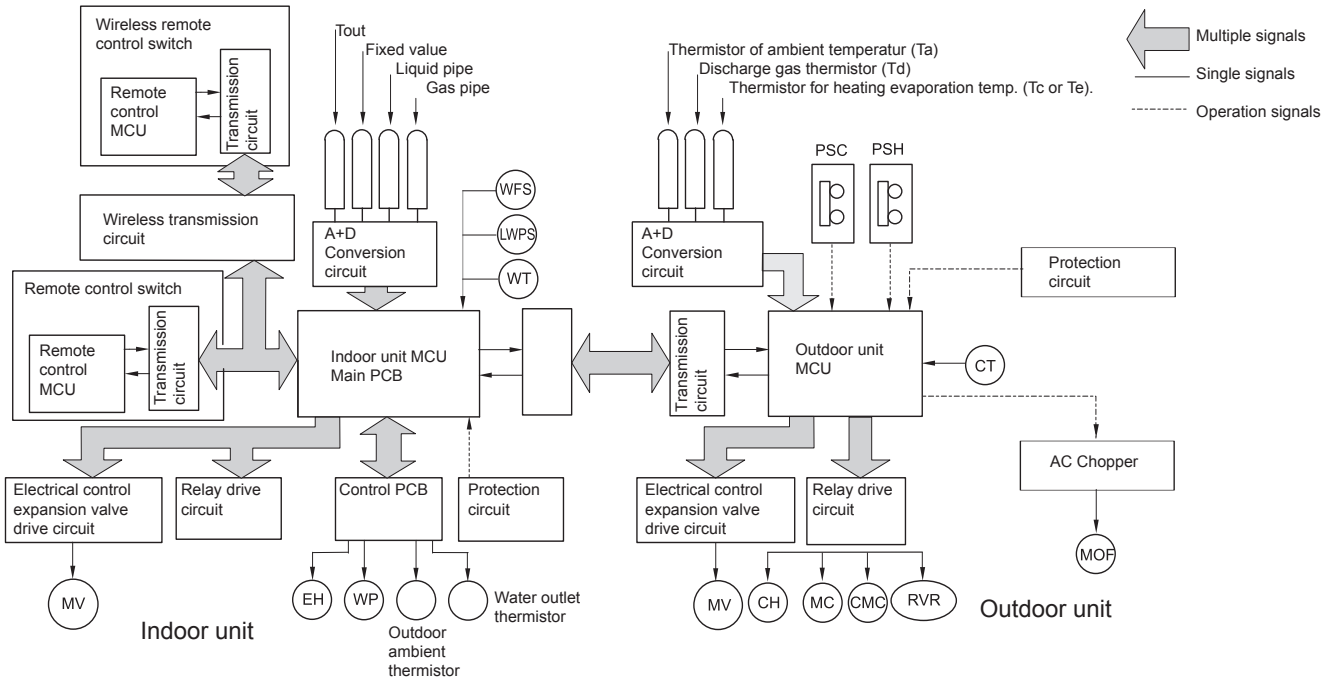
Contents

5.1. Device control system

Control Subject	Purpose				
	Cooling Operation		Heating Operation		Defrost Operation
Control Frequency of Inverter Compressor	Adjust the capacity depending on water.		Adjust the capacity of the indoor unit depending on water temperature.		Fixed frequency
Opening Degree Expansion Valve of Outdoor Unit	For controlling temperature of discharge gas superheat: (TdSH) and temperature of liquid subcooling. (TeSC).TdSH=20K, TeSC=3K		For controlling temperature of Discharge Gas Td.		Fully open
Opening Degree Expansion Valve of Indoor Unit	For controlling temperature of discharge gas superheat: (TdSH) TdSH=20K		Difference between discharge gas temperature and Liquid Pipe temperature of Indoor Unit Heat Exchanger		Opening fixed
Outdoor fan	For controlling the condensing temperature.		For controlling the condensing temperature		Stoppage
	Tc < 33 ºC (3HP) Tc < 25 ºC (4, 5 HP) Liquid pipe T. Of I.U ≤ 0 ºC	1 Step down	Td ≥ 100 ºC Evo ≥ 400 pls	1 Step down	
	Tc < 43 ºC (3HP) Tc < 35 ºC (4, 5 HP)	1 Setp up	Te ≤ 0 ºC Tamb. ≥ 4 ºC	1 Step up	
Control Heater (Crankcase heater)			T Wout ≥ RSW3 (Temp) or T Wout ≥ RSWe (Temp)		Stoppage
Pump	Activation Compressor ON Stop – Press OFF – Thermo OFF – Alarm AR1				Working
Electric heater	Activation 1. Thermo ON 2. SW2 in “Heat mode” 3. SW3 in “ON” 4. TWout < RSW1 5. TWout < RSW2 Stop 1. TWout <RSW3/RSW2 Tout > RSW1 2. TWout < RSW2 Tout > RSW1				Working

Legend:

I.U.:	Indoor Unit
Tc:	Condensing Temperature
Te:	Evaporating Temperature
Td:	Discharge Temperature
T:	Temperature
Evo:	Expansion Valve Outdoor Unit
Tamb:	Ambient Temperature
TWout:	Water outlet temperature

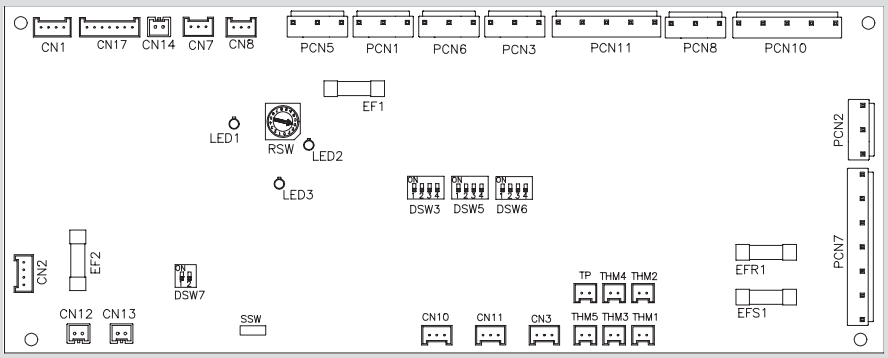


Symbol	Name
MC	Motor (for Compressor)
MIF	Motor (for Indoor Fan)
MOF1,2	Motor (for Outdoor Fan)
MS	Motor (for Auto-Louver)
MV	Electronic Expansion Valve
CMC	Compressor Magnetic Contactor
CH	Crankcase Heater
CT	Current transformer

Symbol	Name
RVR	4-Way Valve
PS(H)	Pressure Switch for protection
PS(C)	Pressure Switch for control
EH	Electric Heater
WP	Water Pump
WFS	Water flow switch
WT	Water temperature security thermostat
LWPS	Low water pressure switch

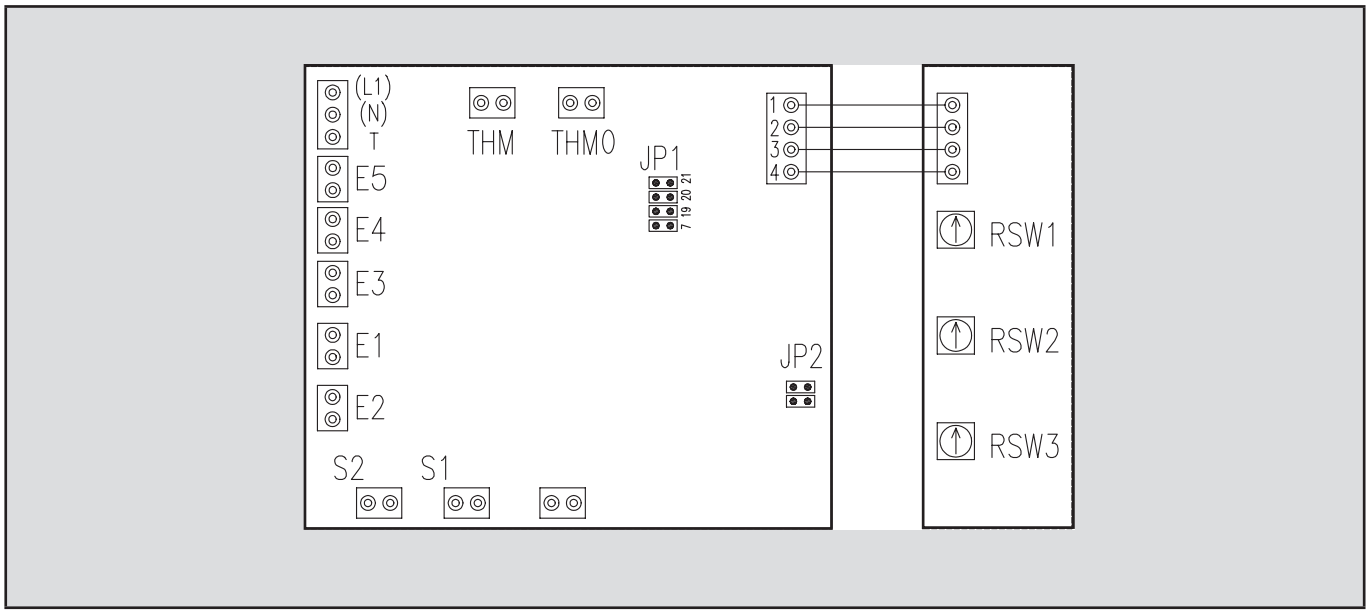
5.2. Indoor unit PCB

5.2.1. Main PCB



Connector indication	
PCN1	Transformer (220V)
PCN2	Water flow switch
PCN3	(Not used)
PCN5	(Not used)
PCN6	(Not used)
PCN7	Power source (1-R, 2-S, 3-N, 4-E)
PCN8	(Not used)
PCN10	(Not used)
PCN11	(Not used)
THM1	Outdoor temperature (simulated)
THM2	Fixed value
THM3	Liquid pipe
THM4	(Not used)
THM5	Gas pipe
EF1	Fuse
EF2	Fuse
EFS1	PCB2 Fuse
EFR2	PCB2 Fuse
CN1	Transformer (pin 1-2: 17.3V / pin 3-4: 20.8V)
CN2	Communication between indoor-outdoor and RCS PC-P1H1E
CN3	Cool/Heat mode
CN7	Alarm detection relay
CN8	Heater relay
CN11	Expansion valve control
CN12	(Not used)
CN13	(Not used)
CN14	Low water presure switch
CN17	Not used
Switch indication	
DSW3	Capacity code
DSW5	Ref. cycle N°
DSW6	Model code
DSW7	Fuse recovery and remote control selector
RSW	Setting of the indoor unit number
SSW	(Nor used)
Led Indication	
LED1	Green: Power source for the PCB
LED2	Yellow: This LED indicates the transmission status between the indoor unit and the outdoor unit
LED3	Red: This LED indicates the transmission status between the indoor unit and the RCS

5.2.2. Control PCB

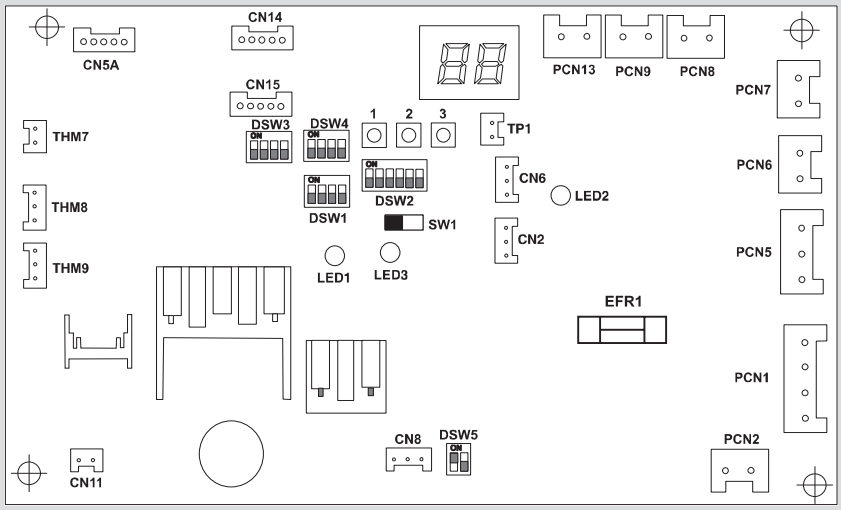


Connector indication	
THM0	Water outlet thermistor
THM	Outdoor thermistor
JP1	Cooling selectrion mode
JP2	Electric heater regulation
Switch indication	
E1	ON/OFF electric heater
E2	Cool/Heat mode
E3	ON/OFF max. inverter frequency
E4	Adjustable water thermostat
E5	Alarm detection relay
RSW1	Water rule choice
RSW2	Outdoor temperature - Heater ON choice
RSW3	Heater water maximum temperature choice

Note:
The mark "■" indicates position of dips switches. Figures show setting before shipment or after selection. Not mark "■" indicates pin position is not affecting

Caution:
Before setting dips switches, firstly turn off power source and set the position of the dips switches. If the switches are set without turning off the power source, the contents of the setting are invalid.

5.3. Outdoor unit PCB



Connector indication		
PCN1		Fuse
PCN2		PCB1 connection from Outdoor to Indoor unit
PCN5	CH	Crankcase Heater of Compressor (Oil)
PCN6		Output optional function
PCN7		Output optional function
PCN8	PSH	Pressure switch protection
PCN9	CMC	Compressor contactor
PCN13	PSC	Pressure switch control
THM7	AIR	Outdoor Air temperature Thermistor
THM8	PIPE	Pipe Temperature Thermistor
THM9	COMP	Compressor Temperature Thermistor
CN2	CT	Current Transformer
CN5A	MV	Micro electronic expansion valve
CN8	H-Link	Transmission from Outdoor to Indoor Unit
CN14		Transmission between PCB1 and ISPM
EFR1	FUSE	Power Protection

Switch indication	
DSW1	Setting
DSW2	Optional functions setting
DSW3	Capacity (Unit type)
DSW4	Ref. cycle N°
DSW5	Transmission setting of end terminal resistance
Led indication	
LED1	Red: This LED indicates the transmission status between the indoor unit and the RCS
LED2	Yellow: This LED indicates the transmission status between the indoor unit and the outdoor unit
LED3	Green: Power source for the PCB

Note:

The mark "■" indicates position of dips switches. Figures show setting before shipment or after selection. Not mark "■" indicates pin position is not affecting

Caution:

Before setting dips switches, firstly turn off power source and set the position of the dips switches. If the switches are set without turning off the power source, the contents of the setting are invalid.

5.4. Protection and safety control

◆ Compressor protection

The following devices and their combinations protect the compressor:

High-Pressure switch	This switch cuts out the operation of the compressor when the discharge pressure exceeds the setting.
Oil heater	This band heater protects against the oil carry-over during the cold starting, as the band heater is energized while the compressor is stopped.
Fan motor protection	Internal thermostat that is embedded in the fan motor winding: this internal thermostat cuts out the operation of the fan motor when the temperature of the fan motor winding exceeds the setting.

5.5. Safety and control device setting

5.5.1 Safety and control device setting for the indoor units

◆ Compressor Protection

High Pressure Switch:

This switch cuts out the operation of the compressor when the discharge pressure exceeds the setting.

◆ Fan Motor Protection

When the temperature of the thermistor reaches the maximum allowed value, the outdoor unit is stopped. As soon as this temperature drops below the authorized threshold, the unit can restart.

5

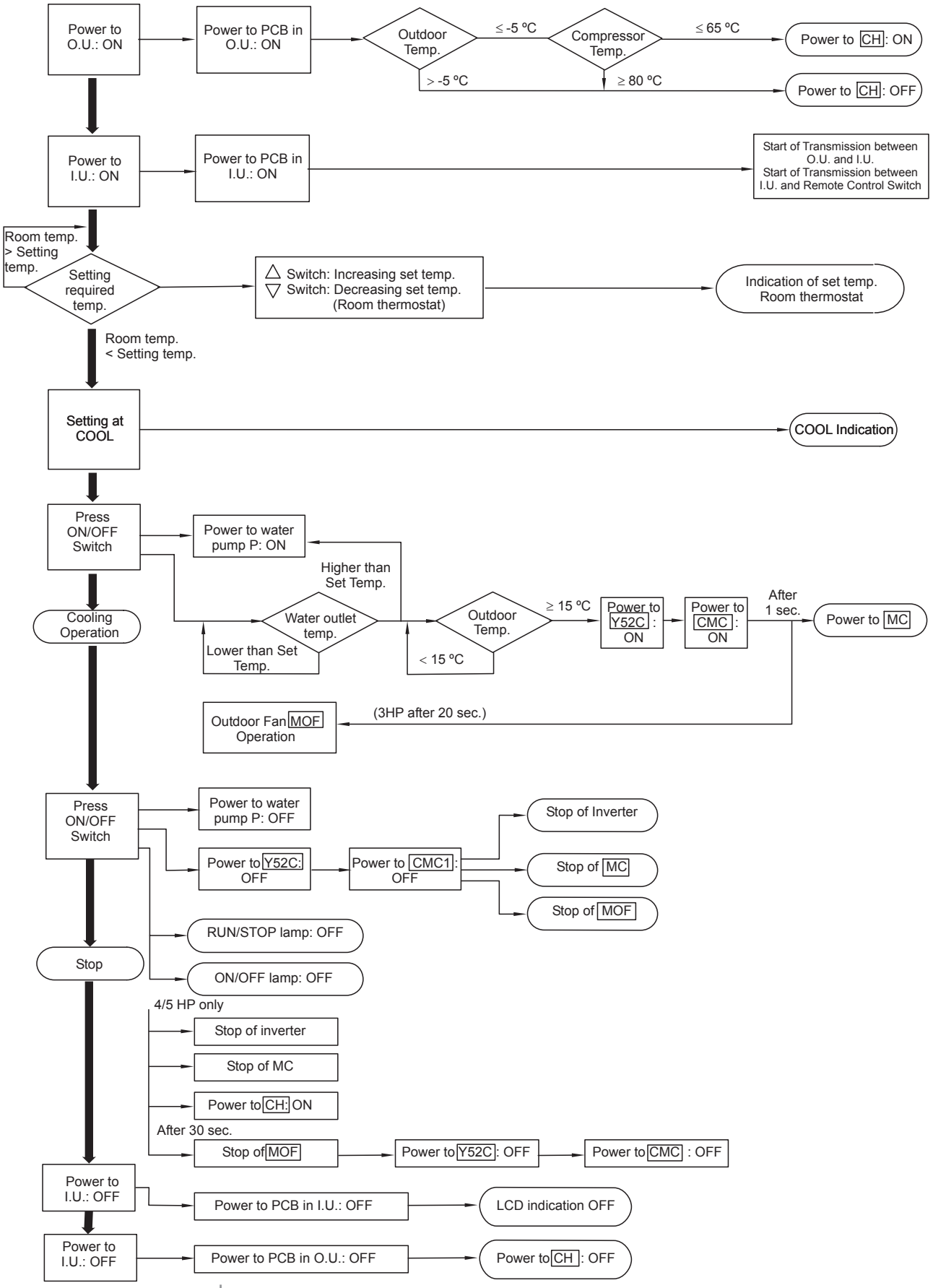
Model			**RWM-3~5FSNE**
Limiter (water thermostat)			48°C –adjustable value Floor: recommended setting at 40°C Automatic reset
Setting at Shipping			
	Klixon (electrical heaters)	°C	65 (Fixed value)
Low water level pressure switch		bar	Automatic reset 1
	Open		
	Closing	bar	1.5
Security valve		bar	3
	Activation		
Flow switch		bar	Automatic reset < 0.9
	Open		

5.5.2 Safety and control device setting for the outdoor units

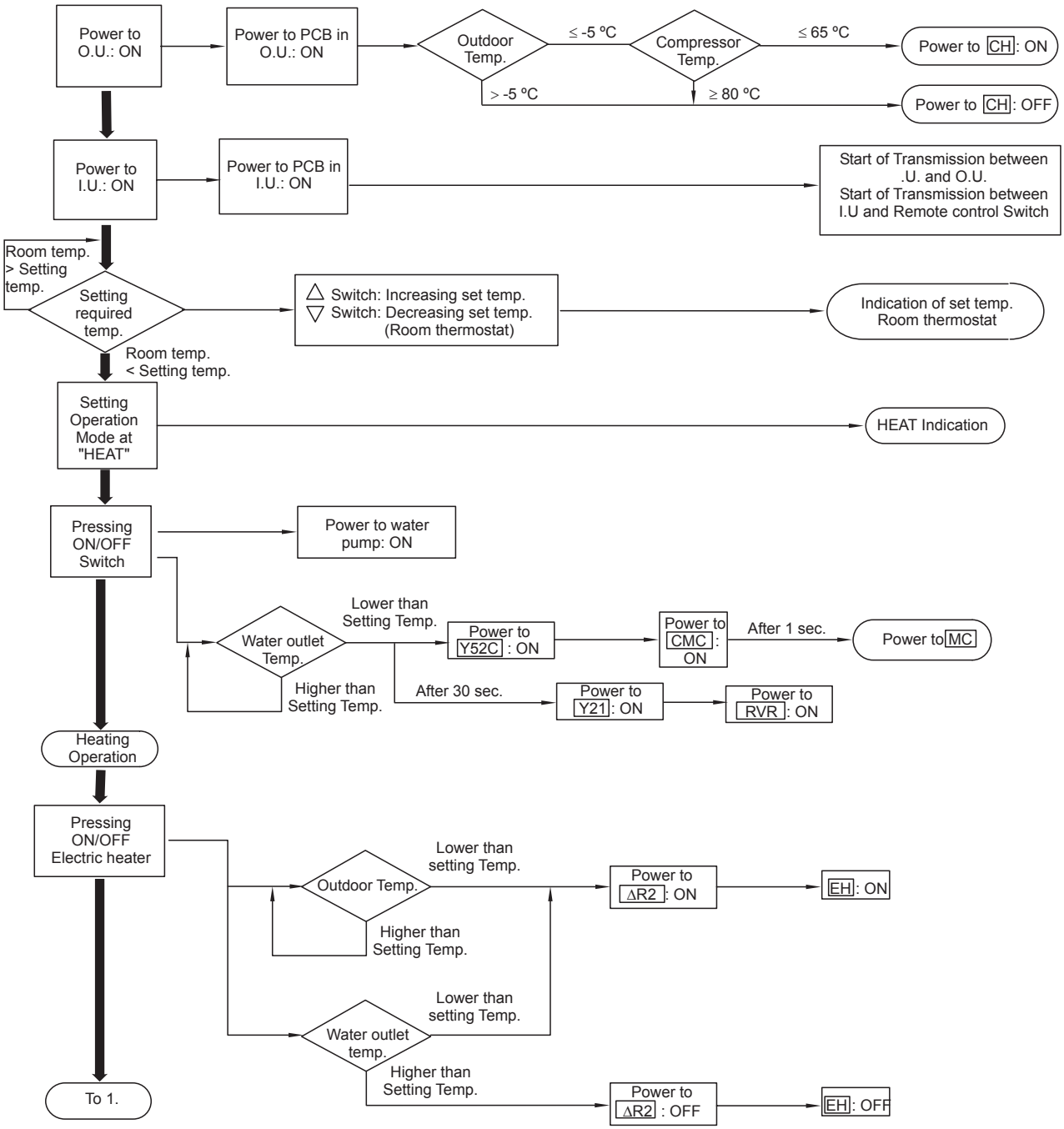
Model		**units**	**RAS-3~5H(V)RNE**
For compressor Compressor			Automatic Reset, Non-Adjustable(each one for each compressor)
High Pressure	Contact opening	MPa	$4.15^{-0.05}_{-015}$
	Contact closing	MPa	3.20 ± 0.15
For Control		A	40
	Fuse		
	1Φ, 230 V, 50 Hz		
CCP Timer		min.	Non-adjustable
Setting time			3
For condenser Fan motor			Automatic Reset, Non-Adjustable(each one for each motor)
Internal Thermostat			
	Contact opening	°C	120 ±5
Fuse Amperage on PCB of control circuit		A	5

5.6. Standard operation sequence

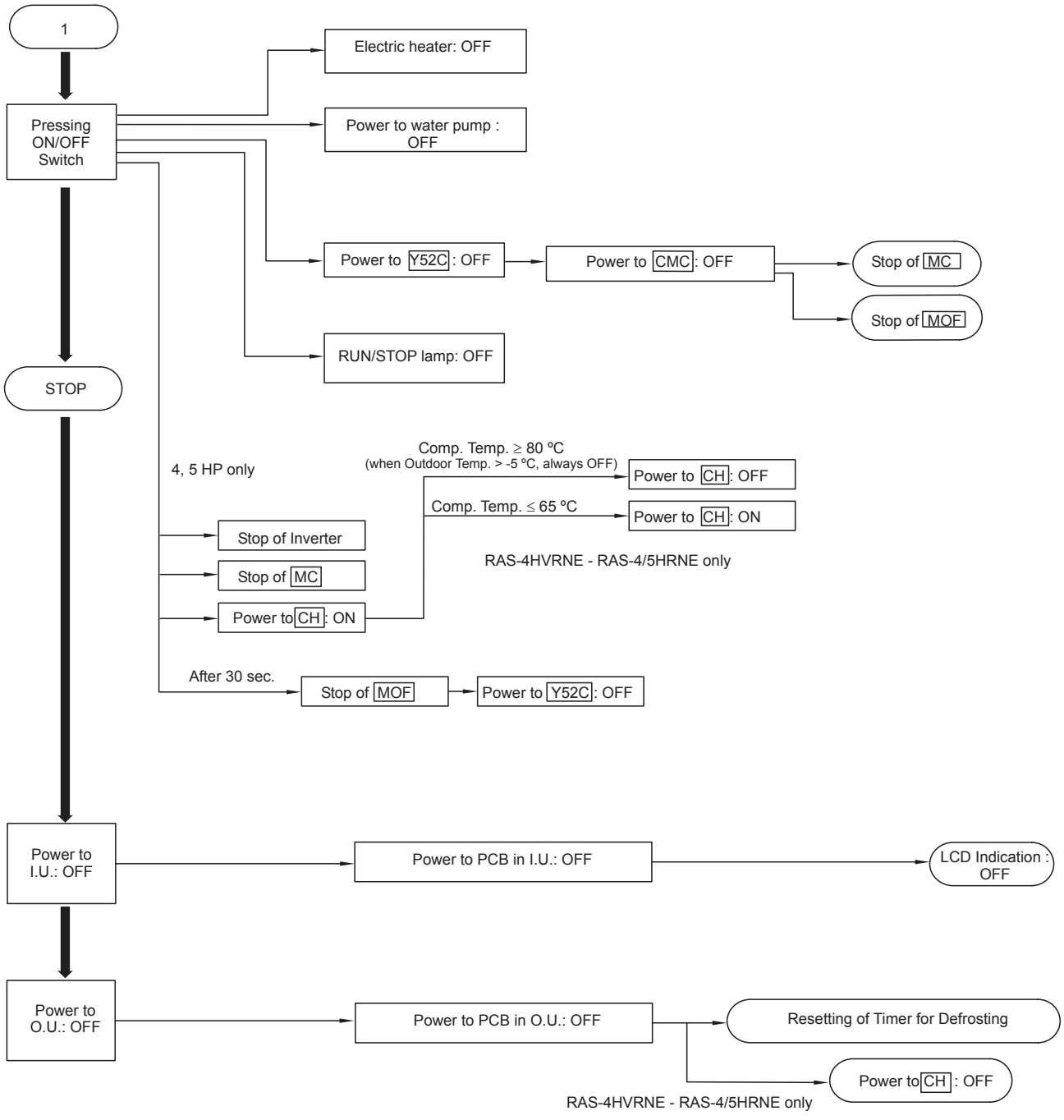
5.6.1. Cooling operation



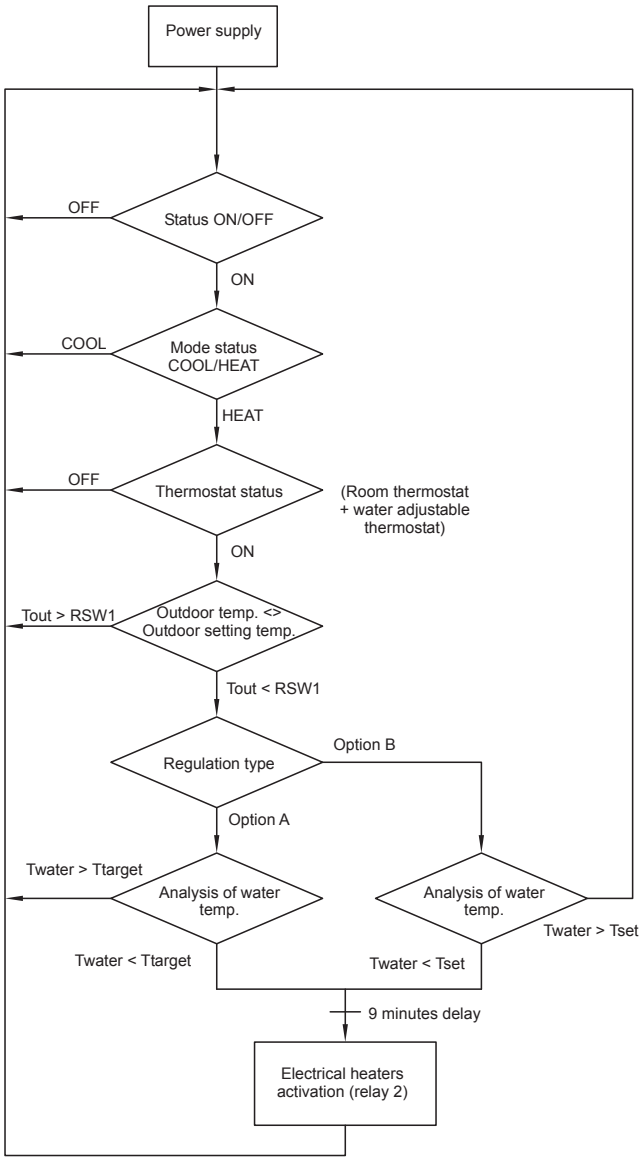
5.6.2. Heating operation



Heating operation (cont)



5.6.3. Electrical heater operation



Ttarget = Option A regulation
Tset = Option B regulation

6. Available optional functions

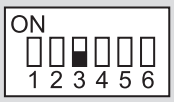
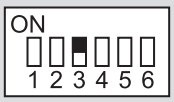
Contents

6.1. Optional functions summary

■ Night mode (Low Sound) Operation

The night mode (low sound) operation can be set by switching No. 3 pin of the dip switch to the “ON” position (only for cooling mode

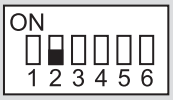
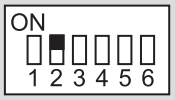
DSW2:

Standard specification (Factory setting)	Night shift mode (Low sound)
	

■ Energy saving operation

In case of customer request energy operation, set the dip switch on the Outdoor printed circuit board as shown below.

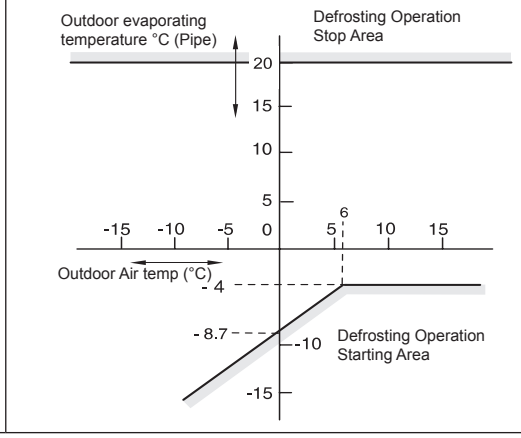
DSW2:

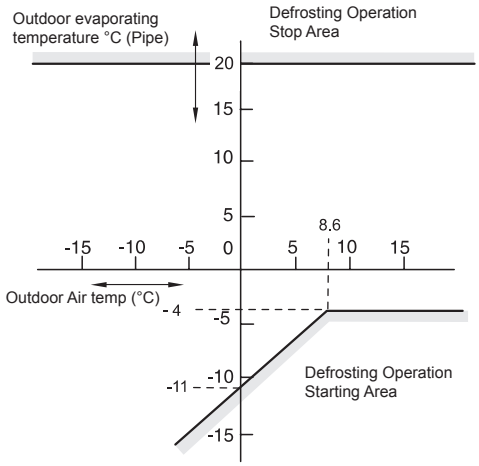
Standard specification (Factory setting)	Energy saving operation
	

■ Change of defrost operation conditions

This function allows to change the operation conditions in defrosting mode.

The change is shown in the following illustrations:

	Normal defrost condition (with jumper wire JP4)
Temperature conditions under defrost operation	

	Optional function condition (with jumper wire JP4)
Temperature conditions	

7. Commisioning

Contents

When installation is completed, perform commissioning according to the following procedure, and hand over the system to the customer. Perform commissioning regarding units one by one in order, and confirm that the electrical wiring and the piping are correctly connected.

Commissioning should be performed according to the next procedure:

7.1. Preliminary check

7.1.1. Electrical check

Warning ☛

Do not operate the system until all the check points have been cleared:

- Check to ensure that the electrical resistance is more than 1 M Ω, by measuring the resistance between ground and the terminal of the electrical parts. If not, do not operate the system until the electrical leakage is found and repaired. Do not impress the voltage on the terminals for transmission 1 and 2.
- Check to ensure that the stop valves of the outdoor unit are fully openned, and then start the system.
- Check to ensure that the switch on the main power source has been ON for more than 12 hours, to warm the compressor oil by the oil heater.
- Check the power supply voltage (±10% of the rated voltage).
- Check that field-supplied electrical components (main switches, breakers, wires, conduit connectors and wire terminals) have been properly selected according to the electrical specifications given in the Technical Catalogue of the unit and check that the components comply with national and local standards.
- Do not touch any electrical components for more than three minutes after turning OFF the main switch
- Confirm that the water circuit and the stop valves are fully open.
- Confirm that the leakage of the refrigerant and does not exist. The flare nuts are sometimes loosened by vibration during transportation.
- Check that the refrigerant piping and the electrical wiring conform to the same system.
- Confirm that the dip switch setting on the printed circuit board of the indoor units and the outdoor units are correct.
- Check whether or not the electrical wiring of the indoor units and the outdoor units are connected as shown in the chapter
- Pay attention to the following items while the system is running:
- Do not touch any of the parts by hand at the discharge gas side, since the compressor chamber and the pipes at the discharge side are heated higher than 90°C.
- DO NOT PUSH THE BUTTON OF THE MAGNETIC SWITCH (ES), it will cause a serious accident.
- Do not touch any electrical components for more than 3 minutes after turning OFF the main switch.

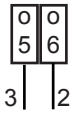
Note

For additional information, please refer to the troubleshooting chapter.

7.1.2. Hidraulic circuit checks

Do not operate the system until all the check points have been cleared:

- Check that the circuit has been properly flushed and filled with water and that the installation has been drained: the pressure of the heating circuit must be 1.8 bar (at least 1.5 bar).
- Check the setting of the water thermostat and adjust it according to the type of transmitter:
  40°C for the radiant floor
  48°C for the radiators:
- Check that the valves of the hydraulic circuit are open
- Check to ensure that the connections between AquaFREE module and receiver Room Thermostat are wired as indicated.



AquaFREE part

Receiver part

7.1.3. Refrigerant circuit checks

- Check that the stop valves of the gas and liquid lines are fully open.
- Confirm that the leakage of the refrigerant does not exist. The flare nuts sometimes loosen due to vibration during transportation.
- Check that the size of the piping and the refrigerant charge comply with the recommendations.
- Check that the setting of the dip switches, rotary switches and jumper switches on the two indoor electronic cards is correct.

Attention

Do not modify the set temperature that is displayed on the remote control that is integrated in the module, since this might cause a malfunction.

Warning

The first time that the system is commissioned it must be in heating mode, no matter what the season is.

7.2. Commissioning procedure

This procedure is valid, no matter what options are on the module.

1. Put the mode switch on the “HEAT” position.
2. Supply power to the installation.
   The pump must start (crank it if necessary)
3. Turn ON the unit
4. On the thermostat:
   - Choose the “HEAT” position
   - Set the desired set temperature
   - Press the ON/OFF button to commission the system.
5. Check the input power consumption Outdoor unit.
6. Check the input power consumption Indoor unit. (Only for units with Electric Heater).
7. Turn ON the Electric heater switch.
8. Check the input power consumption electric heater.

Note:

If the outdoor temperature is above 20ºC WB, the compressor will not start in HEATING mode.

Use the HEATING configuration from PCB outdoor unit, DSW1 pin1 and 2 ON, during the commissioning process, 2 hours. After this put the pin 1 and 2 in OFF.

Note:

(Only for heating radiant floor)

In case of radiant Floor for first commissioning, the temperature can not increase very quickly. The floor can be damage.

It must select the setting temperature for the commissioning following the next points:

Increassing 5°C the ambient temperature each 72 hours, until water temperature regulation (water rule) selected.

7.3. Check list

Installation data

Model	Outdoor Unit	Indoor Unit
Serial number		

Hydraulic circuit

Piping length (m)	
Piping diameter (mm)	
Water Outlet Temperature (ºC)	
Water Inlet Temperature (ºC)	
Pressure range (mH2O)	

Electrical circuit

Wiring length (m)	
Piping diameter (mm2)	
Power source (V, ~, Hz)	
Running current (A)	

Refrigerant circuit

Piping length (m)	
Liquid piping pressure (bar)	
Gas piping pressure (bar)	
Outdoor air temperature (ºC)	

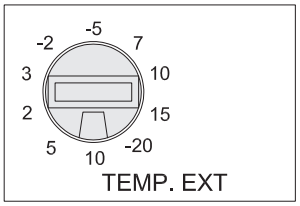
7.4. Operation of the auxiliary electric heater

The auxiliary electric heater is an option; it is found on all models that contain the letter H in the Reference: RWM-FSN1E-H

On the module equipped with the “electric heaters” option, an “ON/OFF” switch for the electric heaters allows you to switch them on (factory setting: OFF).

1. Turn ON the unit
2. Put the mode switch on the “HEAT” position.
3. Put the “electric heaters” switch in the ON position.

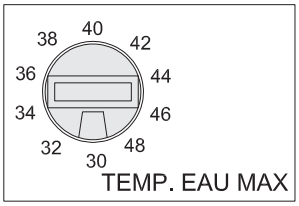
The electric heater starts up if both of the following premises occurs:
If the outdoor temperature is lower than the temperature selected on RSW1



The range of these values is among 10ºC to –20ºC

Note:
For additional information, please refer to the troubleshooting chapter

If the water temperature is lower than the temperature selected on RSW2



The range of these values is among 48ºC to 30ºC

Warning:
This is only a refreshing system, not a cooling system. The water target temperature for 7 ºC is not used for these applications.

7.5. Summer operation

All modules are of the reversible type and can therefore operate as heating or refreshing.This mode is available when the module is connected to radiant floor.

1. Put the mode switch on the “COOL” position.
2. If the module is equipped with electric heaters put the electric heater switch in the “OFF” position.
3. Turn “ON” the unit.
4. On the thermostat:
   - Choose the summer position
   - Set the desired set temperature
   - Press the ON/OFF button.

Under normal operation one condition have to be met for start up (this condition is selected by JP1):

- Water temperature ≤ the “water temp” setting. (Factory setting = 19ºC)

8. Troubleshooting

Contents

8.1. Initial troubleshooting

8.1.1. Failure of the power supply to the indoor unit and the remote control switch

- The LED and the LCD are not indicated.
- Not operated

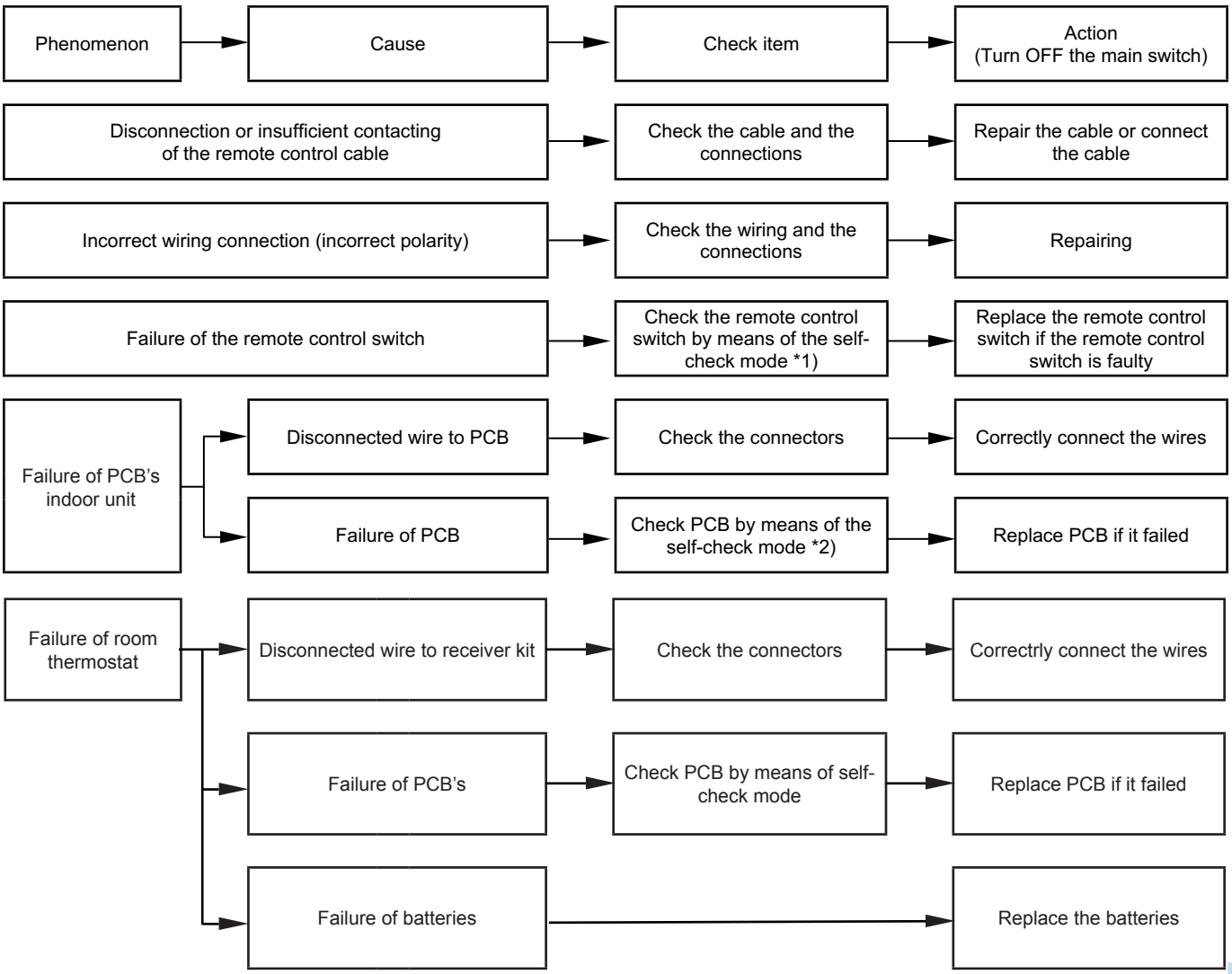
If the fuses are blown out or a breaker is activated, investigate the cause of the overcurrent and take the necessary action.

Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Power failure or power is not ON		Measure the voltage by means of the voltmeter	Supply the power
Blown out fuse or activation of the breaker at the power source	Short circuit supplied between the wires	Check for any uncovered part of the wires	Remove the cause of the short circuit and replace the fuse
	Short circuit of the wires to earth	Measure the insulation resistance	Remove the cause of the short circuit and replace the fuse
Blown out fuse at the control circuit	Short circuit supplied between the wires	Check for any uncovered part of the wires	Remove the cause of the short circuit and replace the fuse
	Short circuit of the control circuit to earth	Measure the insulation resistance	Remove the cause of the short circuit and replace the fuse
Failure of the transformer at the indoor unit side		Measure the voltage at the secondary side	Replace the transformer
Disconnected cable of the remote control switch		Connect the cable	Replace the cable or repair the cable
Insufficient contacting at the connectors of the remote control switch	Insuffcient or incorrect connection of the indoor unit PCB's	Check the connectors	Correctly connect the connector
	Insuffcient or incorrect connec-tion of the indoor unit PCB's in the RCS		
Failure of the remote control switch / (Receiver)		Check the remote control switch by means of the self-check mode *1)	Replace the remote control switch if it failed, or change the batterie
Failure of PCB's	Unconnected wires to PCB's	Check the connectors	Correctly connect the wires
	Failure of PCB's	Check PCB's by means of the self-check mode *2	Replace PCB if it failed
Incorrect wiring connection		Check the cables and the connections	Repair or connect the cable correctly

*2): Refer to section 8.3.1.

8.1.2. Abnormal transmission bteween the remote control switch and the indoor unit

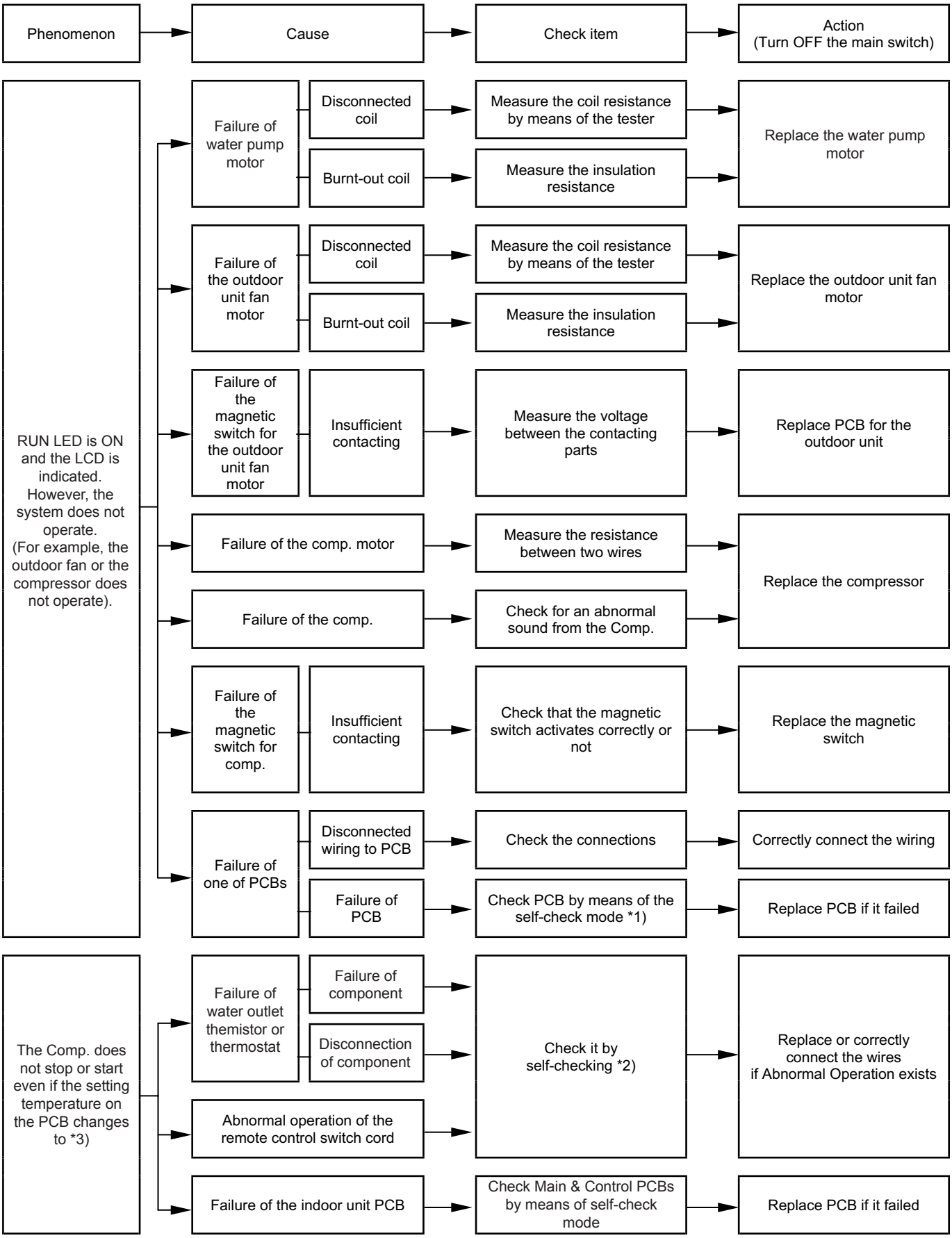
■ RUN LED on the remote control switch:
Flickering every 2 seconds.



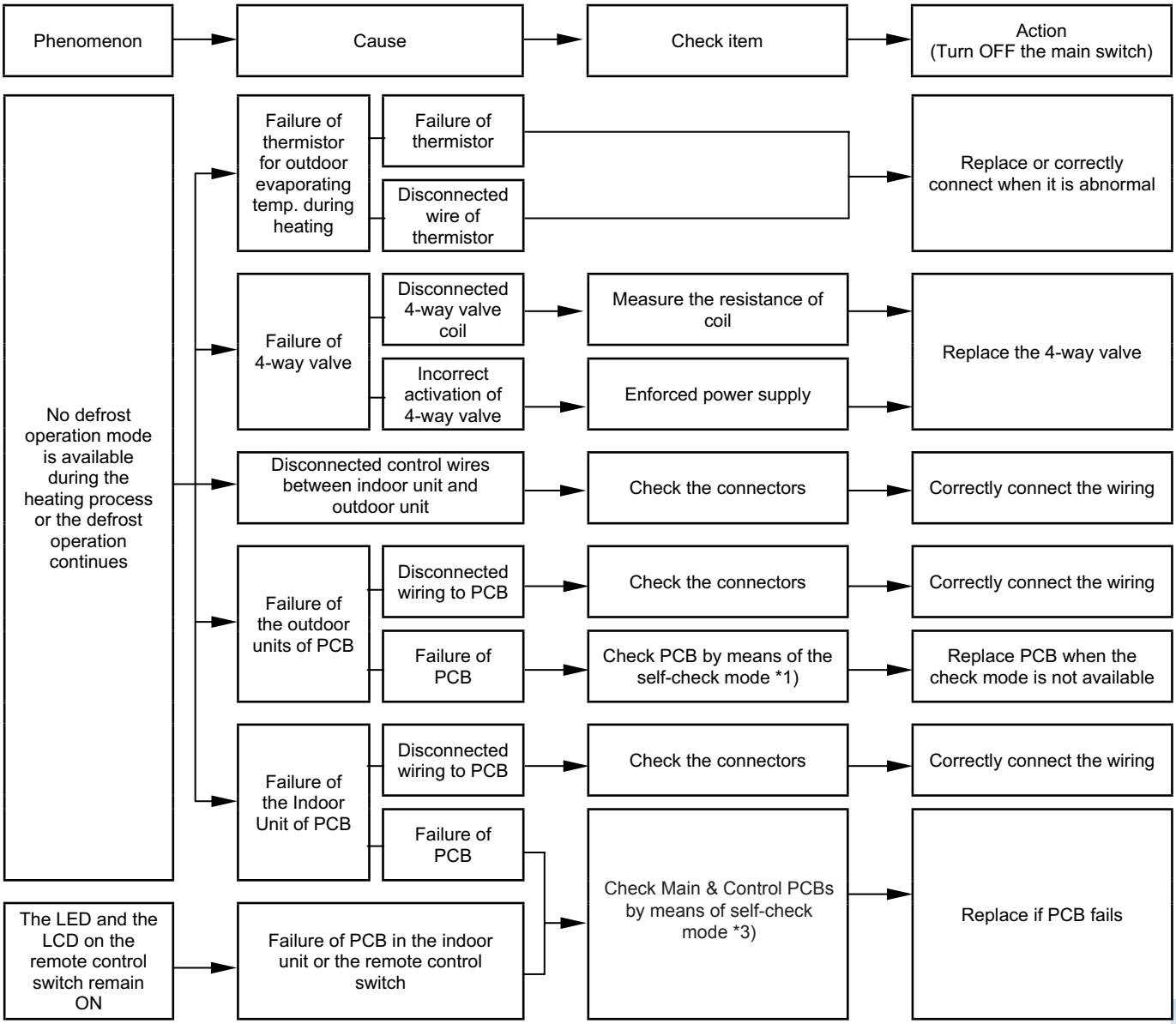
*1): Refer to section 8.3.2
*2): Refer to section 8.3.1

8

8.1.3. Abnormal operation of the devices



Abnormal operation of the devices (cont)

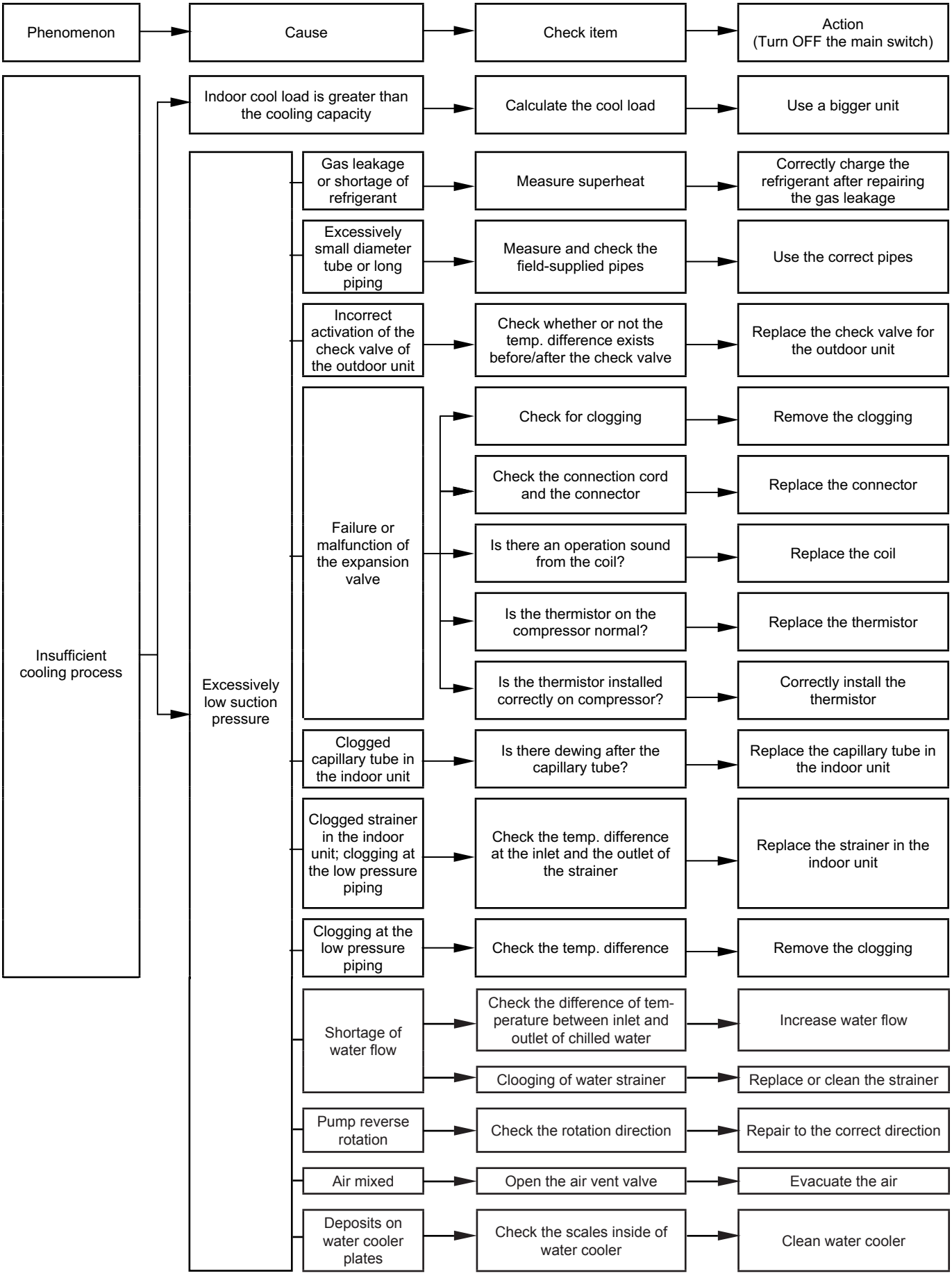


*1): Refer to section 8.3.2.
*2): Refer to section 8.3.1.

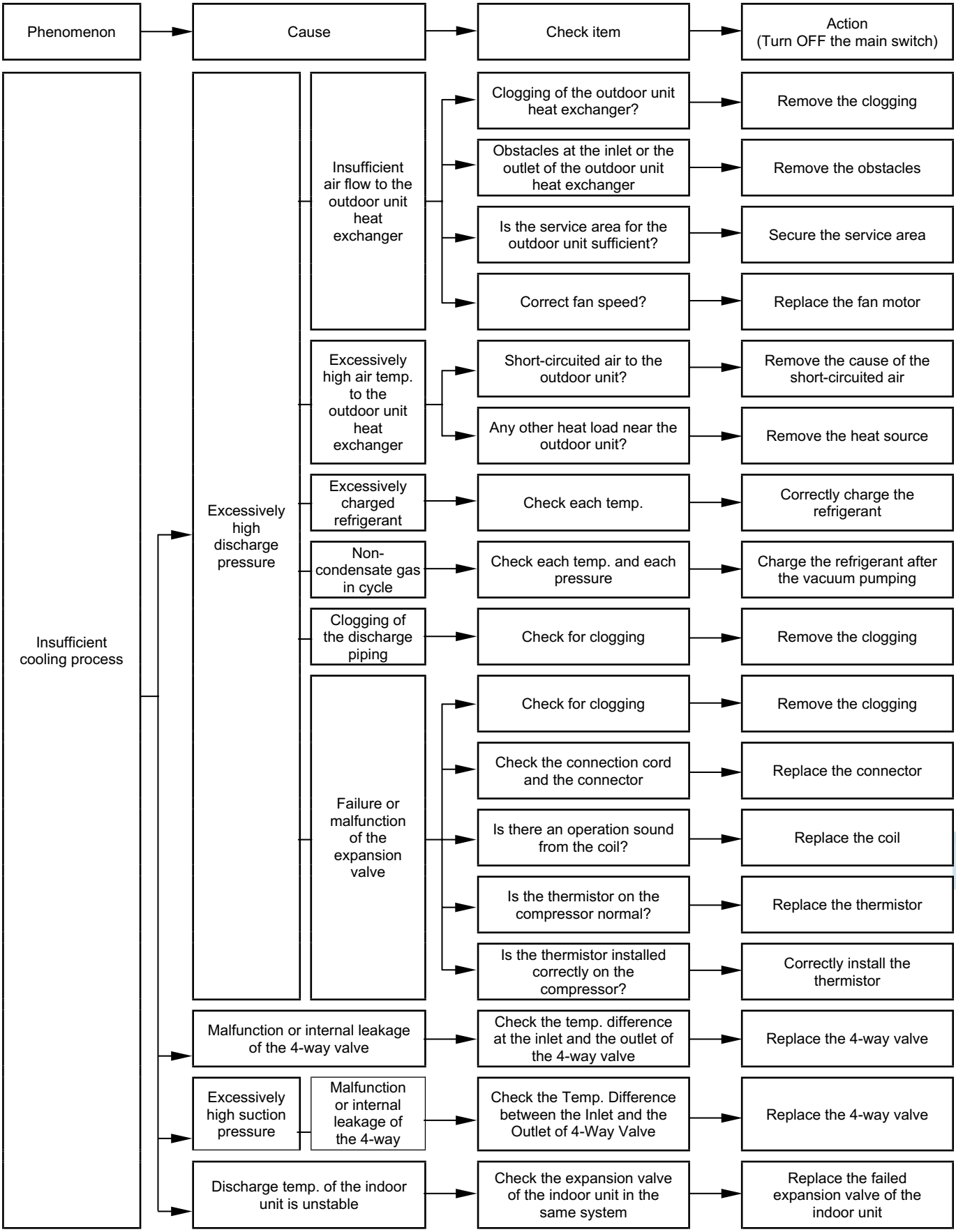
*3): Even if the remote control switches are normal, the compressor does not operate under the following conditions:

1. Water temp. is lower than 20 °C or outdoor temp. is lower than 10 °C during the cooling process (DB).
2. Indoor temp. is higher than 25 °C (DB) or outdoor temp. is higher than 15 °C (WB) during the heating process.
3. When a cooling (or heating) process signal is given to the outdoor unit and a different mode as heating (or cooling) process signal is given to the indoor units.
4. When an emergency stop signal is given to outdoor unit.

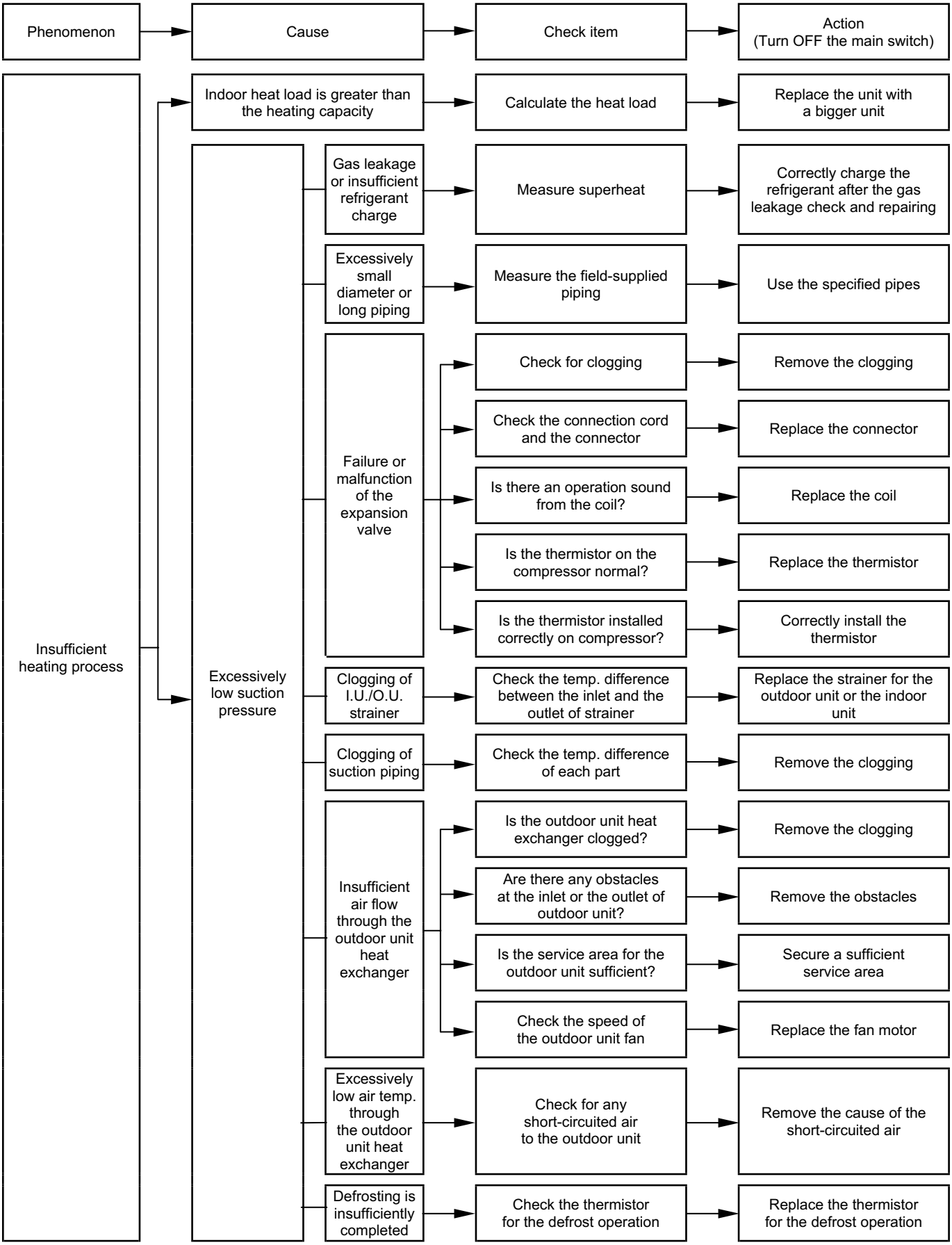
Abnormal operation of the devices (cont)



Abnormal operation of the devices (cont)



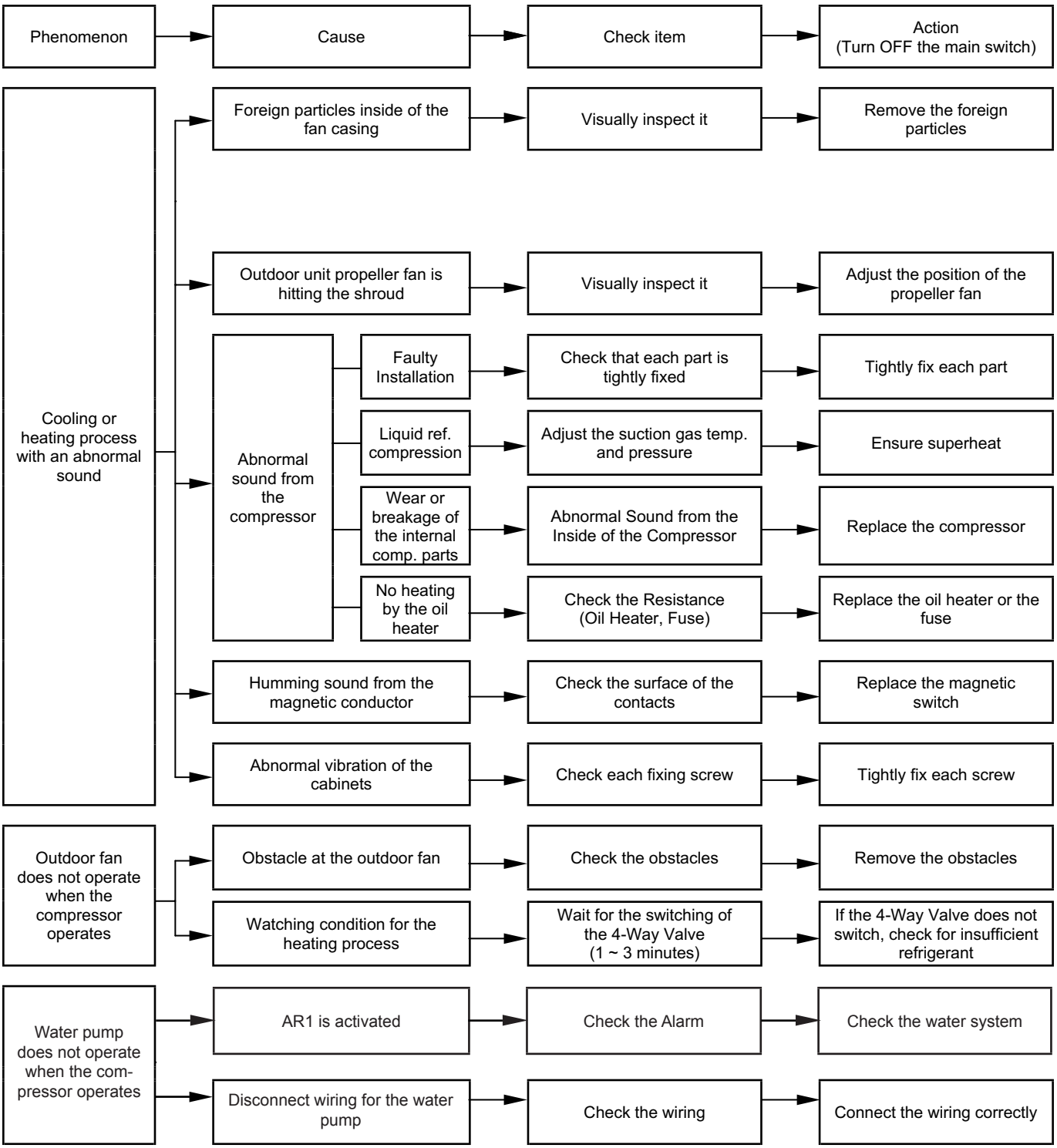
Abnormal operation of the devices (cont)



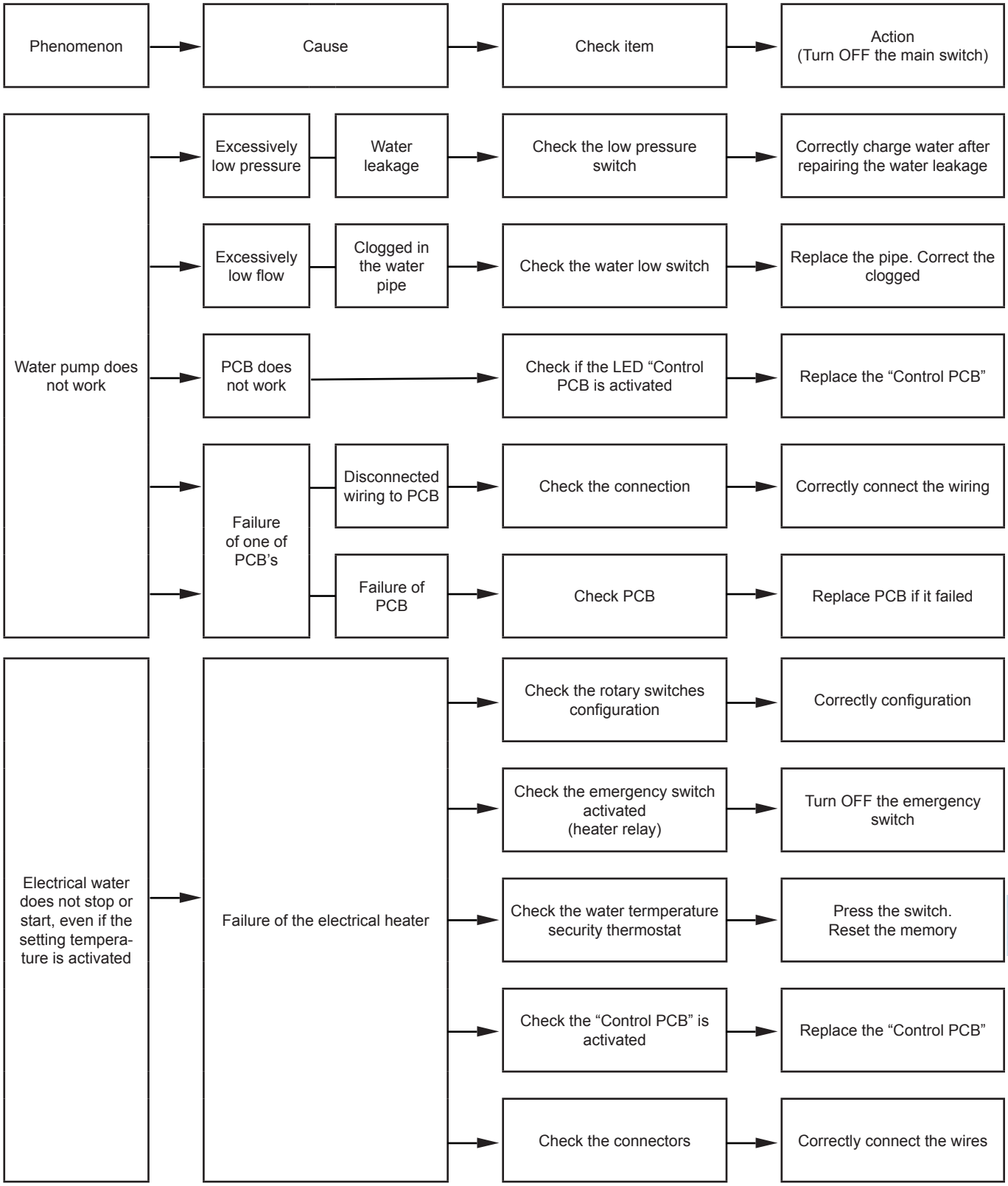
Phenomenon	Cause		Check item	Action (Turn OFF the main switch)
Insufficient heating process	Excessively high discharge pressure	Insufficient water flow to the indoor unit heat exchanger	Check the filter for a clogging	Remove the cloggin
			Check for any obstacles at the inlet or the outlet of the indoor unit	Remove the obstacles
			Check the water pump	Replace the water pump
		Excessively high water temp. to the indoor unit heat exchanger	Check whether or not the short-circuied water exist	Remove the cause of the short-circuited water
		Excessively charged refrigerant	Check the refrigerant quantity *1)	Correctly charge the refrigerant
		Non-condensate gas in ref. cycle	Check the refrigerant quantity *1)	Recharge the refrigerant after the vacuum pumping
		Clogging of the discharge pr. piping	Check for clogging	Remove the clogging
		Storage of water flow	Check the difference of temperature between inlet and outlet of chilled water	Increase water flow
			Clogging of water strainer	Replace or clean the strainer
		Pump reverse rotation	Check the rotation direction	Repair to correct direction
		Air mixed	Open the air vent valve	Evacuate the air
		Deposits on water cooler plates	Check the scales inside of water cooler	Clean water cooler
	Malfunction or internal leakage of the 4-way valve		Check the temp. difference at the inlet and the outlet of the 4-way valve	Replace the 4-way valve
	Malfunction of the check valve of the outdoor unit		Check the temp. difference at the inlet and the outlet of the check valve	Replace the check valve
	Excessively high suction pressure	Malfunction or internal leakage of the 4-way valve	Check the temp. difference at the inlet and the outlet of the 4-way valve	Replace the 4-way valve
	Water outlet temp. of the indoor unit is unstable		Check the expansion valve of the indoor unit in the same system	Replace the failed expansion valve of the indoor unit

*1): Refer to chapter 7 of TC

Abnormal operation of the devices (cont)



Abnormal operation of the devices (cont)



8.2. Troubleshooting procedure

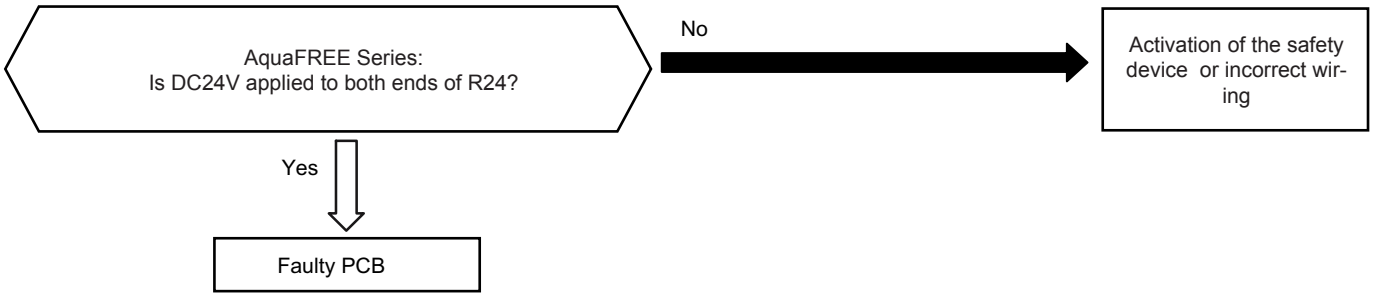
8.2.1. Alarm code table

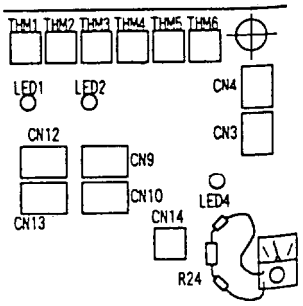
Code No.	Item involved	Contents of abnormality	Leading cause
01	Indoor unit	Tripping of module protective device	Activation of the flow controller, the low water level pressure switch.
02	Outdoor unit	Tripping of protective device	Activation of the PSH, Locked Motor
03	Transmission	Abnormality between Indoor (or Outdoor) and Outdoor (or Indoor)	Incorrect wiring, Failure of the PCB (indoor or outdoor). Blown fuse. Power supply (module or OU) is OFF.
04		Abnormal operation between the inverter and the control PCB	Failure in Transmission between PCBs (for Inverter)
06	Voltage drop	Voltage Drop by Excessively Low or High Voltage to Outdoor Unit	Voltage Drop of Power Supply, Incorrect Wiring or insufficient Capacity of Power Supply Wiring.
07	Cycle	Decrease in Discharge Gas Superheat	Excessive Refrigerant Charge, Expansion Valve Open Lock.
08		Increase in Discharge Gas Temperature.	Insufficient Refrigerant. Ref. Leakage, Clogging or Expansion Valve Close Lock.
11	Sensor on the Indoor Unit	Control PCB	Failure of Thermistor, control card, connection.
12		Heater situated in THM2	
13		Freeze protection thermistor	
14		Thermistor for Gas Piping	
19		Flow controller blocked	Crank the controllerCheck pump operation.
20	Sensor on Outdoor Unit	Thermistor for compressor	Failure of a Thermistor, a sensor, a Connection.
22		Outdoor Air Thermistor	
24		Evaporating thermistor	
31		Incorrect setting of outdoor and indoor unit	Incorrect Setting of Capacity Code
35		Incorrect setting of Indoor Unit No.	Duplication of the Indoor Unit number.
38		Abnormality of Protective Circuit in Outdoor Unit	Faulty PCB for outdoor unit. Incorrect Wiring Connection to PCB in Indoor Unit.
41	Pressure	Overload in cooling mode(HP pressure switch tripped)	-Check the airflow for a condenser (fan motor, battery)- Presence of non-condensable gas- Overcharged Refrigerant
42		Overcharge in cooling mode(HP pressure switch tripped)	- Presence of non-condensable gas- Overcharged Refrigerant- Check the pump (insufficient water flow).
47		Activation of Low Pressure Decrease Protection Device	Stoppage due to Excessive Decrease of evaporating Temperature (Te < -35ºC) is activated 3 times in one hour. Incorrect overheating (gas shortage), insufficient water flow.
51	Inverter	Abnormality of inverter current sensor	Failure of Control PCB, ISPM
52		Overcurrent protection activating	Failure of ISPM, Clogging of Heat Exchanger, Compressor blocked.
53		Activation for protecting the ISPM	ISPM FailureAbnormality of Compressor, clogging of Heat Exchanger
54		Increase in Inverter Fin temperature	Abnormal Inverter Fin Thermistor.Clogging of Heat ExchangerAbnormal Outdoor Unit Fan
55	ISPM	ISPM Abnormality	Defective ISPM
57	Outdoor fan	Fan Motor Abnormality	Disconnected wire or incorrect wiring between Control PCB and inverter PCB.Incorrect Wiring or Fan Motor Abnormality
EE	Compressor	Compressor Protection Alarm	Failure of Compressor

8.2.2. Truobleshooting by alarm code

Alarm code	Tripping of the protective module
01	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the contact between #1 and #3 of PCN13 is not closed over 120 seconds during the cooling process, the heating process or the fan operation.

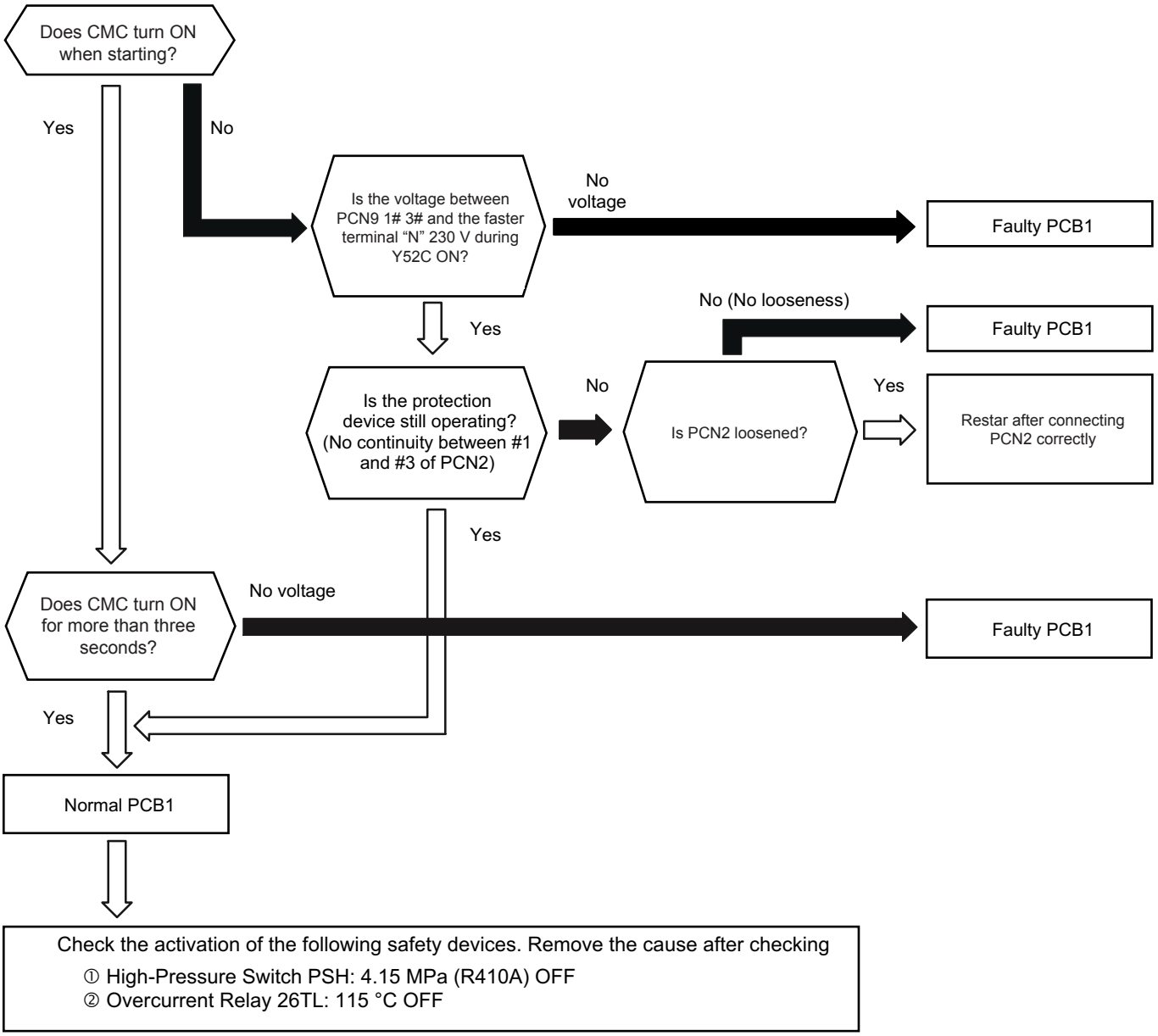


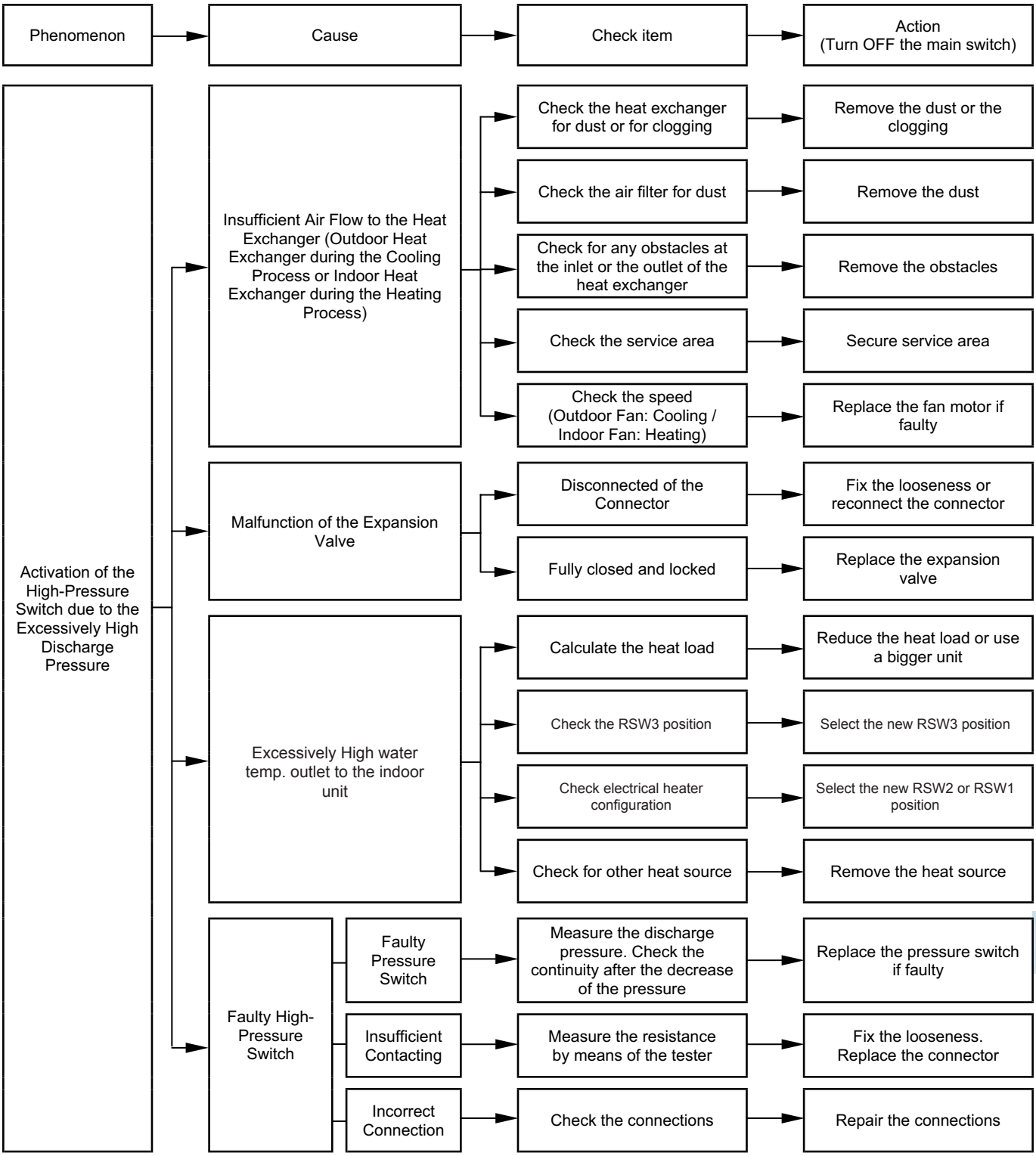


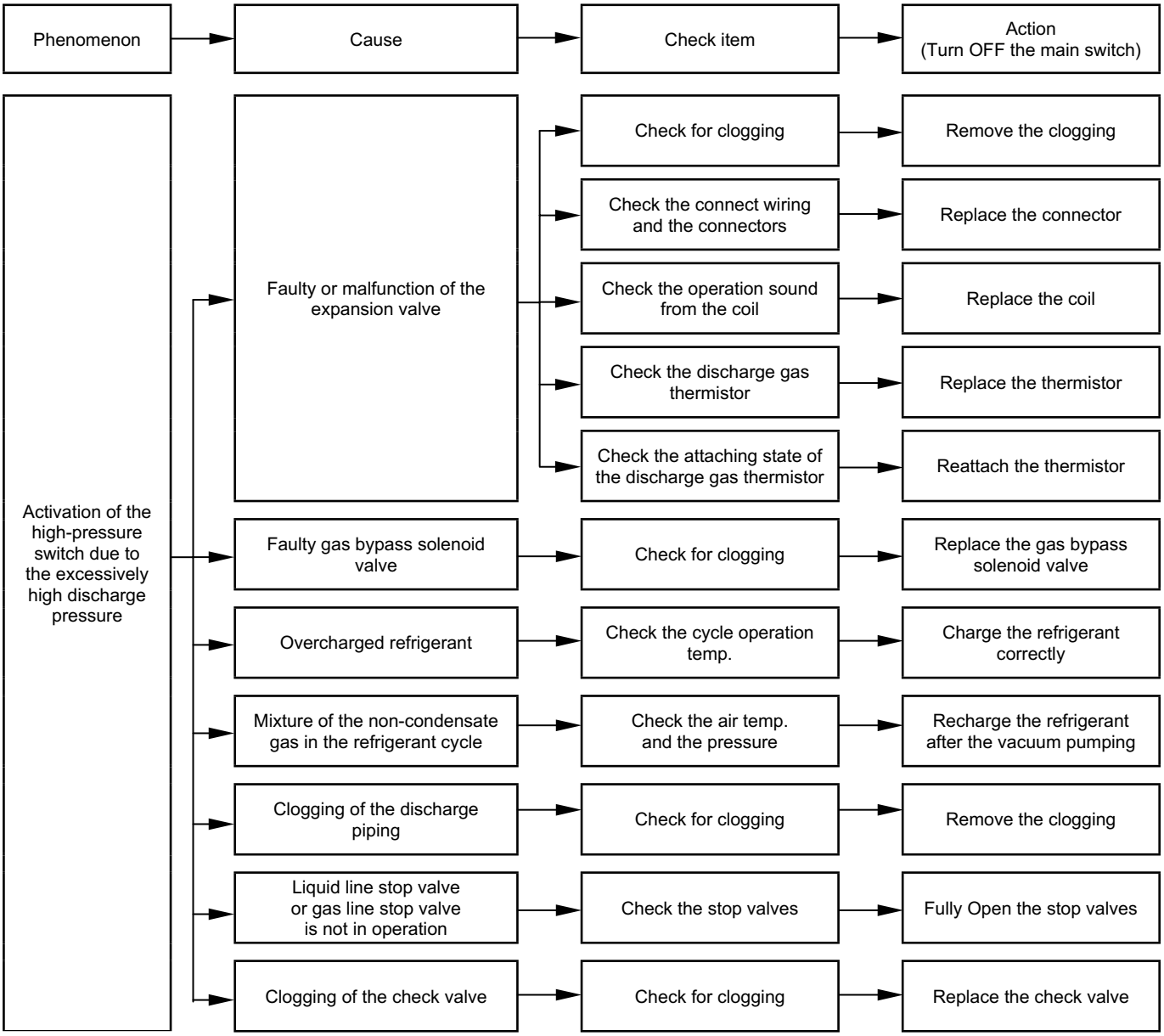
Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Deactivation of the water flow switch	Water leakage	Check the manometer	Repair the water leakage
	Clogged water circuit	Check the water system	Replace or clean the filter
		Check the heat exchanger	Replace the heat exchanger
		Check the connections	Repair the connection
Deactivation of pressure switch	Water pressure drop	Water leakage → Manometer	Repair water leakage
		Water pump faulty → Check connection	Replace
Faulty indoor unit PCB		Check Main & Control PCB	Replace PCB if faulty

Alarm code	Tripping of the protective device
02	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  ✶ This alarm is displayed when one of the safety devices is activated during the compressor operation.




Phenomenon
Cause
Check item
Action
(Turn OFF the main switch)
Activation of the High-Pressure Switch due to the Excessively High Discharge Pressure
Insufficient Air Flow to the Heat Exchanger (Outdoor Heat Exchanger during the Cooling Process or Indoor Heat Exchanger during the Heating Process)
Check the heat exchanger for dust or for clogging
Remove the dust or the clogging
Check the air filter for dust
Remove the dust
Check for any obstacles at the inlet or the outlet of the heat exchanger
Remove the obstacles
Check the service area
Secure service area
Check the speed (Outdoor Fan: Cooling / Indoor Fan: Heating)
Replace the fan motor if faulty
Malfunction of the Expansion Valve
Disconnected of the Connector
Fix the looseness or reconnect the connector
Fully closed and locked
Replace the expansion valve
Excessively High water temp. outlet to the indoor unit
Calculate the heat load
Reduce the heat load or use a bigger unit
Check the RSW3 position
Select the new RSW3 position
Check electrical heater configuration
Select the new RSW2 or RSW1 position
Check for other heat source
Remove the heat source
Faulty High-Pressure Switch
Faulty Pressure Switch
Measure the discharge pressure. Check the continuity after the decrease of the pressure
Replace the pressure switch if faulty
Insufficient Contacting
Measure the resistance by means of the tester
Fix the looseness. Replace the connector
Incorrect Connection
Check the connections
Repair the connections


Phenomenon
Cause
Check item
Action
(Turn OFF the main switch)
Activation of the high-pressure switch due to the excessively high discharge pressure
Faulty or malfunction of the expansion valve
Check for clogging
Remove the clogging
Check the connect wiring and the connectors
Replace the connector
Check the operation sound from the coil
Replace the coil
Check the discharge gas thermistor
Replace the thermistor
Check the attaching state of the discharge gas thermistor
Reattach the thermistor
Faulty gas bypass solenoid valve
Check for clogging
Replace the gas bypass solenoid valve
Overcharged refrigerant
Check the cycle operation temp.
Charge the refrigerant correctly
Mixture of the non-condensate gas in the refrigerant cycle
Check the air temp. and the pressure
Recharge the refrigerant after the vacuum pumping
Clogging of the discharge piping
Check for clogging
Remove the clogging
Liquid line stop valve or gas line stop valve is not in operation
Check the stop valves
Fully Open the stop valves
Clogging of the check valve
Check for clogging
Replace the check valve

Alarm code	Abnormal transmission between the indoor unit and the outdoor unit
03	

■ The RUN LED flickers and “ALARM” is displayed on the remote control switch.

■ The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.

* This alarm is displayed when an abnormal operation is maintained for three minutes after the normal transmission between the indoor unit and the outdoor unit. Also, an abnormal operation is maintained for 30 seconds after the micro-computer is automatically reset.
The alarm is displayed when the abnormal transmission is maintained for 30 seconds from the starting of the outdoor unit.

* Investigate the cause of the overcurrent and take the necessary action when the fuses are blown out or the breaker for the outdoor unit is activated.

(Refer to the next page)

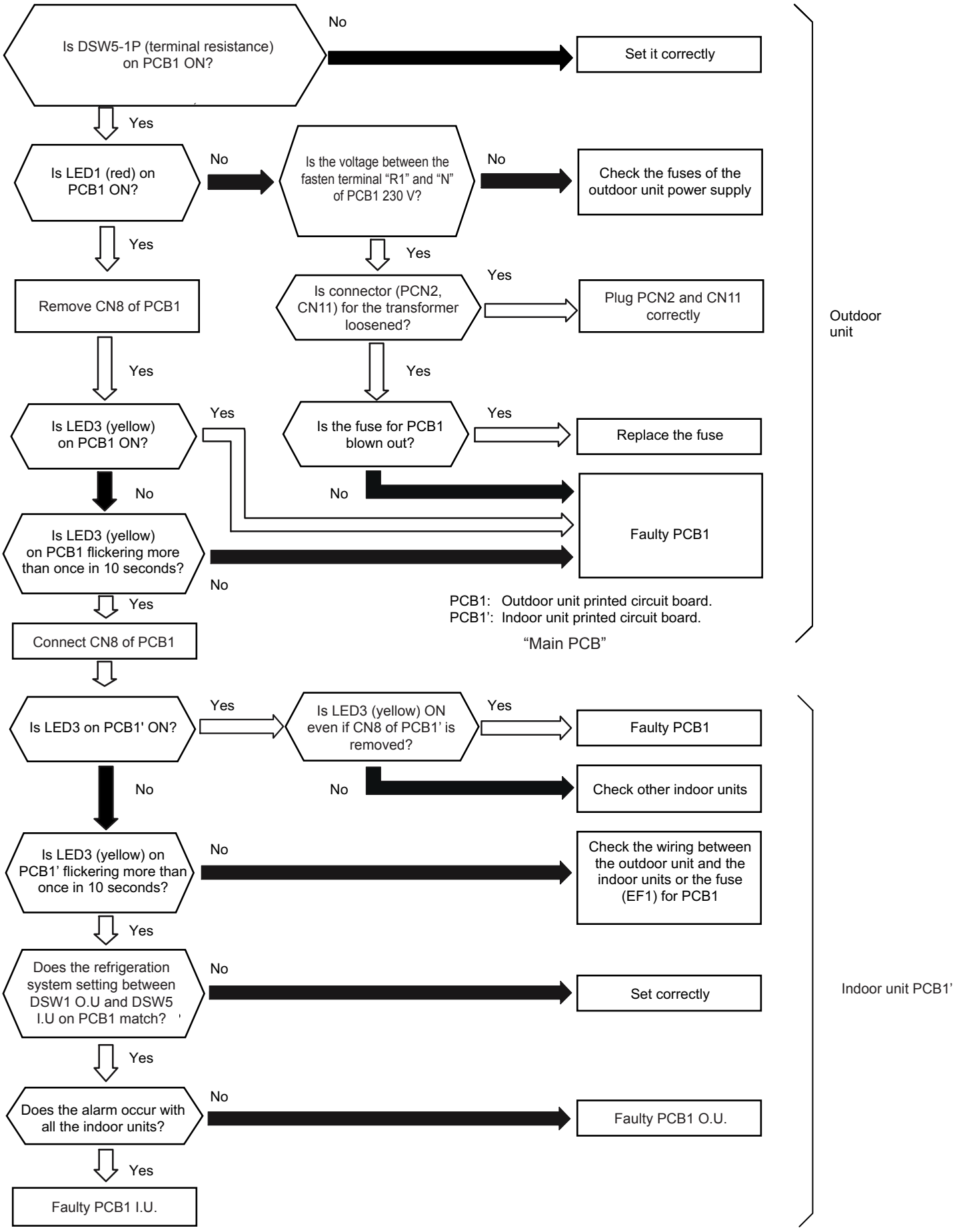
Note from next page:

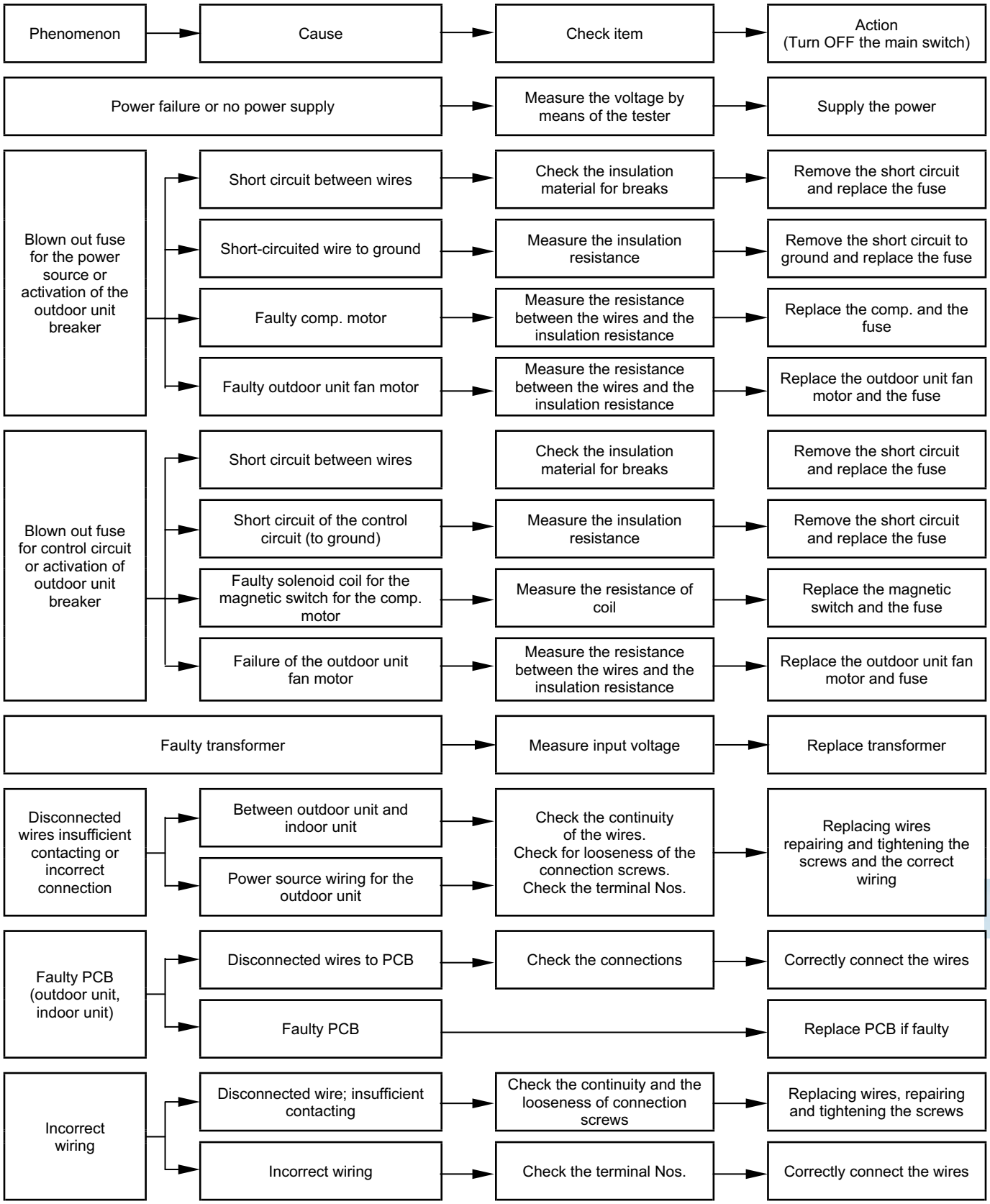
*1) In case that the terminal resistance (DSW5-1P) is OFF when the H-Link Connection is performed.
Set the terminal resistance to ON when CN8 is removed.
Set the terminal resistance to OFF when CN8 is reconnected.

Check item	
Power supply	Fasten terminal
400 V 50 Hz	Between R1 and S1
230 V 50 Hz	Between R1 and N

*2) Factory setting of PCB1 for non-pole transmission

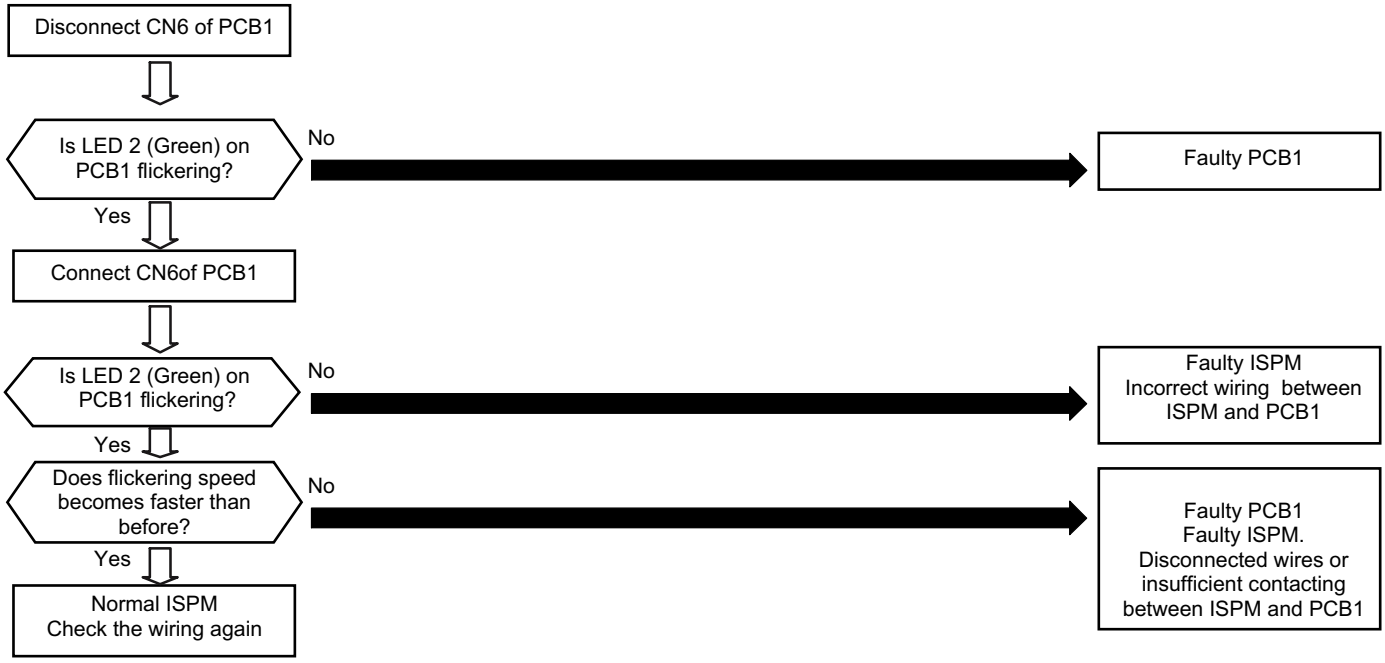
Item	Setting position
SW1	Left side (New transmission side)
JP1	Short circuit
CN2	Transmission wire connector
CN18	Non-occupied


Is DSW5-1P (terminal resistance) on PCB1 ON?
No
Set it correctly
Yes
Is LED1 (red) on PCB1 ON?
No
Is the voltage between the fasten terminal "R1" and "N" of PCB1 230 V?
No
Check the fuses of the outdoor unit power supply
Yes
Yes
Remove CN8 of PCB1
Is connector (PCN2, CN11) for the transformer loosened?
Yes
Plug PCN2 and CN11 correctly
Yes
Yes
Is LED3 (yellow) on PCB1 ON?
Yes
Is the fuse for PCB1 blown out?
Yes
Replace the fuse
No
No
Faulty PCB1
Is LED3 (yellow) on PCB1 flickering more than once in 10 seconds?
No
Yes
Connect CN8 of PCB1
PCB1: Outdoor unit printed circuit board.
PCB1': Indoor unit printed circuit board.
"Main PCB"
Outdoor unit
Is LED3 on PCB1' ON?
Yes
Is LED3 (yellow) ON even if CN8 of PCB1' is removed?
Yes
Faulty PCB1
No
No
Check other indoor units
Is LED3 (yellow) on PCB1' flickering more than once in 10 seconds?
No
Check the wiring between the outdoor unit and the indoor units or the fuse (EF1) for PCB1
Yes
Does the refrigeration system setting between DSW1 O.U and DSW5 I.U on PCB1 match?
No
Set correctly
Yes
Does the alarm occur with all the indoor units?
No
Faulty PCB1 O.U.
Yes
Faulty PCB1 I.U.
Indoor unit PCB1'


Phenomenon
Cause
Check item
Action (Turn OFF the main switch)
Power failure or no power supply
Measure the voltage by means of the tester
Supply the power
Blown out fuse for the power source or activation of the outdoor unit breaker
Short circuit between wires
Check the insulation material for breaks
Remove the short circuit and replace the fuse
Short-circuited wire to ground
Measure the insulation resistance
Remove the short circuit to ground and replace the fuse
Faulty comp. motor
Measure the resistance between the wires and the insulation resistance
Replace the comp. and the fuse
Faulty outdoor unit fan motor
Measure the resistance between the wires and the insulation resistance
Replace the outdoor unit fan motor and the fuse
Blown out fuse for control circuit or activation of outdoor unit breaker
Short circuit between wires
Check the insulation material for breaks
Remove the short circuit and replace the fuse
Short circuit of the control circuit (to ground)
Measure the insulation resistance
Remove the short circuit and replace the fuse
Faulty solenoid coil for the magnetic switch for the comp. motor
Measure the resistance of coil
Replace the magnetic switch and the fuse
Failure of the outdoor unit fan motor
Measure the resistance between the wires and the insulation resistance
Replace the outdoor unit fan motor and fuse
Faulty transformer
Measure input voltage
Replace transformer
Disconnected wires insufficient contacting or incorrect connection
Between outdoor unit and indoor unit
Power source wiring for the outdoor unit
Check the continuity of the wires. Check for looseness of the connection screws. Check the terminal Nos.
Replacing wires repairing and tightening the screws and the correct wiring
Faulty PCB (outdoor unit, indoor unit)
Disconnected wires to PCB
Check the connections
Correctly connect the wires
Faulty PCB
Replace PCB if faulty
Incorrect wiring
Disconnected wire; insufficient contacting
Check the continuity and the looseness of connection screws
Replacing wires, repairing and tightening the screws
Incorrect wiring
Check the terminal Nos.
Correctly connect the wires

Alarm code	
04	**Abnormal transmission between the inverter and the outdoor PCB1 and ISPM**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB1.
  - ✶ This alarm is displayed when the abnormal operation is maintained for 30 seconds after the normal transmission between the outdoor unit PCB1 and ISPM. Also, the abnormal operation is maintained for 30 seconds after the micro-computer is automatically reset. The alarm is displayed when the abnormal transmission is maintained for 30 seconds from the starting of the outdoor unit.
  - ✶ The alarm code "04." is displayed when the abnormal transmision is maintained between ISPM and FANM.

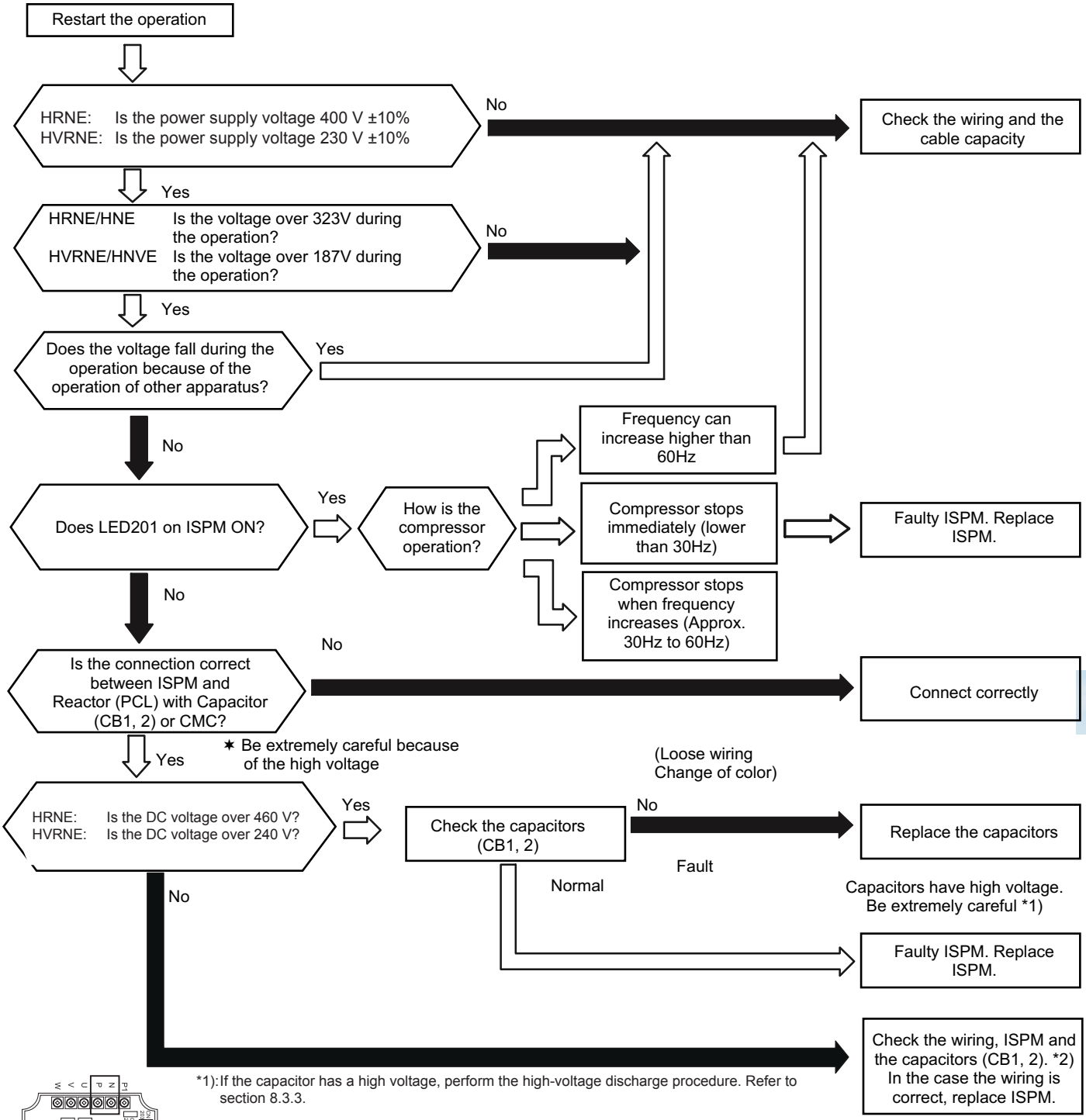


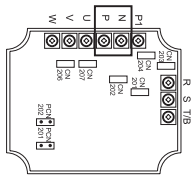
PCB1: Control PCB in the outdoor unit
ISPM: Inverter system power module

Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Disconnected wires, insufficient contacting or incorrect connection	Between control PCB, ISPM and FANM	Check the continuity of wires. Check for looseness of the connection screws. Check the connection No.	Replacing wires, repairing, tightening screws and incorrect wiring
	Power source wiring for the outdoor unit		
Faulty PCB (PCB1 for the control, PCB3 for the inverter)	Disconnected wires to PCB	Check the connections	Repair the wiring connections
	Faulty PCB		Replace PCB if faulty
Incorrect wiring	Disconnected wires; insufficient contacting	Check the continuity. Check for looseness of connection screws	Replacing wires, repairing, tightening screws
	Incorrect wiring	Check the connection Nos.	Correctly connect the wires

Alarm code	
06	**Excessively low voltage or excessively high voltage for the inverter**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the voltage between terminal "P" and "N" of ISPM is insufficient and the alarm has three occurrences in 30 minutes. If the number of occurrences is smaller than two, the retry operation is performed. The alarm code "06." means fan controller Abnormal Operation.





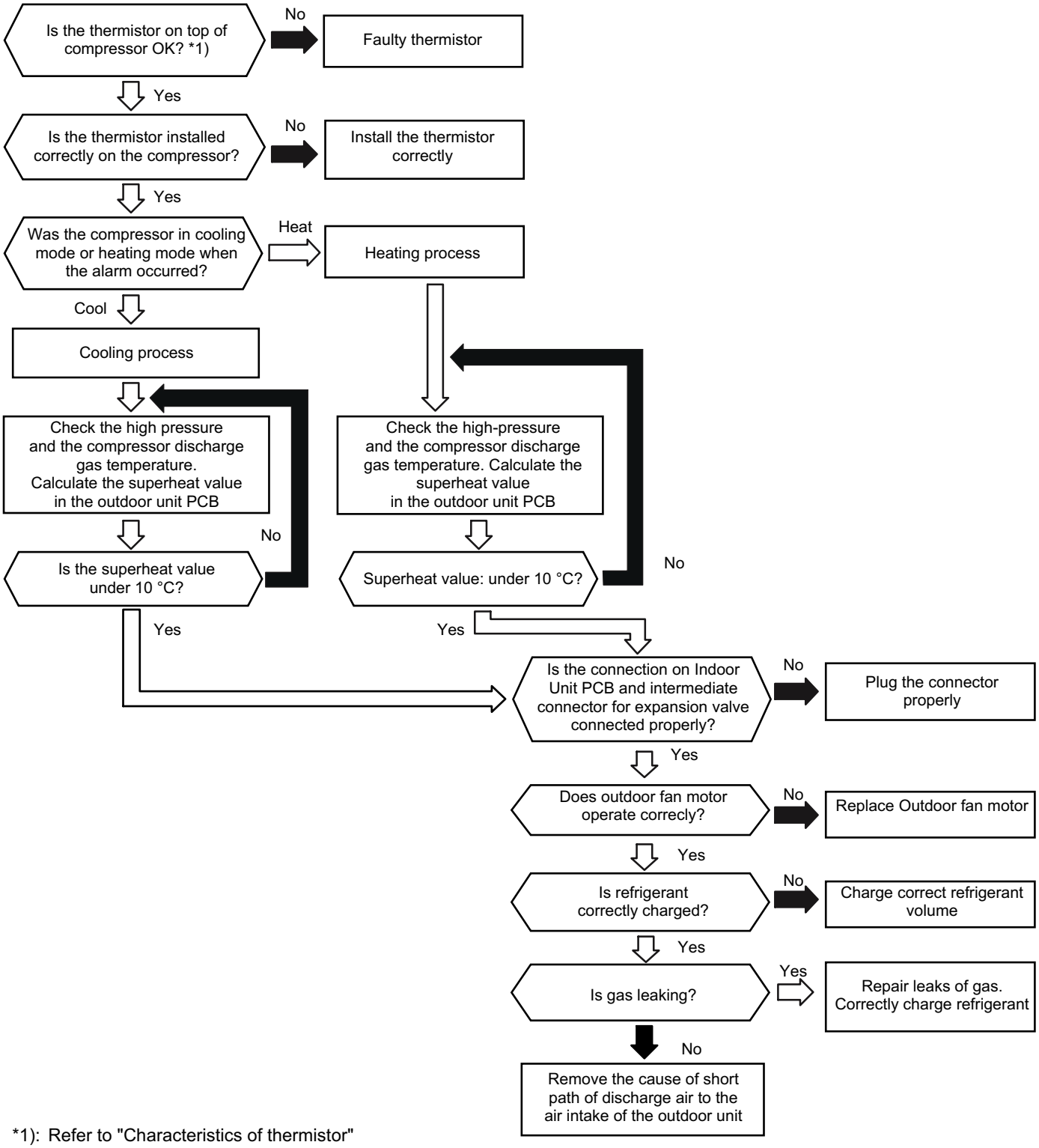
*1): If the capacitor has a high voltage, perform the high-voltage discharge procedure. Refer to section 8.3.3.

*2): Checking procedure of the diode module are displayed in item 8.3.3.

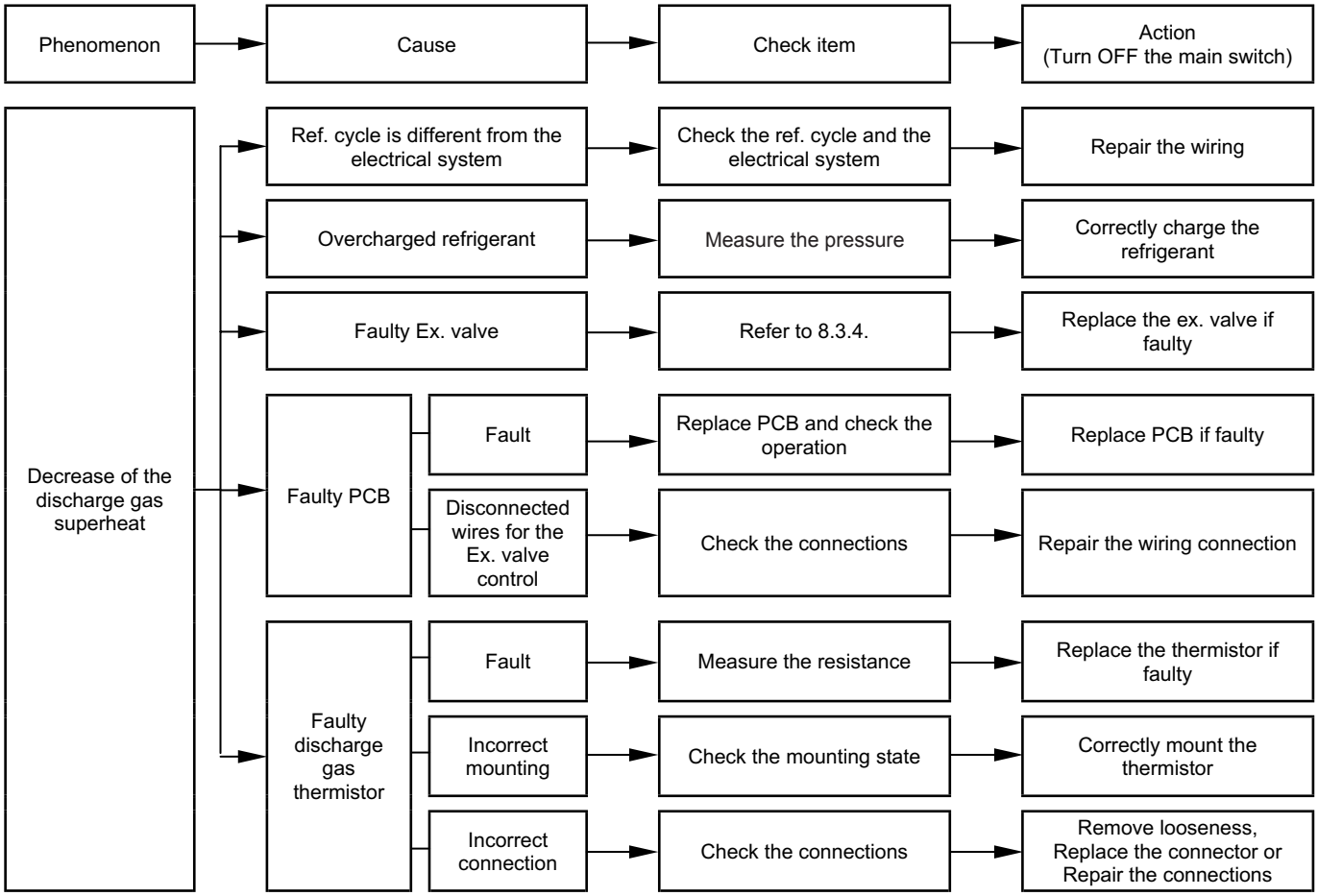
*3): DC voltage measuring position:
ISPM "P" Terminal to "+" Terminal of Tester, "N" Terminal to "–" Terminal of Tester Measuring Position: DC 1000V.

Alarm code	Decrease of the discharge gas superheat
07	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ If the discharge gas superheat is below 20 °C. at the top of the compressor for 30 minutes, the retry operation is performed. However, if the alarm occurs twice in addition to the first occurrence within two hours, this alarm code is displayed.



*1): Refer to "Characteristics of thermistor"


Phenomenon
Cause
Check item
Action
(Turn OFF the main switch)
Decrease of the discharge gas superheat
Ref. cycle is different from the electrical system
Check the ref. cycle and the electrical system
Repair the wiring
Overcharged refrigerant
Measure the pressure
Correctly charge the refrigerant
Faulty Ex. valve
Refer to 8.3.4.
Replace the ex. valve if faulty
Faulty PCB
Fault
Replace PCB and check the operation
Replace PCB if faulty
Disconnected wires for the Ex. valve control
Check the connections
Repair the wiring connection
Faulty discharge gas thermistor
Fault
Measure the resistance
Replace the thermistor if faulty
Incorrect mounting
Check the mounting state
Correctly mount the thermistor
Incorrect connection
Check the connections
Remove looseness, Replace the connector or Repair the connections

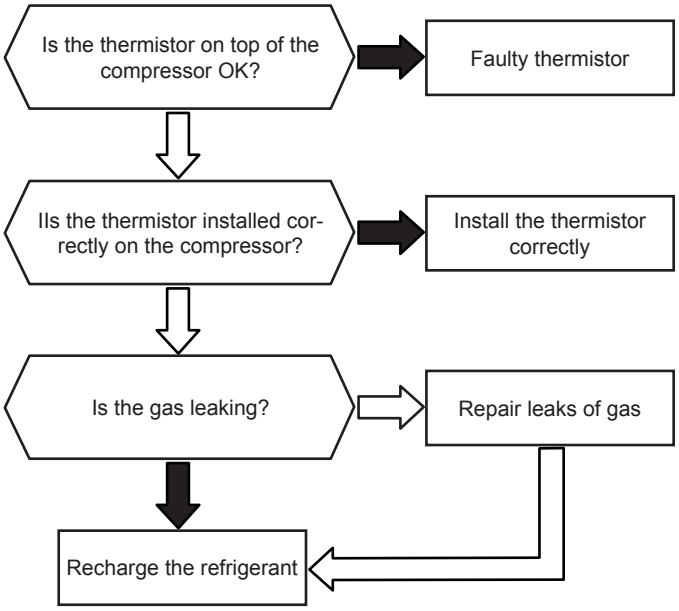
Alarm code	
08	**Excessively high discharge gas temperature at the top of the compressor chamber**

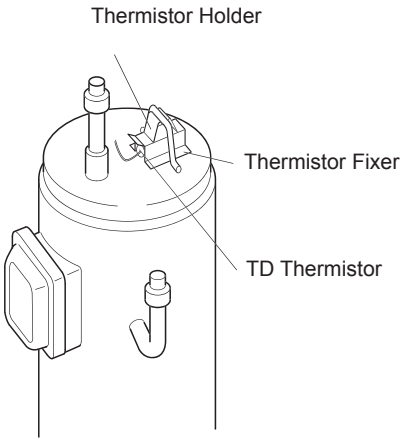
- The RUN LED flickers and “ALARM” is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.

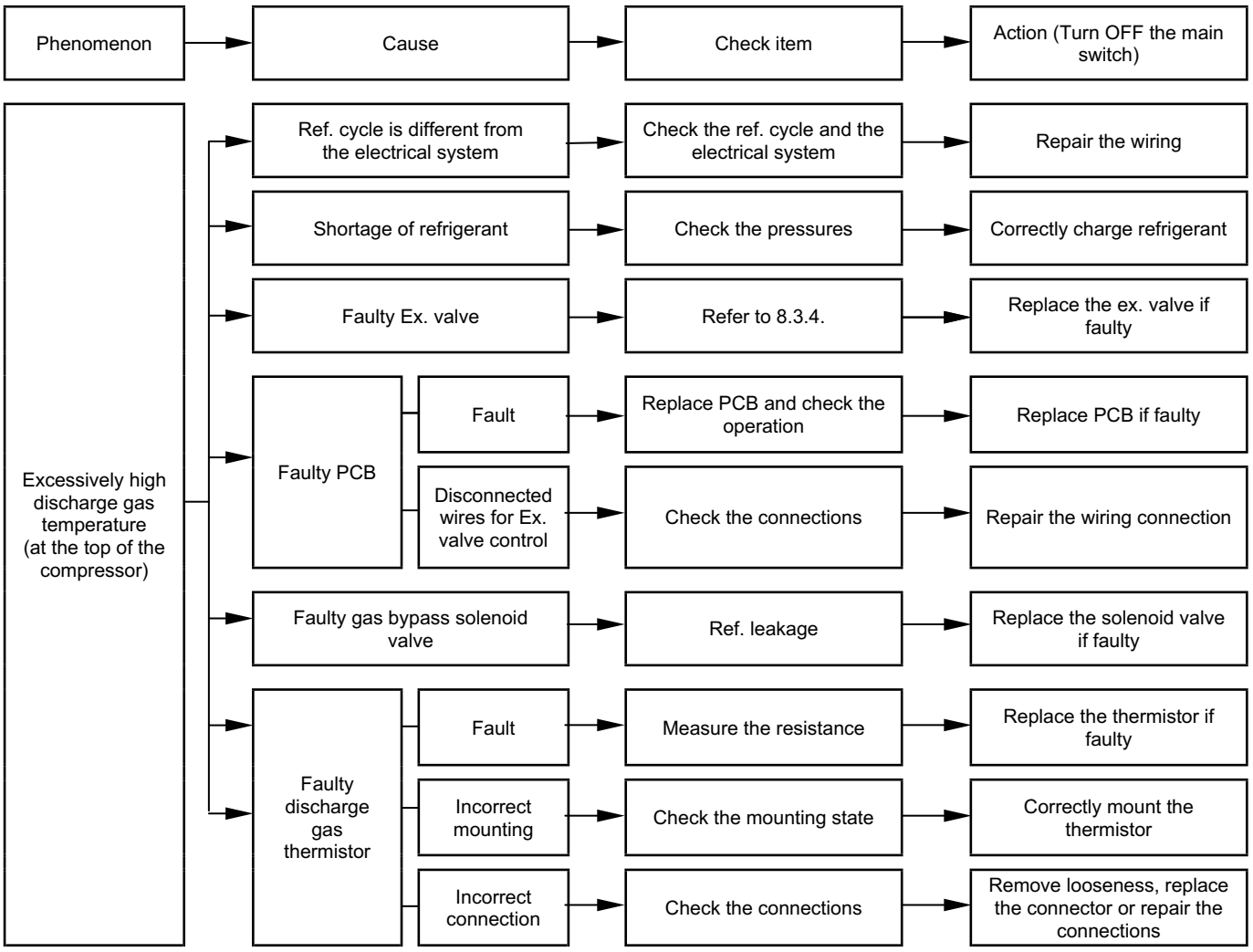
  * This alarm is displayed when the following conditions occur three times within one hour:

  (1) The temperature of the thermistor on the top of the compressor is maintained higher than 127 °C (115 °C for 3HVRNE) for ten minutes or the temperature of the thermistor on the top of the compressor is maintained higher than 140 °C (125 °C for 3HVRNE) for five seconds during cooling.

  (2) The temperature of the thermistor on the top of the compressor is maintained higher than 120 °C (115 °C for 3HVRNE) for ten minutes or the temperature of the thermistor on the top of the compressor is maintained higher than 140 °C (125 °C for 3HVRNE) for five seconds during heating



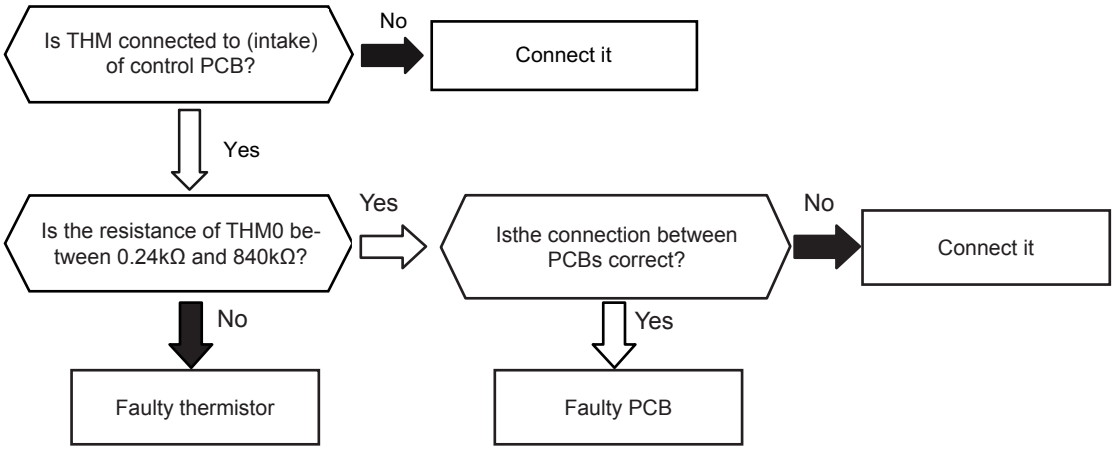



Phenomenon
Cause
Check item
Action (Turn OFF the main switch)
Excessively high discharge gas temperature (at the top of the compressor)
Ref. cycle is different from the electrical system
Check the ref. cycle and the electrical system
Repair the wiring
Shortage of refrigerant
Check the pressures
Correctly charge refrigerant
Faulty Ex. valve
Refer to 8.3.4.
Replace the ex. valve if faulty
Faulty PCB
Fault
Replace PCB and check the operation
Replace PCB if faulty
Disconnected wires for Ex. valve control
Check the connections
Repair the wiring connection
Faulty gas bypass solenoid valve
Ref. leakage
Replace the solenoid valve if faulty
Faulty discharge gas thermistor
Fault
Measure the resistance
Replace the thermistor if faulty
Incorrect mounting
Check the mounting state
Correctly mount the thermistor
Incorrect connection
Check the connections
Remove looseness, replace the connector or repair the connections

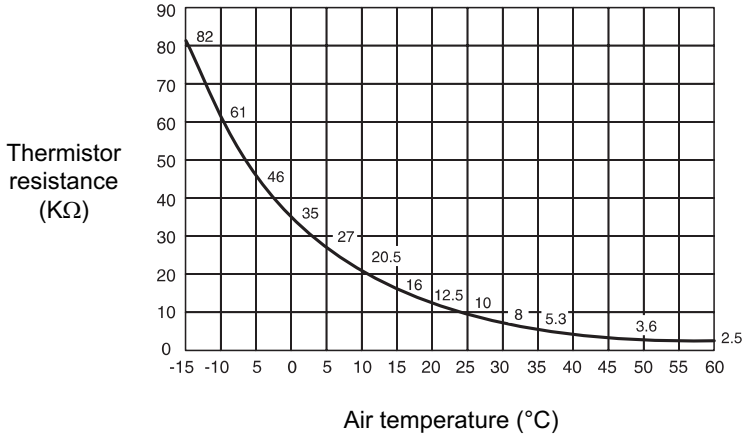
Alarm code	Abnormal operation of control PCB
11	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.

✶ This alarm code is displayed when the thermistor is short-circuited (less than 0.24 kΩ) or cut (greater than 840 kΩ) during the cooling process or the heating process. The system is automatically restarted when the fault is removed.



Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty air inlet thermistor	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect connection	Check the connection	Repair the wiring and the connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty



Thermistor characteristics

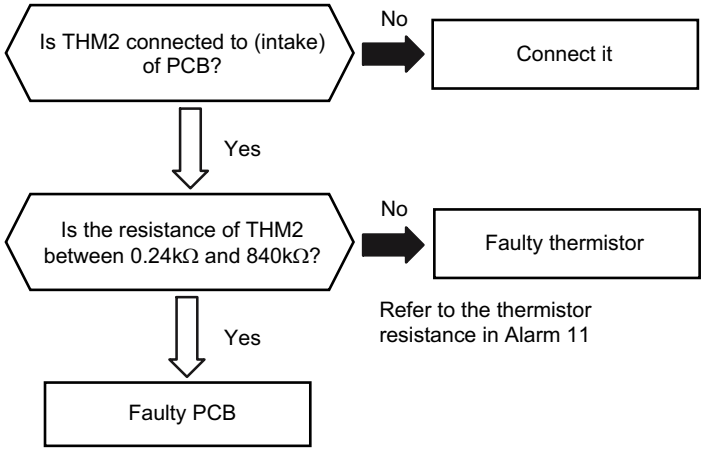
NOTES:

This data is applicable to the following thermistors:

1. Indoor unit liquid refrigerant temperature
2. Indoor unit water outlet temperature
3. Outdoor temperature
4. Outdoor unit evaporating temperature
5. Indoor unit gas piping

Alarm code	Abnormal operation of the thermistor for Heater
12	

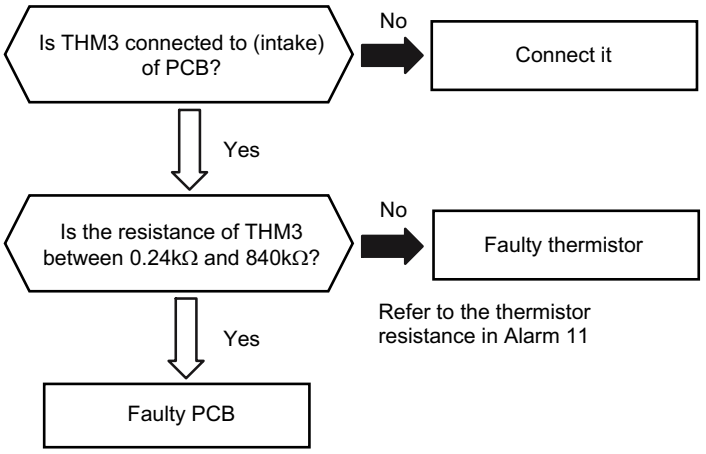
- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the thermistor is short-circuited (less than 0.24 kΩ) or cut (greater than 840 kΩ) during the cooling process or the heating process. The system is automatically restarted when the fault is removed.

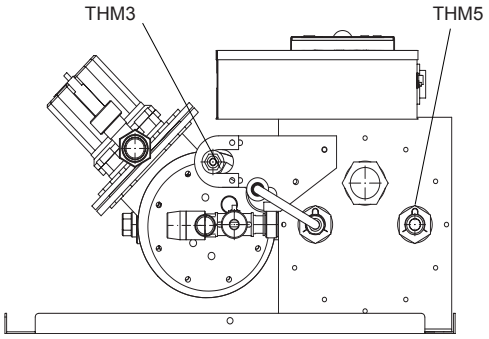


Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty air outlet thermistor	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect connection	Check the connection	Repair the wiring and connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty

Alarm code	
13	**Abnormal operation of the thermistor for the indoor unit heat exchanger liquid pipe temperature (freeze protection thermistor)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the thermistor is short-circuited (less than 0.24 kΩ) or cut (greater than 840 kΩ) during the cooling process or the heating process. The system is automatically restarted when the fault is removed.

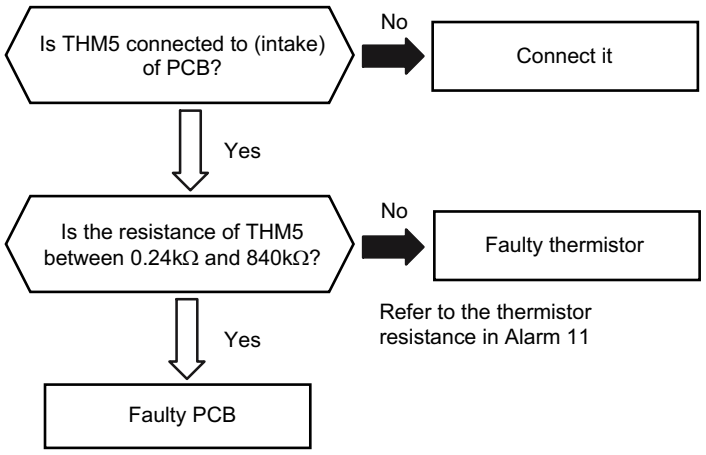


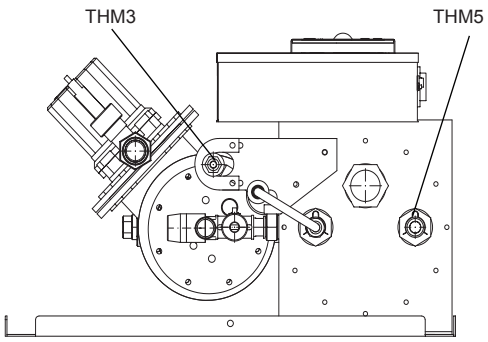


Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty indoor unit liquid pipe	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect connection	Check the connection	Repair the wiring and connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty

Alarm code	
14	**Abnormal operation of the thermistor for the indoor unit gas pipe temperature (gas piping thermistor)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the thermistor is short-circuited (less than 0.24 kΩ) or cut (greater than 840 kΩ) during the cooling process or the heating process. The system is automatically restarted when the fault is removed.



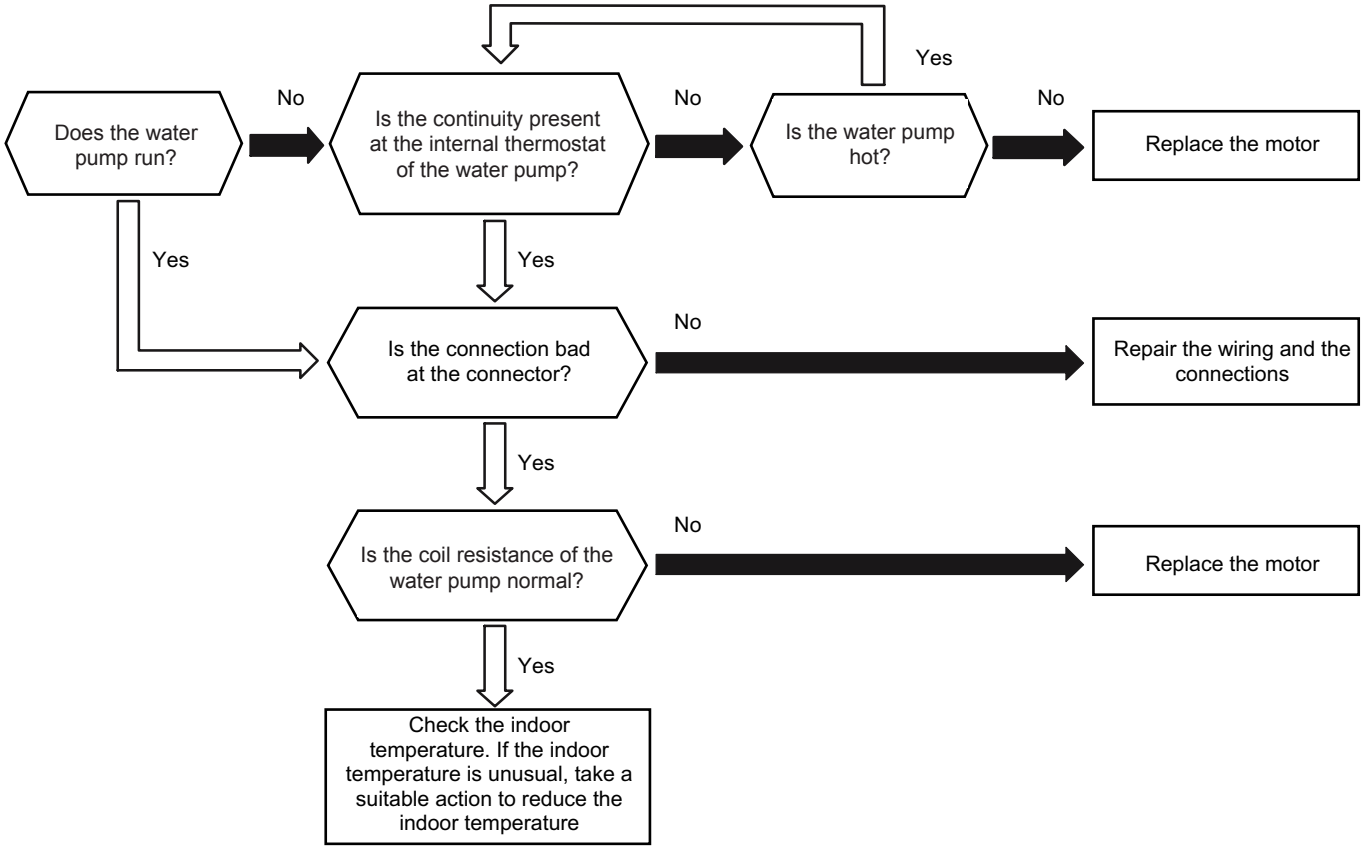


Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty gas pipe thermistor	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect connection	Check the connection	Repair the wiring and the connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty

Alarm code	Activation of the low water flow protection
19	

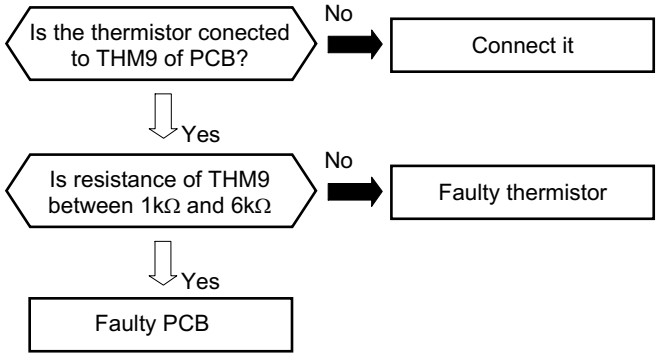
- The RUN LED flickers and “ALARM” is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.

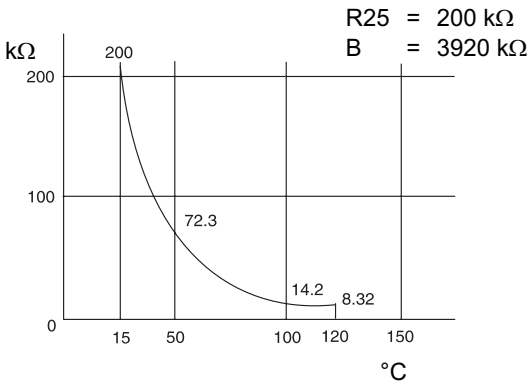
  * This alarm is displayed when when the water flow is lower than 0.90 m³/h.

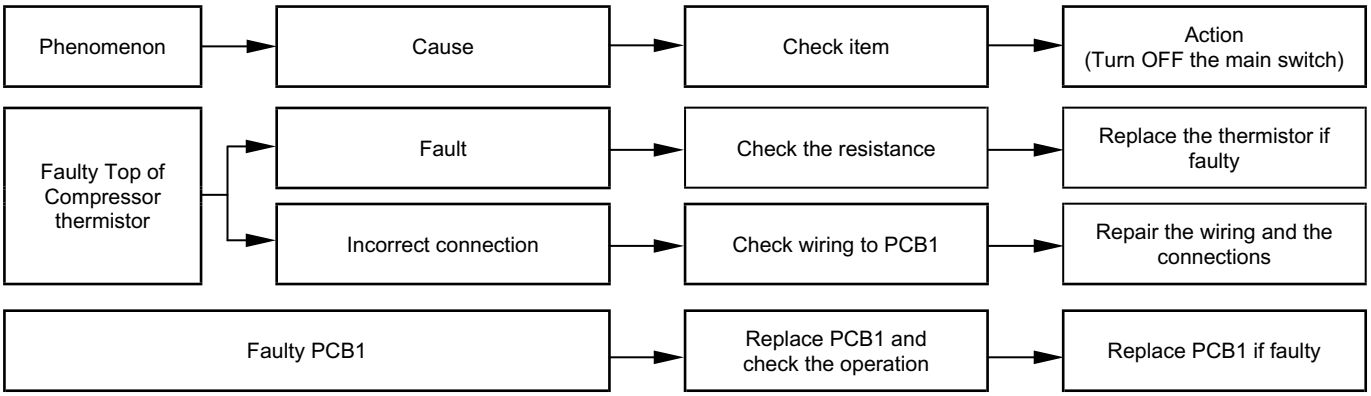


Alarm code	Abnormality of Thermistor for Discharge Gas Temperature (Compressor Thermistor)
20	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are indicated on the display of the outdoor unit PCB.
  - ✶ This alarm code is indicated when the thermistor is short-circuited (less than 1 kΩ) or cut (greater than 6 MΩ) during the cooling or heating operation.







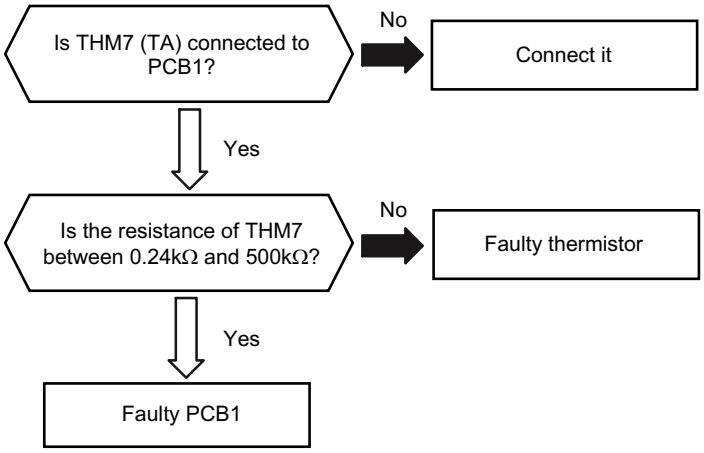
Temperature (°C)	Resistance (kΩ)
0	640.44
5	500.66
10	394.16
15	312.41
20	249.20
25	200.00
30	161.45
35	131.06
40	106.96
45	87.74
50	72.32
55	59.97
60	49.96

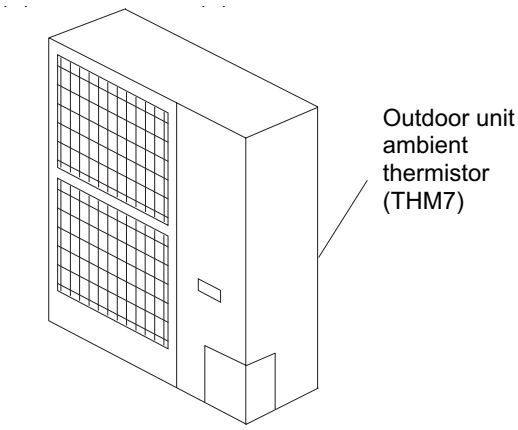
Temperature (°C)	Resistance (kΩ)
65	41.79
70	35.11
75	29.61
80	25.07
85	21.31
90	18.17
95	15.55
100	13.35
105	11.50
110	9.93
115	8.60
120	7.47
125	6.51

The resistance value has fudge factor (±10%)

Alarm code	
22	**Abnormal operation of the thermistor for the outdoor temperature (outdoor unit ambient thermistor)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the thermistor is short-circuited (less than 0.2 kΩ) or cut (greater than 500 kΩ) during the operation. However, this alarm occurs during the test run mode only. In the case that the thermistor is abnormal during the operation, the operation continues based on the assumption that the outdoor temperature is 35 °C (Cooling) / 6 °C (Heating).

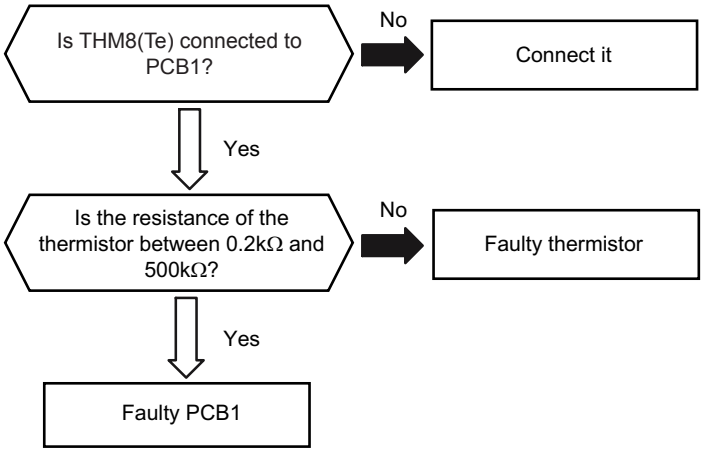


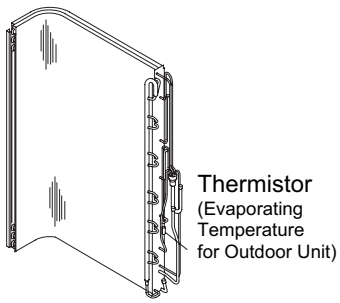


Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty thermistor for the outdoor unit ambient	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect connection	Check the wiring to PCB	Repair the wiring and the connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty

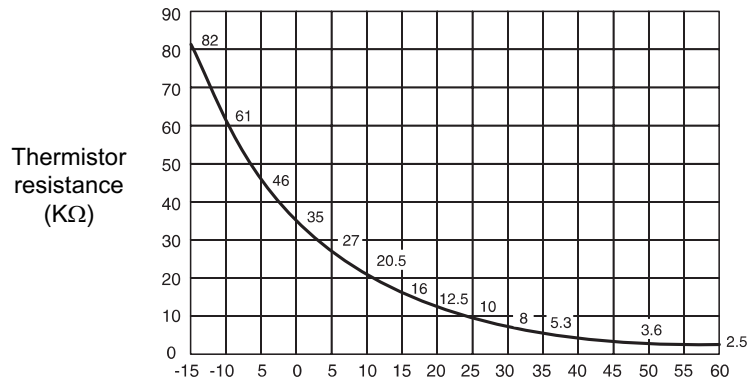
Alarm code	
24	**Abnormal operation of the thermistor for the evaporating temperature during the heating process (outdoor unit)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section.
  The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  If you find an abnormal operation of the thermistor, check all the thermistors as shown below.
  - ✶ The evaporating thermistor during the heating process is attached to the heat exchanger as shown in the figure below.
    If thIs the thermistor is faulty, such as short-circuit (less than 0,2kΩ) or cut (more than 840kΩ) during eight minutes continuously, this alarm is displayed. The position is indicated below.





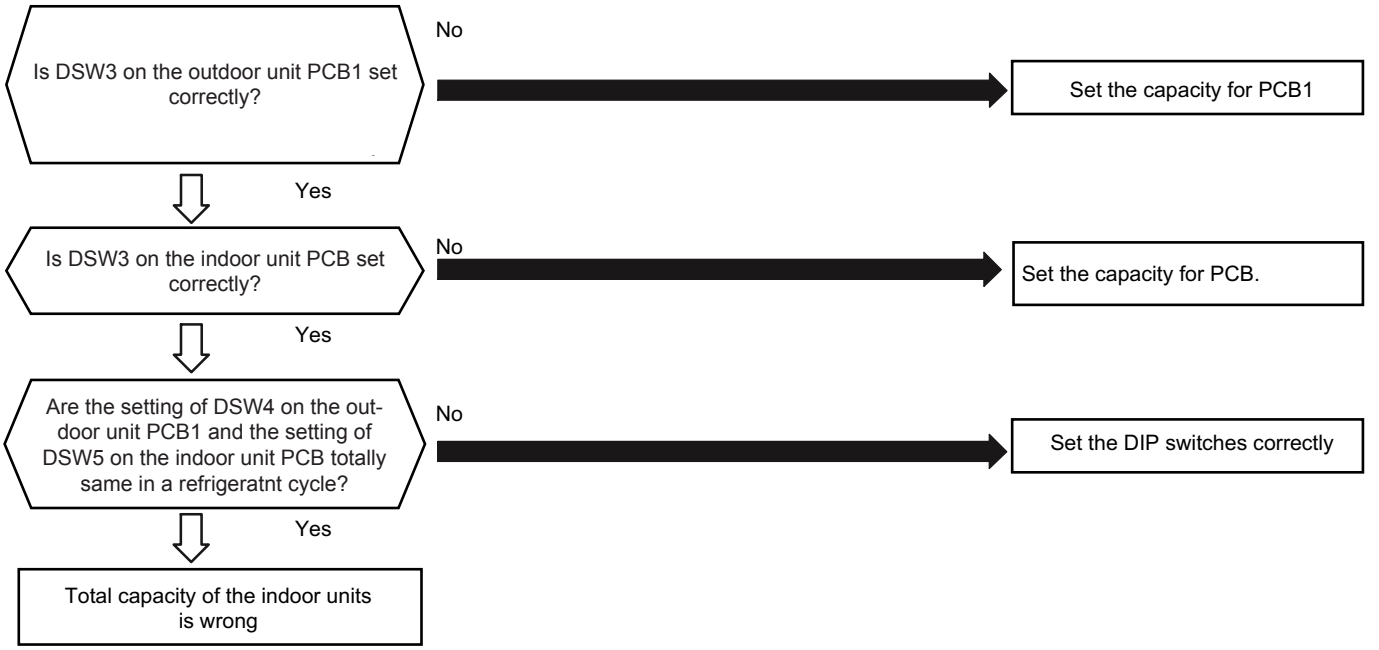
Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Faulty thermistor for the evaporating temperature during heating	Fault	Check the resistance	Replace the thermistor if faulty
	Incorrect Connection	Check the wiring to PCB	Repair the wiring and the connections
Faulty PCB		Replace PCB and check the operation	Replace PCB if faulty



Thermistor characteristics

Alarm code	
31	**Incorrect capacity setting or combined capacity between the indoor units and the outdoor unit**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the DSW3 (DIP switch for the capacity setting) on the outdoor unit PCB1 is not set or when DSW3 has not been correctly set.
  - ✶ This alarm code is displayed when the total indoor unit capacity is smaller than 80% and greater than 120%



Phenomenon	Cause	Check item	Action (Turn OFF the main switch)
Incorrect capacity setting of the indoor unit		Check the combination of the indoor units and the capacity setting on PCB	Correctly set the DIP switch DSW3
Incorrect capacity setting of the outdoor unit		Check the capacity setting on the outdoor unit PCB	Correctly set the DIP switch DSW3
Total indoor unit capacity that is connected to the outdoor unit is beyond the permissible range		Check the outdoor unit model by calculating the total indoor unit capacity	
Refrigerant cycle setting of the outdoor unit and the indoor unit is different		Check the refrigerant cycle setting on outdoor unit PCB and indoor unit PCB	Set them correctly. Match DSW4 on outdoor PCB and DSW5 on indoor PCB

Alarm code	
35	**Incorrect indoor unit number setting**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed five minutes after the power is supplied to the outdoor unit when the indoor unit number which is connected to the outdoor unit is duplicated by the setting of the RSW.

In the case of H-LINK System, this alarm code is displayed when the DSW4 of the outdoor unit PCB and the DSW5 of the indoor unit PCB are incorrectly set.

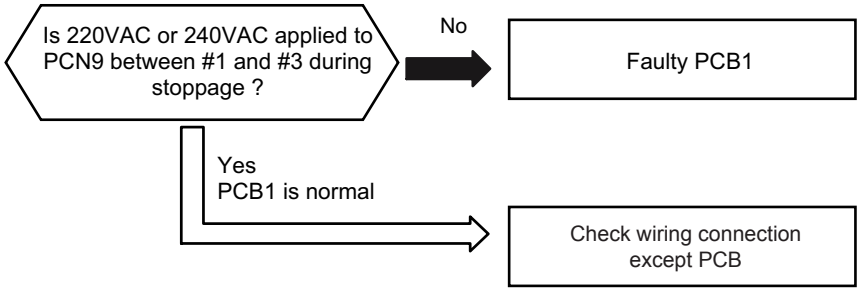
In this case, correctly set DSW4 on the outdoor unit PCB and DSW5 on the indoor unit PCB after turning off the main switch.

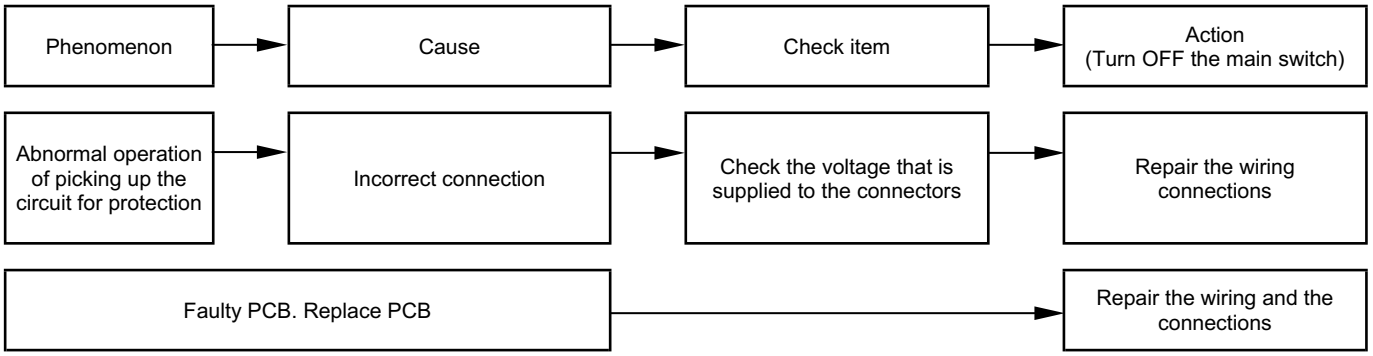
Alarm code	
36	**Incorrect combination of the indoor unit**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the outdoor unit is connected with another type of indoor unit.

Alarm code	
38	**Abnormal operation of picking up the circuit for the protection (outdoor unit)**

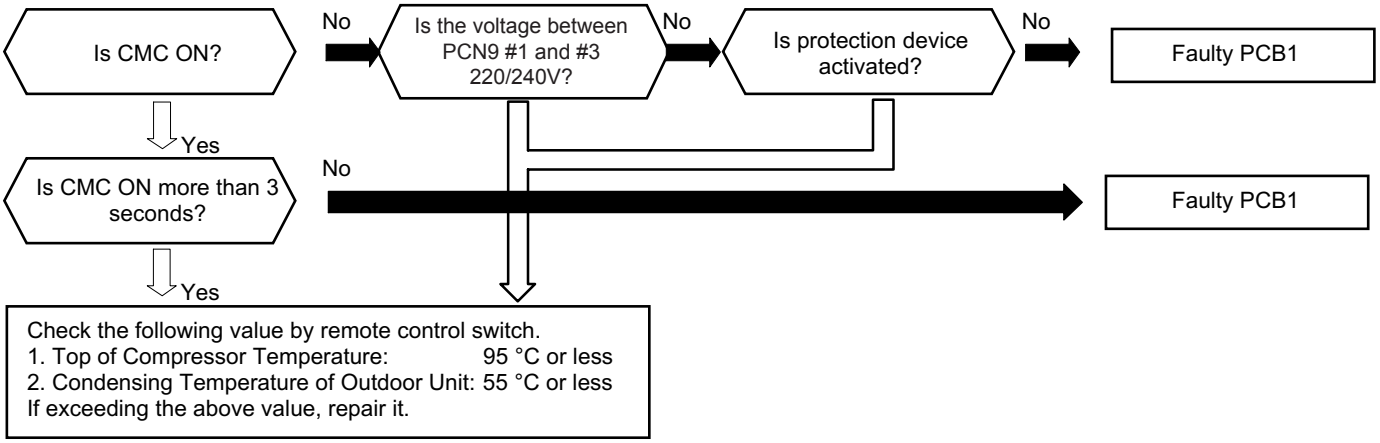
- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when AC220V or AC240V is supplied to the voltage between the terminal #3 of PCN14 on PCB1 and the fasten terminal N on PCB1 in the outdoor unit during the inverter compressor stoppage. This alarm code is displayed when no signal is detected for five seconds when the outdoor fan stops.
  - ✶ This alarm code is displayed when AC220V or AC240V is supplied to the voltage between the terminals #1 and #3 of PCN9 on PCB1 in the outdoor unit during CMC is opened





Alarm code	Cooling overload (High pressure switch will be activated)
41	

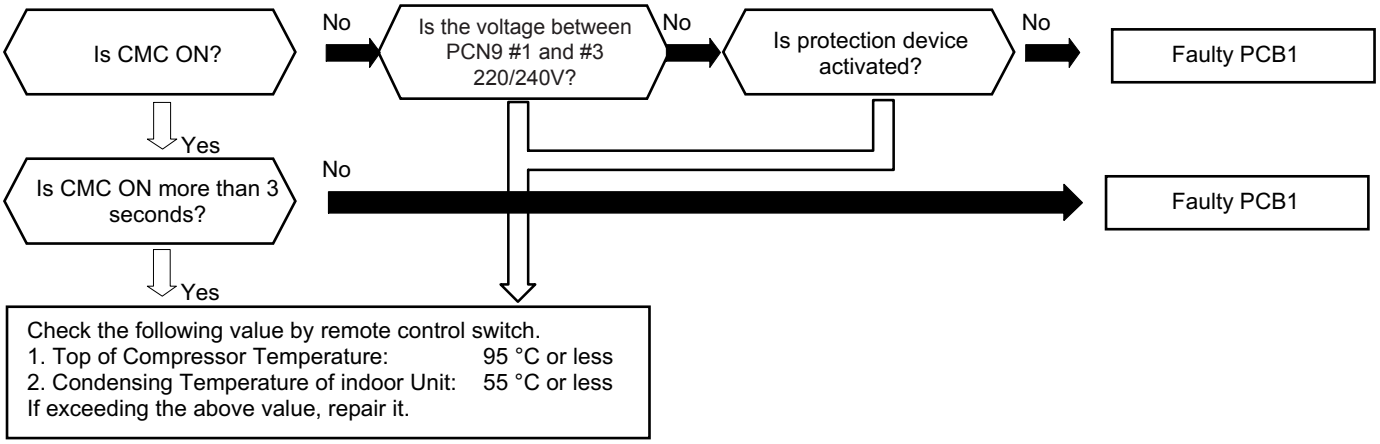
■ The RUN LED flickers and "ALARM" code displayed flickers (1 time / 1 second).
- ✶ This alarm code is indicated when outdoor pipe temperature (THM8) is higher than 55 °C and top compressor temperature (THM9) is higher than 95 °C.
- ✶ This alarm code is indicated when the above condition occurs three times within 30 minutes (within 2 times, d1-13 will be indicated)

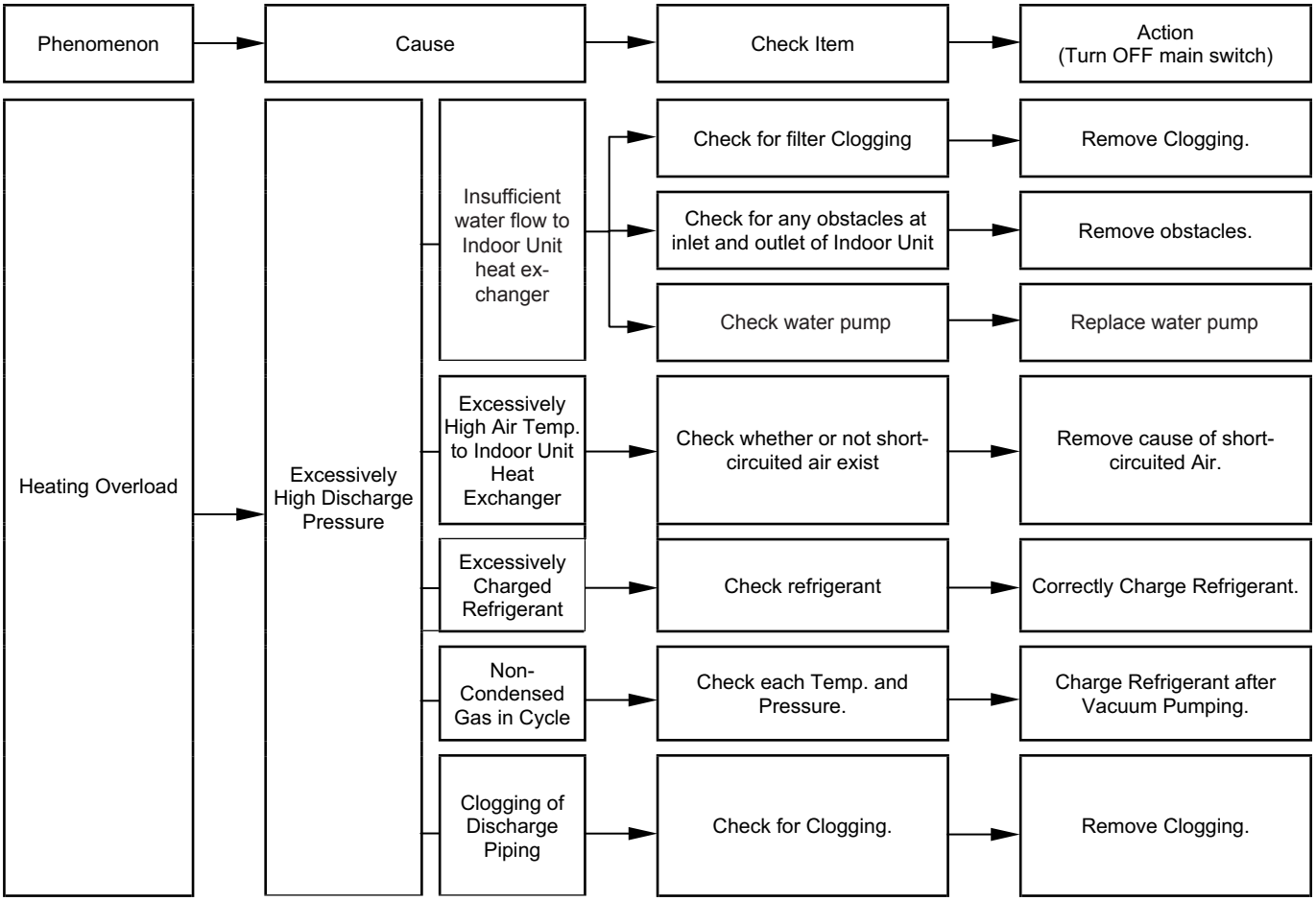


Phenomenon	Cause		Check Item	Action (Turn OFF main switch)
Cooling overload	Excessively High Discharge Pressure	Insufficient Air Flow to Outdoor Unit Heat Exchanger	Clogging of Outdoor Unit Heat Exchanger?	Remove Clogging.
			Obstacles at Inlet or outlet of outdoor unit heat exchanger.	Remove obstacles.
			Is service space for outdoor unit sufficient?	Secure service space.
			Correct Fan Speed?	Replace fan motor.
		Excessively High Air Temp. to Outdoor Unit Heat Exchanger	Short-Circuited Air to Outdoor Unit?	Remove cause of short-circuited Air.
			Any Other Heat Load near Outdoor Unit?	Remove heat source.
		Excessively Charged Refrigerant	Check each Temp.	Correctly Charge Refrigerant.
		Non-Condensed Gas in Cycle	Check each Temp. and Pressure.	Charge Refrigerant after Vacuum Pumping.
		Clogging of Discharge Piping	Check for Clogging.	Remove Clogging.

Alarm code	Heating overload (High pressure switch will be activated)
42	

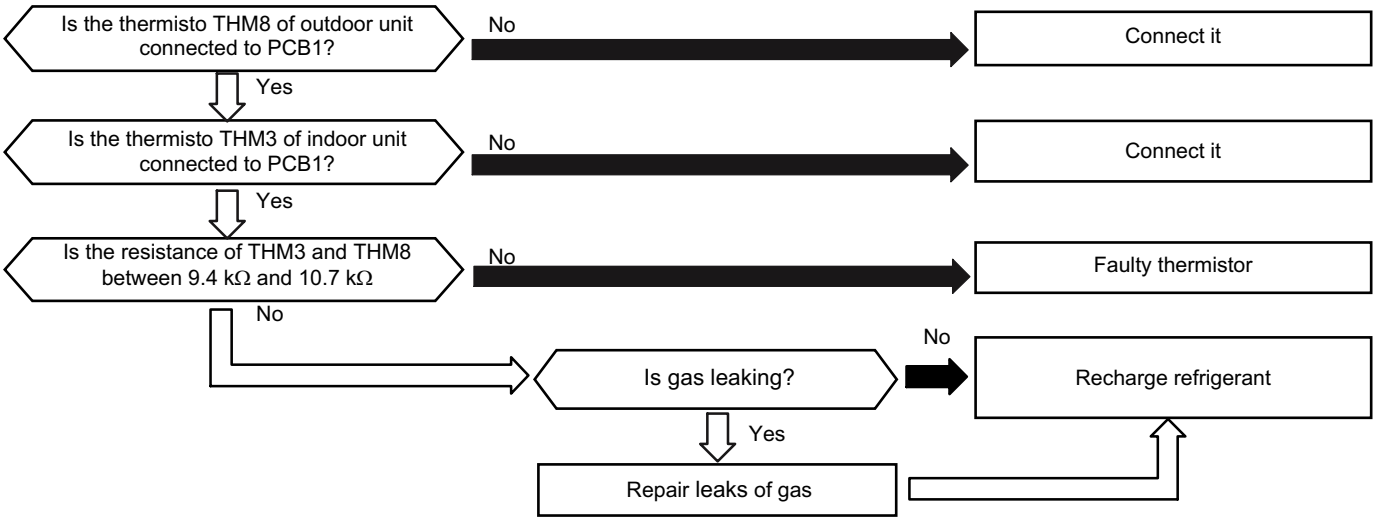
■ The RUN LED flickers and "ALARM" code displayed flickers (1 time / 1 second).
- ✶ This alarm code is indicated when indoor pipe temperature (THM5) is higher than 55 °C and top compressor temperature (THM9) is higher than 95 °C.
- ✶ This alarm code is indicated when the above condition occurs three times within 30 minutes (within 2 times, d1-13 will be indicated)





Alarm code	
47	**Activation for protecting the system from excessively low suction pressure**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - In the case that the evaporating temperature (cooling: liquid refrigerant piping temperature of the indoor unit, or heating: evaporating temperature of outdoor unit) is lower than –35 °C retry operation is performed 3 minutes after compressor stoppage. However, when the state occurs more than 3 minutes including 3 in one hour, this alarm code is indicated.

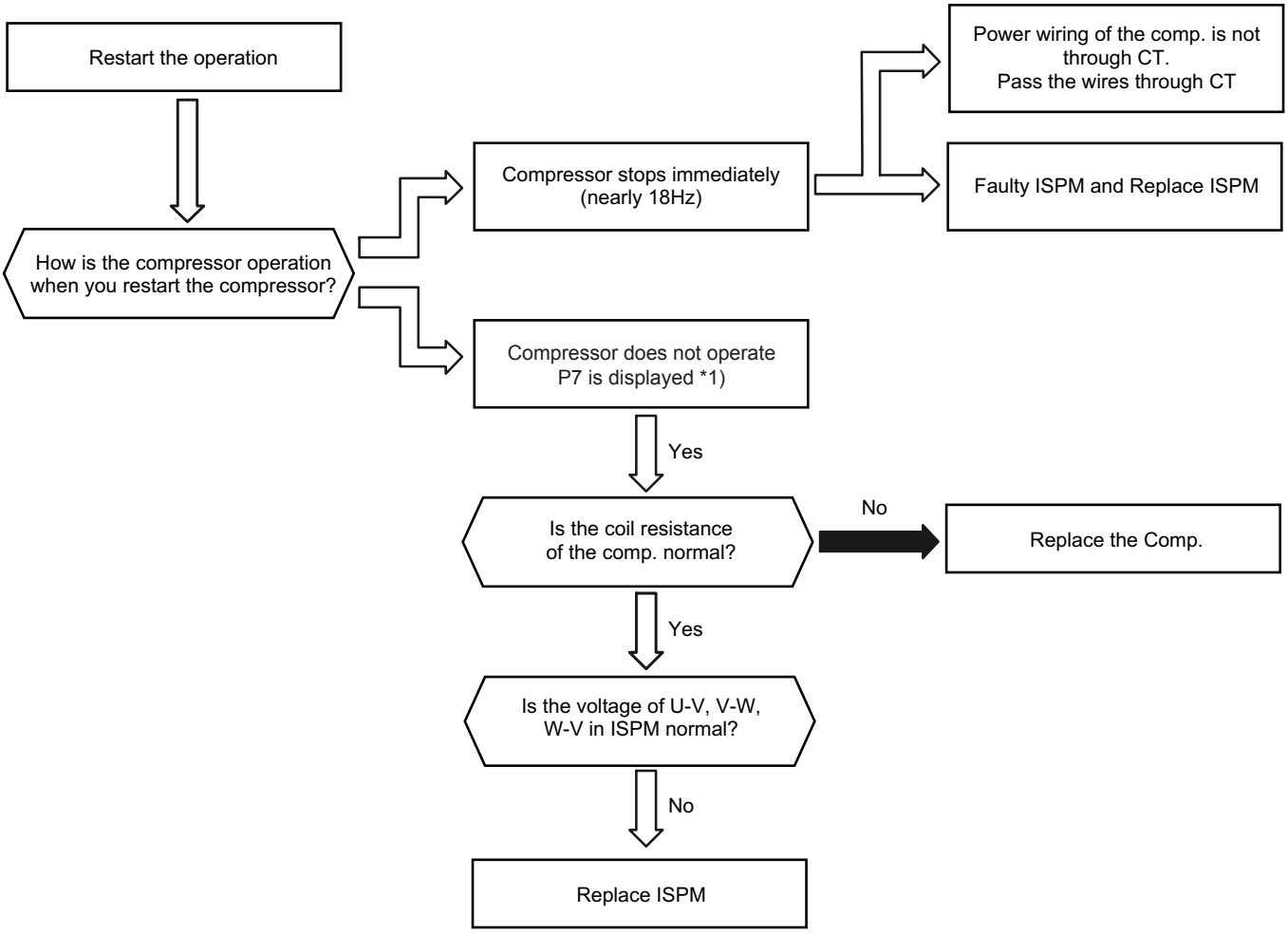


Phenomenon	Cause	Check Item	Action (Turn OFF main switch)
Excessively Low Suction Pressure (in Vacuum)	Shortage of Ref.	Check ref. charged volume or check for leakage.	Repair leakage and correctly charge.
	Closed Stop Valve	Check stop valve.	Open stop valve.
	Abnormal Evaporating thermistor (Te)	Check connector for PCB.	Replace pressure sensor if faulty.
	Incorrect Connection between Indoor Unit and Outdoor Unit	Check electrical system and ref. cycle.	Correctly connect between indoor unit and outdoor unit.
	Locked capilary	Check capilary.	Replace capilary.

Alarm code	
51	**Abnormal operation of the current transformer (0A detection)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the current transformer is abnormal (0A detection or 5A alarm condition) and the alarm has more than three occurrences in 30 minutes.

Condition of Activation: When the frequency of the compressor is maintained at 15~18Hz after the compressor is started, one of the absolute values of the running current at each phase U+, U-, V+ and V- is less than 0.5A (including 0.5A).



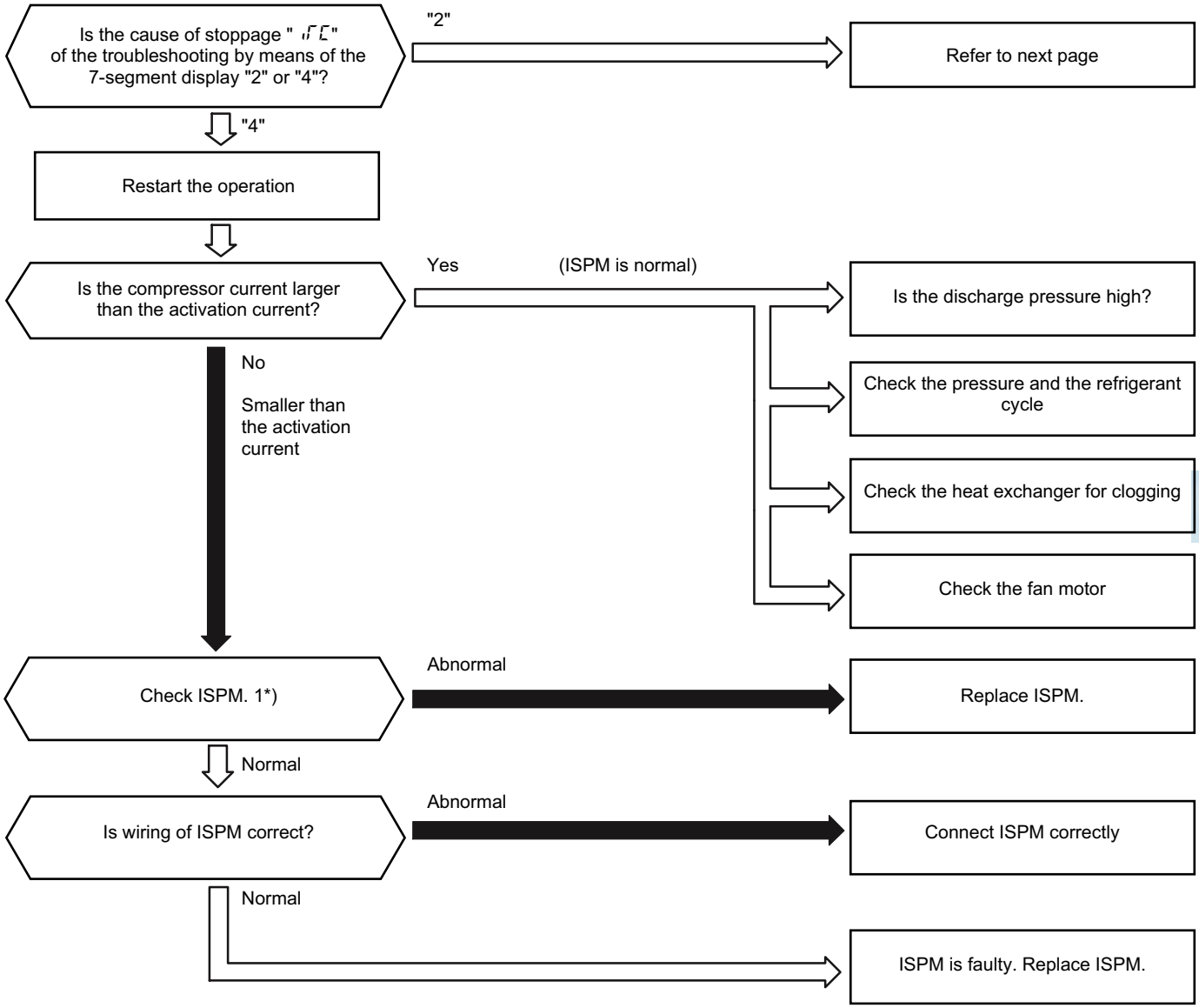
*1) P7 is displayed on the 7-segment display on the outdoor unit PCB

Alarm code	
52	**Activation for protecting the inverter against the instantaneous overcurrent (1)**

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the electronic thermal relay for the inverter is activated six times in 30 minutes. The retry operation is performed five times.
  - ✶ Conditions:
    1. The inverter current with 105% of the rated current runs continuously for 30 seconds.
    2. The inverter current with 105% of the rated current runs intermittently and the accumulated time reaches up to three and a half minutes, in ten minutes.

Current values appear in the next table:

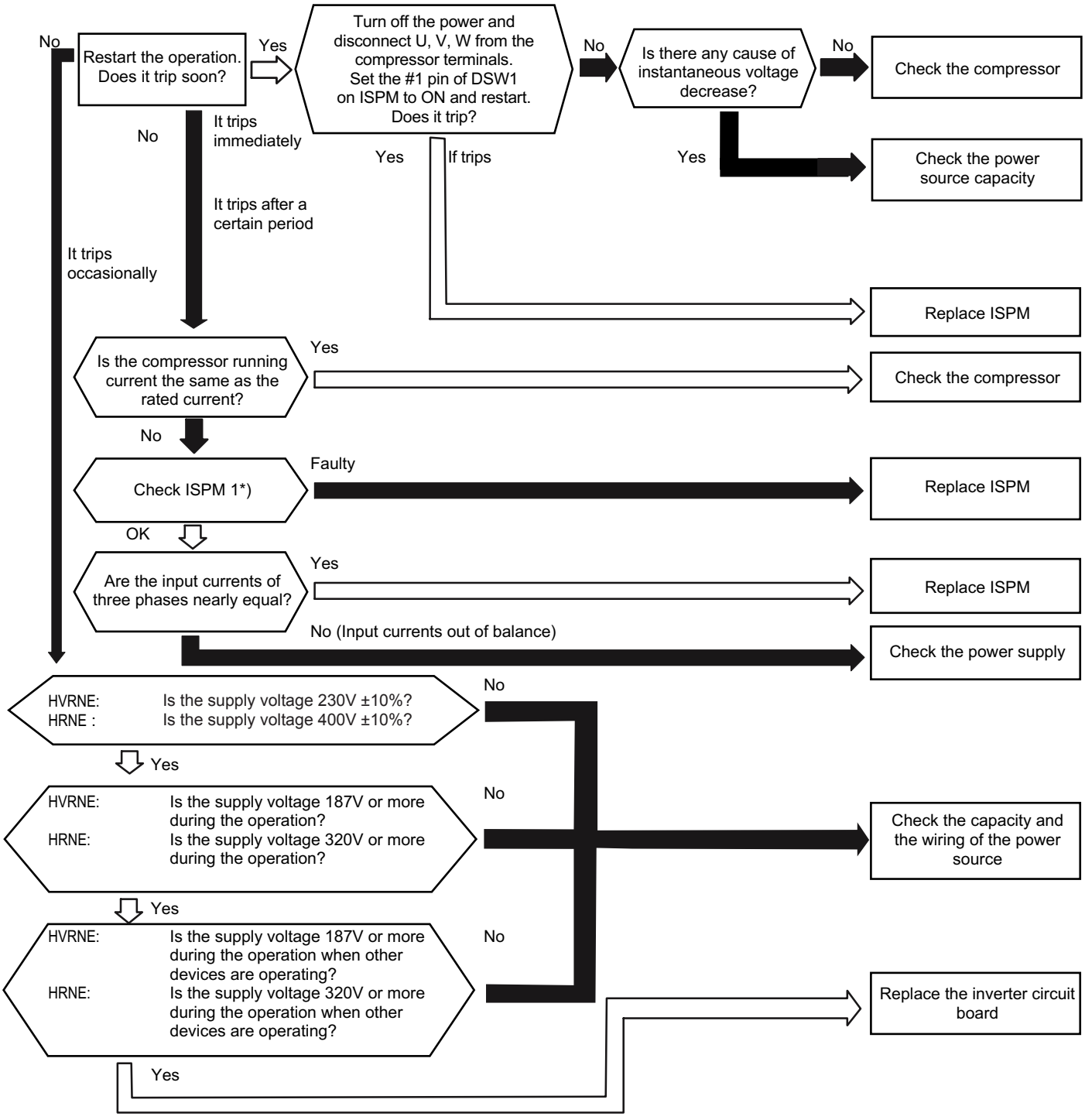
Single phase models	Rated current (A) 230V 50 Hz	Three phase models	Rated current (A) 400V 50 Hz
RAS-3HVRNE	14.5		
RAS-4HVRNE	20.0	RAS-4HRNE	8.5
RAS-5HVRNE	25.0	RAS-5HRNE	10.5



*1): Regarding the checking of inverter components, refer to item 8.3.4.

Alarm code	
52	**Activation for protecting the inverter against the instantaneous overcurrent (2)**

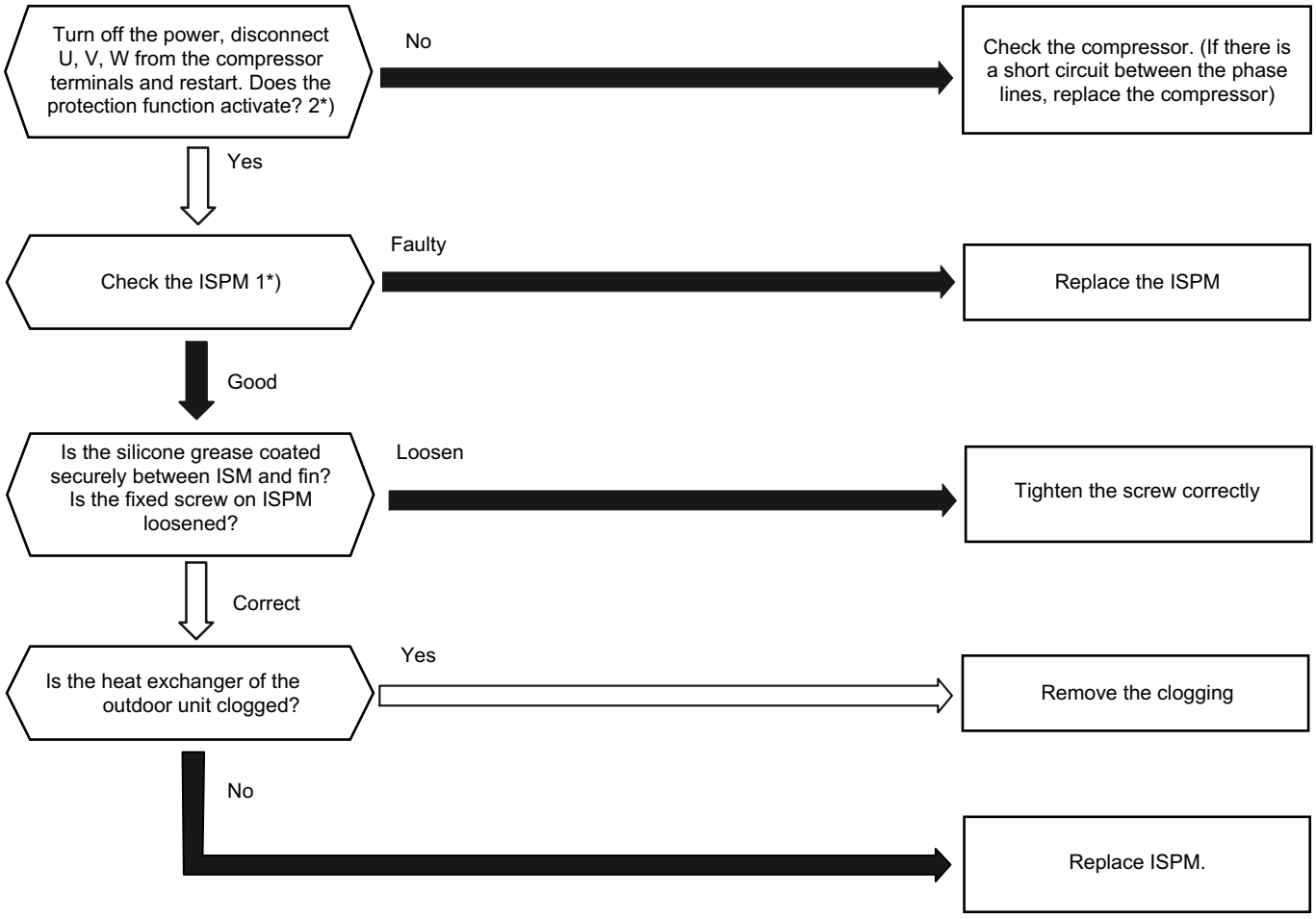
- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm code is displayed when the electronic thermal relay for the inverter is activated 6 times in 30 minutes. Two retries are performed.
    Conditions: the inverter current is 105% of the rated current during 30 seconds continuously or intermittently, and the accumulated time is more than three minutes during ten minutes. The inverter current is 150% or greater of the rated current.



1*): Regarding the checking of inverter components, refer to item 8.3.4.

Alarm code	
53	**Activation for protecting the ISPM**

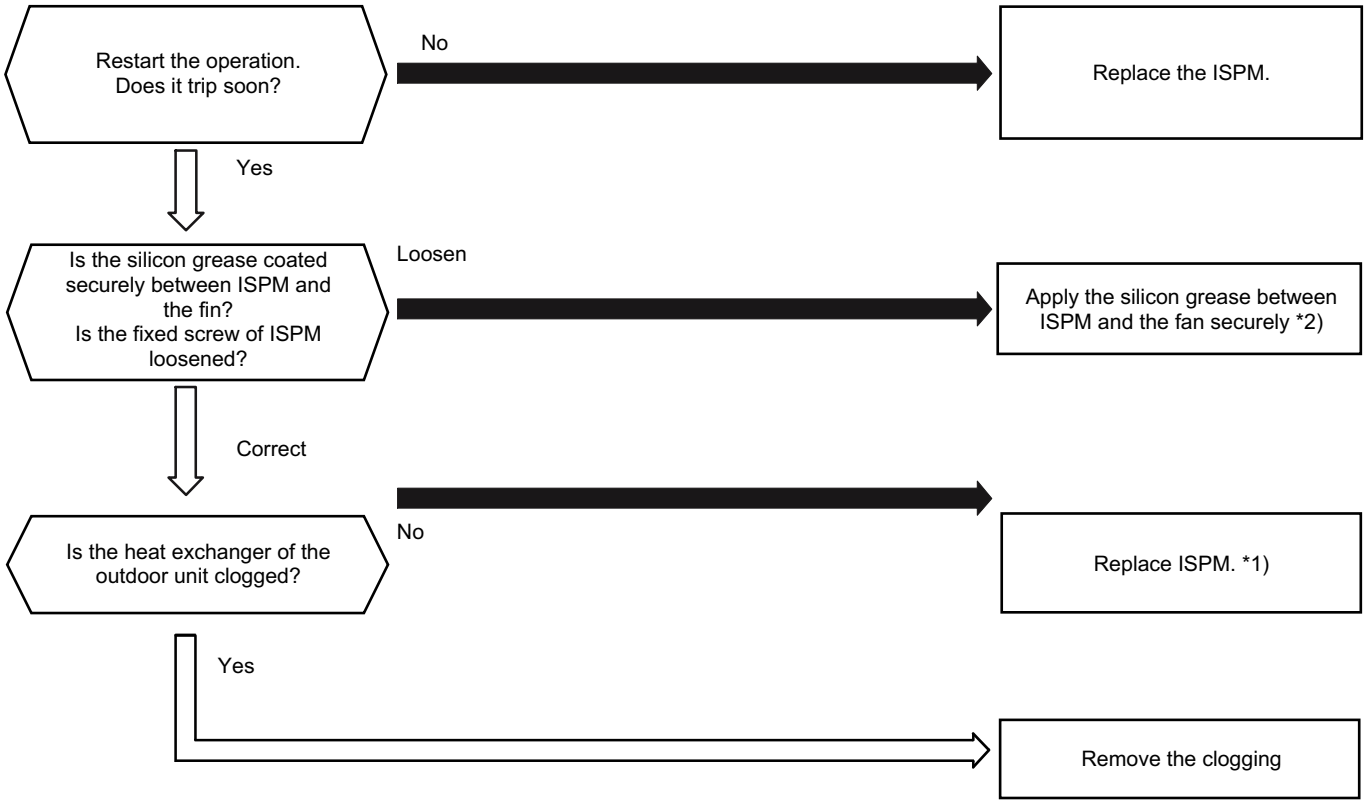
- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ ISPM has a detection function of the abnormal operation. This alarm is displayed when the ISPM module detects the abnormal operation 3 times in 30 minutes. The retry operation is performed 2 times. Conditions: the abnormal current to the ISPM, such as short-circuited, grounded, overcurrent or control voltage decrease.



1*): Regarding replacing or checking method for the ISPM refer to item 8.3.4.
2*): Set the #1 pin of DIP switch DSW1 on ISPM to ON when you are restarting with the terminals of the compressor disconnected. After the troubleshooting, set the #1 pin of DIP switch DSW1 on ISPM to OFF.

Alarm code	
54	**Increase in the inverter fan temperature**

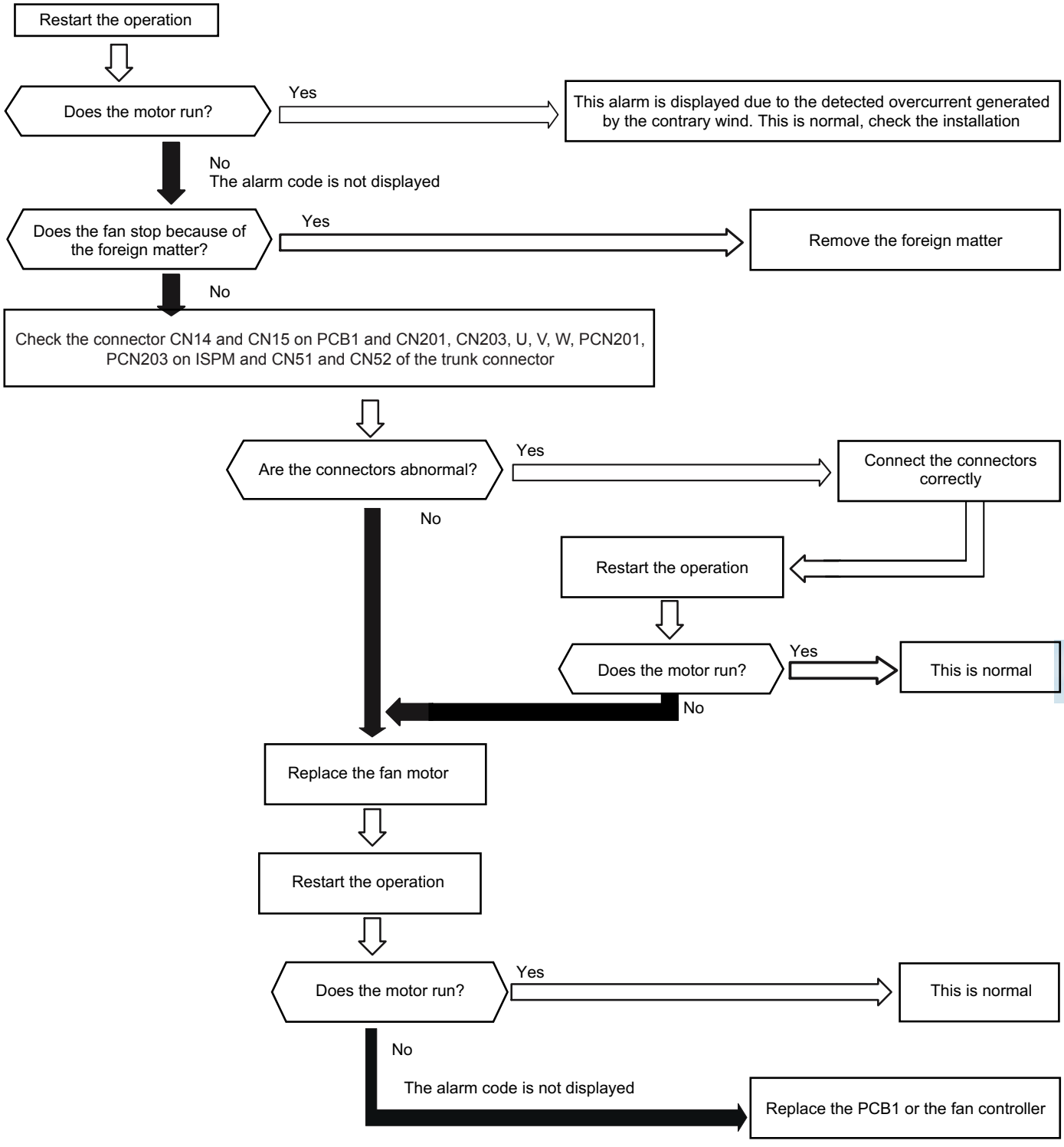
- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ If the alarm code "51" or "54" occurs three times within 30 minutes, the alarm code which occurred for the third time is displayed. The retry operation is performed twice.
    Conditions: This alarm is displayed when the temperature of the internal themostat for ISPM is higher than 100ºC.



1*): Refer to section 8.3.4. for the replacing procedure and the checking procedure for the ISPM.
2*): Use the silicon grease that is provided as an accessory.

Alarm code	Abnormal operation of fan motor protection
56 57 58	

- The RUN LED flickers and "ALARM" is displayed on the remote control switch.
- The unit number, the alarm code and the unit code are alternately displayed on the set temperature section. The unit number and the alarm code are displayed on the display of the outdoor unit PCB.
  - ✶ This alarm is displayed when the revolution pulse output from the fan motor is 10rpm or less and the reverse revolution signal is detected. The fan motor stops once. After ten seconds, the fan motor restarts. If this occurs more than ten times in 30 minutes, this alarm is displayed. The abnormal operation occurs when the fan motor stops and clogs.



If the fan motor does not run even after replacing the PCB1, replace the ISPM.

Alarm code	Compressor protection
EE	

✶ This alarm code is displayed when one of the following alarms occurs three times within six hours. If the outdoor unit operates continuously without removing the cause of the alarm, the compressor may be seriously damaged.

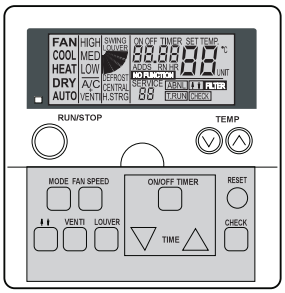
Alarm code:	Content of abnormal operation
02	Tripping of the protection device in the outdoor unit
07	Decrease in the discharge gas superheat
08	Increase in the discharge gas temperature
47	Low pressure decrease protection activating

You can check these alarms by means of the check mode 1. Follow the action that is indicated in each alarm chart. You can clear these alarms only by turning OFF the main switch to the system. **However, you must pay careful attention before starting, because there is a possibility of causing serious damages to the compressors.**

8.2.3. Troubleshooting in check mode

Use the CHECK switch of the remote control in the following cases:

1. When the RUN LED is flickering.
2. To trace back the cause of the malfunction after restarting from the stoppage while the RUN LED is flickering.
3. To check during the normal operation or during the stoppage.
4. To monitor the inlet air temperature and the discharge air temperature.



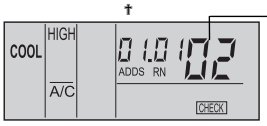
Check mode

- Check mode 1: Current data will be displayed
- Check mode 2: The data which was held immediately before the failure will be displayed

Normal mode

CHECK — Press for more than three seconds

Unit number and alarm code displayed



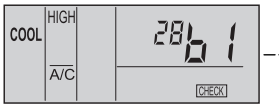
- The indication will delay as the transmission between the remote control switch and the indoor unit takes about ten seconds.
- All the data may be displayed as "FF" or "- -" or "255". These transient data, which are produced temporarily by the software, do not affect the device functions at all. (The alarm code may also be displayed as "FF".)

The alarm code that identifies the last fault that has occurred in the displayed unit.
The unit number of the connected unit or the unit number for which the checking mode was selected previously.

ADDS: Number of the Indoor Unit in No. ** Cycle
RN: No. ** Refrigerant Cycle

After seven seconds ← (A) — Within seven seconds to check another unit

Check mode 1

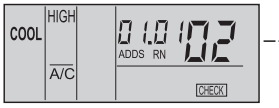


- Forward: Press the "▲" switch to increase from 00 to 01 to 02 ···
- Backward: Press the "▼" switch to decrease from 15 to 14 to 13 ···

Press "▼" to see the previous indication
Press "▲" to see the next indication

CHECK — Press for more than three seconds

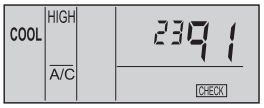
Unit number and alarm code displayed

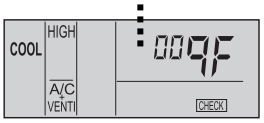


Press "▲" to see the next data
Press "▼" to see the previous data

After seven seconds ← See (A)

Check mode 2
(Refer to "Check mode 1" for details)





Press "▲"

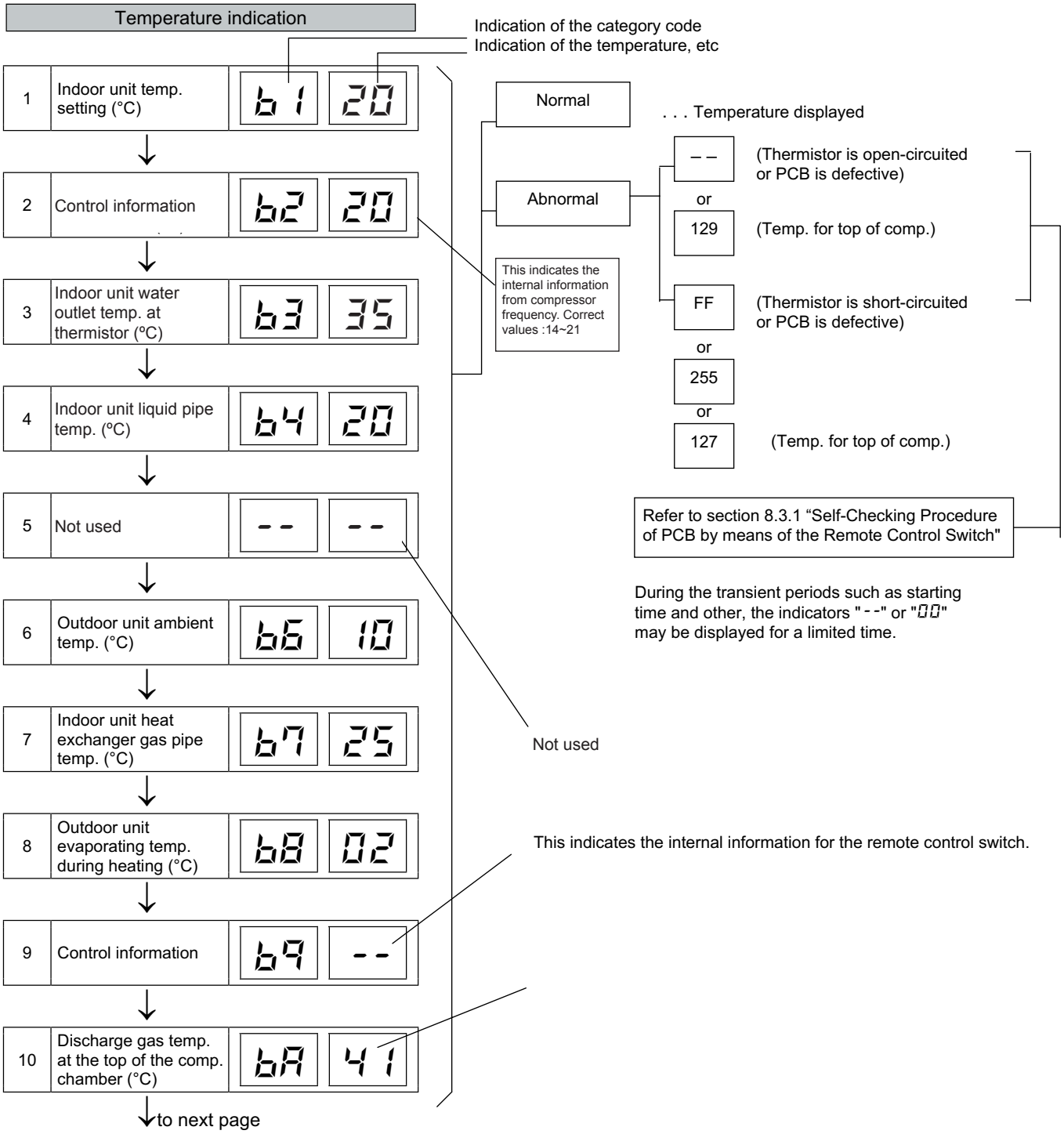
- In the Check mode 2, the data of the first three units that are connected serially to a remote control switch are available.
- You can press the CHECK switch to disable the Check mode 2.
  Check mode 1 cannot be disabled even if you press the CHECK switch.

Check mode disabled

CHECK — Press for more than three seconds

Contents of the Check mode 1

The next indication is shown if you press the part "⌃" of the TEMP switch. If you press the part "⌄" of the TEMP switch, the previous indication is shown.



11	Thermo temp. of the remote control switch	--	--

↓

Indication on micro-computer input /output

12	Micro-computer input/output in indoor unit	C1	4

↓

13	Micro-computer input/output in outdoor unit	C2	-

↓

Indication of unit stoppage cause

14	Cause of stoppage	d1	01

↓

Abnormal operation occurrence counter

15	Abnormal operation occurrence counter	E1	01

↓

16	Instantaneous power failure occurrence counter in indoor unit	E2	00

↓

17	Transmission error occurrence counter between remote control switch and indoor unit	E3	00

↓

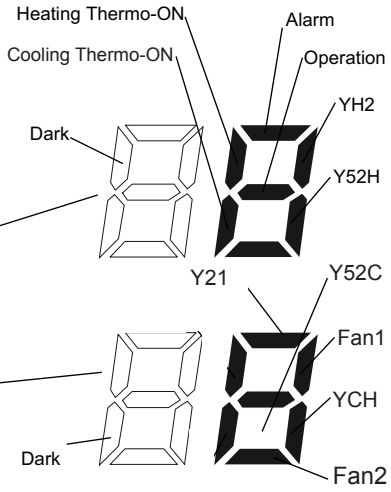
18	Abnormal operation occurrence counter on inverter	E4	00

↓

Indication of automatic louver condition

19	Louver sensor	F1	00

↓to next page



PCB Relay RAS-3~5H(V)RNE	Part name
YH2	Relay for drain pump (MD) and/or dew heater (EHW)
Y21	Relay for 4-way valve
Y52C	Relay for compressor
Fan1	Relay for outdoor Fan1
Fan2	Relay for outdoor Fan2
YCH	Relay for crankcase heater

Symbols with a letter Y are relays of PCB

00	Operation OFF, Power OFF
01	Thermo - OFF (Note 1), Activating Float Switch
02	Alarm (Note 2)
03	Freeze Protection, Overheating Protection
05	Instantaneous Power Failure at Outdoor Unit, Reset (Note 3)
06	Instantaneous Power Failure at Indoor Unit, Reset (Note 4)
07	Stoppage of Cooling Operation due to Low Outdoor Air Temperature, Stoppage of Heating Operation due to High Outdoor Air Temperature
10	Demand, Enforced Stoppage
13	Retry due to High Pressure Increase
15	Retry due to Abnormal High Temperature of Discharge Gas, Excessive Low Suction Pressure
16	Retry due to Decrease of Discharge Gas Superheat
17	Retry due to Inverter TrippingRetry due to Abnormal Current to Comp.
18	Retry due to Voltage Decrease, other Retry due to Inverter
19	Expansion Valve Opening Change Protection
20	Operation Mode Changeover of Indoor Unit
21	Enforced Thermo-OFF when other indoor unit Thermo-OFF
22	Hot start after 4 hours switch on the outdoor unit
24	Thermo-OFF during energy saving operation

NOTE:

1. *Explanation of Terms*
   Thermo-ON: *A condition where an indoor unit is requesting the compressor to operate.*
   Thermo-OFF: *A condition where an indoor unit is not requesting the compressor to operate.*
2. *Even if stoppage is caused by "Alarm", "02" is not always displayed.*
3. *If the transmission between the inverter printed circuit board and the control printed circuit board is not performed during 30 seconds, the stoppage cause is d1-05 and the alarm code "04" may be displayed.*
4. *If the transmission between the indoor unit and the outdoor unit is not performed during three minutes, the Indoor Units are stopped. In this case, the stoppage cause is d1-06 and the alarm code "03" may be displayed.*

Countable up to 99.
Over 99 times, "99" is always displayed.

NOTE:

1. *If a transmission error continues for three minutes, one is added to the occurrence counter.*
2. *The memorized data can be cancelled by the method which is explained in section 8.3.1 "Self-checking Procedure of PCB by means of the Remote Control Switch".*

00 : Normal
FF : Abnormal

Compressor pressure/frequency indication

20	Discharge pressure (high) (x 0.1 MPa)	H1 18
21	Suction pressure (low) (x 0.01 MPa)	H2 04
22	Control information	H3 44
23	Operation frequency (Hz)	H4 44

This is an indication for internal information for the remote control switch. This does not have any specific meaning.

The total frequency is displayed when several compressors are running.

Indoor unit capacity indication

24	Indoor unit capacity	J1 08
25	Outdoor unit code	J2 Fn
26	Refrigerant cycle number	J3 01
27	Refrigerant cycle number	J4 00

The capacity of the Indoor Unit is displayed as shown in the table below.

Capacity code of indoor unit

Indication code	Equivalent capacity (HP)
06	0.8
08	1.0
10	1.3
13	1.5
14	1.8
16	2.0
18	2.3
20	2.5
22	2.8
26	3.0/3.5
32	4.0
40	5.0
48	6.0
64	8.0
80	10.0

"n" indicates the total number of Indoor Units;
n= 1 ~ 9, A, b, C, d, E, F, U
(10) (11) (12) (13) (14) (15) (16)

J3: 01 ~ 16 (01: when shipment (DSW5), Decimal indication
J4: 00 ~ 0F (00: when shipment (DSW5), Indication with 16 numbers

Expansion opening indication

28	Indoor unit expansion valve opening (%)	L1 20
29	Outdoor unit expansion valve MV opening (%)	L2 99
30	Not used	-- --
31	Not used	-- --

In case of models without the expansion valve (MV2), the same figure is displayed.

Not used

Estimated electric current indication

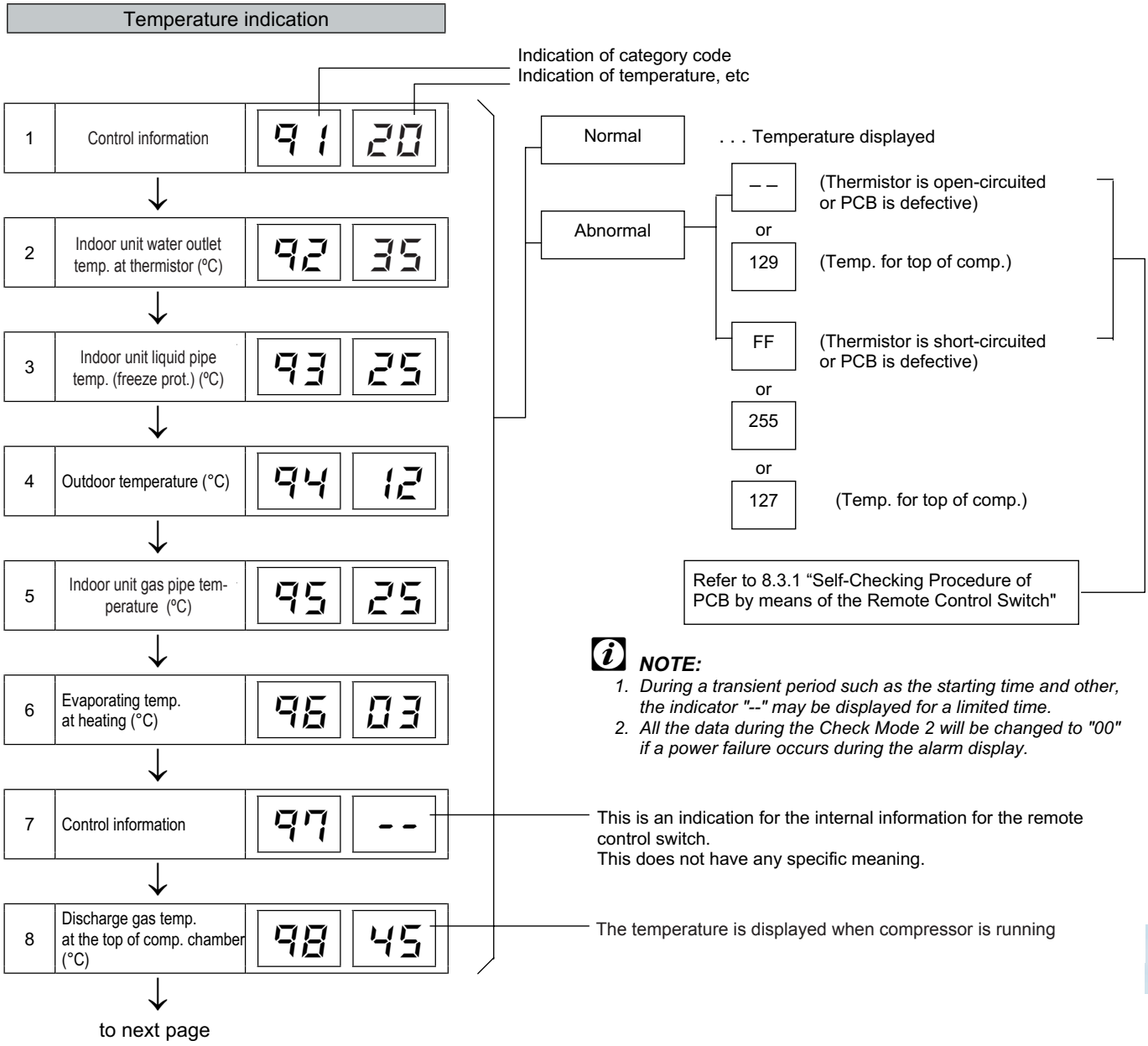
32	Compressor Running Current (A)	P1 25

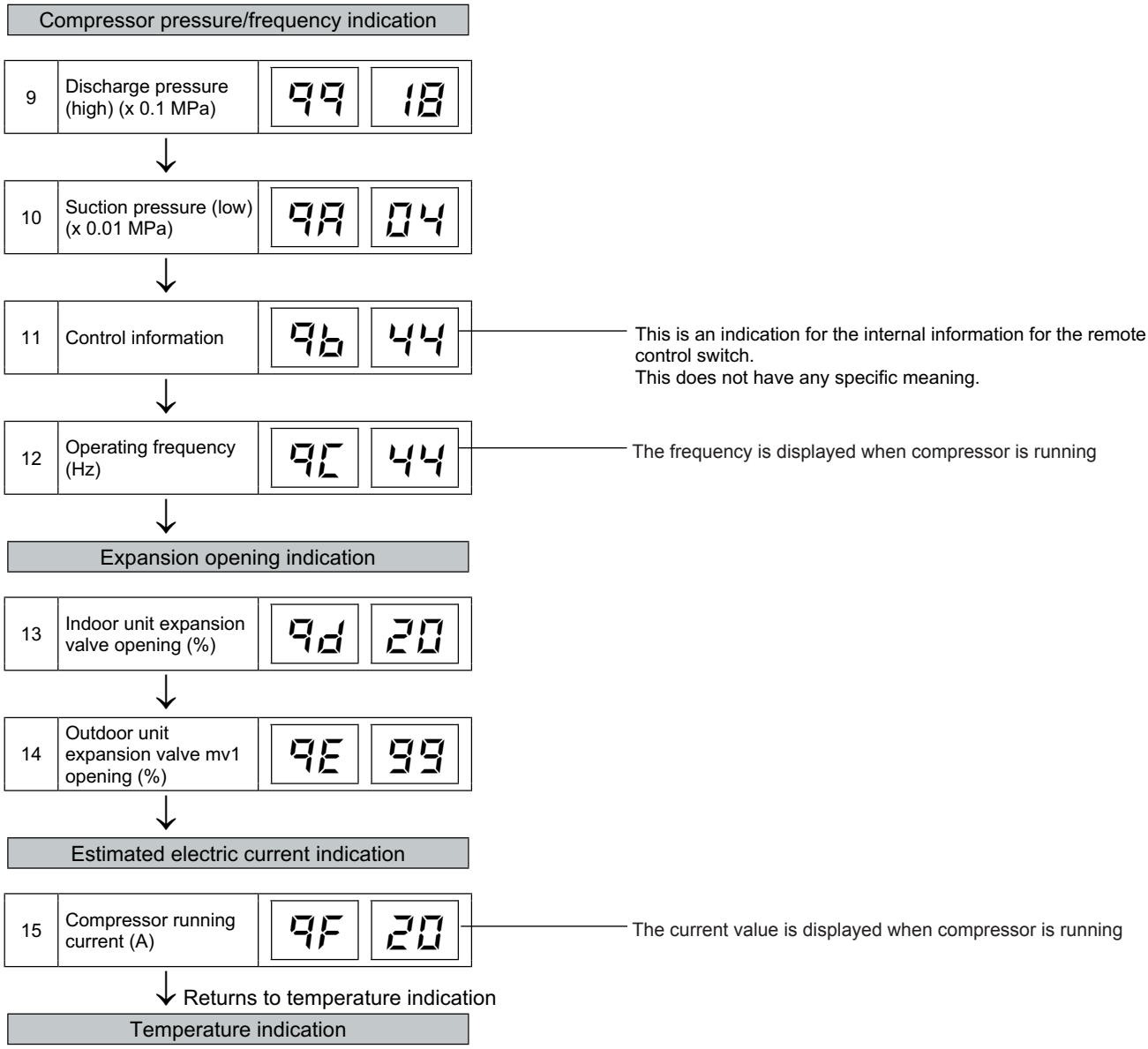
In case of the inverter compressor, the running current of the primary side of the inverter is displayed

Returns to temperature indication

Temperature indication

Contents of the Check mode 2




Compressor pressure/frequency indication
9
Discharge pressure (high) (x 0.1 MPa)
99
18
10
Suction pressure (low) (x 0.01 MPa)
9A
04
11
Control information
9b
44
This is an indication for the internal information for the remote control switch.
This does not have any specific meaning.
12
Operating frequency (Hz)
9C
44
The frequency is displayed when compressor is running
Expansion opening indication
13
Indoor unit expansion valve opening (%)
9d
20
14
Outdoor unit expansion valve mv1 opening (%)
9E
99
Estimated electric current indication
15
Compressor running current (A)
9F
20
The current value is displayed when compressor is running
Returns to temperature indication
Temperature indication

8.2.4. Troubleshooting by means of the 7-segment display

■ Simple checking by 7-segment display

1	❖Turn on All Indoor Units
↓	
2	Turn on All Outdoor Units
↓	
3	Auto--addressing starts

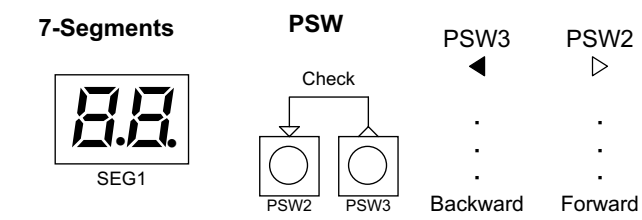
❖ All the Indoor Units Connected to the Outdoor Unit

During auto-addressing, the following items can be checked using the outdoor unit's on-board 7-segment LED display.

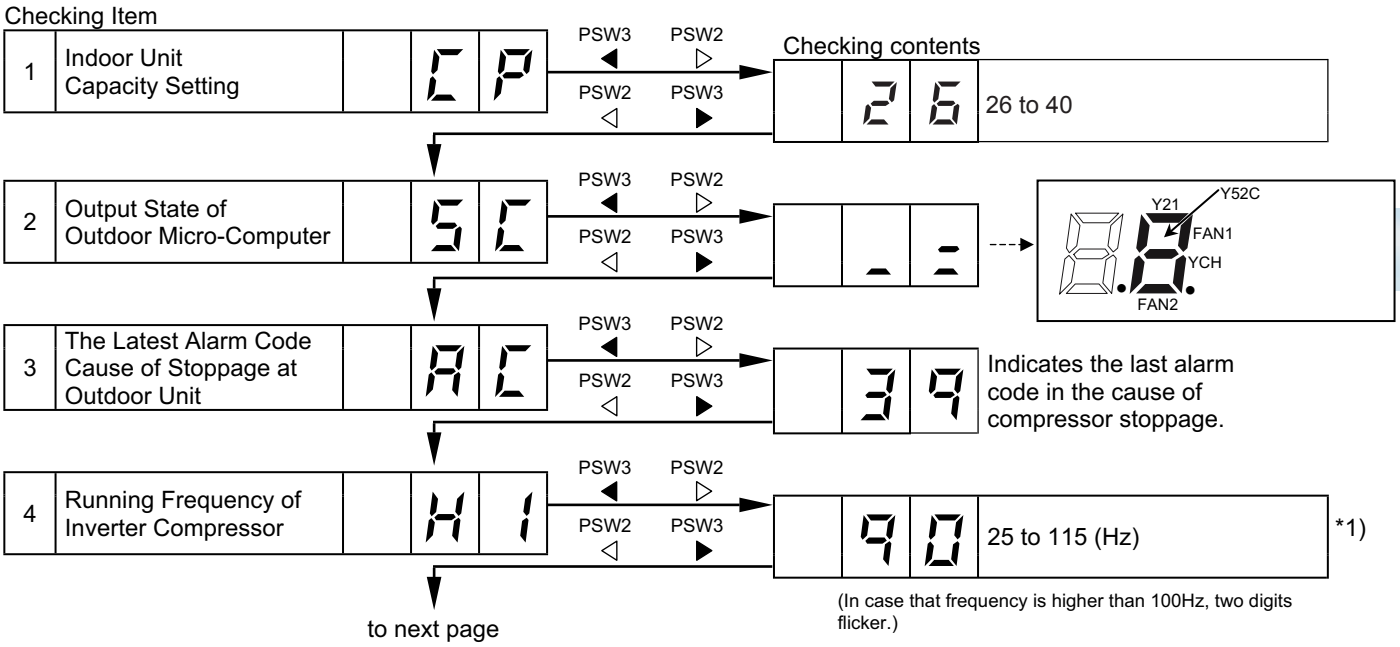
1. Disconnection of power supply to the Indor Unit.
2. Reverse connection of the operating line between the Outdoor and Indoor Units
3. Duplication of Indoor Unit number.

■ Checking method by 7-segment display

By using the 7-segments and check switch (PSW) on the PCB1 in the Outdoor Unit, total quantity of combined Indoor Units, 7-segments operation conditions and each part of refrigerant cycle can be checked.



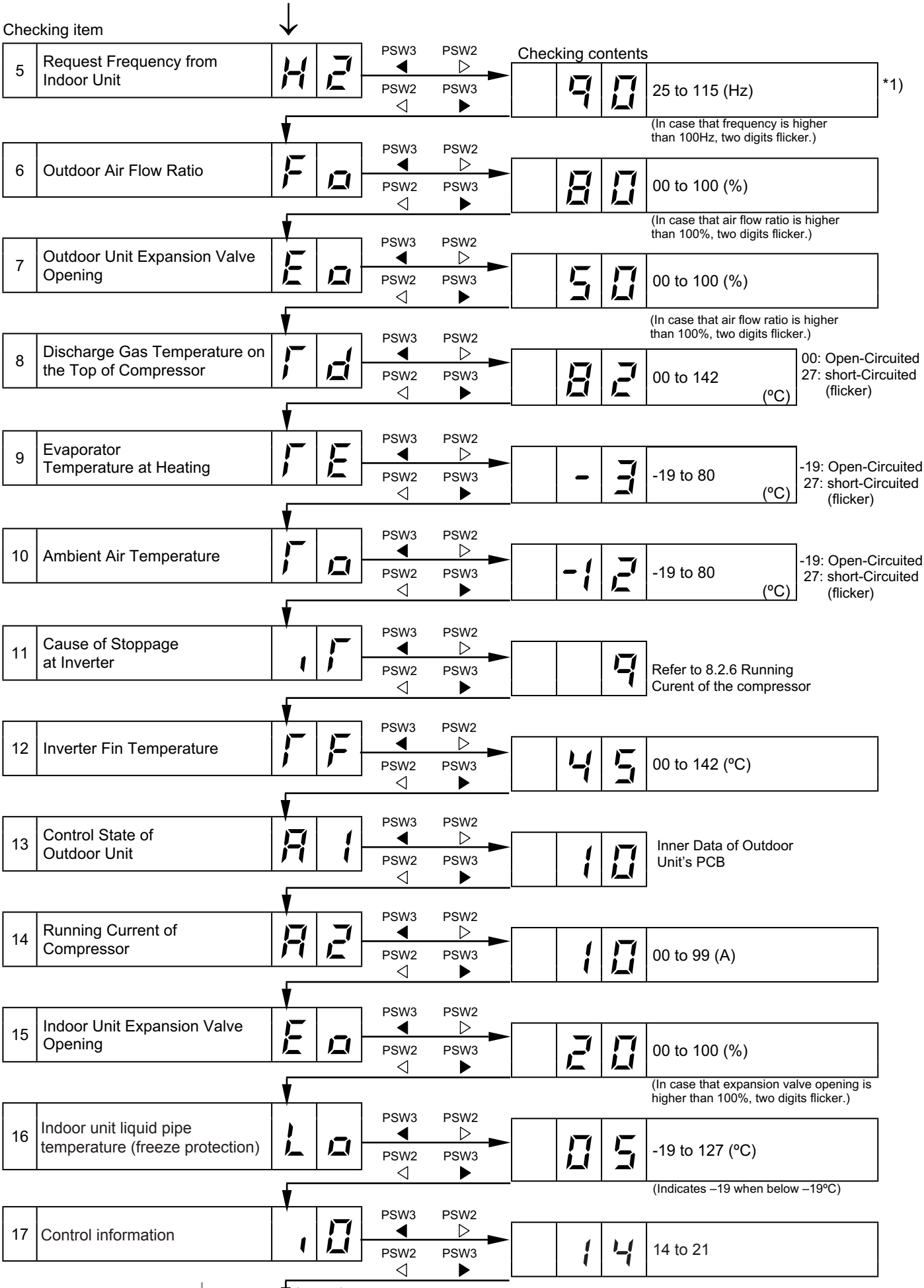
- To start checking, press the "PSW2" switch for more than 3 seconds.
- To proceed checking, press the "PSW2" switch for less than 2 seconds.
- To proceed reversely, press the "PSW3" for less than 2 seconds.
- To cancel this checking, press the "PSW2" switch for more than 3 seconds. The display will be changed to the indication one step before. Then, press the "PSW2" switch once again for more than3 seconds.



*1) The pole of comp. Is four, it is indicated the half value of actual frequency.

8

from previous page



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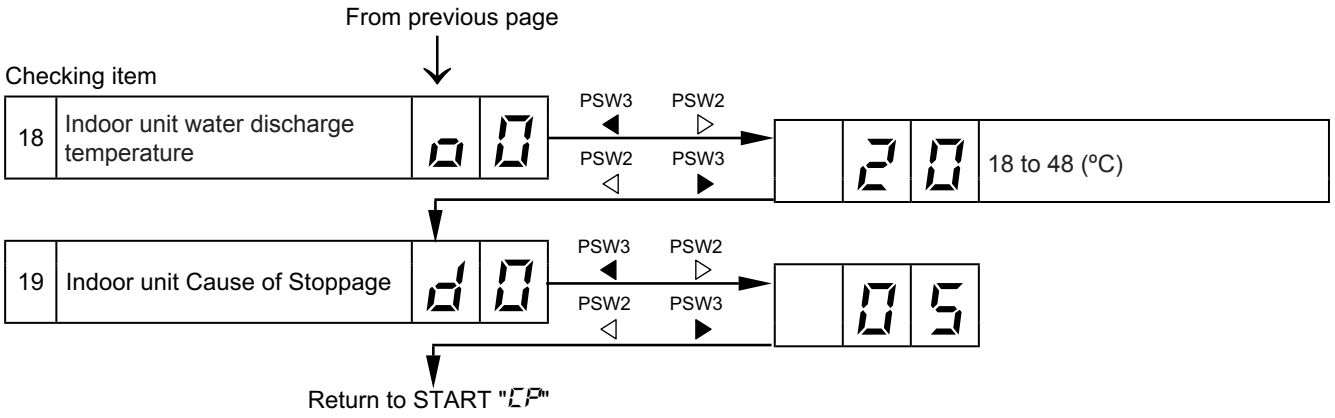
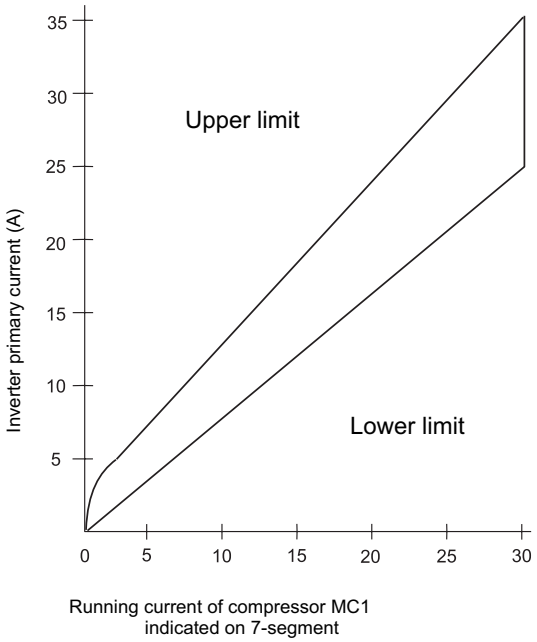


NOTE:
The protection control code being indicated on 7-segment display is changed to an alarm code when the abnormal operation occurs. Also, the same alarm code is indicated on the remote control switch.

8.2.5. Running current of the compressor

■ **Inverter primary current**

The inverter primary current is estimated from the running current of the compressor displayed on the 7-segment display, as shown on the right chart.



■ **Cause code of stoppage for the inverter (content of check item "dFC")**

Code	Cause	Cause of stoppage for corresponding unit	Remark	
			Indication during retry	Alarm code
1	Automatic stoppage of transistor module (ISPM Error) (overcurrent, decrease voltage, increase temperatura)	17	P7	53
2	Instantaneous overcurrent	17	P7	52
3	Abnormal inverter in thermistor	17	P7	54
4	Electronic thermal activation	17	P7	52
5	Inverter voltage decrease	18	P8	06
6	Voltage increase	18	P8	06
7	Abnormal transmission	18	-	04
8	Abnormal current sensor	17	P7	51
9	Instantaneous power failure detection	18	-	-
11	Reset of microcomputer (for inverter)*	18	-	-
12	Earth full detection for compressor (only stating)**	17	P7	53
13	Abnormal power source phace	18	-	-
15	No function inverter	18	-	55

8.2.6. Protection control code on the 7-segment display

1. The protection control indication can be seen on 7-segment when a protection control is activated.
2. The 7-segment continues ON while function is working, and goes out when released.
3. When several protection controls are activated, code number with higher priority will be indicated (see below for the priority order).

- Higher priority is given to protection control related to frequency control than the other.

  Priority Order:

  - Low Pressure Ratio Protection
  - High Pressure Ratio Protection
  - High Pressure Increase Protection
  - Input Protection
  - Current Protection
  - Discharge Gas Temperature Increase Protection
  - Frost Protection
- In relation to retry control, the latest retrial will be indicated unless a protection control related to frequency control is indicated.

Code		Protection Control
P	0	Low Pressure Ratio Control
P	1	High Pressure Ratio Control
P	2	High Pressure Increase Protection
P	3	Current Protection
P	4	Inverter Module Temperature Increase Protection
P	5	Discharge Gas Temperature Increase Protection
P	6	Frost Protection
P	7	Inverter Trip Retry
P	8	Insuficient Voltage / Excessively High Voltage Retry
P	9	Imbalanced Voltage Protection

In the case that degeneration control is activated, c is indicated instead of 0 (*mark)

- Retry indication continues for 30 minutes unless a protection control is indicated.
- Retry indication disappears if the stop signal comes from all rooms.

NOTE:
The protection control code being indicated on 7-segment display is changed to an alarm code when the abnormal operation occurs. Also, the same alarm code is indicated on the remote control switch.

8.2.7. Activating condition of the protection control code

To monitor the conditions such as the temperature change and others, the control of the frequency and other controls are performed by the protection control in order to prevent the abnormal operations.

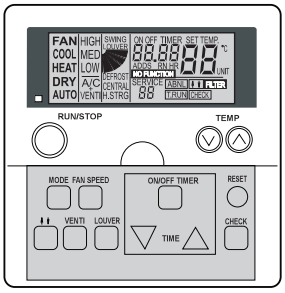
The activating conditions of the protection control are shown in the table below.

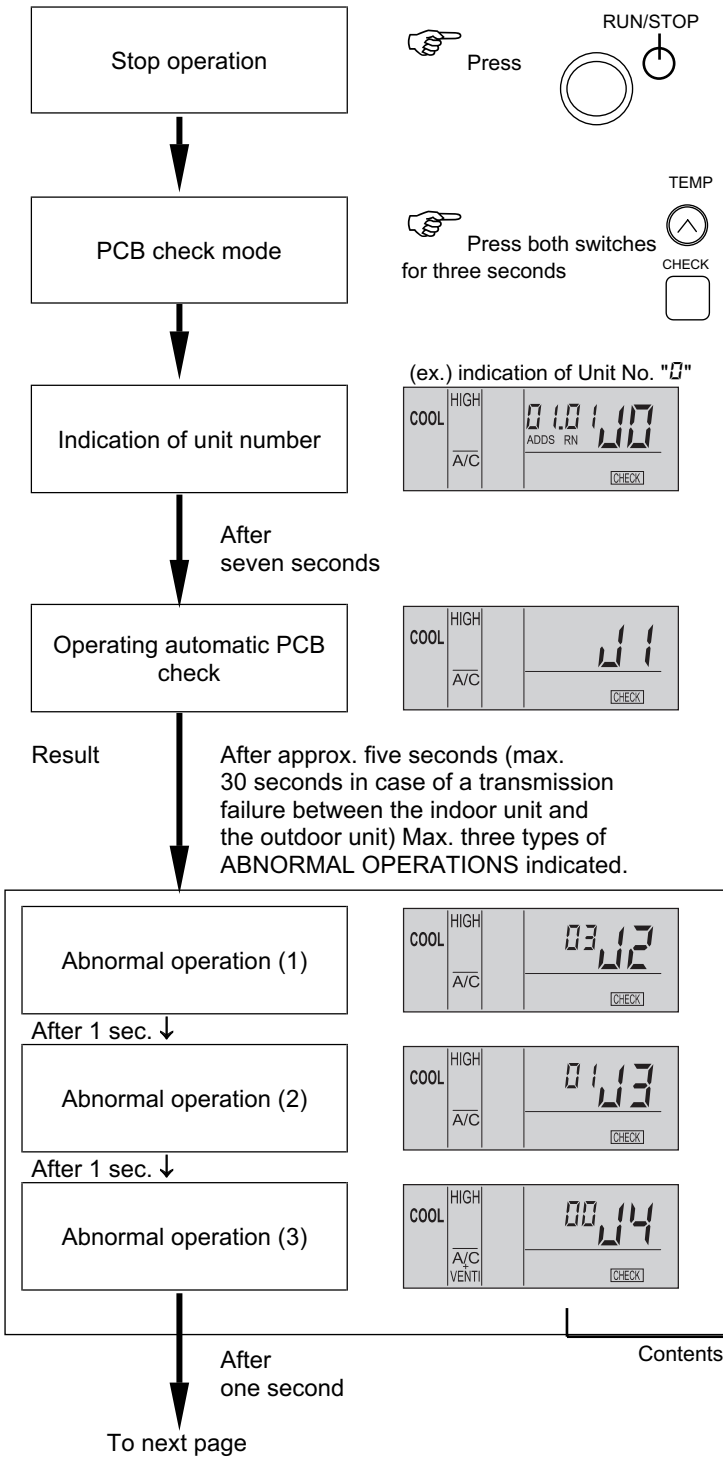
Code	Protection control	Activating condition		Remarks
P0	Low pressure ratio control (cooling)	Compression ratio estimation by: Pd(Tc) / Ps(T_L) < 2.2 → Frecuency increase		Tc: Condensing pipe temperature T_L:Indoor liquid pipe temperature
P1	High pressure ratio control (heating)	Compression ratio estimation by: Pd(T_L) / Ps(Te) ≥ 7.5 → Frecuency decrease		T_L: Indoor liquid pipe temperature Te: Evaporation pipe temperature
P2	High pressure increase protection	PSC activation → Frecuency decrease		PSC: Pressure switch for control
P3	Current protection	Inverter input, Output current ≥:		–
		HVRNE (A)	HRNE (A)	
		14.5 (3 HP) 20.0 (4HP) 25.0 (5HP)	8.5 (4HP) 10.5 (HP)	
		→ Frecuency decrease		
P4	Inverter module temperature increase protection	Inverter module temperature ≥ 89 ºC → Frecuency decrease		–
P5	Discharge gas temperature increase protecion	Temperature at the top of the compressor is high → Frecuency decrease (maximum temperature is different, depends on the frequency)		–
P6	Frost protection (cooling)	In case of T_L < 2 ºC for over 3 min → Frecuency decrease		–
P7	Inverter trip retry	Inverter module microprocessor trip		
P8	Insufficient voltage / Excessive high voltage retry	Insufficient / Excessive high voltage at the inverter module circuit		
P9	Imbalance voltage protection	Imbalance voltage at the inverter module circuit		

8.3. Procedure for checking each main part

8.3.1. Self-checking procedure of PCB by means of the remote control switch

Use the following troubleshooting procedure for testing the PCB in the indoor unit and the outdoor unit





Indi-cation	Contents	
00	Normal	
	Abnormality (open-circuit, short-circuit, etc.) in circuit for:	
01	Control information	Indoor unit PCB
02	(Not used)	
03	(Not used)	
04	Remote thermistor abnormality	
05	Gas pipe temp. thermistor	
06	(Not used)	
08	Transmission of central station	
0A	EEPROM	
0b	Zero cross input failure	
EE	Transmission of indoor units during this checking operation	
07	Transmission of outdoor unit	Outdoor unit PCB
F4	Internal thermostat fan input failure	
F5	PSW input failure	
F6	PSH protection signal detection circuit	
F7	Phase detection	
F8	Transmission of inverter	
FA	High-pressure sensor	
Fb	Comp. discharge gas temp. thermistor	
FC	Low-pressure sensor	
Fd	Heat exchanger evaporation temp. thermistor	
FF	Ambient air temp. thermistor	

8

8.3.2. Self-checking procedure of the remote control switch

Cases where the CHECK switch is used.
1. If the remote control switch displays a malfunction.
2. For the regular maintenance check.

1 Turn ON the power source

↓

2 Simultaneously press the following three switches. (During the operation, you can press the switches.)

TEMP MODE

↓

3 The LCD changes as shown in the right figure.

→ Only for the cancellation of EEPROM, press the following three switches simultaneously during the changes of the LCD.

TEMP

MODE

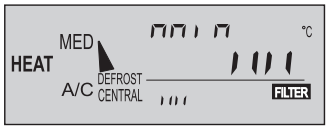
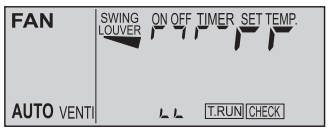
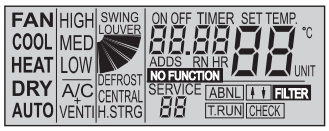
↓

To 11

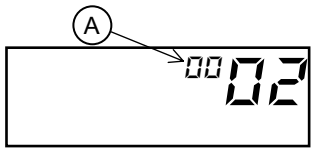
↓

4 After the LCD changes as shown in the right figure, the RUN indicator flickers twice.

↓

No.	LCD indication	Indicating period (sec.)
1 ↓		For one second
2 ↓		For one second
3 ↓		For one second
4 ↓		For one second
5		For three seconds

5 The LCD changes as shown below. Press all the switches (13 switches) one by one.
Every time you press the switch, the number of the indication of the part (A) in the figure below increases one.



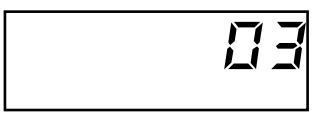
→ Unless all the switches are pressed, the checking does not proceed to the next item.

NOTES:
You can press the switches in any order.

Pressing two or more switches simultaneously is invalid and not counted.

↓

6 The LCD changes as shown below. The remote control switch automatically starts to check the transmission circuit.

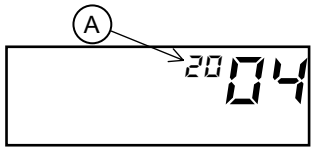


→ In case that the transmission circuit is abnormal, the LCD remains as shown in the left figure and the checking does not proceed to the next item.

↓

To the next page

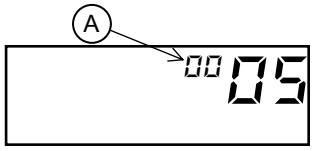
7 The LCD changes as shown below. The detected temperature of the remote control thermostat is displayed at the (A) part in the figure below.



→ If the indicators "--" or "FF" are displayed at the "A" part, the remote control thermostat is abnormal.

8 The LCD changes as shown below.

→ If you press the RESET switch or you leave the switches for 15 seconds, the data of EEPROM (storage cell inside of the remote control switch) is cleared.
At this time, the number is displayed at the (A) part, which is shown in the figure below. When the number "99" is displayed, EEPROM is abnormal.



If the number which is displayed at the (A) part is "99", the checking does not proceed to the next item.

9 The LCD changes as shown below.

← After several seconds have passed, the remote control switch is automatically activated again.

10 When the remote control switch is activated again, the RUN indicator is ON and the operation is started. Therefore, press the RUN/STOP switch and stop the operation.

NOTE:

1. *In case that the operation is not automatically started when the remote control switch is activated again, the detection circuit for the momentary stoppage may be abnormal. However, the detection circuit will not interfere with the normal operation.*
2. *There is a case where the operation is automatically stopped after the automatic operation when the remote control switch is activated again.*

Cancellation of EEPROM

3 →

11 The LCD changes as shown below and the remote control switch automatically cancels the EEPROM.

12 The LCD changes as shown below

After several seconds have passed, the remote control switch is automatically activated again. In this case, the operation is not started automatically.

8

8.3.3. Procedure for checking other main parts

■ **High-voltage discharge procedure for replacing the parts**

DANGER:
Perform this high-voltage discharge procedure in order to avoid an electrical shock.

Procedure:

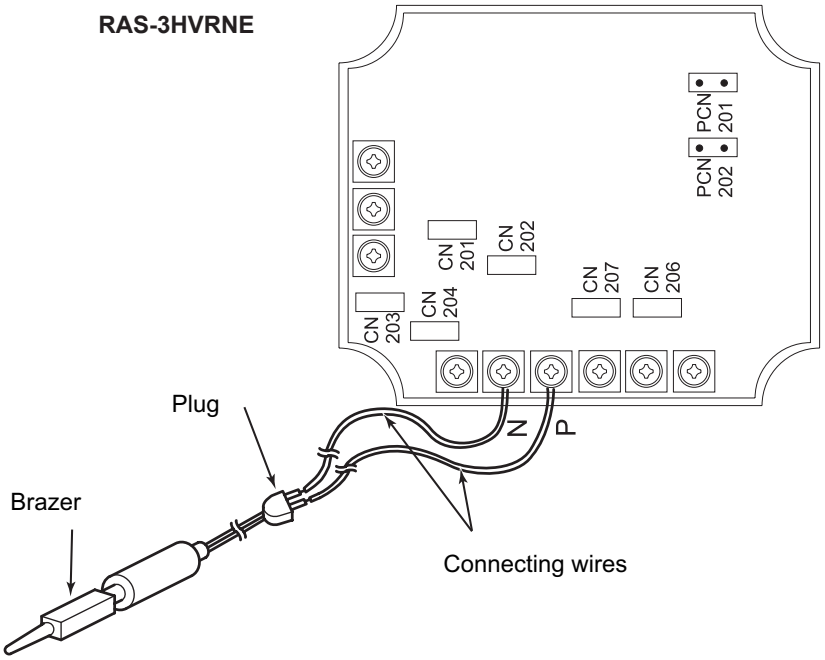
a. Turn OFF the main switches and wait for three minutes. Make sure that no high voltage exists. If LED201 is ON after the start and LED201 is OFF after turning OFF the power source, the voltage will decrease to lower than DC50V.

b. Connect the connect wires to an electrical brazer. The discharging starts and this results in a hot brazer. Pay attention not to short-circuit between the terminal P and N.

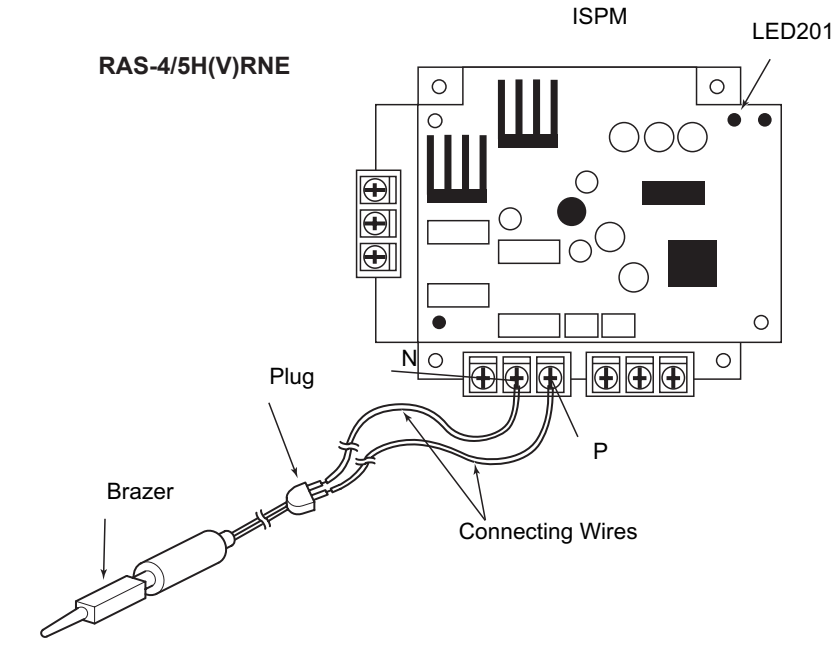
c. Connect the wires to terminals, P and N on ISPM.

d. Wait for two or three minutes and measure the voltage once again. Make sure that no voltage is charged.

RAS-3HVRNE

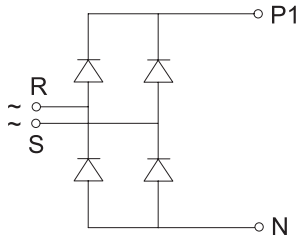


RAS-4/5H(V)RNE



■ Checking procedure ISPM for RAS-3~5HVRNE

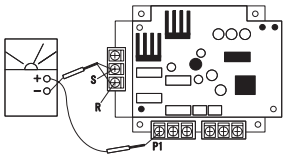
Rectification Parts of Internal Circuit of ISPM (Common)



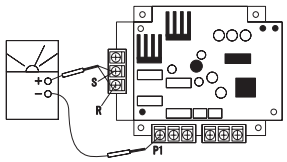
Remove all the terminals of the ISPM before check.
If items (a) to (h) are performed and the results are satisfactory, ISPM is normal. Measure it under 1 kΩ range of a tester.

CAUTION:
Do not use a digital tester.

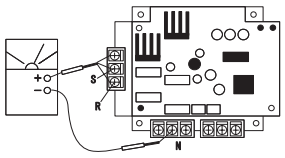
a. By touching the + side of the tester to the P1 terminal of ISPM and the - side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



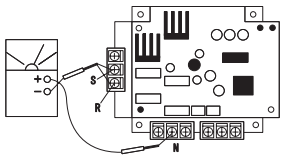
b. By touching the - side of the tester to the P1 terminal of ISPM and the + side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



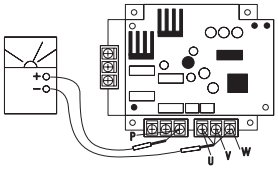
c. By touching the - side of the tester to the N terminal of ISPM and the + side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



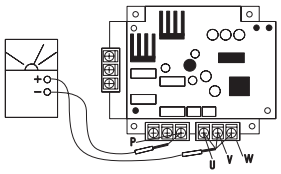
d. By touching the + side of the tester to the N terminal of ISPM and the - side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



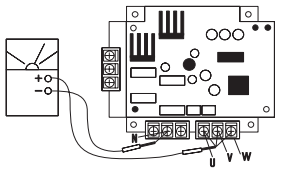
e. By touching the + side of the tester to the P terminal of ISPM and the - side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



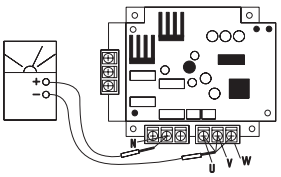
f. By touching the - side of the tester to the P terminal of ISPM and the + side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



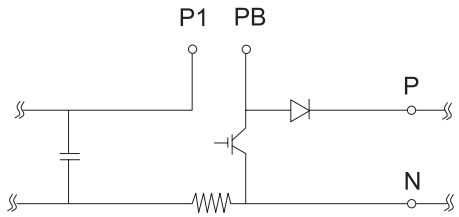
g. By touching the - side of the tester to the N terminal of ISPM and the + side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



h. By touching the + side of the tester to the N terminal of ISPM and the - side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



Active Parts of Internal Circuit of ISPM



i. Perform the item (a) to (h).

j. By touching the + side of the tester to the RB terminal of ISPM and the - side of the tester to P terminal of ISPM. If the resistance is more than 100 kΩ, it is normal.

k. By touching the - side of the tester to the RB terminal of ISPM and the + side of the tester to P terminal of ISPM. If the resistance is more than 1 kΩ, it isnormal.

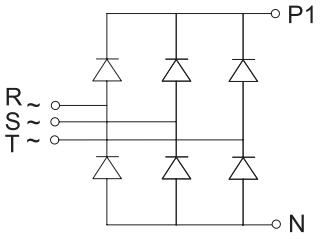
l. By touching the + side of the tester to the RB terminal of ISPM and the - side of the tester to N terminal of ISPM. If the resistance is more than 10 kΩ, it isnormal.

m. By touching the - side of the tester to the RB terminal of ISPM and the + side of the tester to N terminal of ISPM. If the resistance is more than 100 kΩ, it isnormal.

If item (i) to (m) are performed and the results are satisfactory, ISPM is normal.
Measure it under 1 kΩ range of a tester. Do not use a digital tester.

■ Checking procedure ISPM for RAS-4/5HRNE

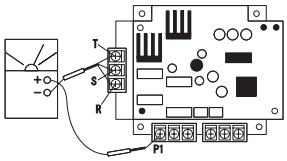
Rectification Parts of Internal Circuit of ISPM (Common)



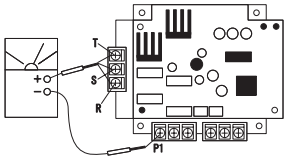
Remove all the terminals of the ISPM before check.
If items (a) to (h) are performed and the results are satisfactory, ISPM is normal. Measure it under 1 kΩ range of a tester.

CAUTION:
Do not use a digital tester.

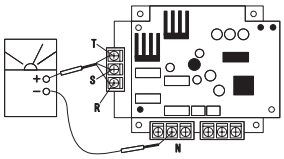
a. By touching the + side of the tester to the P1 terminal of ISPM and the - side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



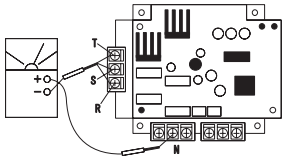
b. By touching the - side of the tester to the P1 terminal of ISPM and the + side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



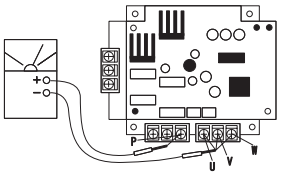
c. By touching the - side of the tester to the N terminal of ISPM and the + side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



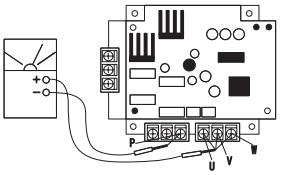
d. By touching the + side of the tester to the N terminal of ISPM and the - side of the tester to R and S of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



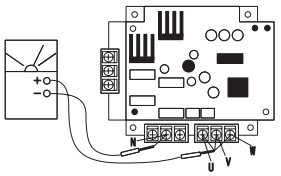
e. By touching the + side of the tester to the P terminal of ISPM and the - side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



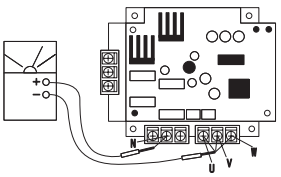
f. By touching the - side of the tester to the P terminal of ISPM and the + side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



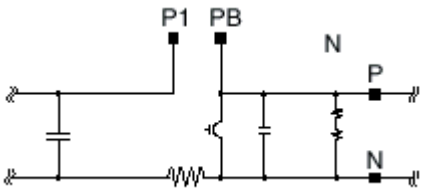
g. By touching the - side of the tester to the N terminal of ISPM and the + side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 100 kΩ, it is normal.



h. By touching the + side of the tester to the N terminal of ISPM and the - side of the tester to U, V and W of ISPM, measure the resistance. If all the resistances are more than 1 kΩ, it is normal.



Active Parts of Internal Circuit of ISPM



i. Perform the item (a) to (h).

j. By touching the + side of the tester to the RB terminal of ISPM and the - side of the tester to P terminal of ISPM. If the resistance is more than 1 kΩ, it is normal.

k. By touching the - side of the tester to the RB terminal of ISPM and the + side of the tester to P terminal of ISPM. If the resistance is more than 100 kΩ, it isnormal.

l. By touching the + side of the tester to the RB terminal of ISPM and the - side of the tester to N terminal of ISPM. If the resistance is more than 90 kΩ, it isnormal.

m. By touching the - side of the tester to the RB terminal of ISPM and the + side of the tester to N terminal of ISPM. If the resistance is more than 90 kΩ, it isnormal.

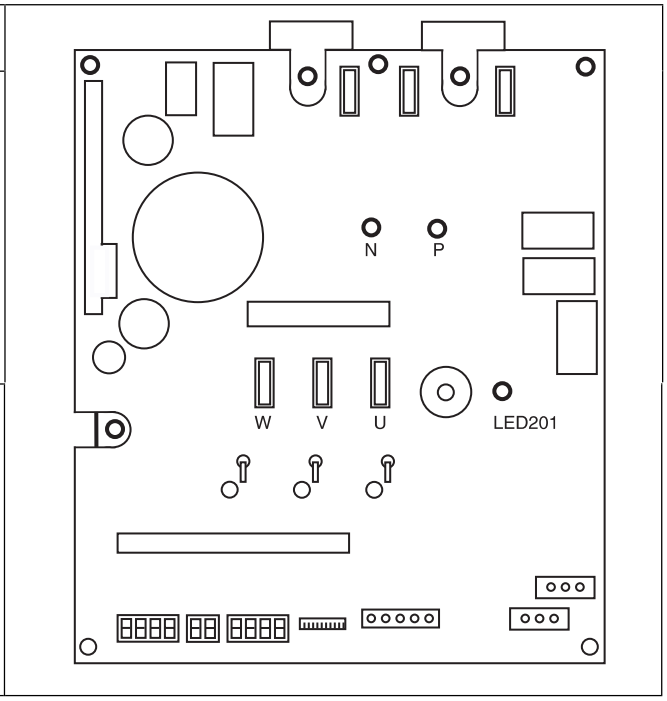
If item (i) to (m) are performed and the results are satisfactory, ISPM is normal.
Measure it under 1 kΩ range of a tester. Do not use a digital tester.

■ **Checking procedure for the fan controller failure**

1) Turn OFF the main switches and make sure that LED201 (Red) on Fan Controller is OFF. Otherwise, an electrical shock may occur because the voltage may have changed more than DC50V in Fan Controller.

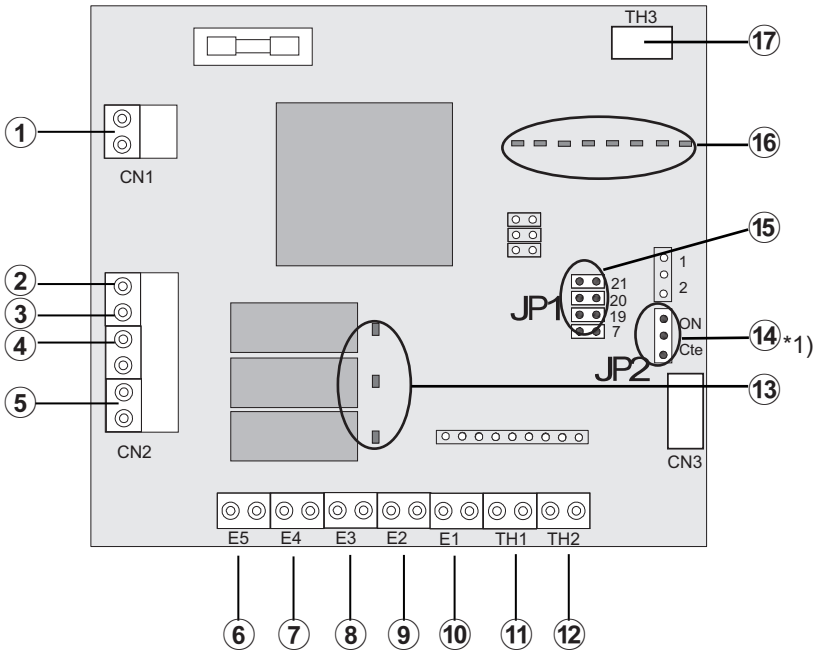
2) Remove all the wirings in Fan Controller and measure the resistance between the terminals by means of an analog tester, according to the table below. Fix the tester range to 1KΩ. Check the color and the terminal for measuring. Do not use a digital tester.

Tester probe Red (+)	Tester probe Black (-)	Criteria for resistance value
P-R P-S P-T R-N S-N T-N P-U P-V P-W U-N V-N W-N		More than 1KΩ
R-P S-P T-P N-R N-S N-T U-P V-P W-P N-U N-V N-W		The resistance value increases by degrees after the indicator moves for a moment. The resistance value increases by degrees after 1700KΩ~1900, KΩ is displayed (x).



The interval of the measurement should be more than 30 seconds. Otherwise, an excessively high value may be displayed.

■ Control PCB



Pos.		Item
1		CN1: Electrical power of the control PCB
Outputs	2	CN3: MAIN PCB connection
	3	COOL-HEAT
	4	ON/OFF: Electric heater
	5	Electrical power of the water pump
Inputs	6	E5: Alarm signal
	7	E4: Room thermostat
	8	E3: Maximum working frequency ON/OFF
	9	E2: Operating mode COOL/HEAT
	10	E1: ON/OFF operation of the electric heater
	11	TH1: Outdoor thermistor
	12	TH2: Water outlet thermistor for the AquaFREE unit
13		System indicator: LED 1 is lighted: System is ON LED 3 is lighted: Electric heater is ON
14		Regulation of the electric heater *1)
15		Cooling regulation. (7ºC not available)
16		LEDS: Frequency control values
17		Connection to the main PCB

Note *1)

Regulation 1		Regulation 2	
	Not used		Not used
	ON Cte		ON Cte

■ Procedure for checking the operation of the control PCB.

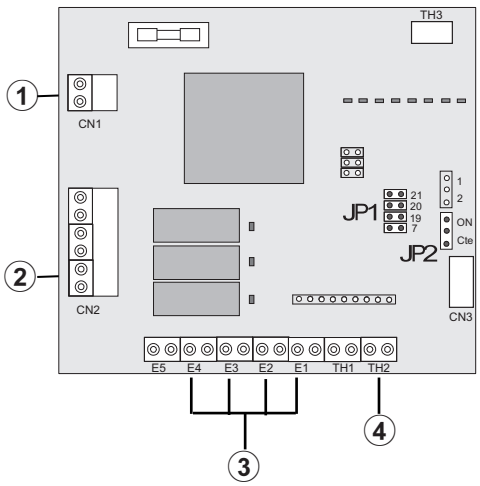
1) Check that the system is operating by means of the LED indicators:

   LED 1 is lighted: The system is ON
   LED 3 is lighted: Heater is ON

2) Cut the power circuit for the AquaFREE unit using the magnetothermic switch. Otherwise there is a risk of electric shock.

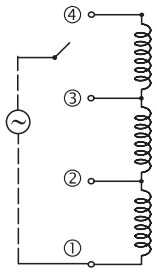
3) Remove all the wiring of the control PCB and measure the resistance between the terminals by using an analog tester. Compare the measurements with the following impedance values:

Pos.	Item	Impedance value
1	Electrical power of the control PCB	2.0 - 2.5 kΩ
2	Electrical power of the water pump	100 MΩ
3	Input signal connectors: E4=E3=E2=E1	0.9 kΩ
4	Outdoor thermistor inlet TH1	9.78 kΩ



8

■ **Checking procedure for the electrical coil parts**

Part name	Model	Electrical wiring diagram	Wiring No.	Resistance (Ω)
Water pump for the indoor unit	(62~132 W)		①⇔② ①⇔③ ①⇔④	0.30 0.42 0.58
Fan motor for the outdoor unit for: RAS-3~5HVRNE	DC Motor 70 W	DC Motor		
Fan motor for the outdoor unit for: RAS-4/5HRNE	DC Motor 70W	DC Motor		

■ **Checking procedure for the compressor**

Check list on the compressor

Client:	Model:	Date
Serial No.	Production date:	Checker

No.	Check item	Check method	Additional information
1	Is THM9, correctly connected? THM9: Discharge gas thermistor	– Are the wires of each thermistor correctly connected in a visual inspection?	The discharge gas temperature (Td) controls the liquid refrigerant return volume to the compressor.
2	Is the thermistor THM8 disconnected?	– Make sure that thermistor on the top of comp. is correctly mounted in a visual inspection.	
3	Are the connectors for current sensor correctly connected	1 Make sure that indication A2 is 0 during the compressor stoppage. 2 Make sure that indication A1 is not 0 during the compressor operation.	The current sensor performs the overcurrent control (the operation frequency control) by detecting the current. In this case, the insulation failure of the motor winding will occur because the control is not available in spite of the actually high current.
4	Is current sensor faulty?		
5	Is current sensing part on PCB faulty?		
6	Is the direction of current sensor (CTU, CTV) reverse?	Check the direction → in a visual inspection.	The current sensor checks the phase and adjusts the output electrical wave, in addition to the above-mentioned items. If a fault occurs, the output electrical wave becomes unstable. This generates stress to the motor winding and results in the insulation failure of the motor winding.
7	Are the power supply wires U and V inserted correctly into the current sensor?	Make sure that the wires are correctly inserted.	

No.	Check item	Check method	Additional information
8	Is the ex. valve MV correctly connected?	Outdoor unit: Make sure that MV~CN5A are correctly connected. Indoor Unit: Mahe sure that MV~CN11 are correctly connected	During a cooling process, the fan speed of the outdoor unit controls the Pd and the MV of each indoor unit controls the Td and the TSH.During a heating process, MV Outdoor unit controls the Td and the TSH. If the expansion valves are incorrectly connected, the correct control is not available. This results in the compressor seizure depending on the returning conditions of the liquid refrigerant. Also, this may result in the insulation failure of the motor winding depending on the overheating conditions.
9	Is the ex. valve coil MV correctly mounted?	Make sure that each coil is correctly mounted on the valve.	
10	Are the refrigerant cycle and electrical wiring system incorrectly connected?	Make sure that the refrigerant is flowing into the indoor units by operating one refrigerating cycle only from the outdoor unit.	If the refrigerant cycle and the electrical system are incorrectly connected, an abnormally low suction pressure operation is maintained or an abnormally high discharge pressure operation is maintained. This results in further stress to the compressor because the correct control of the compressor is not available.
11	Is the opening of ex. valve completely closed (locked)?	Check the following by means of the check mode of the outdoor unit: 1 Liquid pipe temp.(TL)< Control information bC during the cooling process 2 Liquid pipe temp.(TL)> Control information bC during the heating process	
13	Are the contacts for the comp. magnetic switch CMC faulty?	Check the surface of each contact (L1, L2 and L3) in a visual inspection.	If the contacting resistance becomes large, the voltage imbalance among each phase will cause an abnormal overcurrent
14	Is there any voltage malfunction among L1-L2, L2-L3 and L3-L1?	Make sure that the voltage imbalance is smaller than 3%. Note that the power source voltage must be within 400V±10%, 230V±10 %.	In this case, the overcurrent will occur, the efficiency will decrease or the motor winding will be excessively heated
15	Is the comp. oil acidified during the burning of the compressor motor?	Make sure that the oil color is not black.	In this case, it will result in the burning of the motor or the compressor seizure.

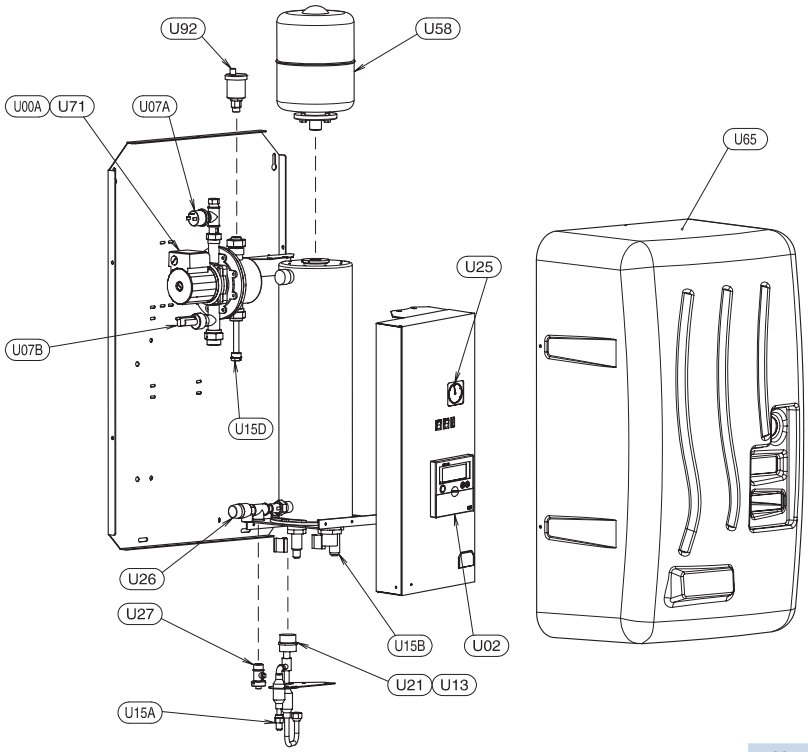
9. Spare parts

This chapter details the spare parts list, and their location in to the Aqua-Free RWM-FSN1E-(S1)(4.5/6H1/3) indoor units and their complementary RAS-H(V)RNE outdoor units of Hitachi's DC Inverter series.

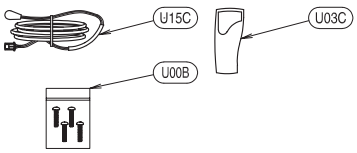
Contents

9.1. Indoor Units

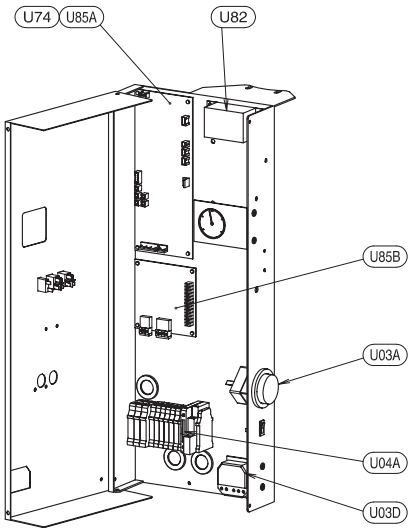
9.1.1. RWM-(3~5)FSN1E



Accessories



Electrical Parts



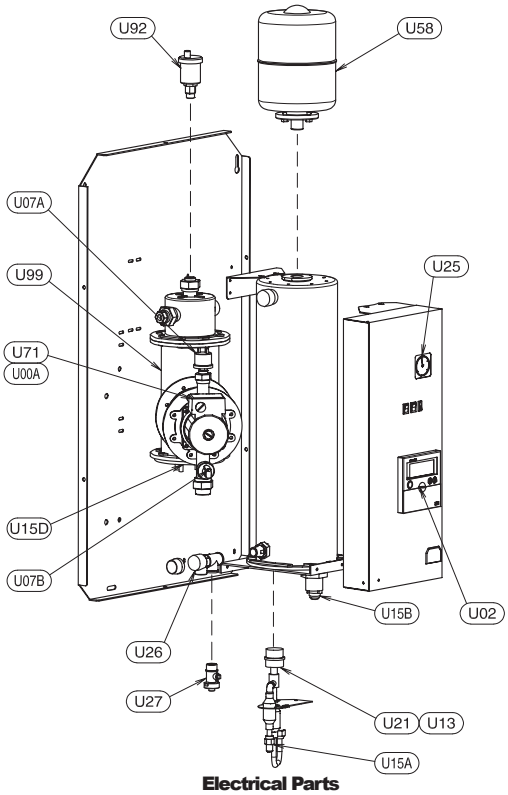
No.	NAME OF PARTS	NOTE
U00A	Water Pump Joint	
U00B	Screws	Set
U02	Remote Control Switch	
U03A	Setting Water Thermostat	
U03C	Room thermostat	Radio
U03D	Receiver	
U04A	Fuse	Input Power (2A)
U07A	Water Pressure Switch	
U07B	Water Flow Switch	
U13	Expansion Valve Cord	
U15A	Thermistor	For drain pipe
U15B	Thermistor	For gas pipe
U15C	Outdoor Sensor Thermistor	
U15D	Water Sensor Thermistor	
U21	Expansion Valve	Assembly
U25	Manometer	
U26	Security Valve	
U27	Water Source Port	
U58	Expansion Vessel	
U65	Casing	
U71	Water Pump	RS 6-3p
U74	Resistance	THM2
U82	Transformer	
U85A	Printed Circuit Board	PCB
U85B	Regulation PCB	
U92	Air Purger	

ATTENTION

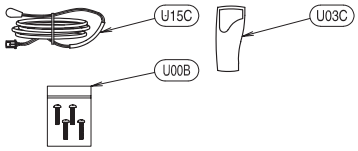
This spare parts list can be updated without previous notification. Check the manufacturing unit number and consult with your distributor.

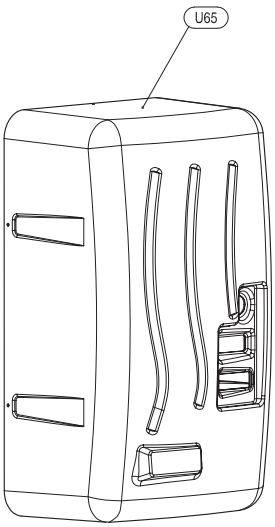
Drawing number:
EPN0607B-1B

9.1.2. RWM-(3~5)FSN1E-(4.5/6)H(1/3)

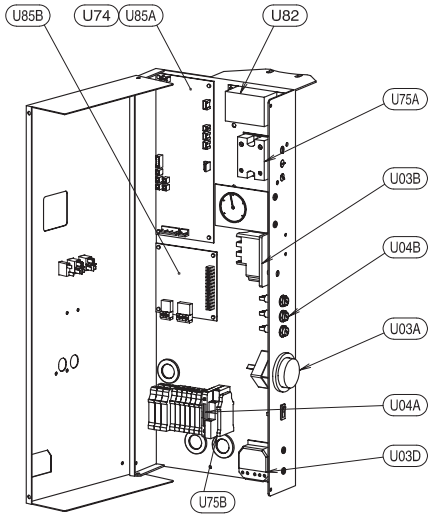


Accessories





Electrical Parts



No.	NAME OF PARTS	NOTE
U00A	Water Pump Joint	
U00B	Screws	Set
U02	Remote Control Switch	
U03A	Setting Water Thermostat	
U03B	Security Water Thermostat	
U03C	Room thermostat	Radio
U03D	Receiver	
U04A	Fuse	Input Power (2A)
U04B	Fuse	Input Power (10A)
U07A	Water Pressure Switch	
U07B	Water Flow Switch	
U13	Expansion Valve Cord	
U15A	Thermistor	For drain pipe
U15B	Thermistor	For gas pipe
U15C	Outdoor Sensor Thermistor	
U15D	Water Sensor Thermistor	
U21	Expansion Valve	Assembly
U25	Manometer	
U26	Security Valve	
U27	Water Source Port	
U58	Expansion Vessel	
U65	Casing	
U71	Water Pump	RS 7-3p
U74	Resistance	THM2
U75A	Electric Heater	1~ / 3~
U75B	Electric Heater Auxiliary Relay	3~
U82	Transformer	
U85A	Printed Circuit Board	PCB
U85B	Regulation PCB	
U92	Air Purger	
U99	Heater	4.5kW / 6kW

Drawing number:
EPN0607B-2B

ATTENTION

This spare parts list can be updated without previous notification. Check the manufacturing unit number and consult with your distributor.

9.1.3. RWM-(3~5)FSN1E-S1

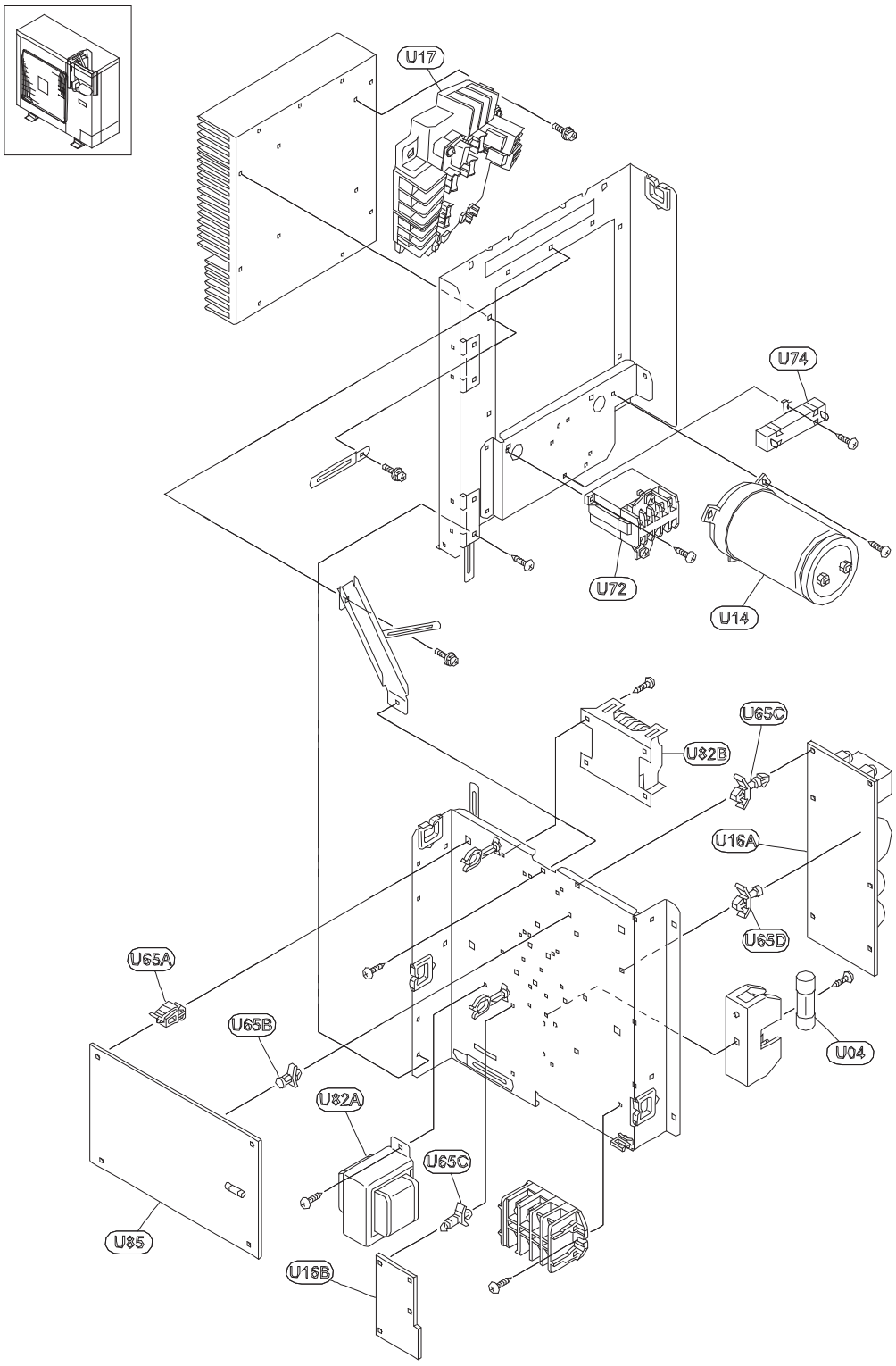
9.1.4. RWM-(3~5)FSN1E-S1-(4.5/6)H(1/3)

TO BE INFORMED LATER

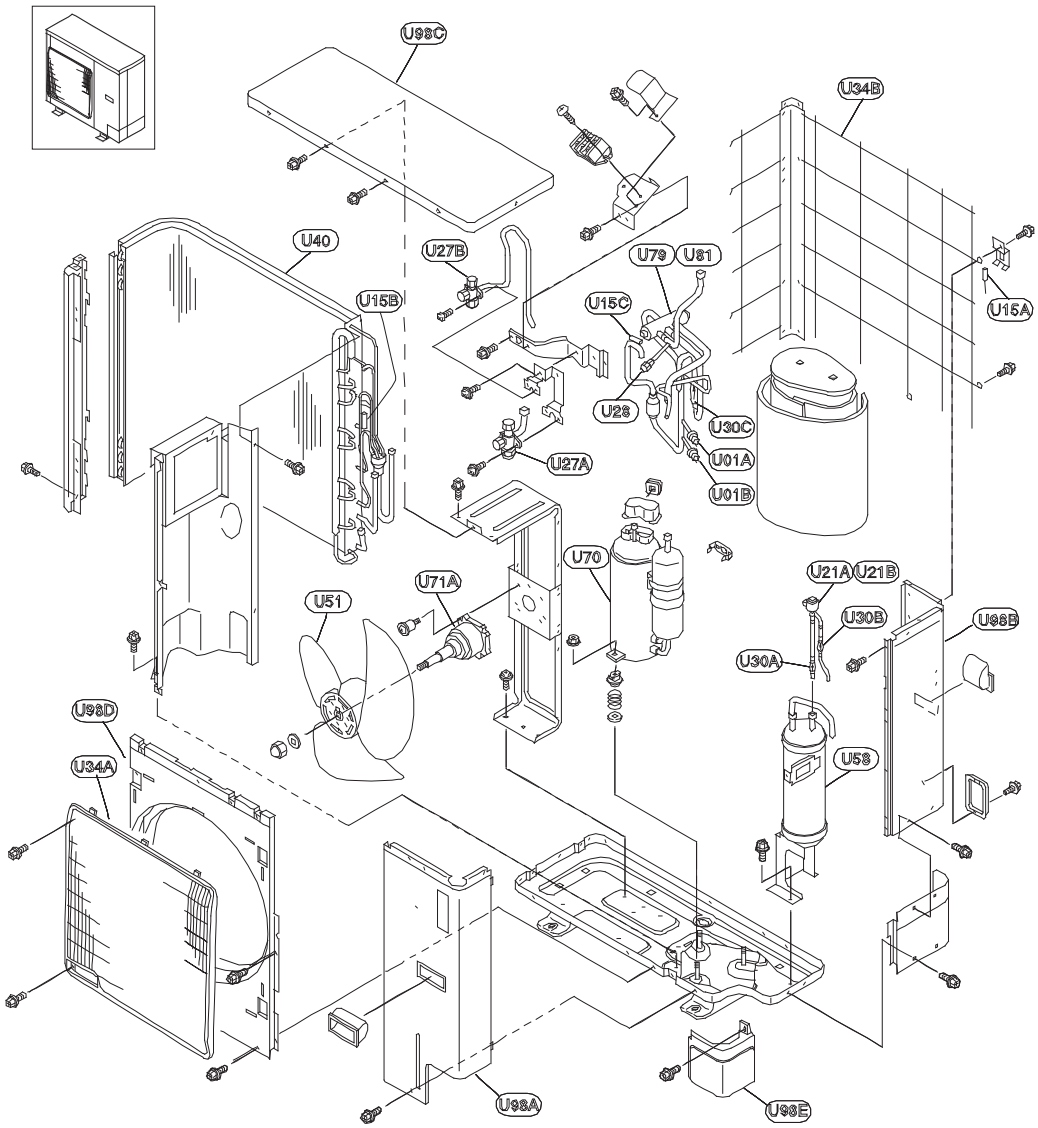
9.2. Outdoor Units

9.2.1. RAS-3HVRNE

- Electric parts



- Structural and cicle parts



No.	NAME	NOTE
U01A	Pressure sensor	High pressure
U01B	Pressure sensor	For control
U04	Fuse	
U14	Condenser	
U15A	Thermistor	
U15B	Thermistor	
U15C	Thermistor	
U16A	Noise filter	
U16B	Noise filter	
U17	INV module	
U21A	Expansion valve	
U21B	Expansion coil	
U27A	Stop Valve	Gas Pipe
U27B	Stop Valve	Liquid Pipe
U28	Check Joint	
U30A	Filter	

No.	NAME	NOTE
U30B	Filter	
U30C	Filter	
U32A	Bushing	
U32B	Bushing	
U34A	Air outlet grille	
U34B	Protector Net	
U40	Heat exchanger	
U42	Check valve	
U51	Propeller Fan	
U58	L tank	Assembly
U65A	Bearing holder	
U65B	Spacer	
U65C	Spacer	
U65D	Spacer	
U70	Compressor	
U71A	Fan Motor .	MOF1

No.	NAME	NOTE
U71B	Fan Motor .	MOF2
U72	Magnetic Contactor	
U74	Resistor	
U77A	Solenoid valve	
U77B	Solenoid valve	For coil
U79	4-way Valve	
U81	4-way Valve	For coil
U82A	Tranformer	
U82B	Tranformer	
U85	Printed Circuit Board	PCB
U98D	Shroud	
U98B	Rear cover	Assembly
U98C	Upper cover	Assembly
U98E	Packing	
U98A	Service cover	Assembly
U98F	Side cover	

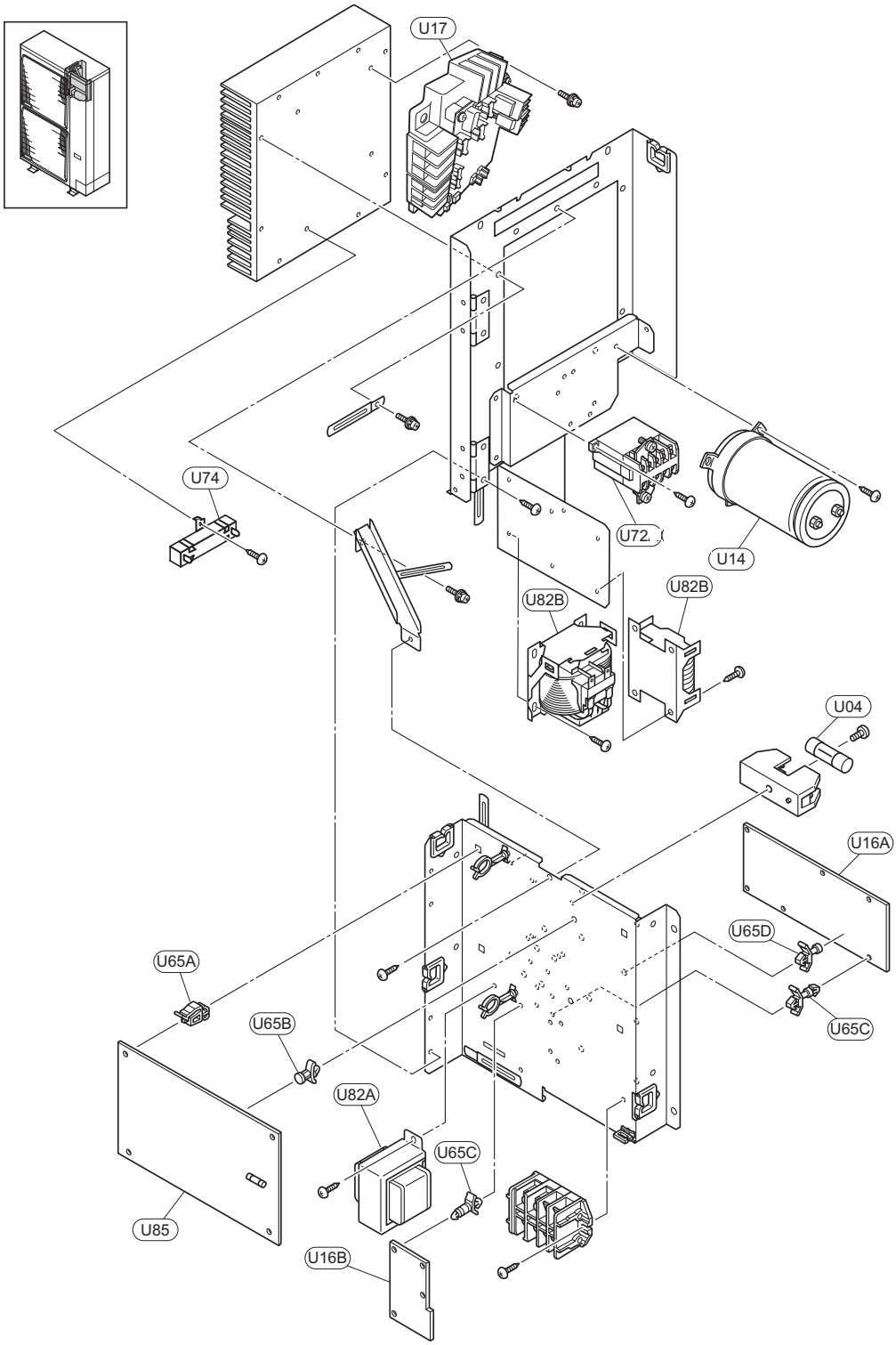
Drawing number:EPN0607A
EPN0607A

ATTENTION

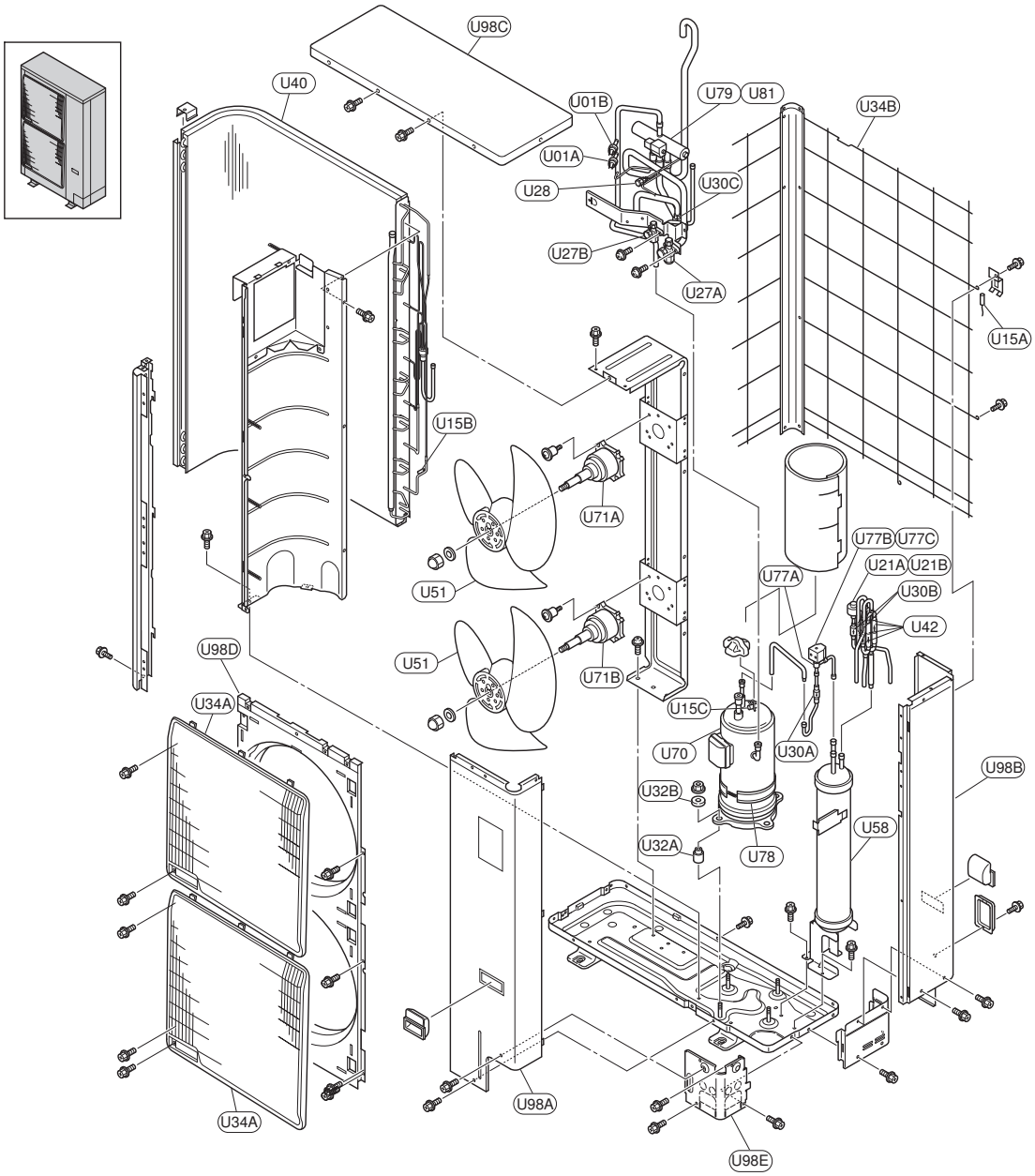
This spare parts list can be updated without previous notification. Check the manufacturing unit number and consult with your distributor.

9.2.2. RAS-(4/5)HVRNE

- Electric parts



- Structural and cicle parts



No.	NAME	NOTE
U01A	Pressure sensor	High pressure
U01B	Pressure sensor	For control
U04	Fuse	
U14	Condenser	
U15A	Thermistor	
U15B	Thermistor	
U15C	Thermistor	
U16A	Noise filter	
U16B	Noise filter	
U17	INV module	
U21A	Expansion valve	
U21B	Expansion coil	
U27A	Stop Valve	Gas Pipe
U27B	Stop Valve	Liquid Pipe
U28	Check Joint	
U30A	Filter	

No.	NAME	NOTE
U30B	Filter	
U30C	Filter	
U32A	Bushing	
U32B	Bushing	
U34A	Air outlet grille	
U34B	Protector Net	
U40	Heat exchanger	
U42	Check valve	
U51	Propeller Fan	
U58	L tank	Assembly
U65A	Bearing holder	
U65B	Spacer	
U65C	Spacer	
U65D	Spacer	
U70	Compressor	
U71A	Fan Motor .	MOF1

No.	NAME	NOTE
U71B	Fan Motor .	MOF2
U72	Magnetic Contactor	
U74	Resistor	
U77A	Solenoid valve	
U77B	Solenoid valve	For coil
U79	4-way Valve	
U81	4-way Valve	For coil
U82A	Tranformer	
U82B	Tranformer	
U85	Printed Circuit Board	PCB
U98D	Shroud	
U98B	Rear cover	Assembly
U98C	Upper cover	Assembly
U98E	Packing	
U98A	Service cover	Assembly
U98F	Side cover	

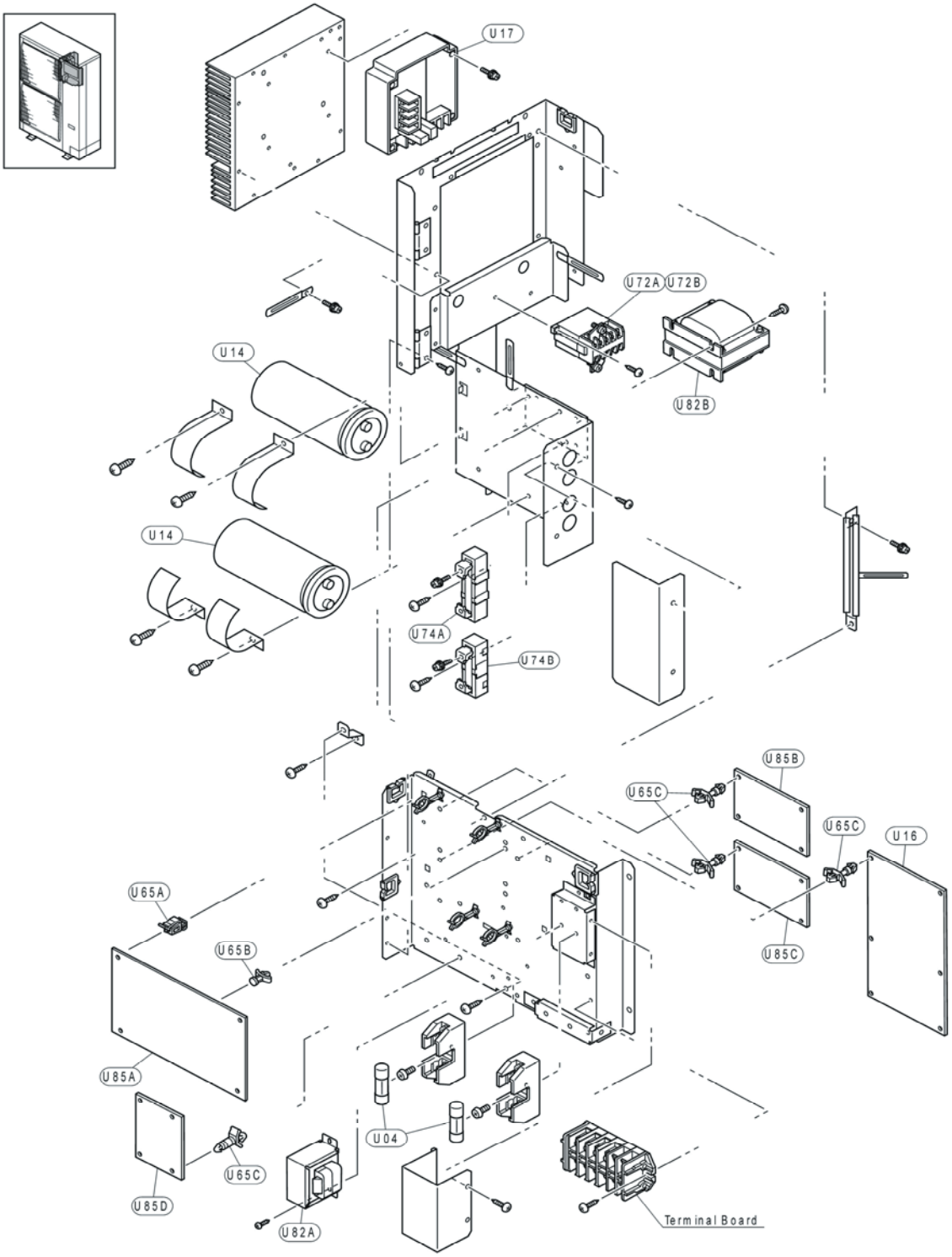
Drawing number: EPN0607A

ATTENTION

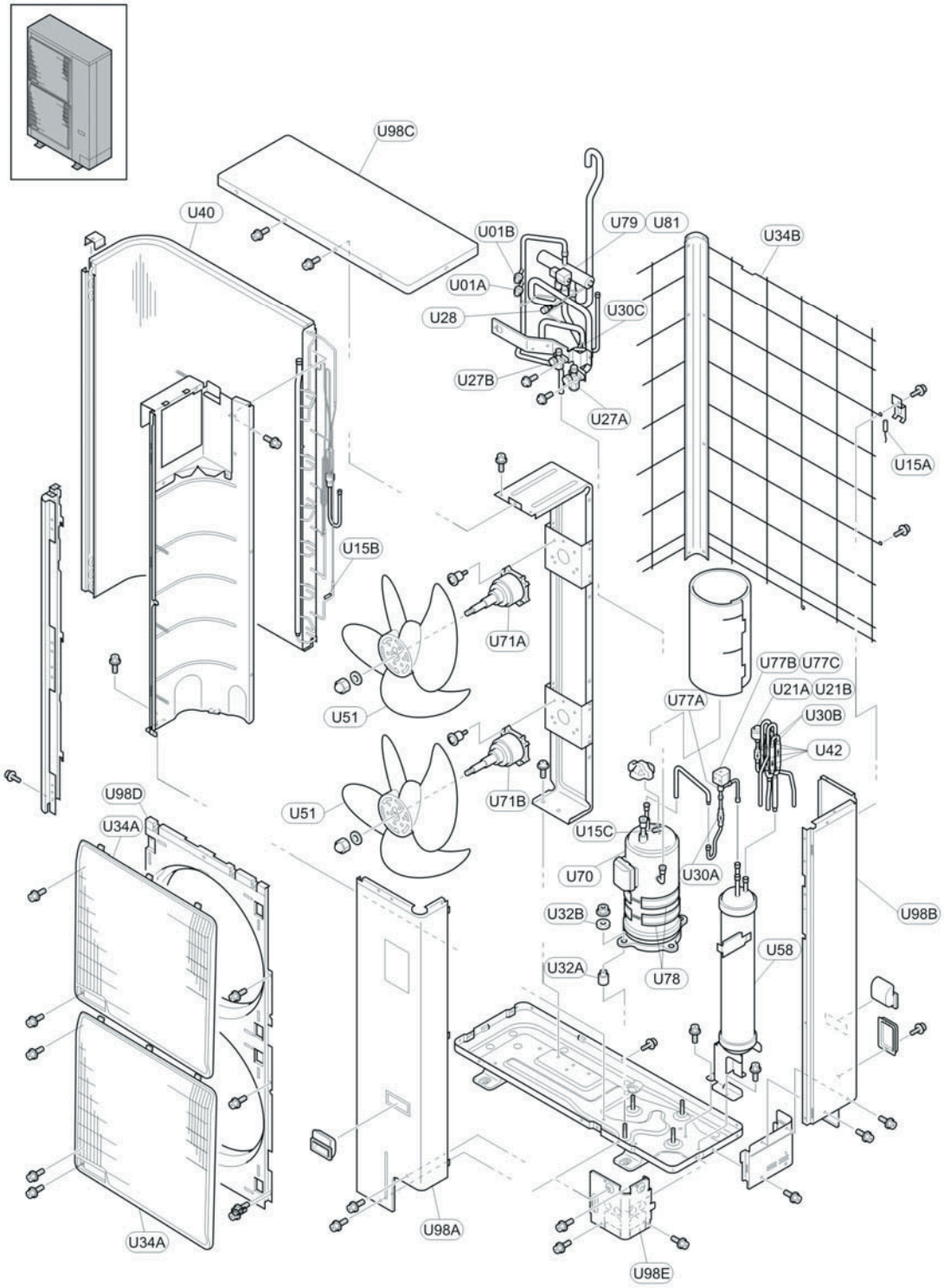
This spare parts list can be updated without previous notification. Check the manufacturing unit number and consult with your distributor.

9.2.3. RAS-(4/5)HRNE

- Electric parts



❋ Structural and cycle parts



Drawing number:
EPN0522C

Spare parts list for RAS-(4/5)HRNE units:

No.	NAME	NOTE
U01A	Pressure sensor	High pressure
U01B	Pressure sensor	For control
U04	Fuse	20 (A)
U14	Condenser	2700µF
U15A	Thermistor	
U15B	Thermistor	
U15C	Thermistor	
U16	Noise filter	
U17	INV module	
U21A	Expansion valve	
U21B	Expansion valve coil	
U27A	Stop Valve	Liquid Pipe (3/8)
U27B	Stop Valve	Gas Piping (5/8)
U28	Check Joint	
U30A	Filter	
U30B	Filter	
U30C	Filter	
U32A	Bushing	
U32B	Bushing	
U34A	Air outlet grille	
U34B	Protector net	Assembly
U40	Heat exchanger	
U42	Check valve	
U51	Propeller Fan	
U58	L tank	

No.	NAME	NOTE
U65A	Bearing holder	
U65B	Spacer	
U65C	Spacer	
U70	Compressor	
U71A	Fan Motor .	MOF1
U71B	Fan Motor .	MOF2
U72A	Magnetic Contactor	
U74A	Resistor	
U74B	Resistor	
U77A	Selenoid Valve	
U77B	Coil 20	
U78	Electric resistance	
U79	4-way Valve	Assembly
U81	4-Way valve coil	
U82A	Tranformer	
U82A	Reactor	
U85A	Printed Circuit	PCB
U85B	Printed Circuit	Assembly
U85C	Printed Circuit	Assembly
U85D	Relay	
U98D	Shroud	Assembly
U98B	Rear cover	Assembly
U98C	Upper cover	
U98E	Packing	

ATTENTION

This spare parts list can be updated without previous notification. Check the manufacturing unit number and consult with your distributor.

10. Servicing

This chapter describes the steps you must follow to perform AquaFREE units servicing, and their complementary outdoor units from Utopia DC Inverter of Hitchi.

Contents

10.1. Indoor units

RWM-3~5FSN1E-(S1)-(4.5/6)H(1/3) - AquaFREE

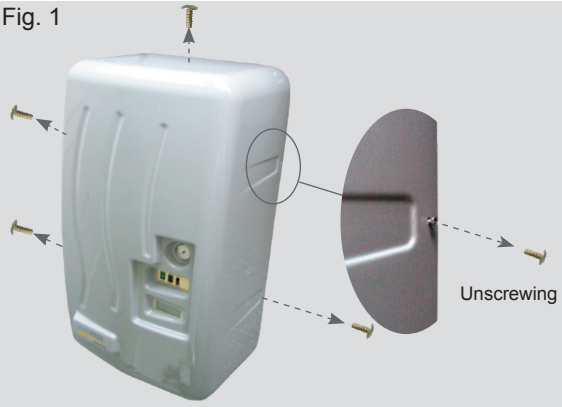
10.1.1 Front cover removing

1 Remove five front cover attached screws, (fig.1)

2 Carefully, in two steps, take out the front cover of the unit (fig.2).

Once front cober is removed, inner parts will be accessible (fig.3).

Fig. 1



Front cover of the unit

Fig. 2

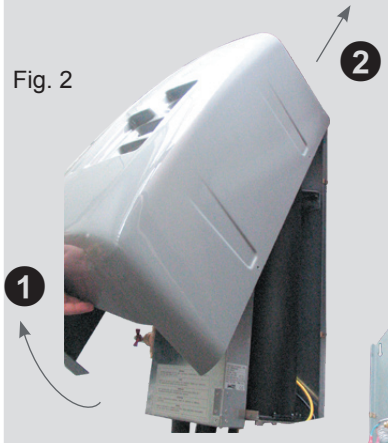


Fig. 3

Inside of the unit

10.1.2 Expansion vasel removing

Warning

When this operation is performed, prevent the unit from water or dampness, otherwise some kind of electrical damage could happen.

1. Once front cover is removed, identify exapnsion vesel (fig.4) and water safety valve (fig.11) in the unit.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before expansion vasel removing, empty the unit from water by using water safety valve (fig.11).
3. Remove the expansion vasel turning in opposition to the needles of the clock

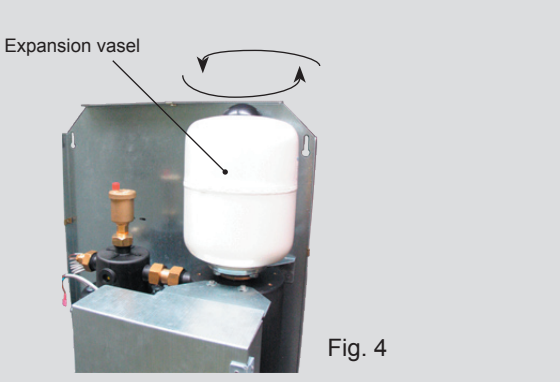


Fig. 4

10.1.3. Water pump removing

Warning

When this operation is performed, prevent the unit from water or dampness, otherwise some kind of electrical damage could happen.

1. Once front cover is removed, identify water pump according to the indoor unit model.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before expansion vasel removing, empty the unit from water by using water safety valve (fig.11).
3. Disconnect wiring water pump (fig.5)
4. Loosen four body water pump screwsand remove the water pump throw it outside (fig.6).

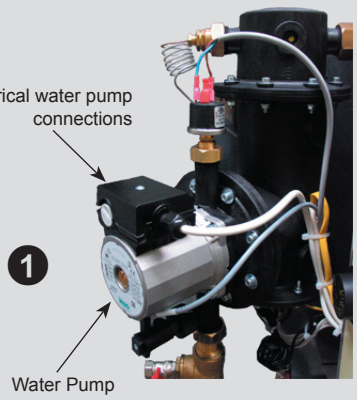


Fig. 5

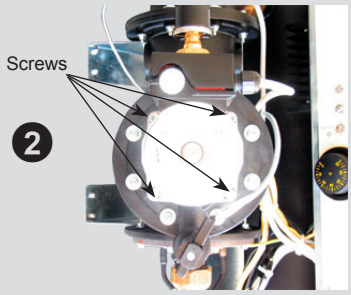


Fig. 6

10.1.4. Pressure switch removing

1. Once front cover is removed, identify pressure switch according to the indoor unit model.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before expansion vasel removing, empty the unit from water by using water safety valve (fig.11).
3. Disconnect pressure switch wiring (fig.7).
4. Remove the pressure switch with a spanner

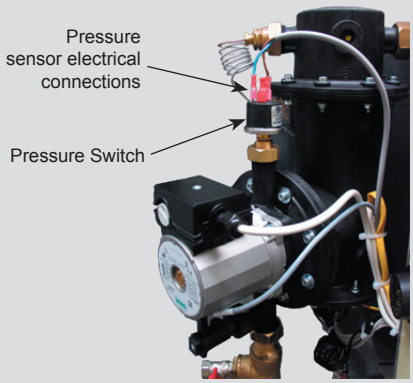


Fig. 7

10.1.5. Float switch sensor removing

1. Once front cover is removed, identify float switch sensor according to the indoor unit model.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before expansion vasel removing, empty the unit from water by using water safety valve (fig.11).
3. Loosen the sensor by hand and replace it

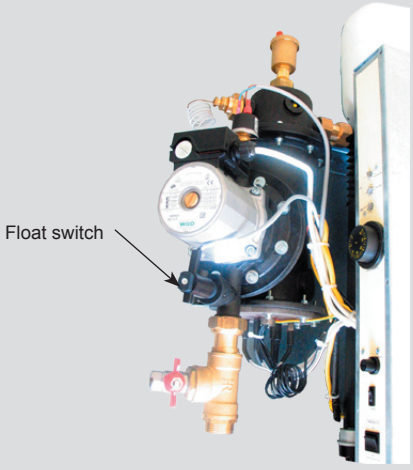


Fig. 8

10.1.6. Thermistors removing

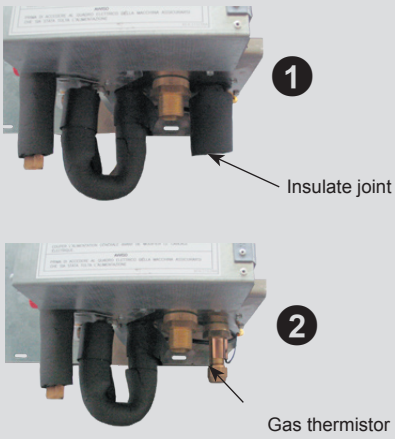
Note

After thermistor replaced, put the thermistor holder and joint insulation in the same position. If damage during the process, replace them.

■ Gas thermistor

1. In the electrical box, disconnect THM form the PCB.
   Consult chapter 3 of this manual to identify gas THM connector location in the PCB.
   For electrical parts access, consult point 10.1.12 of this chapter.
2. Locate gas thermistor in the lower side of the unit (fig.9).
   Consult chapter 9 of this manual to locate this part in the unit
3. Remove joint insulation for dampness protection.
   Throw out the THM holder, that attach thermistor to the gas pipe.

Fig. 9



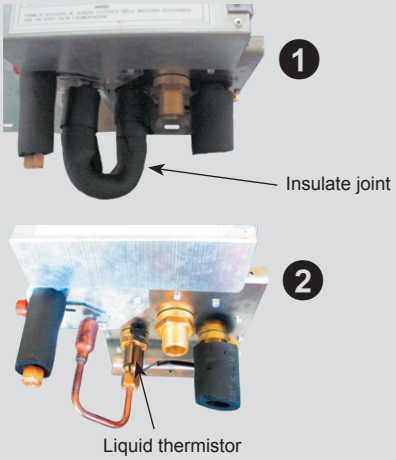
Note

After thermistor replaced, put the thermistor holder and joint insulation in the same position. If damage during the process, replace them.

■ Liquid thermistor

1. Once front cober is remove, diconnect THM form the PCB.
   Consult chapter 3 of this manual to identify liquid THM connector location in the PCB.
   For electrical parts access, consult point 10.1.12 of this chapter.
2. Locate liquid thermistor in the lower side of the unit (fig.10).
   Consult chapter 9 of this manual to locate this part in the unit.
3. Throw out the protection joint insulation, against dampness damages.
4. Throw out the THM holder, that attach thermistor to the liquid pipe.

Fig. 10



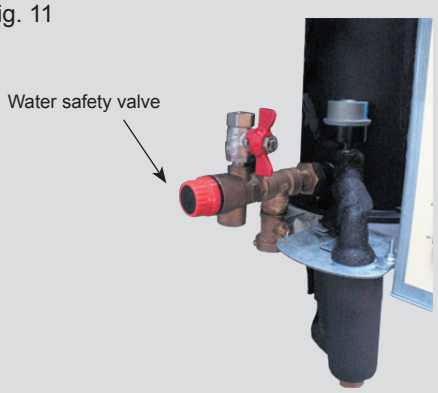
10.1.7. Water safety valve removing

Note

To avoid leakage, replace it applying insulation on the thread joint.

1. Once front cover is removed, identify water safety valve in the lower side of the indoor unit.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before safety valve removing, empty the unit from water using the same valve. If the valve is damage, unroll it softyand empty the unit
3. Replace the water safety valve unrolling the part.

Fig. 11



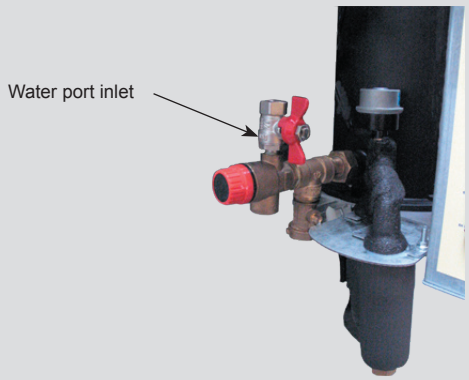
10.1.8. Port water supply removing

Note

To avoid leakage, replace it applying insulation on the thread joint.

1. Once front cover is removed, identify the water inlet port location. Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Empy from water by using the safety valve, before water port supply removing, and check that the main water circuit is closed.
3. Creplace the port water supply by using a spanner.

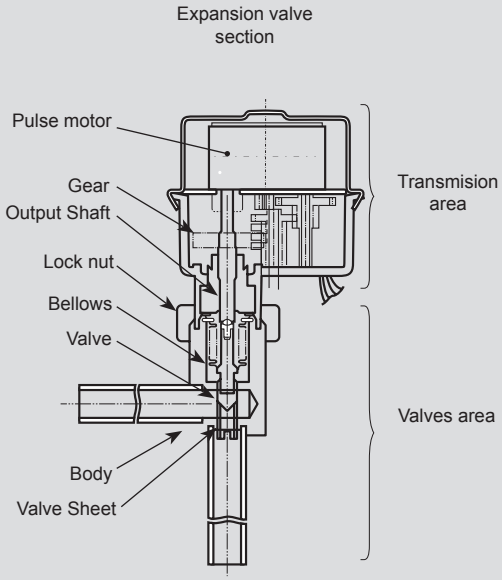
Fig. 12



10.1.9. Removing the Electronic Expansion Valve Coi

1. Once front cover is removed, identify the expansion valve in the unit. Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. In the electrical box, disconnect expansion valve coil form the PCB. Consult chapter 3 of this manual to identify the expansion valve coil conector in the PCB. For electrical parts access, consult point 10.1.12 of this chapter.
3. Prepare two spanners. Subject the valve body with a spanner and loosen the nut turning to the left with the other. Do not subject the coil when loosen the nut with the spanner. The base of the drive part may turn idle and be broken.
4. Turn round the nut. The transmision part will be free from the nut and could be replaced.

Fig. 13



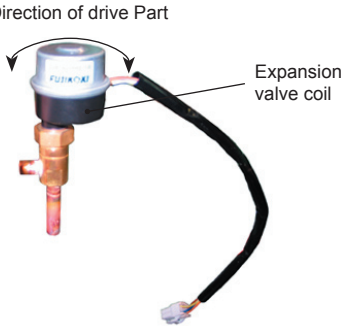
■ Substitution

Caution

During replacement work, pay attention to the separation part and prevent the dust, foreign particle, etc. from entering into the separation part. (The exposed part by separation is the mechanical part of the valve.)

1. Prepare the new drive part for replacement (servicing part) with the position of the driver (drive screw) already adjusted.
2. Put the transmision part on the valve body. Subject them together by the axis, and put the nut on the valve body.
3. Tighten the nut with spanner after tightening lightly by hand.

Fig. 14



Note

The tightening torque should be within the range of 120Nm (120 Kg-cm) to 15Nm (150Nm-cm).

Caution

Do not apply heavy torque to the coil (as the rotation torque and the flexion charge). Subject by the hand when torque the nut.

The direction of the eccentric part of the motor is assembled as the eccentric part of although the motor is directed toward the counter direction of the fittings for piping at the valve body, the alteration of this direction do not affect the open/close function of the valve. Therefore , the adjustement of direction of the part of the motor is not necesssary if the motor position is moved in rotation direction after the replacement, as is showed in the figure (fig.14).

However, pay attention to the direction of the motor for the coil of the electronic expansion valve not to touch other pipings or with another part of the unit.

10.1.10. Air purger removing

Note

To avoid leakage, replace it applying insulation on the thread joint.

1. Once front cover is removed, identify the air puger according to the indoor unit model.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before air purger removing, empty the unit from water by using water safety valve (fig.11).
3. Unscrew the air purger by a spanner.

Fig. 15

10.1.11.Electric heater removing

Note

To avoid water leakages, when replace the electric heater, make sure put the pipe joint correctly.

1. Once front cover is removed, identify the electric heater in the unit.
   Consult the chapter 9 of this manual to identify the location of this part in the unit.
2. Before electric heater removing, empty the unit from water by using water safety valve (fig.11).
3. Loosen the nuts located under the electric heater body (fig.17)).
   The electric heater leave the body downwards with the protection insulation pipe.

Fig. 16

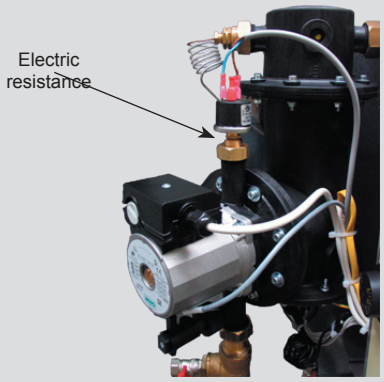
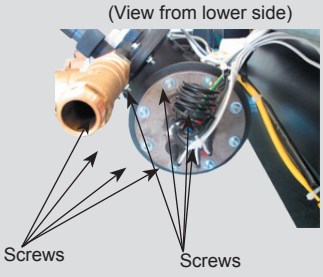


Fig. 17



10.1.12. Electrical parts removing

■ Electric parts removing

- Setting water thermostat
- Water securety thermostat
- Fuse (2A)
- Fuse (10A)
- Resistor
- Electric resistance relay
- Transformer
- Printed circuit boards (PCB's)

■ Access to electrical parts:

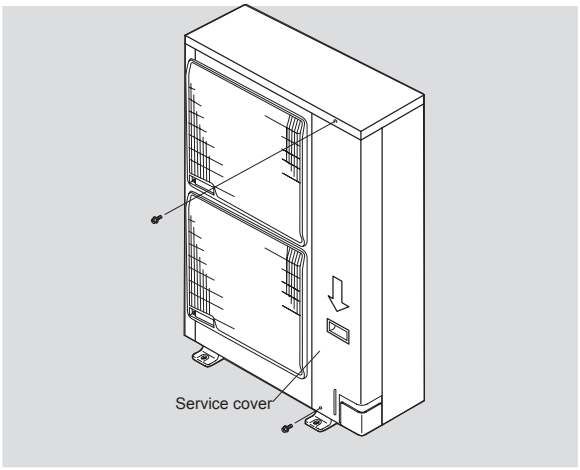
1. Once front cover is removed, identify the electrical box in the unit.
2. Open the electric box cover unscrewing three screws located on the side of the electrical box (fig.).
3. Open the box door from left to right direction to accees all the electrical components.
   Consult the chapter 9 of this manual to identify the location of each component inside the electrical box.

10.2. Outdoor units

RAS-3~5H(V)RNE - DC Inverter

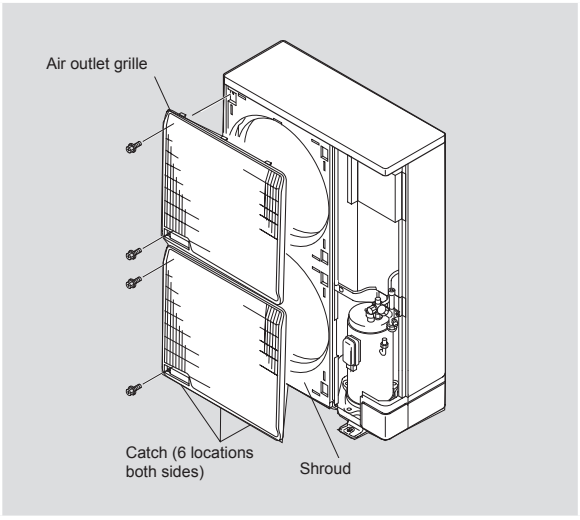
10.2.1. Removing service cover

1. Remove the main parts according to the following procedures. To reassemble perform the procedures in reverse order.
2. To prevent contamination of the refrigerant with water or foreign particles, do not expose open to atmosphere for long periods.
3. If necessary, seal pipe ends using caps or tape.
4. Remove the two fixing screws (upper part 1, lower part 1), slide the service cover downward and remove.



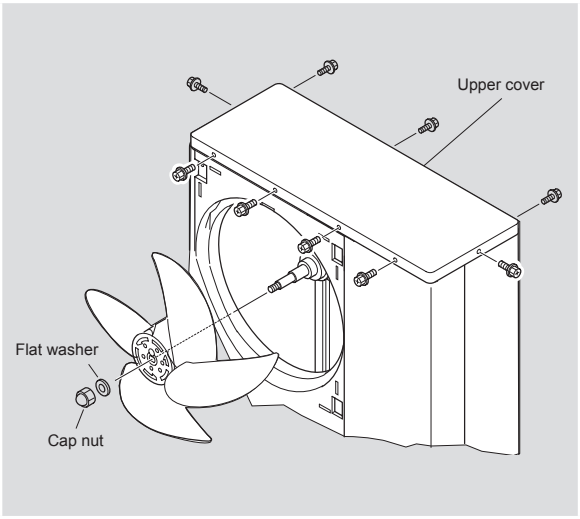
10.2.2. Removing air outlet grille

1. Remove the two (2) fixing screws of the shroud. Lift the air outlet grille holding the lower parts and unhook the extrusion (3 locations) of the air outlet grille from the shroud.



10.2.3. Removing outdoor fan

1. Remove the service cover according to the item “Removing Service Cover”.
2. Remove the air outlet grille according to the item “Removing Air Outlet Grille”.
3. Remove the fans by removing the cap nuts and the flat washers fixing the propeller fans onto the motor shaft. If it is difficult to remove the fan, use pullers.
4. Remove the eight (8) screws fixing the upper cover and remove the upper cover.



10.2.4. Removing outdoor fan motor

Notes:

– When mounting the motor, ensure the cables point directly downward. Fix the protection tube edge downward to ensure the water may not keep in it.

– Fix the motor wires onto the motor clamp with a plastic tie to prevent them obstructing the propeller fans.

Caution:

When mounting the fan motor, don't touch the shaft of connector pins. Static electricity could damage the motor

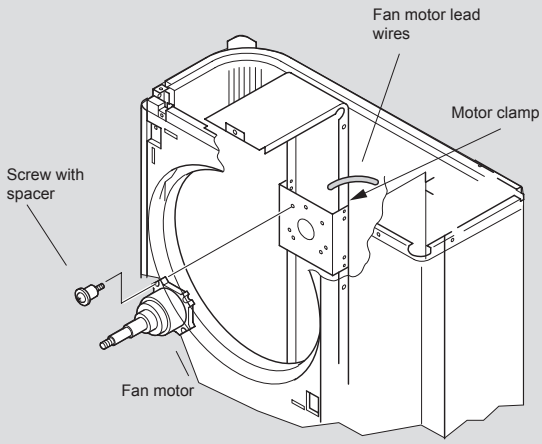
1. Disconnect the connectors for the motors in the electrical box. (*)
2. Cut the plastic tie of the motor clamp by using nipper.
3. Remove the four (4) fixing screws for the motor.

Mounting propeller Fan:

– Insert the skidding protection part of fan boss in accordance with the cutting part of the motor shaft, and fix the screw after exerting screw part of the shaft. (Tightening Torque of 8.0 N.m: 80 kg.cm)

– When connecting the motor wire, check to ensure that the colors of the connectors on the PCB are matched with wires.

– Firmly fix the air outlet grille to the shroud.



(*) Motor connectors:
RAS-3HVRNE: CN201, PCN201
RAS-4/5HVRNE: CN201-202, PCN201-202
RAS-4/5HRNE: CN201-203, PCN201-203

10.2.5. Removing the compressor

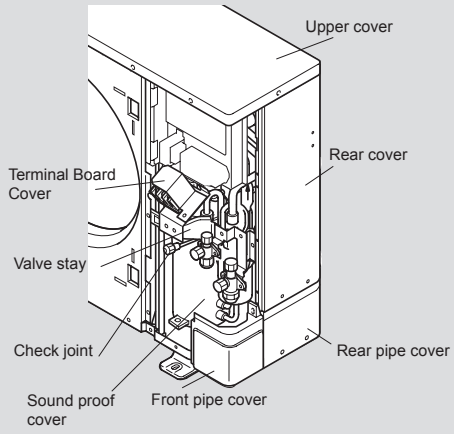
Notes:

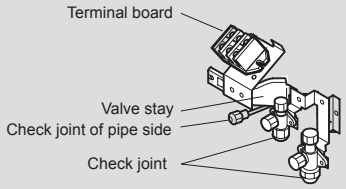
– Remove the Sound Proof Cover in the arrow mark direction as shown.

– Do not deform any piping when you are removing the panel. If you deform the piping, the welded portion may be broken. Pay attention to the sharp edges of the side panel in order to avoid any injury.

■ For RAS-3HVRNE:

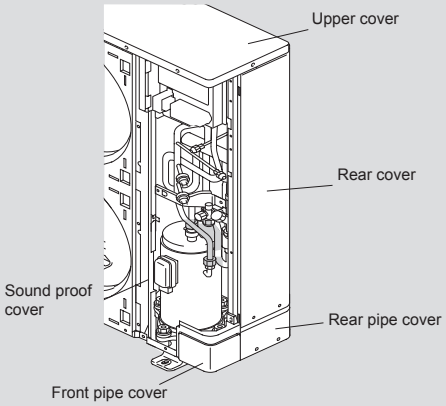
1. Remove the service cover according to the item "Removing Service Cover". If the outdoor unit is installed close to a wall, disconnect the refrigerant pipe and move the outdoor unit away from the wall.
   – Remove the terminal board cover
   – Disconnect the upper wiring of the terminal board.
2. Remove the valve stay
3. Collect refrigerant from check joint of stop valve and pipe side.
4. Release the lace for the sound proof cover. Open the sound proof cover from the front side.





■ For RAS-4/5H(V)RNE:

1. Remove the service cover according to the item "Removing Service Cover". If the outdoor unit is installed close to a wall, disconnect the refrigerant pipe and move the outdoor unit away from the wall.
2. Collect the refrigerant from the check joint.
3. Remove the valve stay.
4. Release the lace for the Sound Proof Cover. Open the Sound Proof Cover from the front side.

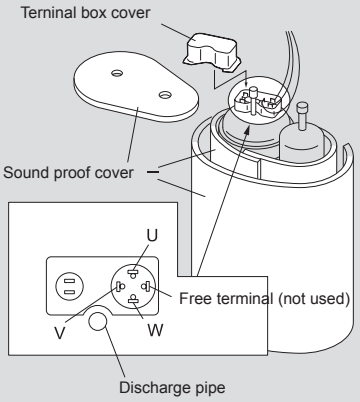


10.2.5. Removing the compressor (cont.)

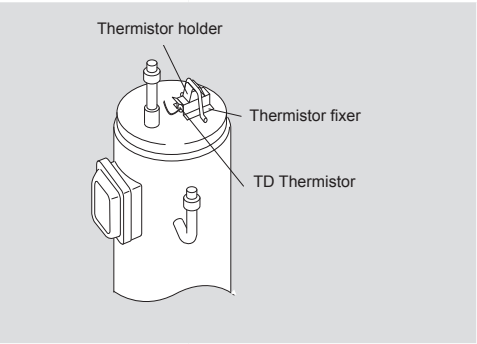
Notes:

- Make sure that the fasten terminals for the compressors are normal. When a pulling force of 20N or more is required, it is normal. Otherwise, replace the fasten terminals with new terminals.
- Make sure that the wires are correctly inserted.
- It is recommended that the fasten terminals be clamped to increase the contacting force after replacing the compressor.

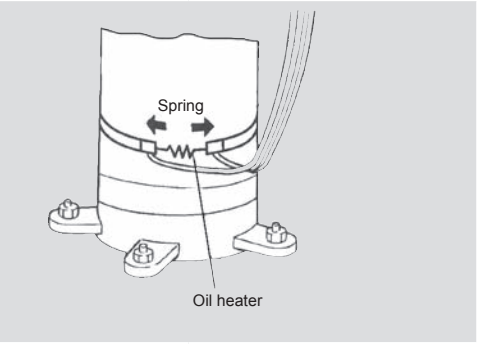
5. Remove the terminal panel for the compressor and disconnect the wiring to the compressor terminals. Make sure that the terminal numbers and the mark band are correct. If the terminal numbers and the mark band are not identified, this will cause incorrect wiring when you are reassembling.



6. Remove the thermistor holder and remove the thermistor.



7. Remove the oil heater by releasing the spring. Remove the spring by expanding as shown in the figure beside. (For RAS-4/5HRNE there are two springs).

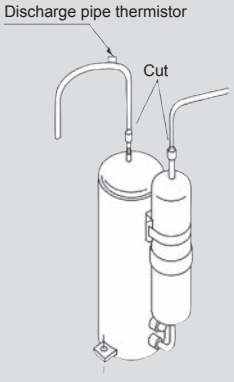


Notes:

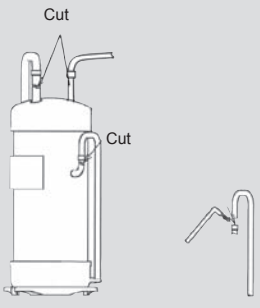
- Completely clean the oil if the oil has spread to the other parts such as the compressor panel, the wiring bottom base, and others.
- Make sure that the pipes are cut before working with a burner.
- Make sure that you do not burn electrical components when brazing

8. Disconnect the discharge and suction pipes of the compressor. (For RAS-4~5H(V)RNE disconnect the gas injection pipe).Make sure that there is no positive pressure inside the pipes. Cut the pipe at the compressor side of the brazing part. Remove the cut pipe of the compressor.
9. Removing by using burner after cuting

RAS-3HVRNE



RAS-4/5H(V)RNE



10

10.2.5. Removing the compressor (cont.)

Notes:

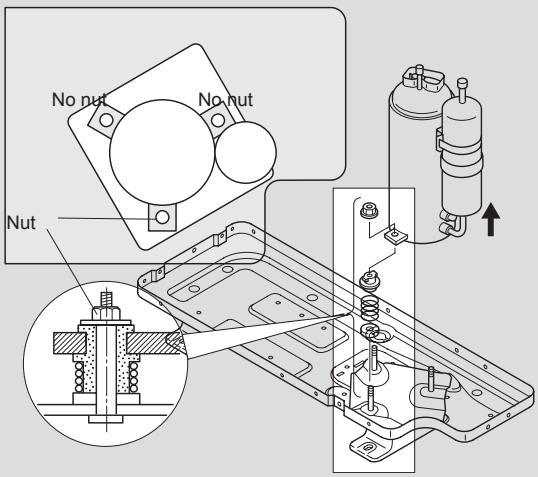
- Pay special attention to the edges of the plates and others when you are working.
- If you cannot measure the oil level, charge an additional 300 (cm3).
- If the oil is foul, replace the old oil with the new oil.

11. Remove the nut that fix the compressor and remove the compressor. There is no nut at the rear side. When you are removing the compressor, pay special attention not to touch or deform the surrounding pipes.

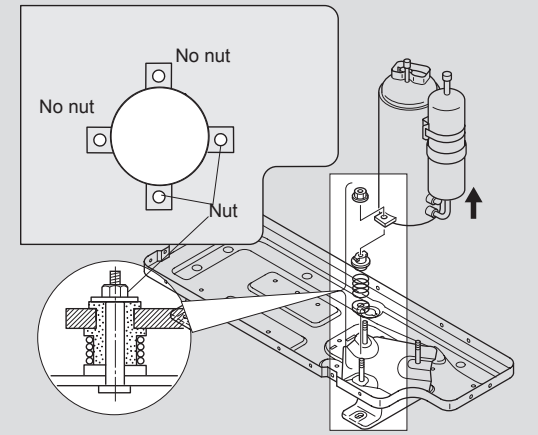
    If you are removing the compressor with the oil pipe, cover the end of the pipe with the tape in order to avoid a spill.

    Do not expose the refrigerant cycle to the environment for a long period in order to avoid mixing the water with foreign particles. Mount the new compressor quickly.

RAS-3HVRNE



RAS-4/5H(V)RNE



10.2.5. Removing the compressor (cont.)

Notes:

- When you are brazing the suction pipe, make sure that the connecting part is firmly inserted and that the compressor side is cooled in order to avoid the brazing material from entering the compressor.
- The piping of compressor shall be connected by brazing.When heating with a burnner, oil adhered inside of pipes can flame up. Make sure that flammable material is not around before the operation.

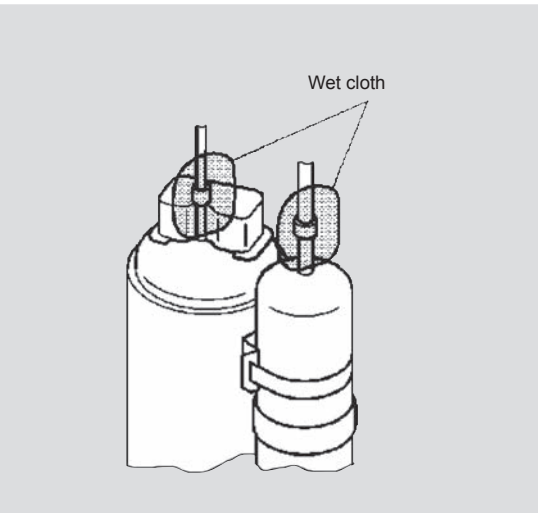
12. Attach the new compressor. Perform the brazing according to the following order:

    1. Discharge pipe.
    2. Suction pipe.
    3. Liquid injection pipe.

    Attach the compressor with the cap. Remove the cap just before you start the brazing work

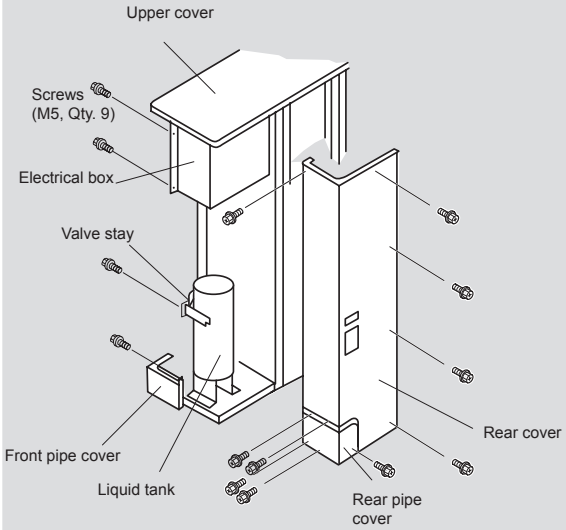
    Connect the change hose for the pressure release to the check joint of the low-pressure side.

    To avoid overheating the compressor when you are brazing, cool it down using a wet cloth.



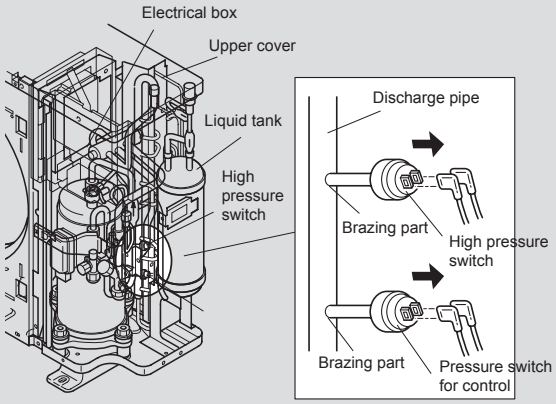
10.2.6. Removing high pressure switch and pressure switch for control

1. Remove the service cover according to the item “Removing Service Cover”.
2. Remove the nine (9) M5 screws fixing the rear cover and the five (5) M5 screws fixing the pipe rear cover. Slide the rear cover and pipe cover downward.

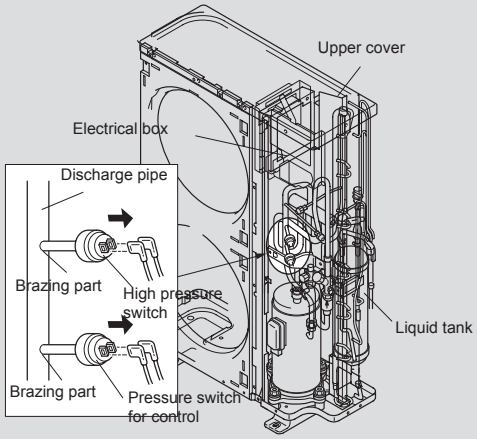


3. Collect the refrigerant from the check joint according to the item “Removing Compressor”.
4. Disconnect the fasten terminals.
5. Remove the high pressure switch and pressure switch for control from the brazing part by a burner.

RAS-3HVRNE



RAS-4/5H(V)RNE



10

10.2.7. Removing coil for reversing valve

Danger:

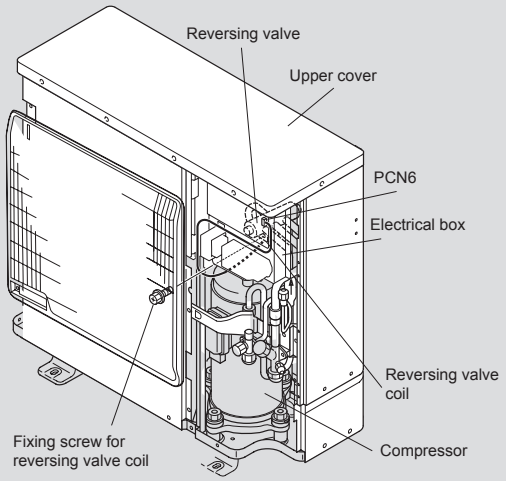
Do not touch the electrical parts when LED201 (Red) on the ISPM is lit to prevent from an electrical shock.

Note:

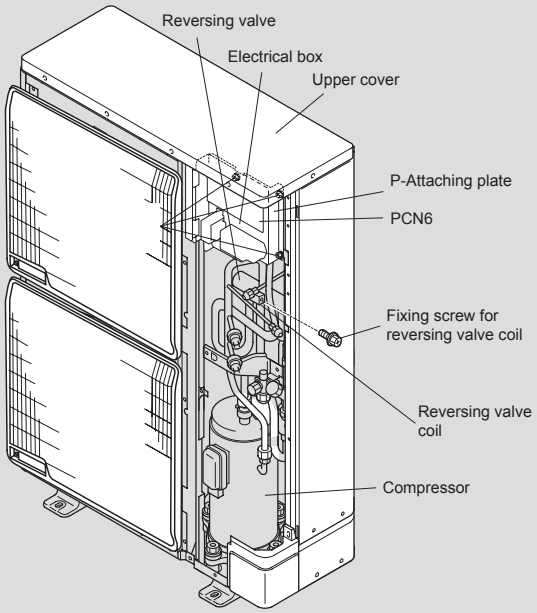
- Check to ensure that LED201 (Red) is OFF when turning the power plate.
- Refer to section "Removing electrical components" for LED 201 location

1. Remove the service cover according to the item "Removing Service Cover".
2. Remove three (3) screws fixing the power plate and turn the one toward the front side.
3. Disconnect the PCN6 on the PCB1 of the electrical box.
4. Remove the coil for the reversing valve after removing the fixing screw (1 piece).

RAS-3HVRNE



RAS-4/5H(V)RNE



10.2.8. Removing coil for expansion valve

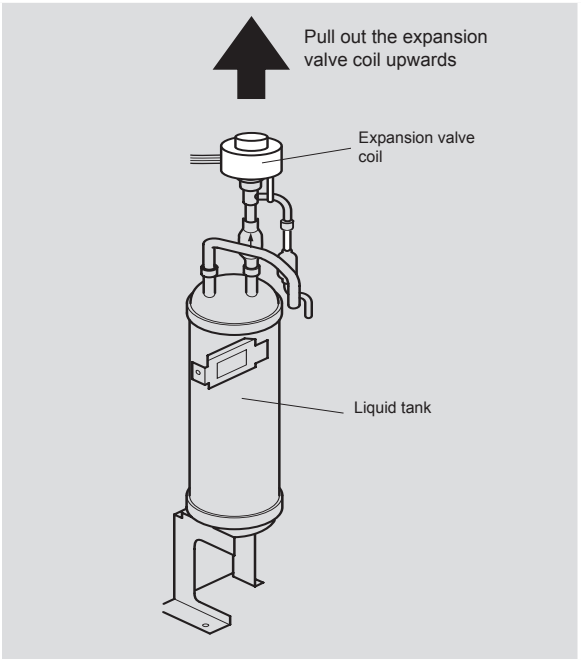
Danger:

Do not touch the electrical parts when LED201 (Red) on the ISPM is lit to prevent from an electrical shock.

Notes:

- Check to ensure that LED201 (Red) is OFF when turning the power plate.
- Refer to section "Removing electrical components" for LED 201 location

1. Remove the service cover according to the item "Removing Service Cover".
2. Remove the three (3) screws fixing the electrical box and turn the power plate toward the front side as shown in the item "Removing Coil for Reverse Valve".
3. Disconnect the CN5A connector on the PCB1 of the electrical box.
4. Pull out the coil for expansion valve on the liquid tank upwards.

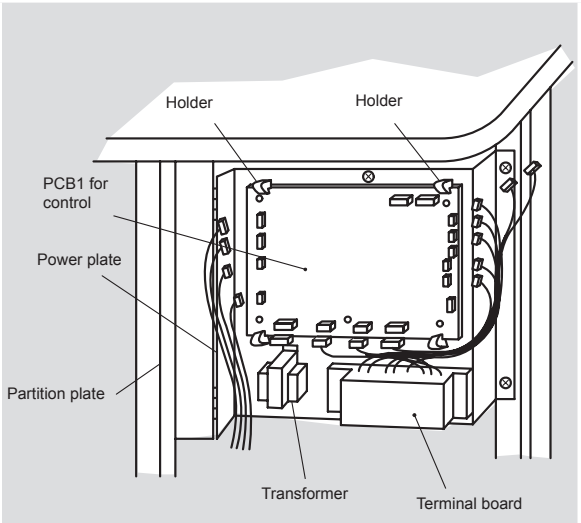


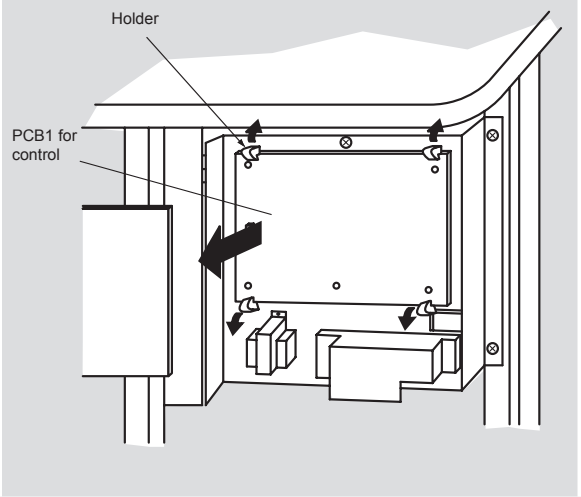
10.2.9. Removing PCB1

Danger:

Do not touch the electrical components.When handling the PCB1, take care of not to use excessive force as this will cause damage.

1. Remove the service cover according to the item "Removing Service Cover"
2. Disconnect all the connectors connected to the PCB1.
3. Pull out the PCB1 from the power plate by unhooking the extrusion parts.





10.2.10. Removing ISPM

Danger:

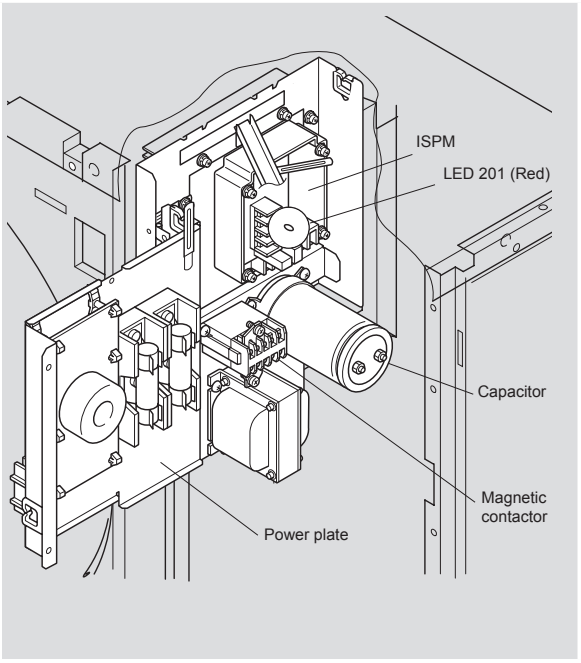
Do not touch the electrical parts when LED201 (Red) on the ISPM is lit to prevent from an electrical shock.

Notes:

- Check to ensure that LED201 (Red) is OFF when turning the power plate.
- Identify terminal Nos. with the mark band Nos. when reassembling. If incorrectly connected, malfunction or damage to the electrical parts will occur.
- When changing the PCB, ensure to set all the dip switches to the same configuration as the original.

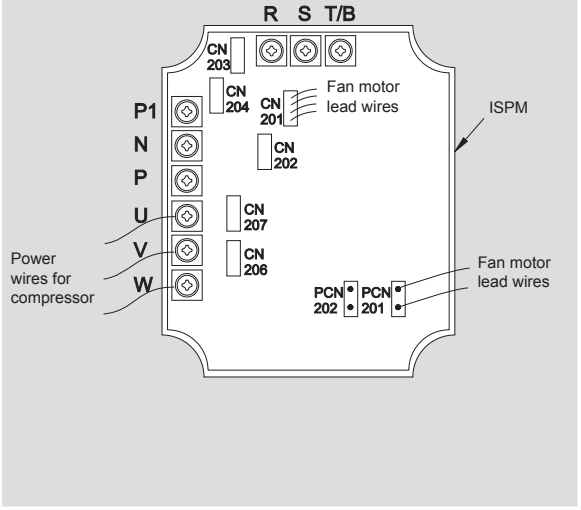
■ RAS-3HVRNE

1. Remove the service cover according to the item “Removing Service Cover”.
2. Remove the three (3) screws fixing the electrical box and turn the power plate toward the front side as shown in the item “Removing Coil for Reverse Valve”.
3. Disconnect all wires connecting to the ISPM.
   - Disconnect CN201, CN202, PCN201, PCN202 (Wire for Fan Motor)
   - Disconnect CN203, CN204, CN206,
   - Disconnect TB, N, P, P1 and R, S, U, V, W on the terminal board and the faston terminal TB3 of ISPM.
4. Remove the four (4) screws fixing the ISPM.



Notes ☛

- Do not hold the PCB on the ISPM when removing the ISPM. When handling the PCB, take care of not to use excessive force as this will cause damage.
- Do not remove the insulation part from the screw after removing the screws.
- Identify terminal number with the mark band number when reassembling. If incorrectly connected, malfunction or damage to the electrical parts will occur.
- Pay attention not to clamp the wires when close the power plate.



10.2.10. Removing ISPM (cont)

Danger:

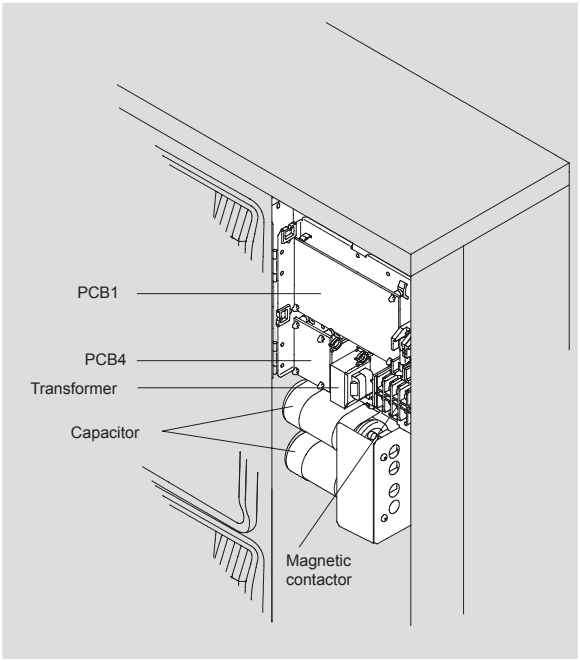
Do not touch the electrical parts when LED201 (Red) on the ISPM is lit to prevent from an electrical shock.

Notes:

- Check to ensure that LED201 (Red) is OFF when turning the power plate.
- Identify terminal Nos. with the mark band Nos. when reassembling. If incorrectly connected, malfunction or damage to the electrical parts will occur.
- When changing the PCB, ensure to set all the dip switches to the same configuration as the original.

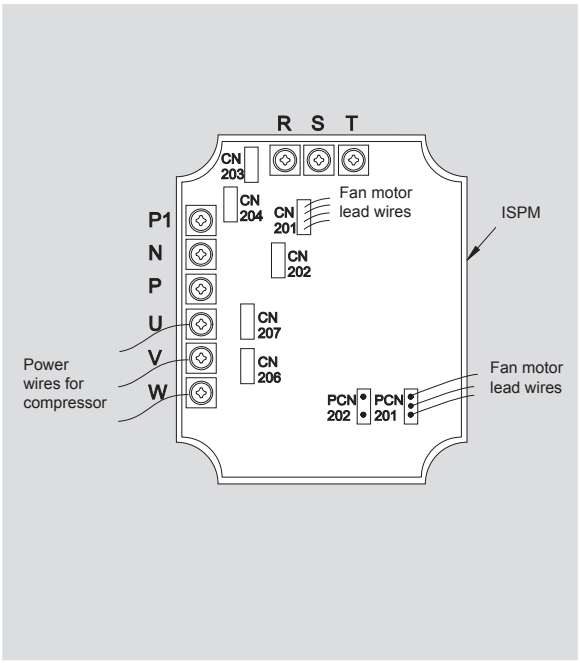
■ RAS-4/5H(V)RNE

1. Remove the service cover according to the item “Removing Service Cover”.
2. Remove the three (3) screws fixing the electrical box and turn the power plate toward the front side as shown in the item “Removing Coil for Reverse Valve”.
3. Disconnect all wires connecting to the ISPM.
   - Disconnect PCN201, PCN203 (Wire for Fan Motor) Disconnect CN202, CN206, CN201
   - Disconnect N, P, P1 and R, S, U, V, W on ISPM.
4. Remove the four (4) screws fixing the ISPM.



Notes ☛

- Do not hold the PCB on the ISPM when removing the ISPM. When handling the PCB, take care of not to use excessive force as this will cause damage.
- Do not remove the insulation part from the screw after removing the screws.
- Identify terminal number with the mark band number when reassembling. If incorrectly connected, malfunction or damage to the electrical parts will occur.
- Pay attention not to clamp the wires when close the power plate



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10.2.11.Removing electrical components

Danger:

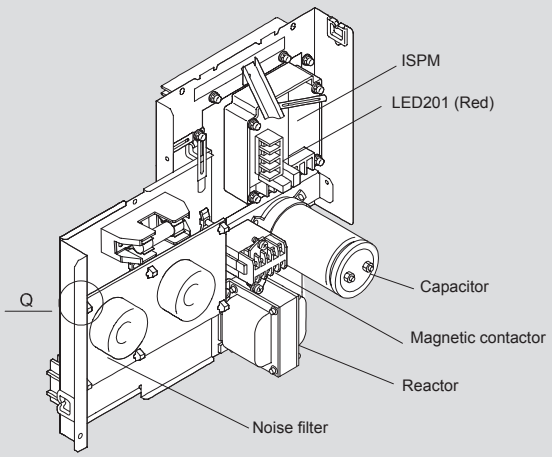
Do not touch the electrical parts when LED201 (Red) on the ISPM is lit to prevent from an electrical shock.

Notes:

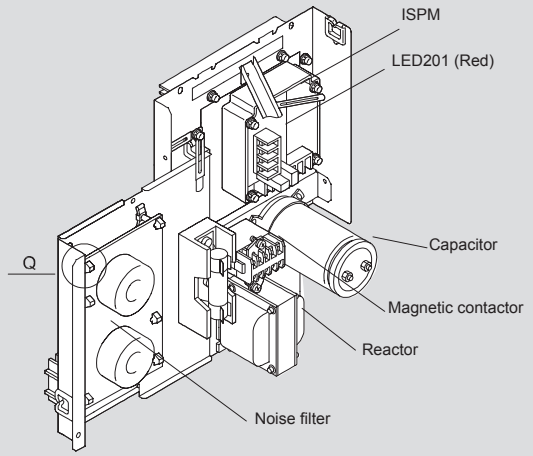
- Check to ensure that LED201 (Red) is OFF when turning the power plate.
- Capacitor has polarity (+ and -), check to ensure each terminal No.
- When reassembling, identify terminal number with the mark band number.

1. Remove the service cover according to the item “Removing Service Cover”.
2. Remove the three (3) screws fixing the electrical box and turn the power plate toward the front side as shown in the item “Removing Coil for Reverse Valve”.
3. Removing Other Electrical Components
   - Remove the wire connecting to the capacitor.
   - Disconnect the wire connecting to the magnetic contactor.Remove the magnetic contactor by removing two (2) screws.
   - Remove the reactor by removing four (4) screws. (In case of 4/5 HP the screws are eight.)
   - Disconnect the wire connecting to the noise filter.
   - Remove the noise filter by holding the expanded part of the holders (6 pcs.) with long-nose pliers.

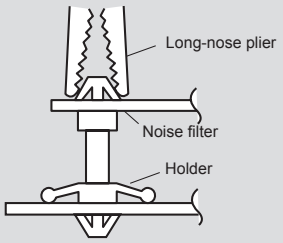
RAS-3HVRNE

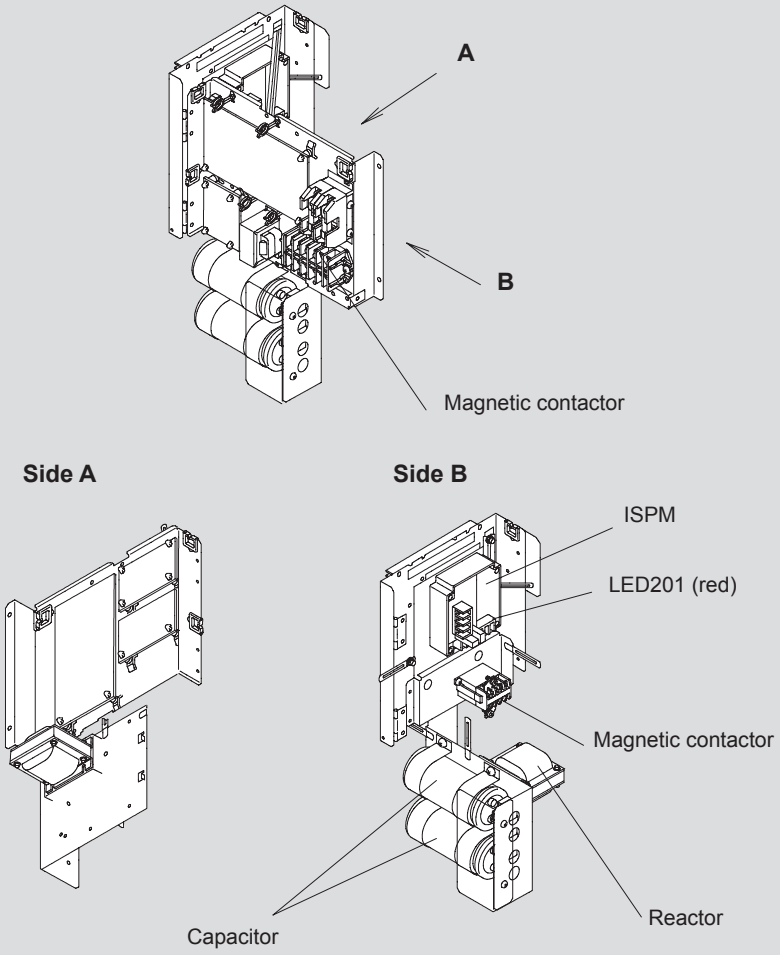


RAS-4/5H(V)RNE



Details of Q



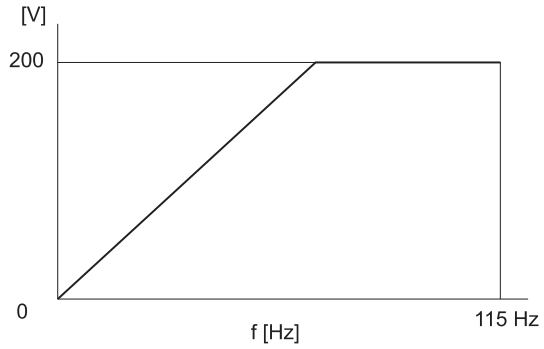
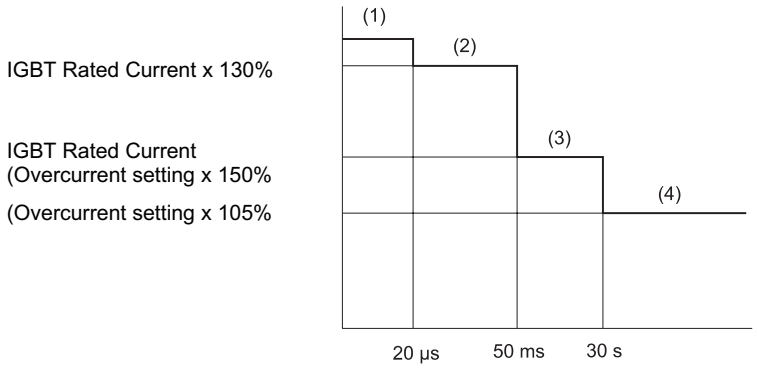

A
B
Magnetic contactor
Side A
Side B
ISPM
LED201 (red)
Magnetic contactor
Capacitor
Reactor

11. Main parts

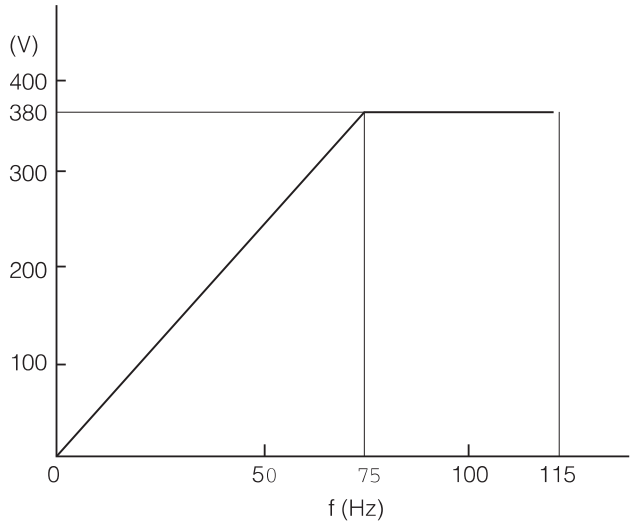
Contents

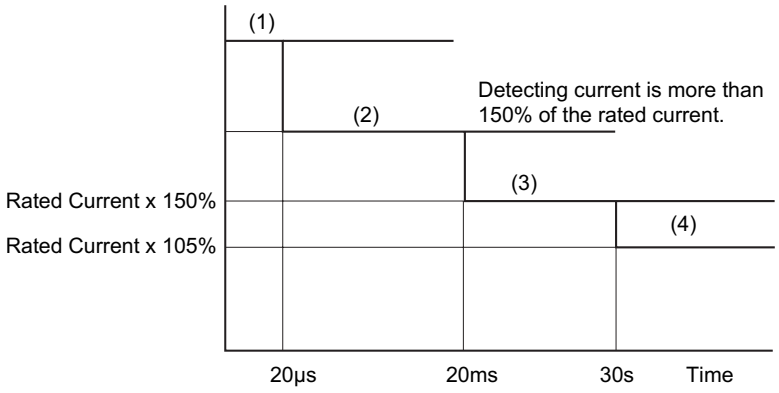
11.1. Inverter

11.1.1. Specification of inverter (single phase)

Applicable Model	**RAS-3~5HVRNE**
Applicable Power Source	1 Phase, 230 V 50 Hz
Input Voltage	180 ~ 264 VAC
Input Current	RAS-3HVRN: 25A; RAS-4/5HVRNE: 32A (at rated current 230 V 50 Hz)
Control Method	Vector Control
Range Output Frequency	20 to 115Hz
Accuracy of Frequency	0.01Hz at Applicable Frequency Range
Controlled Frequency	1Hz
Output / Characteristics	
Soft Start Stop	0.125 ~ 3.00 Hz/s
Protection Function Excessive High or Low Voltage for Inverter	Excessive Low Voltage at a voltage is lower than 194V DC Excessive High Voltage at a voltage is higher than 420V DC
Abnormality of Current Sensor (0A Detection)	Stoppage at a current of compressor smaller than 1.5A. When the frequency is 15 to 18Hz after starting. Cause of Abnormality: Failure of Current Sensor Failure of ISPM Failure of Compressor / Fan motor Disconnected Wiring
Protection Function Overcurrent Protection for Inverter	 (1) Short-Circuit Trip of Arm (2) Instantaneous Overcurrent Trip (3) Instantaneous Overcurrent Trip } Internal Protection of ISPM (4) Electronic Thermal Trip Condition is maintained longer than 30 seconds or accumulated longer than 3 minutes during 10 minutes sampling time.
Protection of ISPM	ISPM has four protection function for self-protection (1) Some of the output terminals between "U" and "V", "V" and "W", "W" and "U" has a short-circuit. (2) Running current reaches the maximum rated current. (3) Temperature is measured by internal thermistor increases excessively. (4) Control voltage decreases excessively.
Overload Control	Overload control as a current greater than (Rated Current X105%). Overload control release at a current smaller than (Rated Current X 88%).
Fin Temperature Decrease	The unit is stopped when the ISPM temperature is higher than 100°C.
Earth Detection	The unit is stopped when the compressor is earthing.

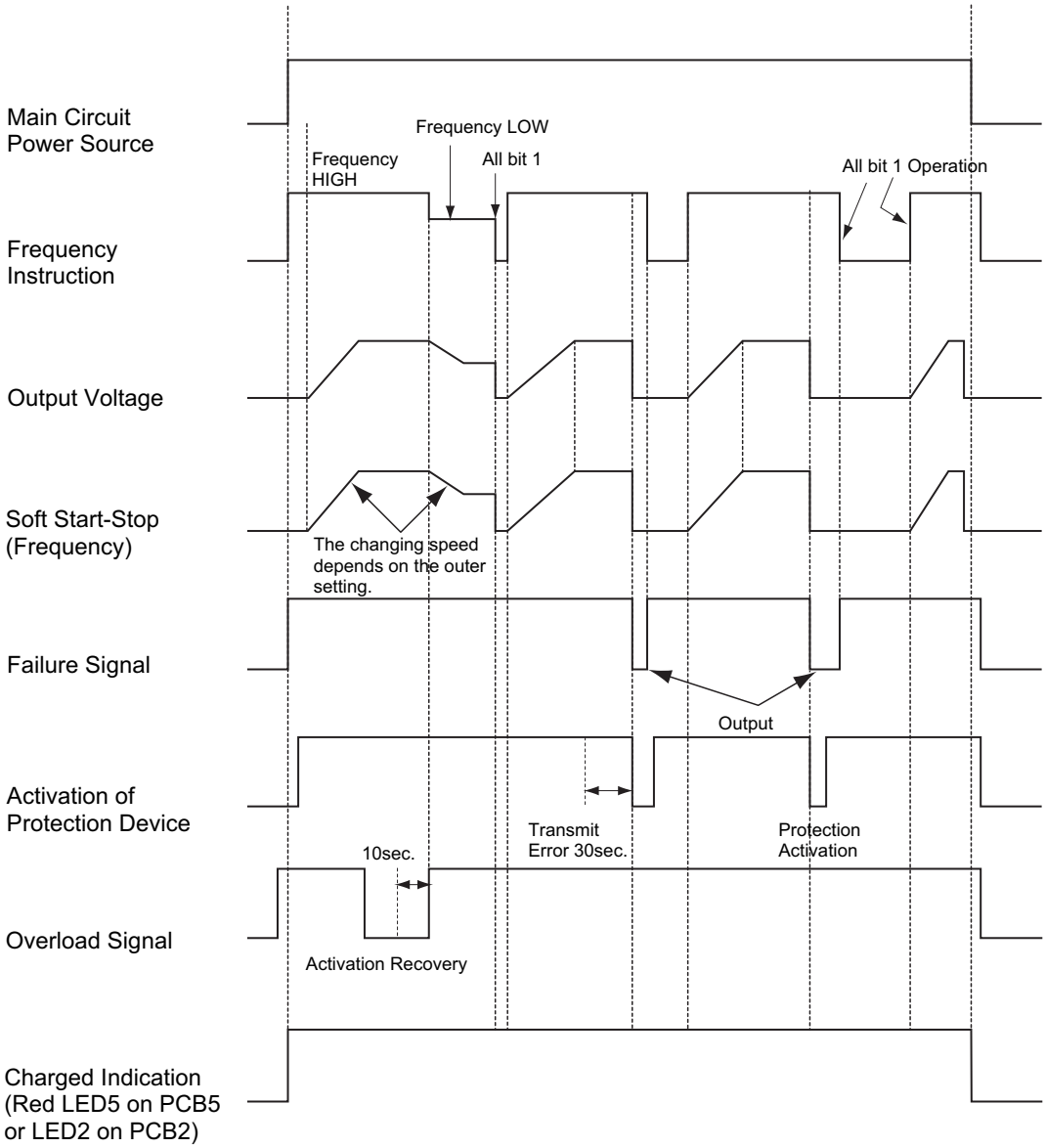
11.1.2. Specifications of inverter (three phases)

Aplicable model	**RAS-4/5HRNE**
Applicable Power Source	3 Phase, 400 V 50 Hz
Input Voltage	RAS-4HRNE: 11A; RAS-5HRNE: 15A
Control Method	Vector Control
Range Output Frequency	20~115HZ
Accuracy of Frequency	0.01 Hz
Controlled Frequency	1 Hz at applicable frequency range
Output / Characteristics	Conditions: 1. Power Source Voltage AC380/415V 2. Non-Loading (Free Output) 3. Ammeter Type Volt-Meter (X1.1)  Refer to the note in next page.
Soft Start Stop	0.125~3.00 Hz/s
Protection Function Excessive High or Low Voltage for Inverter	Excessive Low Voltage at a voltage is lower than 350V DC Excessive High Voltage at a voltage is higher than 750V DC
Abnormality of Current Sensor (0A Detection)	Stoppage at a current of compressor smaller than 1.5A. When the frequency is 15 to 18Hz after starting. Cause of Abnormality: Failure of Current Sensor Failure of ISPM Failure of Compressor / Fan motor Disconnected Wiring

<table>
<tr><td>Protection Function
Overcurrent Protection for Inverter</td><td> 

(1) Short-Circuit Trip of Arm
(2) Instantaneous Overcurrent Trip
(3) Instantaneous Overcurrent Trip
(4) Electronic Thermal Trip
Internal Protection
Transistor Module or ISPM
Condition is maintained longer than 30 seconds or accumulated longer than 3 minutes during 10 minutes sampling time.</td></tr>
<tr><td>Protection of Transistor Module</td><td>Transistor module or ISPM has four protection function for self-protection.
(1) Some of the output terminals between "U" and "V", "V" and "W", "W" and "U" has a short-circuit.
(2) Running current reaches the maximum rated current.
(3) Abnormal temperature is measured by internal thermistor.
(4) Control voltage decreases abnormally.</td></tr>
<tr><td>Overload Control</td><td>Overload control as a current greater than (Rated Current X105%).
Overload control release at a current smaller than (Rated Current X 88%).</td></tr>
</table>

11.1.3. Inverter time chart



11.1.4. Protective function

1. Excessive High or Low Voltage for Inverter
   a) Level of Detection
      - When the voltage of direct current is greater than (A) V, abnormalities are detected.
      - When the voltage of direct current is smaller than (B) V, abnormalities are detected.

Power supply	400V 50 Hz	230V 50Hz
(A)	750	440
(B)	350	194

   b) Function

      When abnormalities are detected, the inverter compressor is stopped and transmit the signal code of stoppage cause to PCB1.

   c) Cancellation of Protection Function

      Transmission for signal code of stoppage cause is cancelled when a stopping order is given or main power source is cut off.

2. Abnormality of Current Sensor
   a) Level of Detection

      When current of the inverter compressor decreases lower than 0.5A during the inverter compressor frequency between 15Hz and 18Hz, an abnormality is detected.

   b) Function

      When abnormalities are detected, the inverter compressor is stopped, and transmit the signal code of stoppage cause to PCB1.

   c) Cancellation of Protection Function

      Transmission for signal code of stoppage cause is cancelled when a stopping order is issued or main power source is cut off.

3. Overcurrent Protection for Inverter
   a) Level of Detection

      When the current detected by current sensor reaches 150% of the rated current, overcurrent is detected. (Instantaneous Overcurrent)

      When the current detected by current sensor exceeds 105% of the rated current continuously for 30 seconds or for 3.5 minutes in total during a 10 minutes period, overcurrent is detected. (Electric Thermal Relay)

   b) Function

      When abnormalities are detected, the inverter compressor is stopped and transmit the signal code of stoppage cause to PCB1.

   c) Cancellation of Protection Function

      Transmission for signal code of stoppage cause is canceled by stopping order is issued or main power source is cut off.

4. Protection of Transistor Module and ISPM
   a) Level of Detection

      When some of the output terminals between “U” and “V”, “V” and “W”, “W” and “U” of transistor module or ISPM are short-circuited, an abnormality is detected.

      When the running current of transistor module or ISPM reaches (Maximum Rated Current x 105%), an abnormality is detected.

      When an internal temperature is measured by internal thermistor of transistor module or ISPM, an abnormality is detected.

      When the control voltage of transistor module or ISPM decreases, an abnormality is detected.

   b) Function

      When abnormalities are detected, the inverter compressor is stopped and the signal code of stoppage cause is transmitted to PCB1.

   c) Cancellation of Protection Function

      Transmission for signal code of stoppage cause is canceled when a stopping order is issued or main power source is cut off.

5. Earth Detection
   a) Level of Detection

      When the starting current of the compressor reaches 80% of the overcurrent protection value, an abnormality is detected.

   b) Function

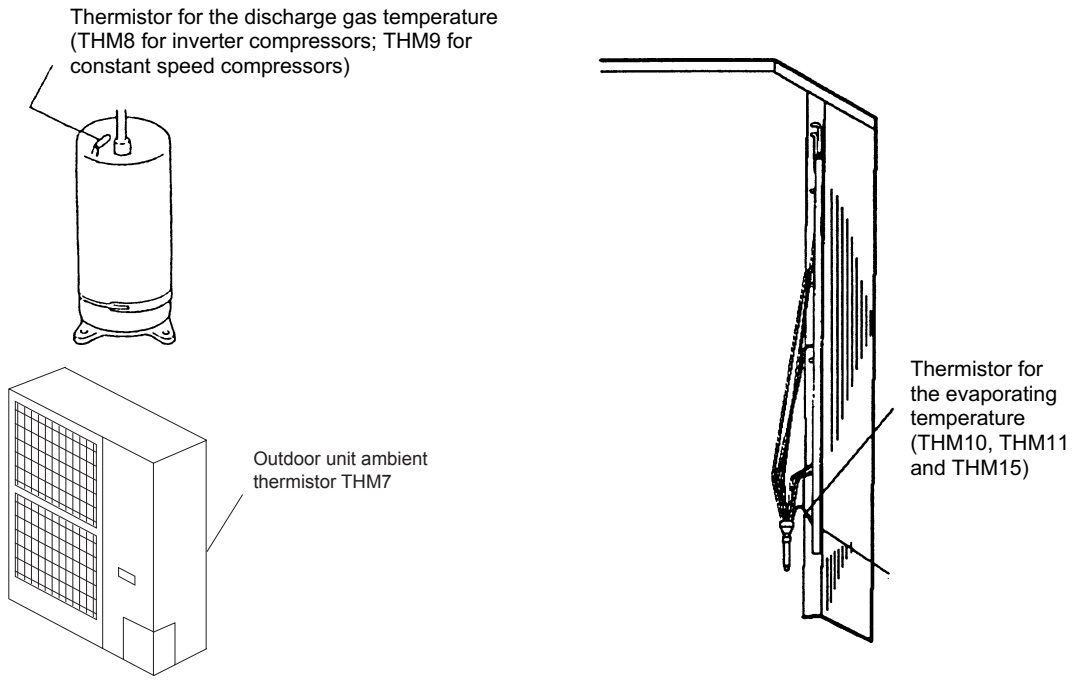
      When abnormalities are detected, the inverter compressor is stopped and the signal code of stoppage cause is transmitted to PCB1.

   c) Cancellation of Protection Function

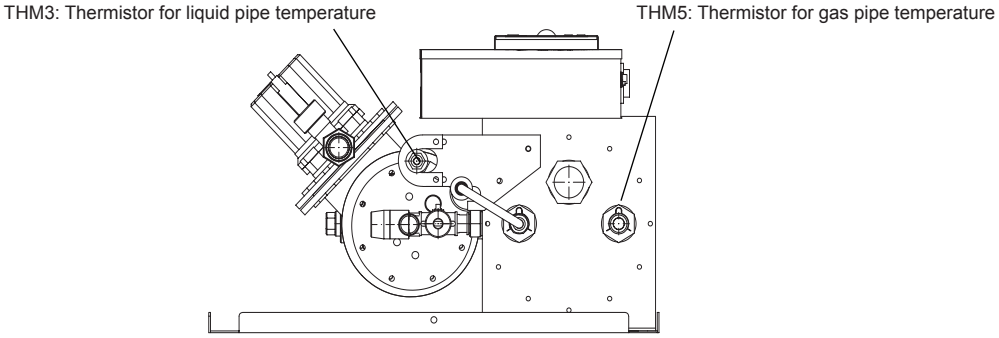
      Transmission for signal code of stoppage cause is canceled when a stopping order is issued or main power source is cut off.

11.2. Thermistor

Thermistors for the outdoor unit



Thermistors for the indoor unit



11.2.1. Resistance value of the thermistor

■ **Overheating prevention of the discharge gas (Thermistor for checking the upper part of compressor: THM9)**

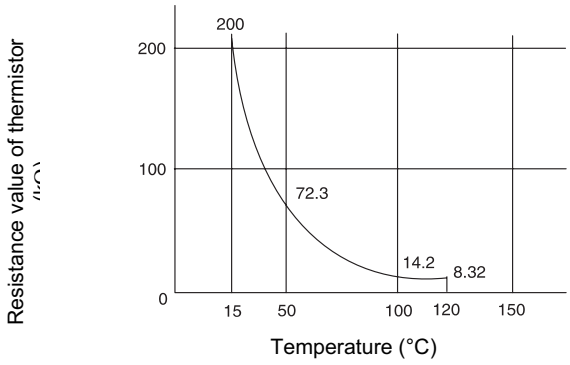
a. There is a thermistor that checks the temperature of the upper part of the compressor in order to prevent the discharge gas from overheating. If the discharge gas temperature increases excessively, the deterioration of the lubrication oil and its lubrication properties will occur. This will cause a shorter compressor life.

b. If the discharge gas temperature increases excessively, the compressor temperature increases. In the worst case, the winding of the compressor motor will burn out.

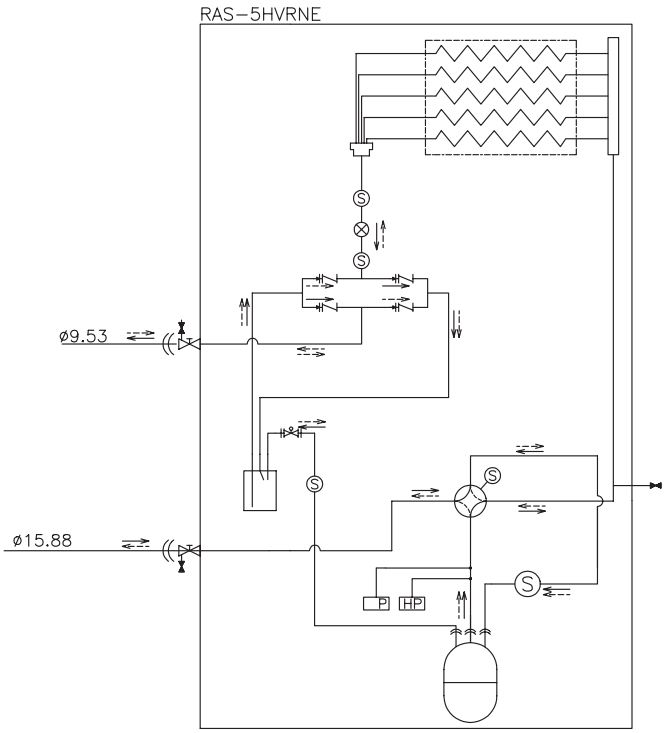
c When the temperature of the upper part of the compressor increases during the heating process, the unit is controlled according to the following method:

1. An electronic expansion valve of the liquid bypass opens and the high-pressure refrigerant returns to the compressor through the accumulator. This decreases the compressor temperature.
2. If the temperature of the upper part of the compressor exceeds 120°C for 10 minutes, the compressor will stop. Even if an electronic expansion valve opens in that situation, the compressor will also stop. This way, the compressor is protected. Resistance values of the thermistor are shown in the figure below

d. If the temperature of the upper part of the compressor exceeds 120°C for 10 minutes during the cooling process, the compressor will stop. (Refer to the block diagram for details.)



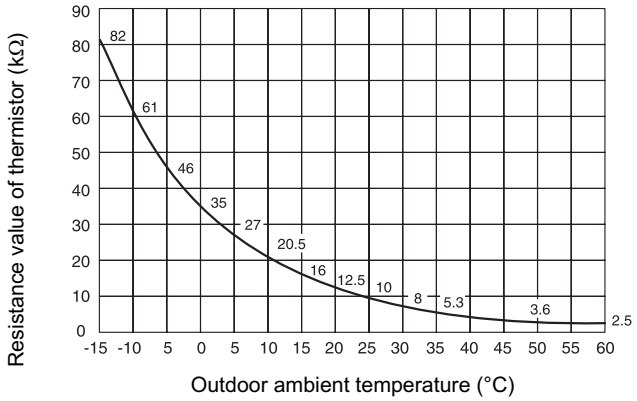
Resistance values of the thermistor for overheating protection of the discharge gas



Refrigerant cycle of the outdoor unit RAS-5HVRNE

■ **Thermistor for the outdoor temperature (THM7)**

When the outdoor ambient temperature decreases to -8°C or a lower temperature during the cooling process, the compressor will stop. Resistance values of the thermistor are shown in the figure below.



Resistance values of the thermistor for the outlet air temperature

■ **Thermistor for the defrost operation (THM8)**

The resistance values of this thermistor are the same as the resistance values of the thermistor for the outdoor ambient temperature.

■ Thermistor for the liquid pipe temperature (THM3)

When the temperature of the indoor liquid pipe decreases to 0ºC or a lower temperature for 3 minutes, the thermostat automaticaly turns off. When the temperature of the indoor liquid pipe increases to 16ºC or a higher temperature, the thermostat turns on.

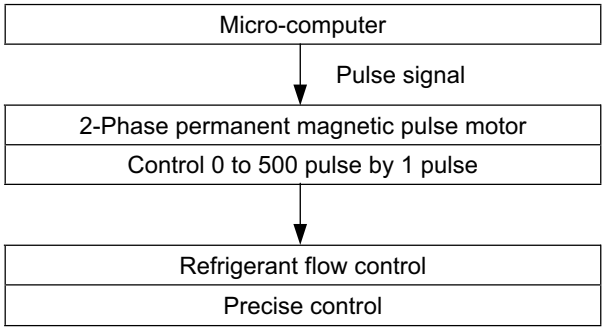
The purpose of this function is to prevent frosting on the indoor heat exchanger during the cooling process and the dry operation.
The resistance values of the thermistor are shown in the graphic.

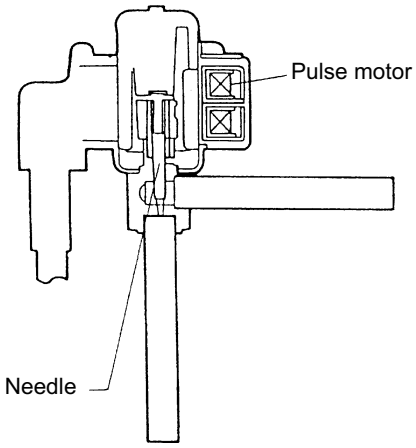
■ Thermistor for the gas pipe temperature of the indoor heat exchanger (THM5)

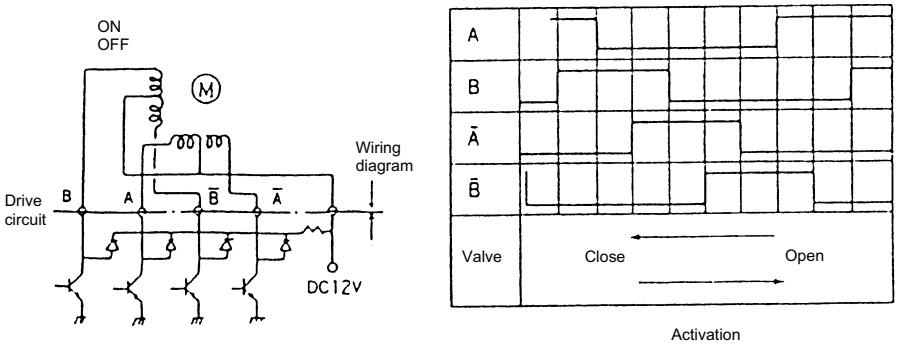
The thermistor for the gas pipe temperature senses the evaporating temperature during the heating process. The resistance values of the thermistor are shown in the graphic.

11.3. Electronic expansion valve

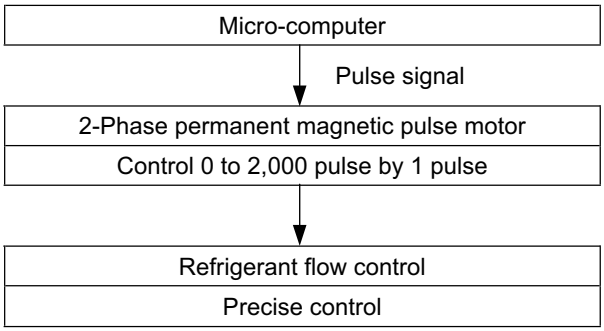
11.3.1. Electronic expansion valve for the outdoor unit

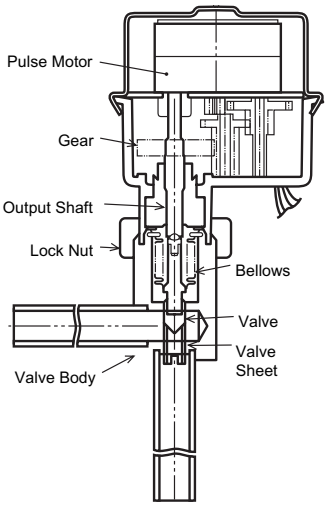


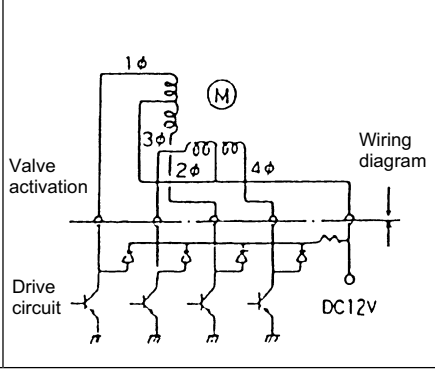
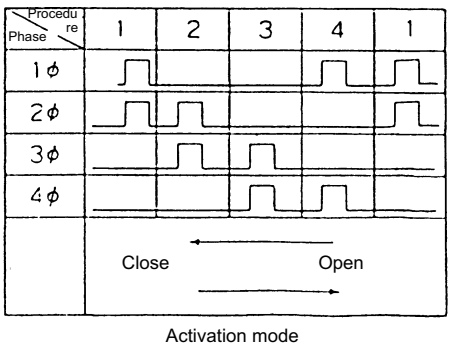


Items	Specifications
Applicable to the models	For the main cycle of H(V)RNE / HN(V)E series
Type	EKV (10.0USRT) series for RAS-8~12HRNE CAM series for RAS-2~6H(V)RNE / HN(V)E
Refrigerant	R410A
Working temperature range	-30°C ~ 65°C (Operation time of the coil: less than 50%)
Mounting direction	Drive shaft in vertical direction within an angle of 45° as maximum
Flow direction	Reversible
Drive method	4-Phase canned motor method
Rated voltage	DC12V±1.8V
Drive condition	83PPS (Pulse width at ON: 36mm sec, OFF: 60mm sec) 1,2 Phase excitation
Coil resistance (each phase)	46Ω ± 10% (at 20°C)
Wiring diagram, Drive circuit and activation mode	

11.3.2. Electronic expansion valve for the indoor unit





Items	Specifications
Type	EDM type
Refrigerant	R410A
Working temperature range	-30°C ~ 70°C (with coils which are not electrified)
Mounting direction	Drive shaft in vertical direction, motor upside and 90° in four direction
Flow direction	Reversible
Drive method	4-Phase pulse motor
Voltage rate	DC12V±1.2V
Drive condition	100Ω ± 250PPS (Pulse width over 3mm) 2 Phase excitation
Coil resistance (each phase)	150Ω ± 10% (at 20°C)
Wiring diagram, drive circuit and activation mode	 

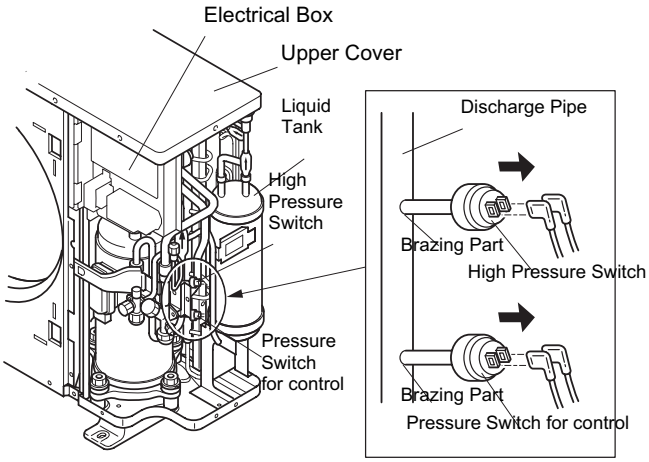
Activation mode

11.4. Pressure sensor

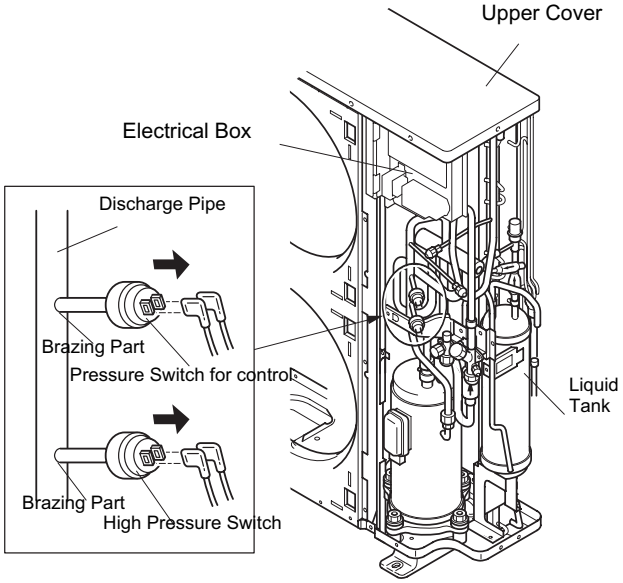
■ **For RAS3~5H(V)RNE**

1. High Pressure Switch (for Protection)
   When the discharge pressure reaches 4.15MPa, compressor is stopped to protect the refrigerant cycle components.
2. Pressure Switch for Control
   When the discharge pressure reaches 3.2MPa during heating operation, gas by-pass control or fan control are performed.

Example RAS-3HVRNE



Example RAS-4/5H(V)RNE



12. Field work instruction

Contents

12.1. Caution with the refrigerant leakage

The designers and the installers have the responsibility to follow the local codes and the local regulations that specify the safety requirements against the refrigerant leakage.

12.1.1. Maximum permissible concentration of the HCFC Gas.

The refrigerant R410A, which is charged in the AquaFREE, is an incombustible non-toxic gas. However, if the leakage occurs and the gas fills a room, the gas may cause suffocation.

The maximum permissible concentration of the HCFC gas and the R410A in the air is 0.44 kg/m³, according to the refrigeration and air conditioning system standard (KHK S 0010) by the KHK (High-Pressure Gas Protection Association) of Japan. Therefore, you must take some effective measures in order to lower the R410A concentration in the air below 0.44 kg/m³, if there is a leakage.

12.1.2. Calculation of the refrigerant concentration

1. Calculate the total quantity of refrigerant R (kg) that is charged in the system that connects all the indoor units of the rooms that need air conditioning systems.
2. Calculate the room volume V (m³) of each room.
3. Calculate the refrigerant concentration C (kg/m³) of the room according to the following equation:

$\frac{R}{V} = C$	R: Total quantity of charged refrigerant (kg) V: Room volume (m³) C: Refrigerant concentration (≤0.44* kg/m³ for the R410A)

* Use this value only for reference because this value is not fixed yet

12.1.3. Countermeasure for the refrigerant leakage according the KHK standard

According to the KHK standards, you should arrange the facility as follows so that the refrigerant concentration will be bellow 0.44 kg/m³.

1. Provide a shutterless opening that will allow the fresh air to circulate into the room.
2. Provide a doorless opening with a size of 0.15% or more to the floor area.
3. Provide a ventilator, which must be linked with a gas leak detector, with a ventilating capacity of 0.5m³/min or more per Japanese Refrigeration Ton (=compressor displacement m³/h/8.5 of the air conditioning system which uses the refrigerant).

O.U. model	Ton
RAS-3HVRNE	1.05
RAS-4H(V)RNE	1.35
RAS-5H(V)RNE	1.84

12.2. Maintenance work

■ For the indoor unit

1. Heat exchanger

   Clog: Inspect the heat exchanger at regular intervals and remove any accumulated dirt and any accumulated dust from the heat exchanger.

   You should also remove from the outdoor units other obstacles, such as the growing grass and the pieces of paper, which might restrict the airflow.

2. Piping connection

   Leakage: Check for the refrigerant leakage at the piping connection.

3. Water piping connection

   Leakage: Check for the water leakage at the piping connection

4. Electrical equipment

   Activation: Check for an abnormal activation of the magnetic contactor, the auxiliary relay, the PCB and others.

Line condition: Pay attention to the working voltage, the working amperage and the working phase balance. Check for any faulty contact that is caused by the loosened terminal connections, the oxidized contacts, the foreign matter, and other items. Check the electrical insulation resistance.

5. Electrical heater

Activation: Check the activation configuration of Electrical heater. Check Check SW3 and RSW1 or SW3 and RSW2

Desactivation:Check the activation configuration of electrical heater

Check the desactivation services:

– Water flow switch ≤ 0.9 m³/h.
– Low water pressure switch ≤ 1 bar.
– Max- temperature. Water thermostat RSW4 ≤ 48 ºC
– Water temperature seciruty thermostat (aquastat) ≤ 65 ºC

■ For the outdoor unit

1. Fan and fan motor

Lubrication: All the fan motors are prelubricated and sealed at the factory. Therefore, no lubrication maintenance is required.

Sound and vibration: Check for abnormal sounds and vibrations.

Rotation: Check the clockwise rotation and the rotating speed.

Insulation: Check the electrical insulation resistance.

2. Heat exchanger

Clog: Inspect the heat exchanger at regular intervals and remove any accumulated dirt and any accumulated dust from the heat exchanger.

You should also remove from the outdoor units other obstacles, such as the growing grass and the pieces of paper, which might restrict the airflow.

3. Piping connection

Leakage: Check for the refrigerant leakage at the piping connection.

4. Cabinet

Stain and Lubrication: Check for any stain and any lubrication. Remove the stain and the lubrication.

Fixing Screw: Check for any loosened screw or any lost screw. Fix the loosened screws and the lost screws. Insulation Material: Check for any peeled thermal insulator on the cabinet. Repair the thermal insulator.

5. Electrical equipment

Activation: Check for an abnormal activation of the magnetic contactor, the auxiliary relay, the PCB and others.

Line condition: Pay attention to the working voltage, the working amperage and the working phase balance. Check for any faulty contact that is caused by the loosened terminal connections, the oxidized contacts, the foreign matter, and other items. Check the electrical insulation resistance.

6. Control device and protection device

Setting: Do not readjust the setting in the field unless the setting is maintained at a point that is different from the point that is listed in the section “Safety and control device setting”.

12.3. Service and maintenance record

No.	Check item	Action	Judgement	
1	Is the service area sufficient?		Yes	No
2	Is there a short circuit of the discharged air?		Yes	No
3	Any heat influence?		Yes	No
4	Is the ground wire connected?		Yes	No
5	Refrigerant piping		Good	Not good
6	Water piping		Good	Not good
7	Fixing the units		Good	Not good
8	Is there any damage on the outer surface or the internal surface?		Yes	No
9	Checking the screw and the bolts	Tighten if loosened.	Tightened	Not tightened
10	Tightening the Terminal Screws	Tighten all the terminal screws with a Phillips screwdriver.	Tightened	Not tightened
11	Are the compressor terminals tightly fixed?	Push all the terminals.	Pushed	Not pushed
12	Insulation resistance	Measure the insulation resistance with an insulation resistance meter. Comp.and fan motor: > 3 MΩ Others: > 3 MΩ	Good	Not good
13	Does the drain water flow smoothly?	Check the smooth flow by pouring some water.	Good	Not good
14	Check for a leakage in the compressor.	Check for any leakage.	Good	Not good
15	Check for a leakage in the outdoor heat exchanger.	Check for any leakage.	Good	Not good
16	Check for a leakage in the indoor heat exchanger.	Check for any leakage.	Good	Not good
17	Check for a leakage in the 4-way valve.	Check for any leakage.	Good	Not good
18	Check for a leakage in the check valve.	Check for any leakage.	Good	Not good
19	Check for a leakage in the accumulator.	Check for any leakage.	Good	Not good
20	Check for a leakage in the strainer.	Check for any leakage.	Good	Not good
21	Check for a leakage in the electronic expansion valve.	Check for any leakage.	Good	Not good
22	Check for a leakage in the piping.	Check for any leakage.	Good	Not good
23	Check the direction of the fans.	By viewing the airflow volume	Good	Not good
24	Voltage among each phase	Higher than 230V/400V AC	Good	Not good
25	Vibration and sound	Check the fan, the compressor, the piping, and others.	Good	Not good
26	Activation of each operation mode	Check the activation of the COOL switch, the HEAT switch, the STOP switch and the TEMP switch.	Good	Not good
27	High-pressure cut-out switch	Check the actual activation value.	Good	Not good
28	Check the activation of the drain-up mechanism.	Check the activation during the cooling process.	Good	Not good
29	Water inlet temperature		(°C)	
30	Water outlet temperature		(°C)	
31	Air inlet temperature of the outdoor unit DB/WB		(°C)DB	(°C)WB
32	Air outlet temperature of the outdoor unit DB/WB		(°C)DB	(°C)WB
33	High-pressure switch		kg/cm²G	
34	Low-pressure switch		kg/cm²G	
35	Operating voltage		V	
36	Operating current		A	
37	Water flow switch		m³/h	
38	Low water pressure switch		bar	
39	Water thermostat		°C	
40	Instructions to the client for cleaning the air filter		Done	Not yet
41	Instructions to the client about the cleaning method		Done	Not yet
42	Instructions to the client about the operation		Done	Not yet

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