ESIE10-03B



Service Manual

Daikin ALTHERMA Flex Type

for apartments and collective housing

EMRQ 8/10/12/14/16 AAY1
EKHVMYD50/80AA/ABV1
EKHVMRD50/80AA/ABV1
R-410A, R-134a
EKHTS 200/260 AB/AC
EKHTSU 200/260 AB/AC

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1. Introduction

1.1 Safety Cautions

Cautions and Warnings

- Be sure to read the following safety cautions before conducting repair work.
- The caution items are classified into "⚠ **Warning**" and "⚠ **Caution**". The "⚠ **Warning**" items are especially important since they can lead to death or serious injury if they are not followed closely. The "⚠ **Caution**" items can also lead to serious accidents under some conditions if they are not followed. Therefore, be sure to observe all the safety caution items described below.
- About the pictograms

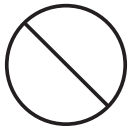
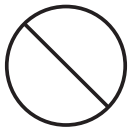
△ This symbol indicates an item for which caution must be exercised.
The pictogram shows the item to which attention must be paid.

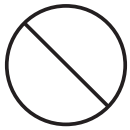
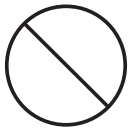
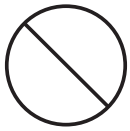
◯ This symbol indicates a prohibited action.
The prohibited item or action is shown inside or near the symbol.

● This symbol indicates an action that must be taken, or an instruction.
The instruction is shown inside or near the symbol.

- After the repair work is complete, be sure to conduct a test operation to ensure that the equipment operates normally, and explain the cautions for operating the product to the customer

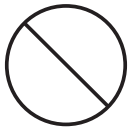
1.1.1 Caution in Repair

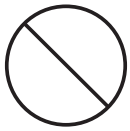
⚠ Warning	
Be sure to disconnect the power cable plug from the plug socket before disassembling the equipment for a repair. Working on the equipment that is connected to a power supply can cause an electrical shook. If it is necessary to supply power to the equipment to conduct the repair or inspecting the circuits, do not touch any electrically charged sections of the equipment. Be careful as the capacitors (top surfaces) can hold up to 220V.	
If the refrigerant gas discharges during the repair work, do not touch the discharging refrigerant gas. The refrigerant gas can cause frostbite.	
When disconnecting the suction or discharge pipe of the compressor at the welded section, release the refrigerant gas completely at a well-ventilated place first. If there is a gas remaining inside the compressor, the refrigerant gas or refrigerating machine oil discharges when the pipe is disconnected, and it can cause injury.	
If the refrigerant gas leaks during the repair work, ventilate the area. The refrigerant gas can generate toxic gases when it contacts flames.	
The step-up capacitor supplies high-voltage electricity to the electrical components of the outdoor unit and indoor unit. Be sure to discharge the capacitor completely before conducting repair work. A charged capacitor can cause an electrical shock as the capacitors (top surfaces) can hold up to 220V.	
Do not start or stop the heat pump operation by plugging or unplugging the power cable plug. Plugging or unplugging the power cable plug to operate the equipment can cause an electrical shock or fire.	

⚠ Caution	
Do not repair the electrical components with wet hands. Working on the equipment with wet hands can cause an electrical shock.	
Do not clean the heat pump by splashing water. Washing the unit with water can cause an electrical shock.	
Be sure to provide the grounding when repairing the equipment in a humid or wet place, to avoid electrical shocks.	
Be sure to turn off the power switch and unplug the power cable when cleaning the equipment. The internal fan rotates at a high speed, and cause injury.	
Do not tilt the unit when removing it. The water inside the unit can spill and wet the furniture and floor.	
Be sure to check that the refrigerating cycle section has cooled down sufficiently before conducting repair work. Working on the unit when the refrigerating cycle section is hot can cause burns.	
Use the welder in a well-ventilated place. Using the welder in an enclosed room can cause oxygen deficiency.	

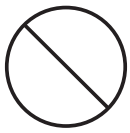
1.1.2 Cautions Regarding Products after Repair

⚠ Warning	
Be sure to use parts listed in the service parts list of the applicable model and appropriate tools to conduct repair work. Never attempt to modify the equipment. The use of inappropriate parts or tools can cause an electrical shock, excessive heat generation or fire.	
When relocating the equipment, make sure that the new installation site has sufficient strength to withstand the weight of the equipment. If the installation site does not have sufficient strength and if the installation work is not conducted securely, the equipment can fall and cause injury.	
Be sure to use an exclusive power circuit for the equipment, and follow the technical standards related to the electrical equipment, the internal wiring regulations and the instruction manual for installation when conducting electrical work. Insufficient power circuit capacity and improper electrical work can cause an electrical shock or fire.	
Be sure to use the specified cable to connect between the indoor and outdoor units. Make the connections securely and route the cable properly so that there is no force pulling the cable at the connection terminals. Improper connections can cause excessive heat generation or fire.	

⚠ Warning	
When connecting the cable between the indoor and outdoor units, make sure that the terminal cover does not lift off or dismount because of the cable. If the cover is not mounted properly, the terminal connection section can cause an electrical shock, excessive heat generation or fire.	
Do not damage or modify the power cable. Damaged or modified power cable can cause an electrical shock or fire. Placing heavy items on the power cable, and heating or pulling the power cable can damage the cable.	
Do not mix air or gas other than the specified refrigerant (R-410A / R-134a) in the refrigerant system. If air enters the refrigerating system, an excessively high pressure results, causing equipment damage and injury.	
If the refrigerant gas leaks, be sure to locate the leak and repair it before charging the refrigerant. After charging refrigerant, make sure that there is no refrigerant leak. If the leak cannot be located and the repair work must be stopped, be sure to perform pump-down and close the service valve, to prevent the refrigerant gas from leaking into the room. The refrigerant gas itself is harmless, but it can generate toxic gases when it contacts flames, such as fan and other heaters, stoves and ranges.	

⚠ Caution	
Installation of a leakage breaker is necessary in some cases depending on the conditions of the installation site, to prevent electrical shocks.	
Do not install the equipment in a place where there is a possibility of combustible gas leaks. If a combustible gas leaks and remains around the unit, it can cause a fire.	
Be sure to install the packing and seal on the installation frame properly. If the packing and seal are not installed properly, water can enter the room and wet the furniture and floor.	For integral units only

1.1.3 Inspection after Repair

⚠ Warning	
Check to make sure that the power cable plug is not dirty or loose, then insert the plug into a power outlet all the way. If the plug has dust or loose connection, it can cause an electrical shock or fire.	
If the power cable and lead wires have scratches or deteriorated, be sure to replace them. Damaged cable and wires can cause an electrical shock, excessive heat generation or fire.	
Do not use a joined power cable or extension cable, or share the same power outlet with other electrical appliances, since it can cause an electrical shock, excessive heat generation or fire.	

Caution	
Check to see if the parts and wires are mounted and connected properly, and if the connections at the soldered or crimped terminals are secure. Improper installation and connections can cause excessive heat generation, fire or an electrical shock.	
If the installation platform or frame has corroded, replace it. Corroded installation platform or frame can cause the unit to fall, resulting in injury.	
Check the grounding, and repair it if the equipment is not properly grounded. Improper grounding can cause an electrical shock.	
Be sure to measure the insulation resistance after the repair, and make sure that the resistance is 1 Mohm or higher. Faulty insulation can cause an electrical shock.	
Be sure to check the drainage of the indoor unit after the repair. Faulty drainage can cause the water to enter the room and wet the furniture and floor.	

1.1.4 Using Icons

Icons are used to attract the attention of the reader to specific information. The meaning of each icon is described in the table below:

1.1.5 Using Icons List

Icon	Type of Information	Description
 Note:	Note	A “note” provides information that is not indispensable, but may nevertheless be valuable to the reader, such as tips and tricks.
 Caution	Caution	A “caution” is used when there is danger that the reader, through incorrect manipulation, may damage equipment, loose data, get an unexpected result or has to restart (part of) a procedure.
 Warning	Warning	A “warning” is used when there is danger of personal injury.
	Reference	A “reference” guides the reader to other places in this binder or in this manual, where he/she will find additional information on a specific topic.

1.2 PREFACE

Thank you for your continued patronage of Daikin products.

This is the new service manual for Daikin's Year 2010 Altherma Flex Type air to water heat pump.
Daikin offers a wide range of models to respond to the residential heating market. We are confident that customers will be able to find the models that best suit their needs.

This service manual contains information regarding the servicing of Daikin Altherma Flex Type Heat Pump System.

June, 2010

After Sales Service Division

Part 1 - General Information

1. Model Names of Indoor/Outdoor Units & Tanks 2
2. Options.....3

1. Model Names of Indoor/Outdoor Units & Tanks

Indoor Units

Type	Model Name	Power Supply
EKHVMYD	50 AA	V1
	80 AA	
EKHVMRD	50 AA	V1
	80 AA	

Outdoor Units

Type	Model Name	Power Supply
EMRQ	8 AA	Y1
	10 AA	
	12 AA	
	14 AA	
	16 AA	

Tanks

Type	Model Name	
EKHTS(U)	200 AB	
	260 AB	
	200 AC	AD
	260 AC	AD

2. Options

Kits connected to the outdoor unit

Reference	Description	EMRQ8AAY1	EMRQ10AAY1	EMRQ12AAY1	EMRQ14AAY	EMRQ16AAY1
Combined with heating only indoor unit (EKHVMRD*)						
KHRQ(M)22M29H8	Refnet header	○	○	○	○	○
KHRQ(M)22M64H8	Refnet header			○	○	○
KHRQ(M)22M20T8	Refnet joint	○	○	○	○	○
KHRQ(M)22M29T8	Refnet joint	○	○	○	○	○
KHRQ(M)22M64T8	Refnet joint			○	○	○
Combined with reversible indoor unit (EKHVMRD*)						
KHRQ(M)23M29H8	Refnet header	○	○	○	○	○
KHRQ(M)23M64H	Refnet header			○	○	○
KHRQ(M)23M20T8	Refnet joint	○	○	○	○	○
KHRQ(M)23M29T8	Refnet joint	○	○	○	○	○
KHRQ(M)23M64T8	Refnet joint			○	○	○
KWC25C450	Drain pan kit	○	○	○	○	○

Kits connected to the indoor unit

Reference	Description	Indoor unit			
		EKHVMRD*		EKHVMYD*	
		50AAV1	80AAV1	50AAV1	80AAV1
EKHTS200(AB/AC)	Stainless domestic hot water tank 200l	○	○	○	○
EKHTS260(AB/AC)	Stainless domestic hot water tank 260l	○	○	○	○
EKHTSU200(AB/AC)	Stainless domestic hot water tank 200l UK-version	○	○	○	○
EKHTSU260(AB/AC)	Stainless domestic hot water tank 260l UK-version	○	○	○	○
EKRP1HBAA	Digital I/O PCB	○	○	○	○
EKRP1AHTA	Demand PCB (2)	○	○	○	○
EKRUAHTB	Remote user interface (Remocon) (3)	○	○	○	○
EKRTWA	Wired room thermostat (1)	○	○	○	○
EKRTR1	Wireless room thermostat (1)	○	○	○	○
EKRTETS	Remote sensor for room thermostat (1)	○	○	○	○
EKMBIL1	Individual billing - connection kit (5)	○	○	○	○

Kits connected to the domestic hot water tank

Reference	Description	DHW			
		EKHTS		EKHTSU	
		200A	260A	200AA	260AA
EKUHWHTA	Option kit for UK EKHTSU200-260A			○	○
EKFMAHTA(4)	Option kit for standalone tank	○	○	○	○

Remarks

Other combinations are not guaranteed.
(1) Requires Demand PCB EKRP1AHTA.
(2) Required to install to be able to connect Room thermostat.
(3) Same controller as supplied with Cascade unit can be mounted parallel or on other location. If 2 controllers are installed, the installer needs to select 1 master and 1 slave.
(4) Only required if tank is not mounted on top of Cascade indoor unit.
(5) Only required if the tank heat meter is placed between tank and hydrobox, and tank is mounted on top of Cascade indoor unit.

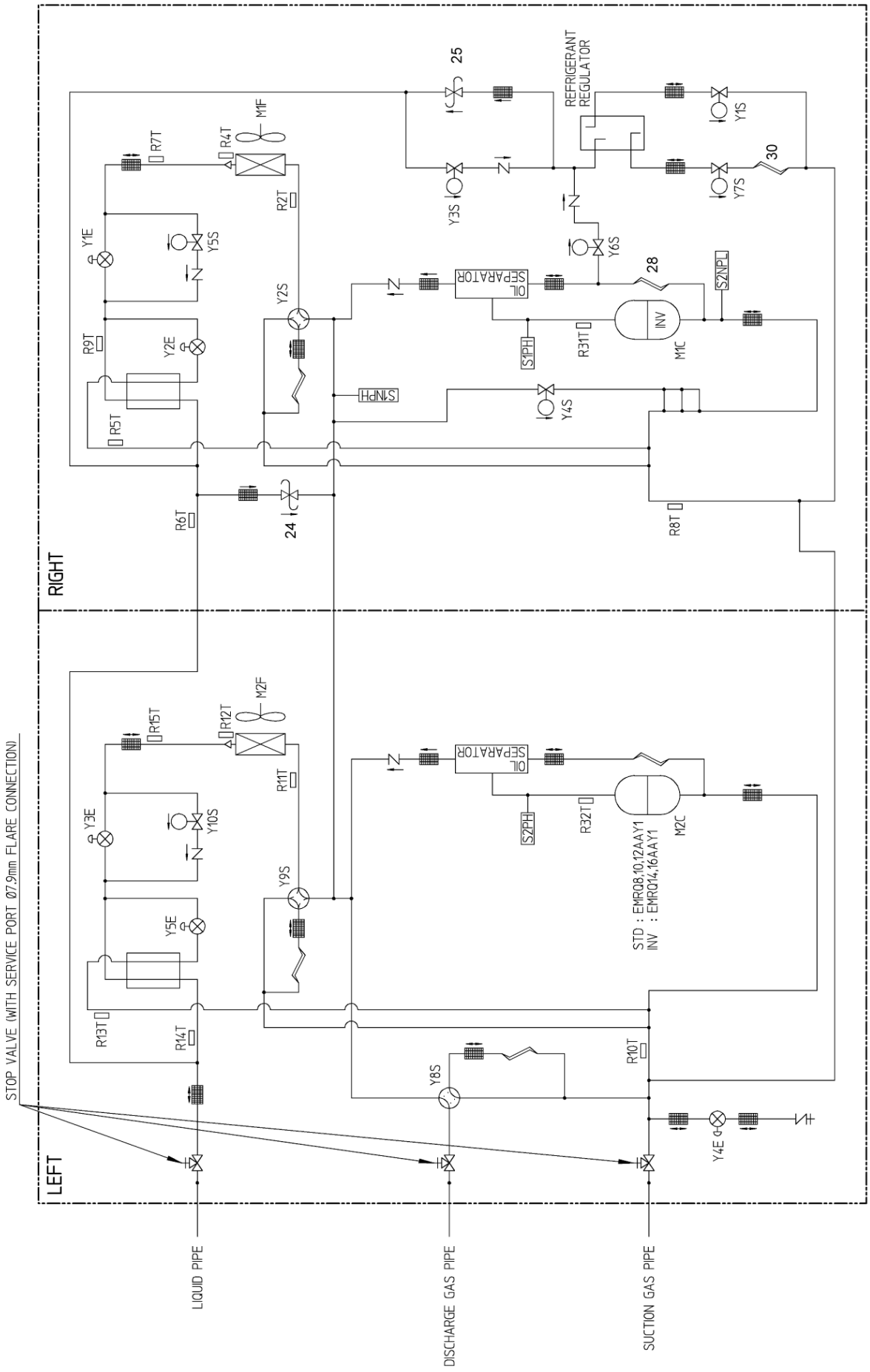
Part 2 - Refrigerant Circuit & Functional Parts

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1. Refrigerant Circuit

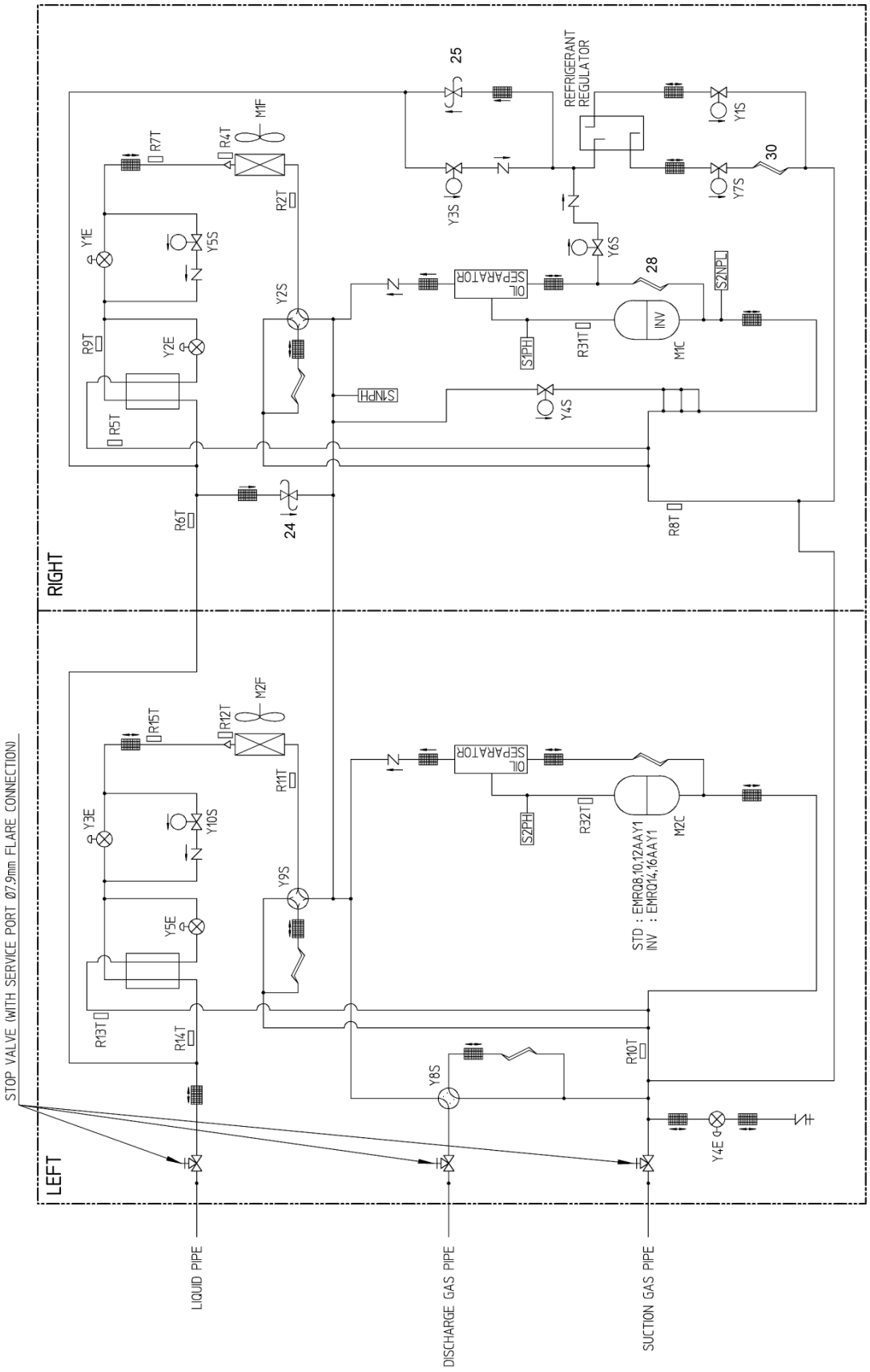
1.1 Outdoor Unit - EMRQ 8/10/12 AAY1

No. in refrigerant system diagram	Symbol	Name	Major Function
	M1C	Inverter compressor (INV)	Inverter compressor is operated on frequencies between 52Hz and 210Hz by using the inverter, while Standard compressor is operated with commercial power supply only. The number of operating steps is as follows when Inverter compressor is operated in combination with Standard compressor. EMRQ8: 30 steps; EMRQ10, 12: 37 steps
	M2C	Standard compressor 1 (STD1)	
	M1F	Inverter fan	Since the system is of air heat exchanging type, the fan is operated at 9-step rotation speed by using the inverter.
	M2F	Inverter fan	Since the system is of air heat exchanging type, the fan is operated at 9-step rotation speed by using the inverter.
	Y1E (Y3E)	Electronic expansion valve (Main1 (Main2))	While in heating operation, PI control is applied to keep the outlet superheated degree of air heat exchanger constant.
	Y2E (Y5E)	Electronic expansion valve (Subcool1 (Subcool2))	PI control is applied to keep the outlet superheated degree of subcooling heat exchanger constant.
	Y4E	Electronic expansion valve (Refrigerant charge EVJ)	This is used to open/close refrigerant charge port.
	Y5S (Y10S)	Solenoid valve (Main bypass1 (Main bypass2))	This opens in cooling operation.
	Y4S	Solenoid valve (Hot gas: SVP)	Used to prevent the low pressure from transient falling.
	Y3S	Solenoid valve (Refrigerant regulator liquid pipe SVL)	This is used to collect refrigerant to the refrigerant regulator.
	Y1S	Solenoid valve (Refrigerant regulator gas purging pipe SVG)	This is used to collect refrigerant to the refrigerant regulator.
	Y7S	Solenoid valve (Refrigerant regulator discharge pipe SVO)	This is used to discharge refrigerant from the refrigerant regulator.
	Y6S	Solenoid valve (Discharge pipe of refrigerant regulator)	Bypass the high pressure gas to the refrigerant regulator.
	Y2S (Y9S)	4 way valve (Heat exchanger switch 20SA)	This is used to switch outdoor heat exchanger to evaporator or condenser.
	Y8S	4 way valve (Dual pressure gas pipe switch 20SB)	This is used to switch dual pressure gas pipe to high pressure or low pressure.
	S1NPH	High pressure sensor	Used to detect high pressure.
	S2NPL	Low pressure sensor	Used to detect low pressure.
	S1PH	HP pressure switch (For INV)	This functions when pressure increases to stop operation and avoid high pressure increase in the fault operation.
	S2PH	HP pressure switch (For STD)	
24	—	Pressure regulating valve (Liquid pipe)	This is used when pressure increases, to prevent any damage on components caused by pressure increase in transport or storage.
25	—	Pressure regulating valve (Refrigerant regulator)	This is used when pressure increases, to prevent any damage on components caused by pressure increase in transport or storage.
26	—	Subcooling heat exchanger	Apply subcooling to liquid refrigerant.
27	—	Refrigerant regulator	Surplus refrigerant is held according to the operation conditions.
28	—	Capillary tube	Used to return the refrigerating oil separated through the oil separator to the INV compressor.
29	—	Capillary tube	Used to return the refrigerating oil separated through the oil separator to the STD1 compressor.
30	—	Capillary tube	This is used to discharge refrigerant from the refrigerant regulator.
	R1T	Thermistor (Outdoor air: Ta)	Used to detect outdoor temperature, correct discharge pipe temperature, and others.
	R8T (R10T)	Thermistor (Suction pipe: TsA)	Used to detect suction pipe temperature.
	R31T	Thermistor (INV discharge pipe: Tdi)	Used to detect discharge pipe temperature. Used for compressor temperature protection control.
	R32T	Thermistor (STD1 discharge pipe: Tds1)	
	R4T (R12T)	Thermistor (Heat exchanger deicer: Tb)	Used to detect liquid pipe temperature of air heat exchanger. Used to make judgments on defrosting operation.
	R2T (R11T)	Thermistor (Heat exchanger gas pipe Tg)	This detects temperature of gas pipe for air heat exchanger. Used to exercise the constant control of superheated degree when an evaporator is used for outdoor unit heat exchanging.
	R7T (R15T)	Thermistor (Heat exchanger liquid pipe Tf)	This detects temperature of liquid pipe between the air heat exchanger and main electronic expansion valve. Used to make judgments on the recover or discharge refrigerants to the refrigerant regulator.
	R5T (R13T)	Thermistor (Subcooling heat exchanger gas pipe: Tsh)	Used to detect gas pipe temperature on the evaporation side of subcooling heat exchanger. Used to exercise the constant control of superheated degree at the outlet of supercooled heat exchanger.
	R6T	Thermistor (Subcooling heat exchanger liquid pipe Tl)	This detects temperature of liquid pipe between the main expansion valve and subcooling heat exchanger.
	R9T (R14T)	Thermistor (Liquid pipe Tsc)	This detects temperature of liquid pipe between the liquid stop valve and subcooling heat exchanger.


RIGHT
LEFT
REFRIGERANT REGULATOR
25
30
28
24
M1F
R4T
R7T
R2T
Y1E
Y5S
Y2S
Y2E
R9T
R5T
R6T
Y3S
Y6S
Y1S
Y7S
OIL SEPARATOR
S1PH
R31T
INV
M1C
S2NPL
S1NPH
Y4S
R8T
M2F
R12T
R15T
R11T
Y3E
Y10S
Y9S
Y5E
R13T
R14T
S2PH
R32T
M2C
STD : EMRQ08,10,12AAY1
INV : EMRQ14,16AAY1
R10T
Y8S
Y4E
STOP VALVE (WITH SERVICE PORT Ø7.9mm FLARE CONNECTION)
LIQUID PIPE
DISCHARGE GAS PIPE
SUCTION GAS PIPE

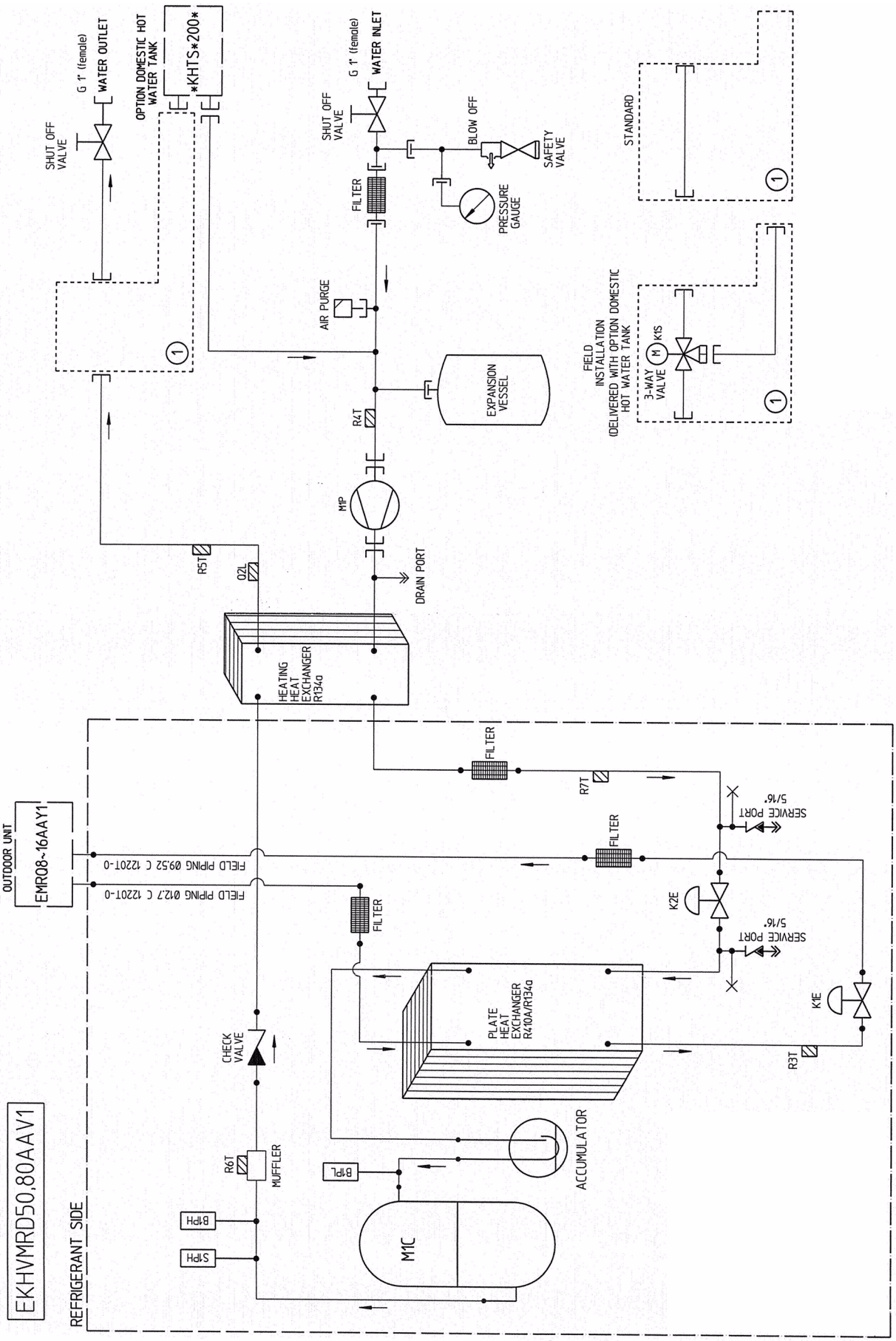
1.2 Outdoor Unit - EMRQ 14/16 AAY1

No. in refrigerant system diagram	Symbol	Name	Major Function
	M1C	Inverter compressor (INV1)	Inverter compressor is operated on frequencies between 52Hz and 266Hz by using the inverter. The number of operating steps is as follows. EMRQ14 or 16 : 26 steps
	M2C	Inverter compressor (INV2)	
	M1F	Inverter fan	Since the system is of air heat exchanging type, the fan is operated at 9-step rotation speed by using the inverter.
	M2F	Inverter fan	Since the system is of air heat exchanging type, the fan is operated at 9-step rotation speed by using the inverter.
	Y1E (Y3E)	Electronic expansion valve (Main1 (Main2))	While in heating operation, PI control is applied to keep the outlet superheated degree of air heat exchanger constant.
	Y2E (Y5E)	Electronic expansion valve (Subcool1 (Subcool2))	PI control is applied to keep the outlet superheated degree of subcooling heat exchanger constant.
	Y4E	Electronic expansion valve (Refrigerant charge EVJ)	This is used to open/close refrigerant charge port.
	Y5S (Y10S)	Solenoid valve (Main bypass1 (Main bypass2))	This opens in cooling operation.
	Y4S	Solenoid valve (Hot gas: SVP)	Used to prevent the low pressure from transient falling.
	Y3S	Solenoid valve (Refrigerant regulator liquid pipe SVL)	This is used to collect refrigerant to the refrigerant regulator.
	Y1S	Solenoid valve (Refrigerant regulator gas purging pipe SVG)	This is used to collect refrigerant to the refrigerant regulator.
	Y7S	Solenoid valve (Refrigerant regulator discharge pipe SVO)	This is used to discharge refrigerant from the refrigerant regulator.
	Y6S	Solenoid valve (Discharge pipe of refrigerant regulator)	Bypass the high pressure gas to the refrigerant regulator.
	Y2S (Y9S)	4 way valve (Heat exchanger switch 20SA)	This is used to switch outdoor heat exchanger to evaporator or condenser.
	Y8S	4 way valve (Dual pressure gas pipe switch 20SB)	This is used to switch dual pressure gas pipe to high pressure or low pressure.
	S1NPH	High pressure sensor	Used to detect high pressure.
	S2NPL	Low pressure sensor	Used to detect low pressure.
	S1PH (S2PH)	HP pressure switch (For INV compressor)	This functions when pressure increases to stop operation and avoid high pressure increase in the fault operation.
24	—	Pressure regulating valve (Liquid pipe)	This is used when pressure increases, to prevent any damage on components caused by pressure increase in transport or storage.
25	—	Pressure regulating valve (Refrigerant regulator)	This is used when pressure increases, to prevent any damage on components caused by pressure increase in transport or storage.
26	—	Subcooling heat exchanger	Apply subcooling to liquid refrigerant.
27	—	Refrigerant regulator	Surplus refrigerant is held according to the operation conditions.
28	—	Capillary tube	Used to return the refrigerating oil separated through the oil separator to the INV compressor.
29	—	Capillary tube	This is used to discharge refrigerant from the refrigerant regulator.
	R1T	Thermistor (Outdoor air: Ta)	Used to detect outdoor temperature, correct discharge pipe temperature, and others.
	R8T (R10T)	Thermistor (Suction pipe: TsA)	Used to detect suction pipe temperature.
	R31T	Thermistor (INV1 discharge pipe: Tdi)	Used to detect discharge pipe temperature. Used for compressor temperature protection control.
	R32T	Thermistor (INV2 discharge pipe: Tds1)	
	R4T (R12T)	Thermistor (Heat exchanger deicer: Tb)	Used to detect liquid pipe temperature of air heat exchanger. Used to make judgments on defrosting operation.
	R2T (R11T)	Thermistor (Heat exchanger gas pipe Tg)	This detects temperature of gas pipe for air heat exchanger. Used to exercise the constant control of superheated degree when an evaporator is used for outdoor unit heat exchanging.
	R7T (R15T)	Thermistor (Heat exchanger liquid pipe Tf)	This detects temperature of liquid pipe between the air heat exchanger and main electronic expansion valve. Used to make judgments on the recover or discharge refrigerants to the refrigerant regulator.
	R5T (R13T)	Thermistor (Subcooling heat exchanger gas pipe: Tsh)	This detects temperature of gas pipe on the evaporator side for the subcooling heat exchanger. Used to exercise the constant control of superheated degree at the outlet of supercooled heat exchanger.
	R6T	Thermistor (Subcooling heat exchanger liquid pipe Tl)	This detects temperature of liquid pipe between the main expansion valve and subcooling heat exchanger.
	R9T (R14T)	Thermistor (Liquid pipe Tsc)	This detects temperature of liquid pipe between the liquid stop valve and subcooling heat exchanger.


RIGHT
LEFT
REFRIGERANT REGULATOR
25
30
28
24
M1F
R4T
R7T
R2T
Y1S
Y3S
Y7S
Y6S
Y1E
Y5S
Y2S
Y2E
R9T
R5T
R6T
R8T
Y4S
S1PH
S1NPH
R31T
M1C
INV
S2NPL
OIL SEPARATOR
M2F
R12T
R15T
R11T
Y3E
Y10S
Y9S
Y5E
R13T
R14T
S2PH
R32T
M2C
STD : EMRO8,10,12AAY1
INV : EMRO14,16AAY1
R10T
Y8S
Y4E
STOP VALVE (WITH SERVICE PORT Ø7.9mm FLARE CONNECTION)
LIQUID PIPE
DISCHARGE GAS PIPE
SUCTION GAS PIPE

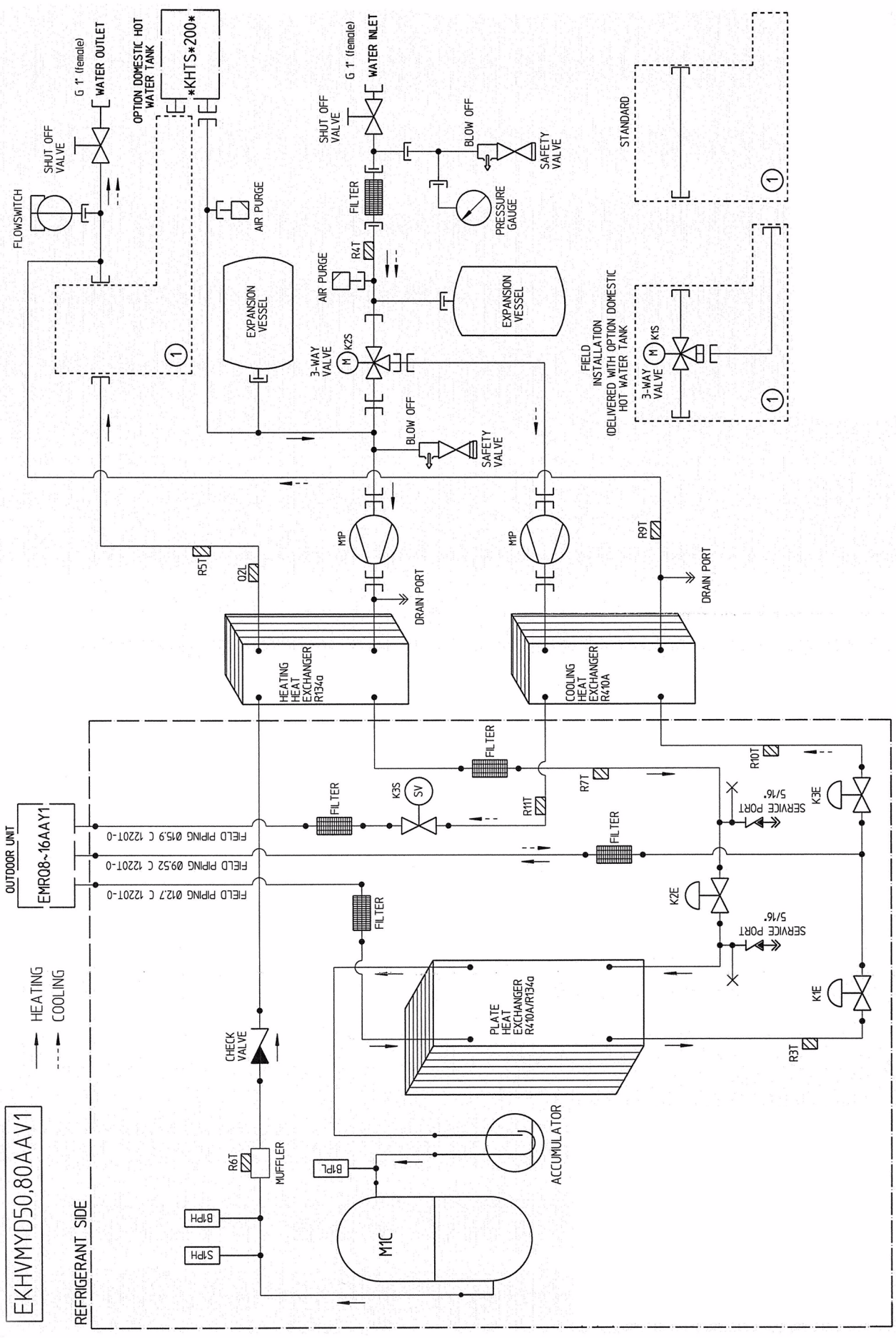
1.3 Indoor Unit - EKHVMRD50/80AA/ABV1

Symbol	Name	Major Function
M1C	Inverter compressor on R-134a	Inverter compressor is operated on frequencies between 40 Hz and 210 Hz by using the inverter. Max. of 30 steps.
B1PL	Low pressure sensor R-134a	Used to detect low pressure.
B1PH	High pressure sensor R-134a	Used to detect high pressure.
S1PH	High pressure switch R-134a	In order to prevent the increase of high pressure when a malfunction occurs, this switch is activated at high pressure of 3.8 MPa or more to stop the compressor operation.
K1E	Electronic expansion valve	Used to regulate the refrigerant flow of R-410A.
K2E	Electronic expansion valve	Used to regulate the refrigerant flow of R-134a.
M1P	DC inverter pump	Used to regulate water flow to achieve a constant ΔT for space heating.
Q2L	Thermistor protector water piping	Used to protect the water system against high temperatures.
K1S	3 way valve (option for water tank)	Used to switch over between space heating and domestic hot water.
R3T	Liquid thermistor R-410A	Subcool calculation.
R6T	Discharge thermistor	Used to detect discharge pipe temperature, make the temperature protection control of compressor, and others.
R7T	Liquid thermistor R-134a	Subcool calculation.
R4T	Returning water thermistor	Used to control and protect the water system.
R5T	Leaving water thermistor	Used to control and protect the water system.


EKHVMRD50,80AAV1
REFRIGERANT SIDE
OUTDOOR UNIT
EMR08~16AAY1
FIELD PIPING Ø9,52 C 1220T-0
FIELD PIPING Ø12,7 C 1220T-0
HEATING HEAT EXCHANGER R134a
PLATE HEAT EXCHANGER R410A/R134a
ACCUMULATOR
M1C
M1P
MUFFLER
CHECK VALVE
FILTER
SERVICE PORT 5/16"
K2E
K1E
R3T
R4T
R5T
R6T
R7T
Q2L
B1PL
B1PH
S1PH
DRAIN PORT
AIR PURGE
EXPANSION VESSEL
SHUT OFF VALVE
G 1" (female)
WATER OUTLET
WATER INLET
OPTION DOMESTIC HOT WATER TANK
*KHTS*200*
BLOW OFF
SAFETY VALVE
PRESSURE GAUGE
STANDARD
FIELD INSTALLATION (DELIVERED WITH OPTION DOMESTIC HOT WATER TANK
3-WAY VALVE
K1S

1.4 Indoor Unit - EKHVMYD50/80AA/ABV1

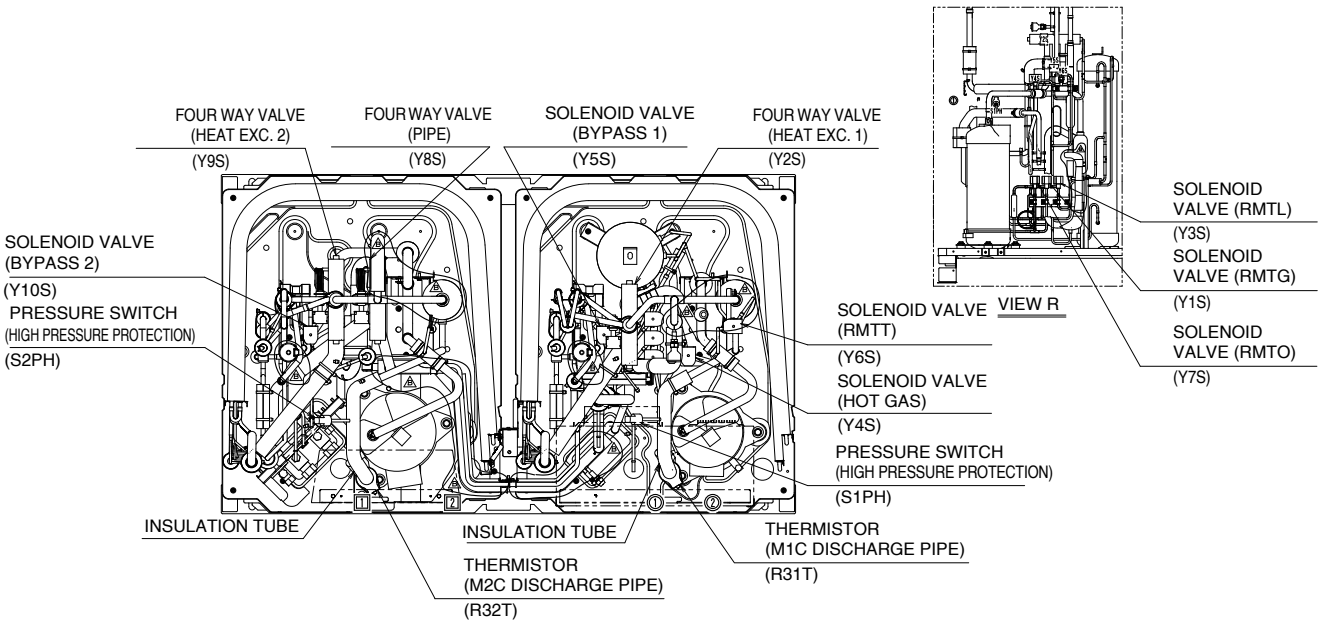
Symbol	Name	Major Function
M1C	Inverter compressor on R-134a	Inverter compressor is operated on frequencies between 40 Hz and 210 Hz by using the inverter. Max. of 30 steps.
B1PL	Low pressure sensor R-134a	Used to detect low pressure.
B1PH	High pressure sensor R-134a	Used to detect high pressure.
S1PH	High pressure switch R-134a	In order to prevent the increase of high pressure when a malfunction occurs, this switch is activated at high pressure of 3.8 MPa or more to stop the compressor operation.
K1E	Electronic expansion valve	Used to regulate the refrigerant flow of R-410A.
K2E	Electronic expansion valve	Used to regulate the refrigerant flow of R-134a.
K3E	Electronic expansion valve	Used to regulate the refrigerant flow of R-410R during cooling operation.
M1P	DC inverter pump	Used to regulate water flow to achieve a constant ΔT for space heating.
M2P	DC inverter pump	Used to regulate water flow to achieve a constant ΔT for space cooling.
Q2L	Thermistor protector water piping	Used to protect the water system against high temperatures.
K1S	3 way valve (option for water tank)	Used to switch over between space heating and domestic hot water.
K2S	3 way valve	Used to switch over between space heating and space cooling.
K3S	2 way valve	Used during cooling operation.
R3T	Liquid thermistor R-410A	Subcool calculation.
R6T	Discharge thermistor	Used to detect discharge pipe temperature, make the temperature protection control of compressor, and others.
R7T	Liquid thermistor R-134a	Subcool calculation.
R4T	Returning water thermistor	Used to control and protect the water system.
R5T	Leaving water heating thermistor	Used to control and protect the water system.
R9T	Leaving water cooling thermistor	Used to control and protect the water system.
R10T	Liquid thermistor R410A (cooling)	
R11T	Suction thermistor R410A	


EKHVMYD50,80AAV1
REFRIGERANT SIDE
OUTDOOR UNIT
EMRQ8~16AAY1
HEATING
COOLING
FIELD PIPING Ø15,9 C 1220T-0
FIELD PIPING Ø9,52 C 1220T-0
FIELD PIPING Ø12,7 C 1220T-0
HEATING HEAT EXCHANGER R134a
COOLING HEAT EXCHANGER R410A
PLATE HEAT EXCHANGER R410A/R134a
ACCUMULATOR
CHECK VALVE
MUFFLER
FILTER
SERVICE PORT 5/16"
DRAIN PORT
EXPANSION VESSEL
AIR PURGE
SHUT OFF VALVE
BLOW OFF
SAFETY VALVE
PRESSURE GAUGE
FLOWSWITCH
WATER OUTLET
WATER INLET
G 1" (female)
OPTION DOMESTIC HOT WATER TANK
*KHTS*200*
3-WAY VALVE
FIELD INSTALLATION (DELIVERED WITH OPTION DOMESTIC HOT WATER TANK
STANDARD
M1C
M1P
K1E
K2E
K3E
K1S
K2S
K3S
SV
R3T
R4T
R5T
R6T
R7T
R9T
R10T
R11T
O2L
BPH
SPH
BPL

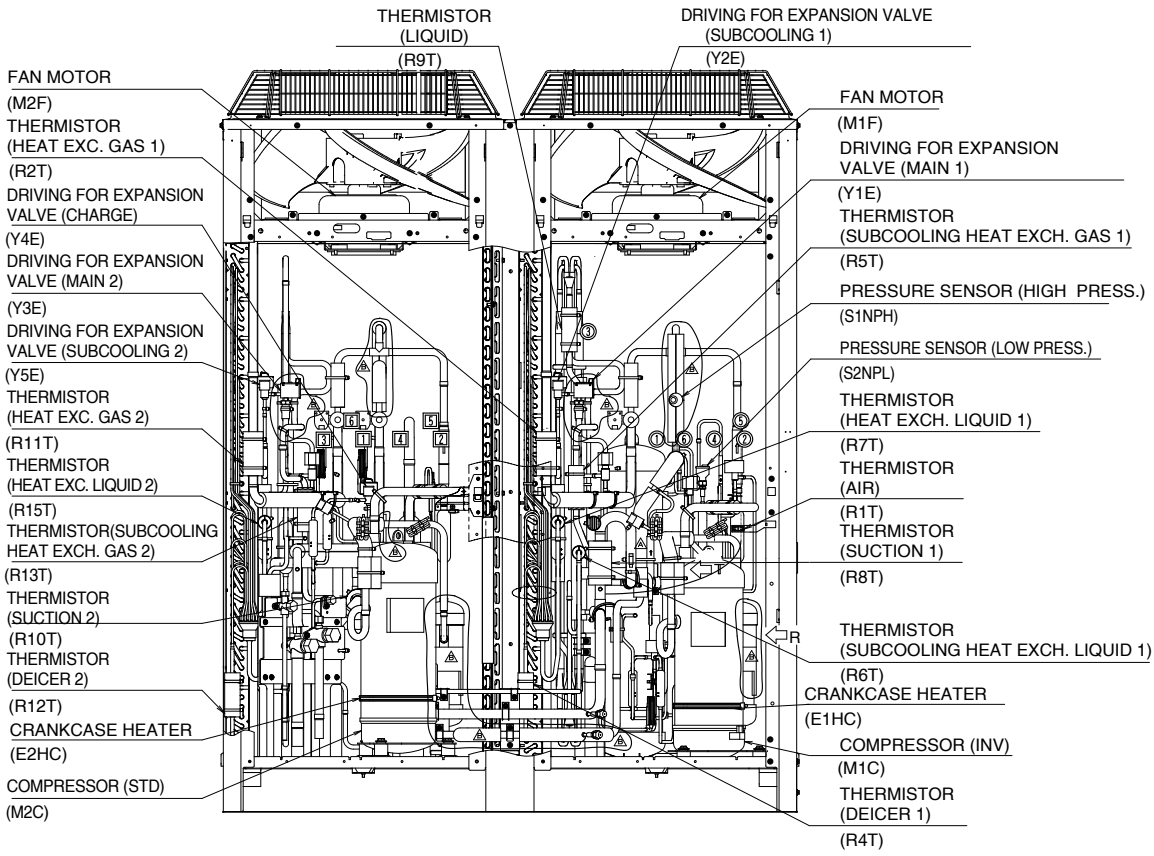
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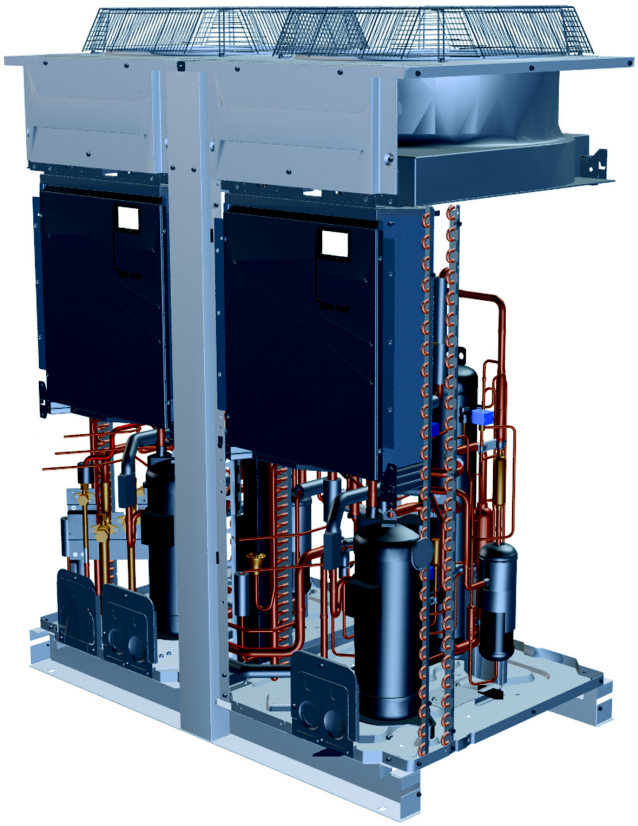
2.1 EMRQ 8/10/12 AAY1

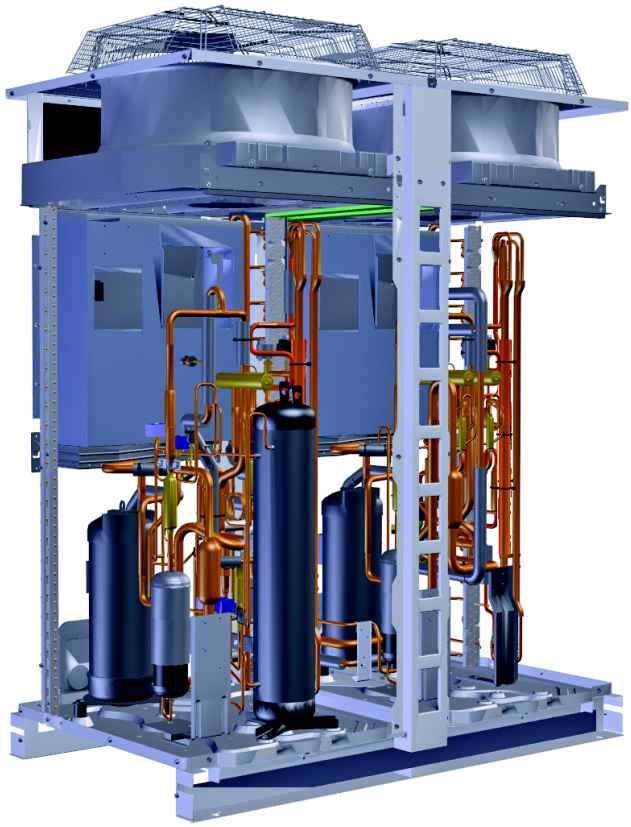
Plan

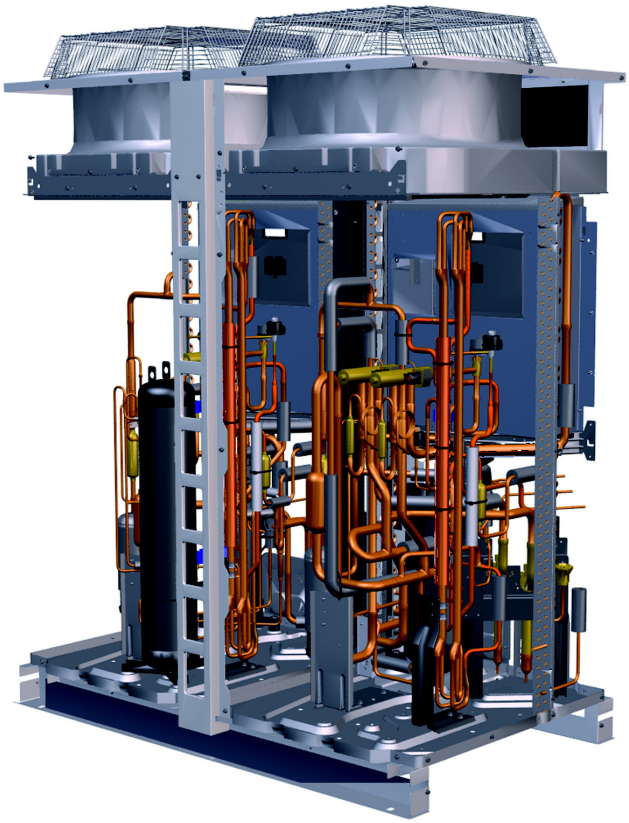


Front View



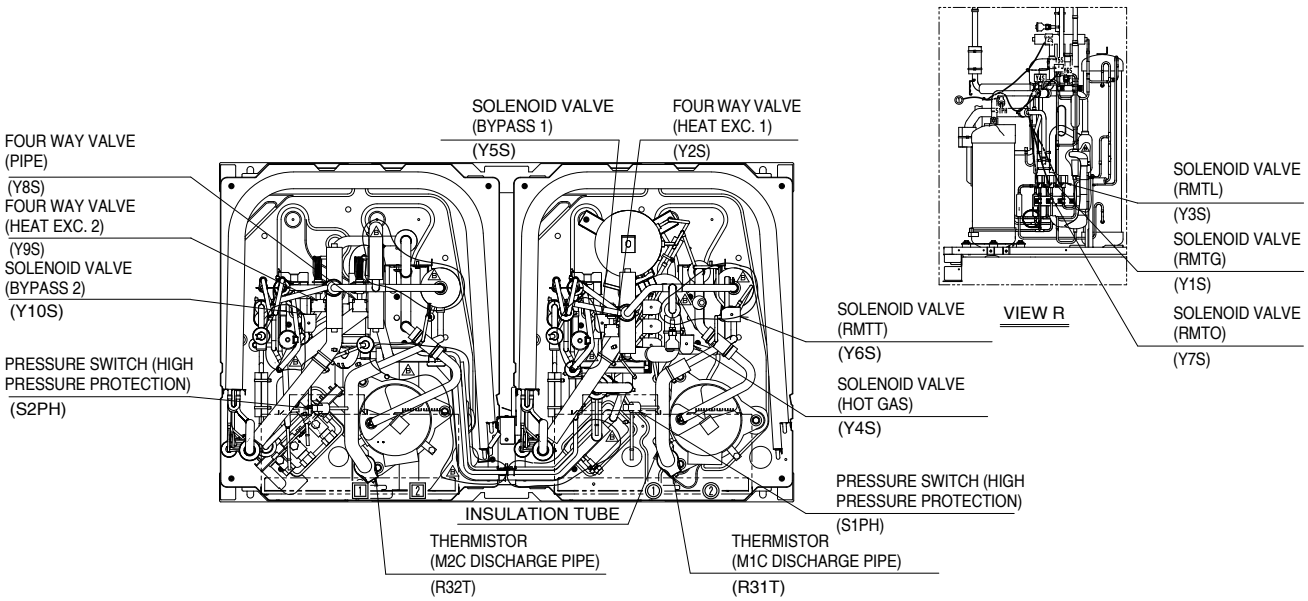




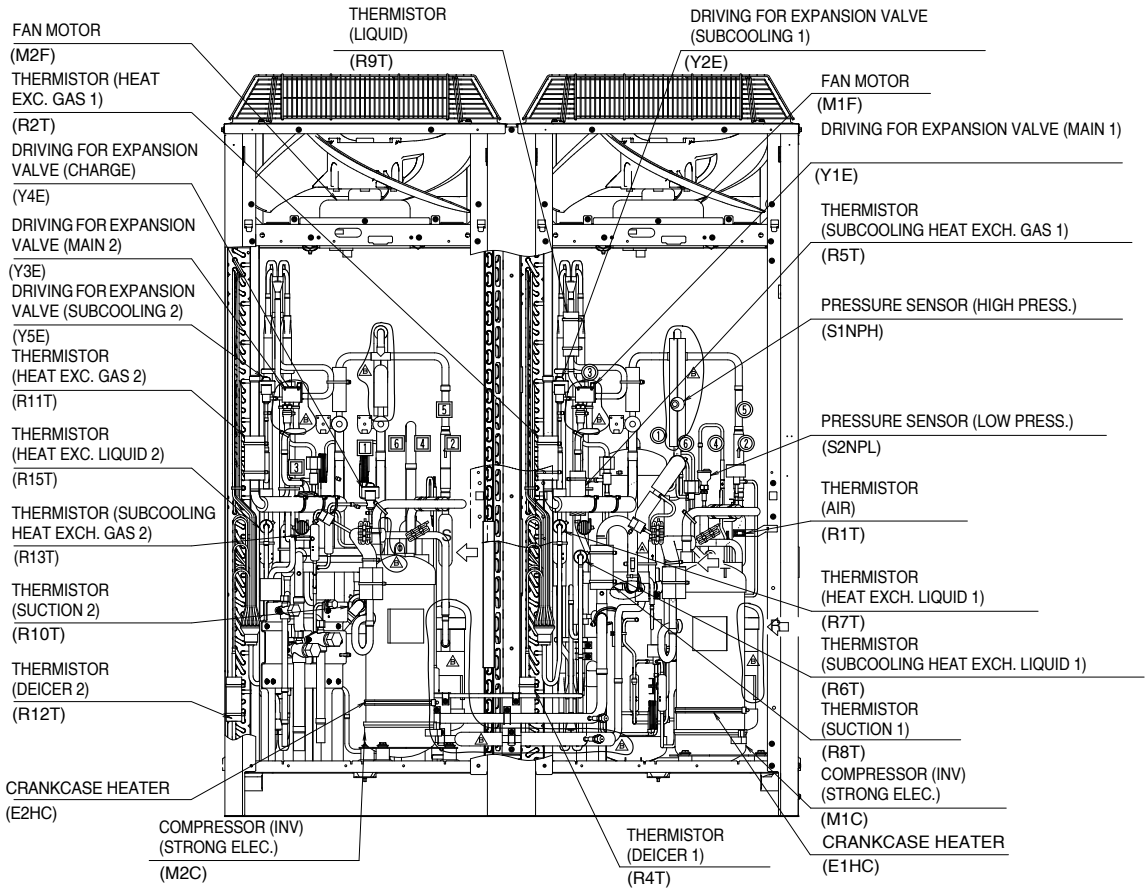


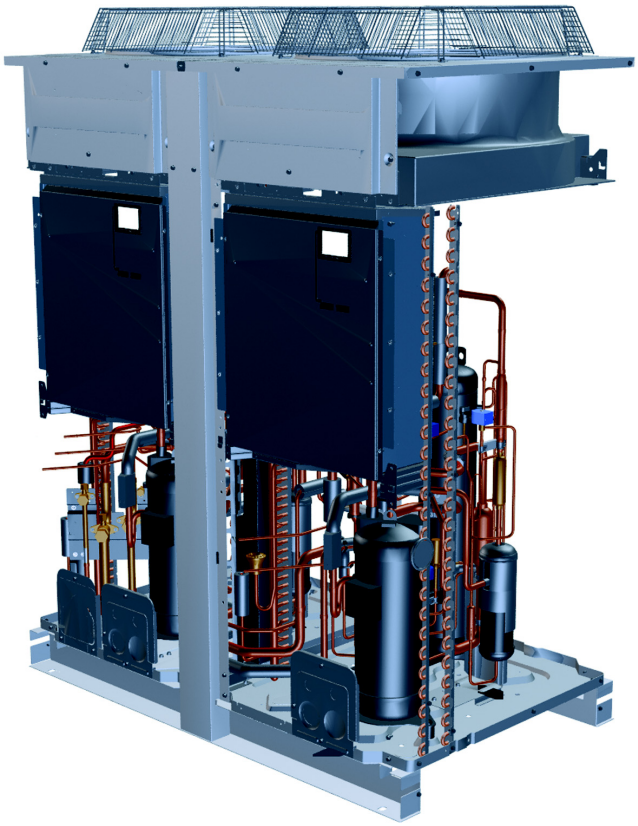
2.2 EMRQ 14/16 AAY1

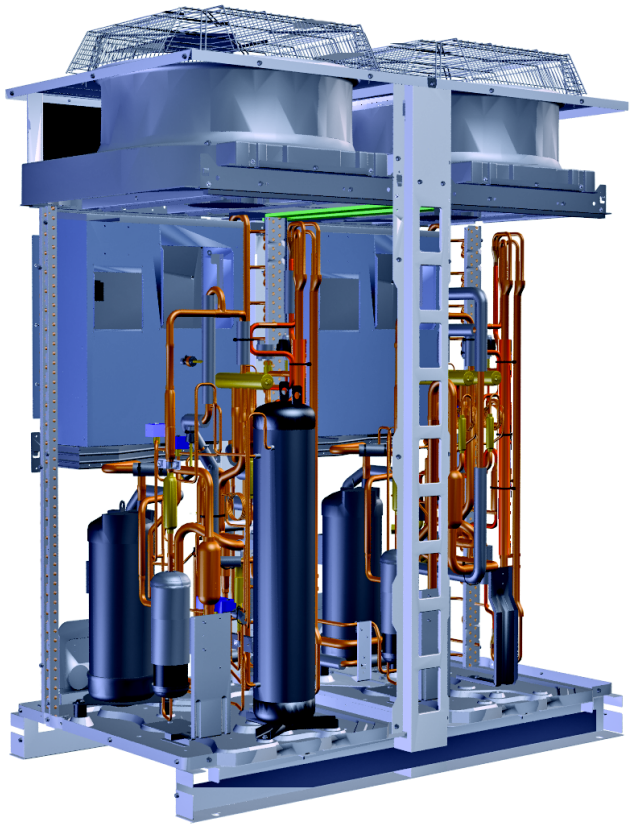
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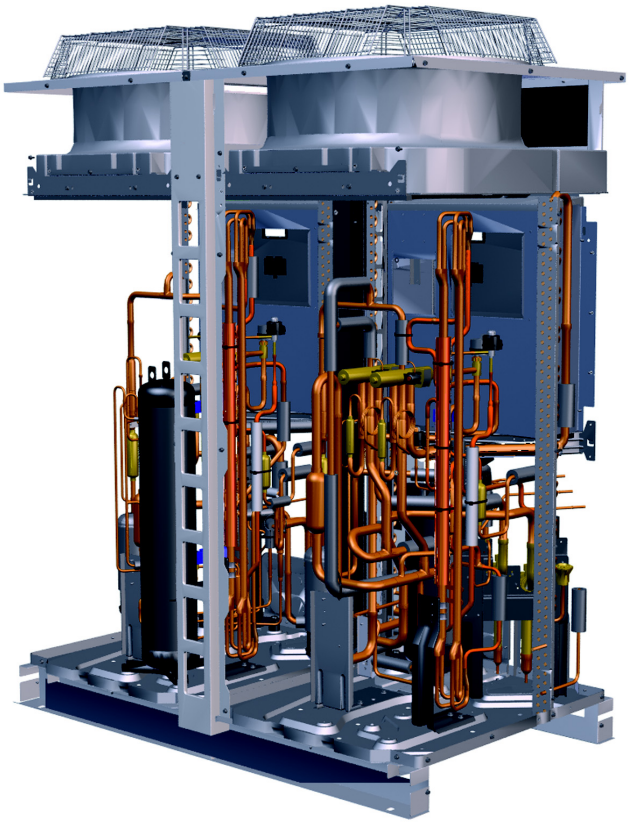


Front View



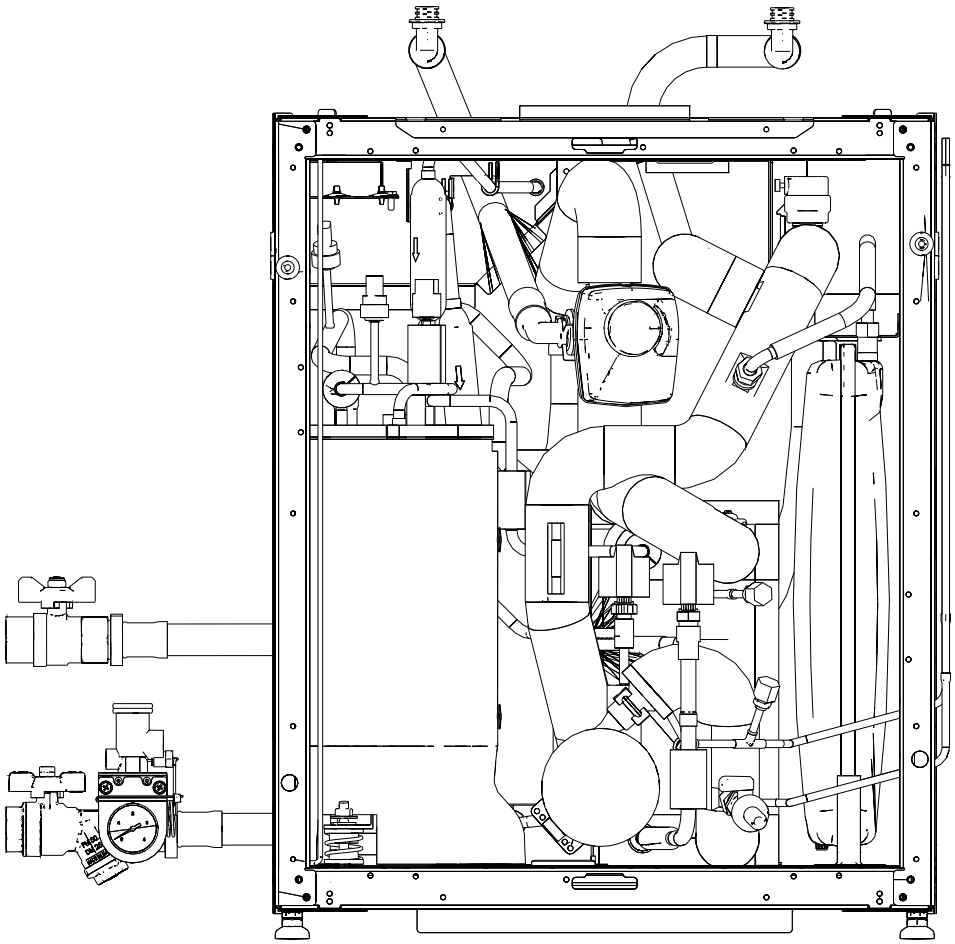




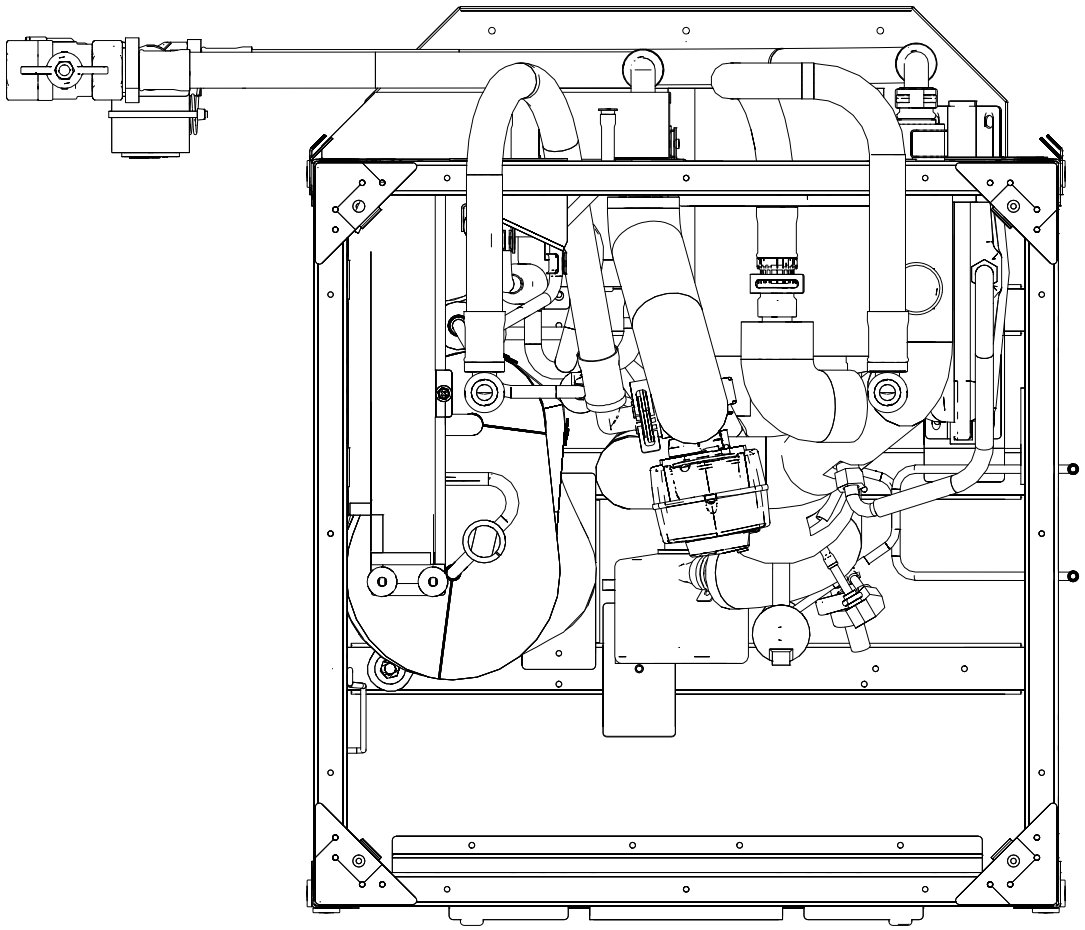


2.3 Indoor Unit - EKHVMRD50/80AA/ABV1

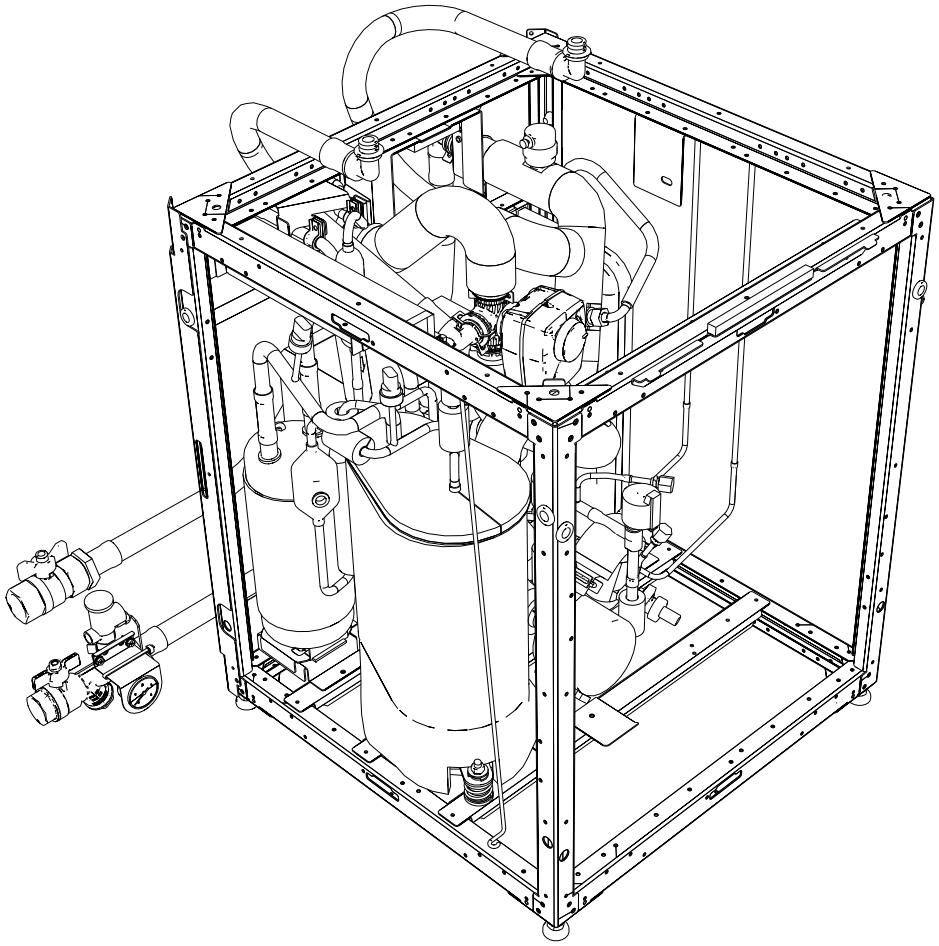
Front view



Top view



Bird’s-eye view



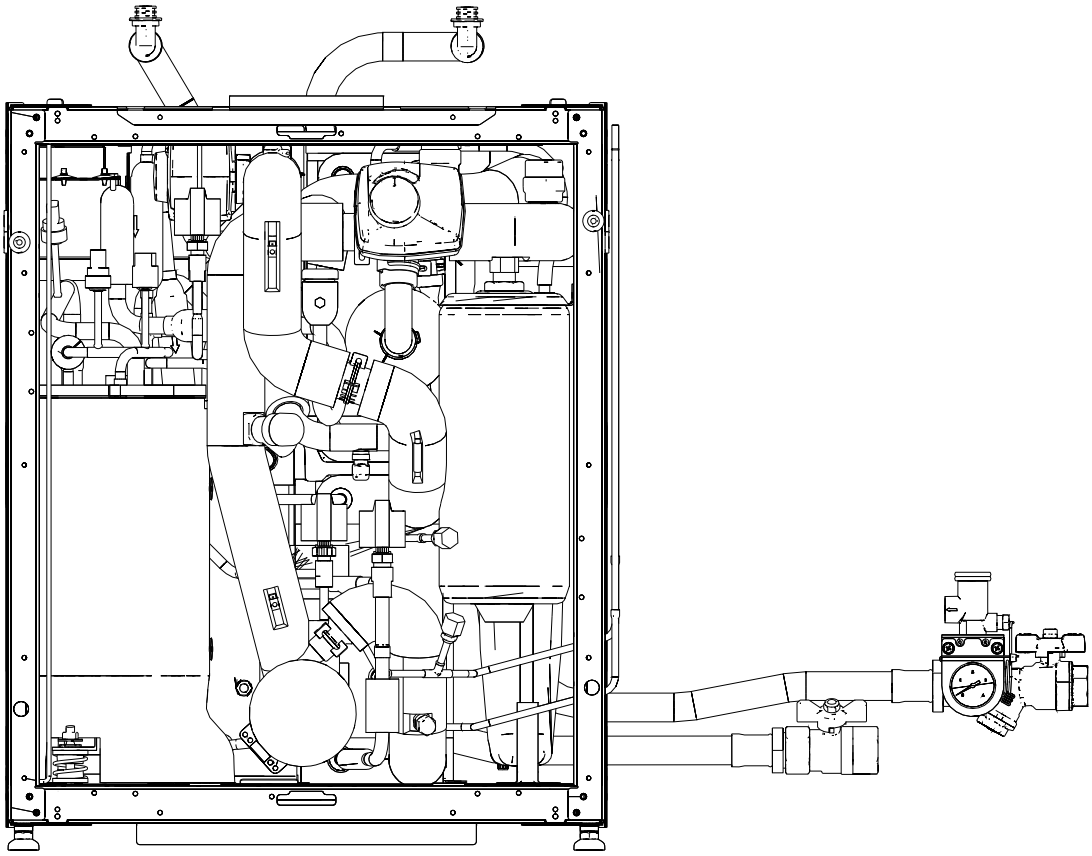
Legend

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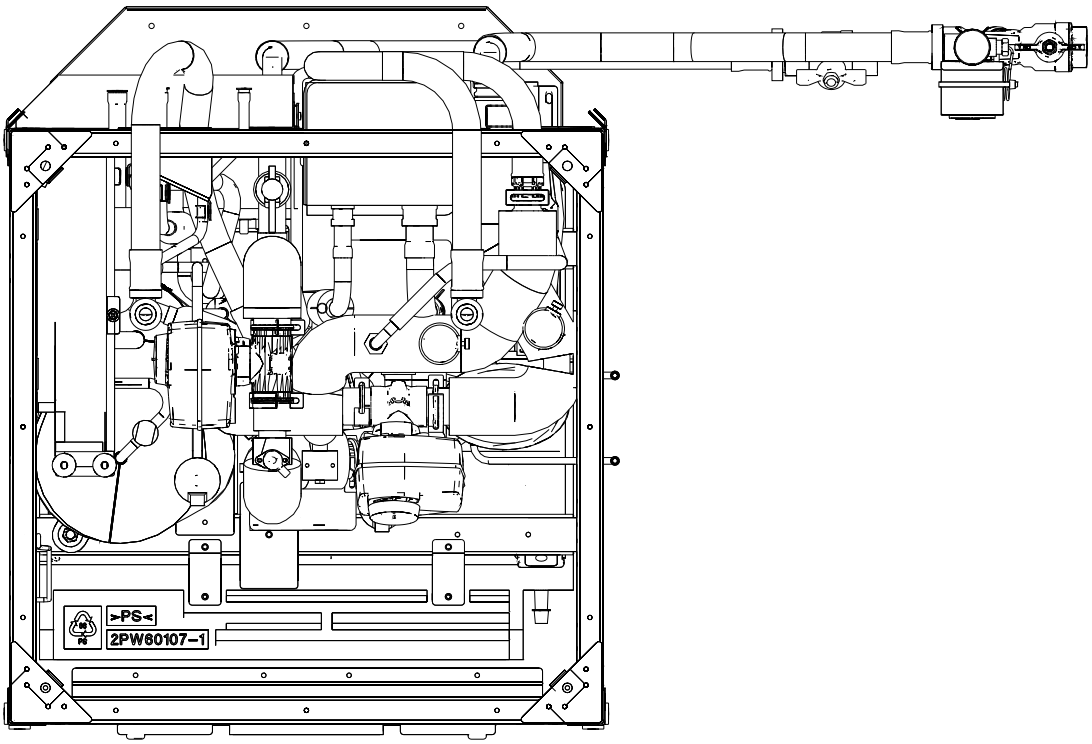
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2.4 Indoor Unit - EKHVMYD50/80AA/ABV1

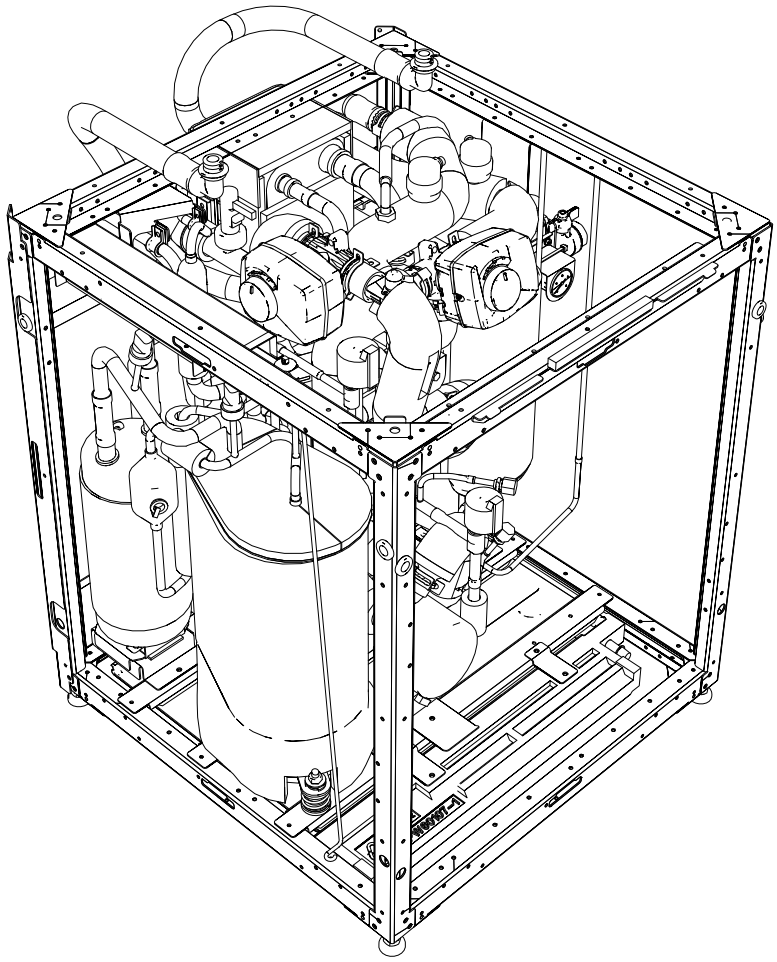
Front view



Top view



Bird’s-eye view



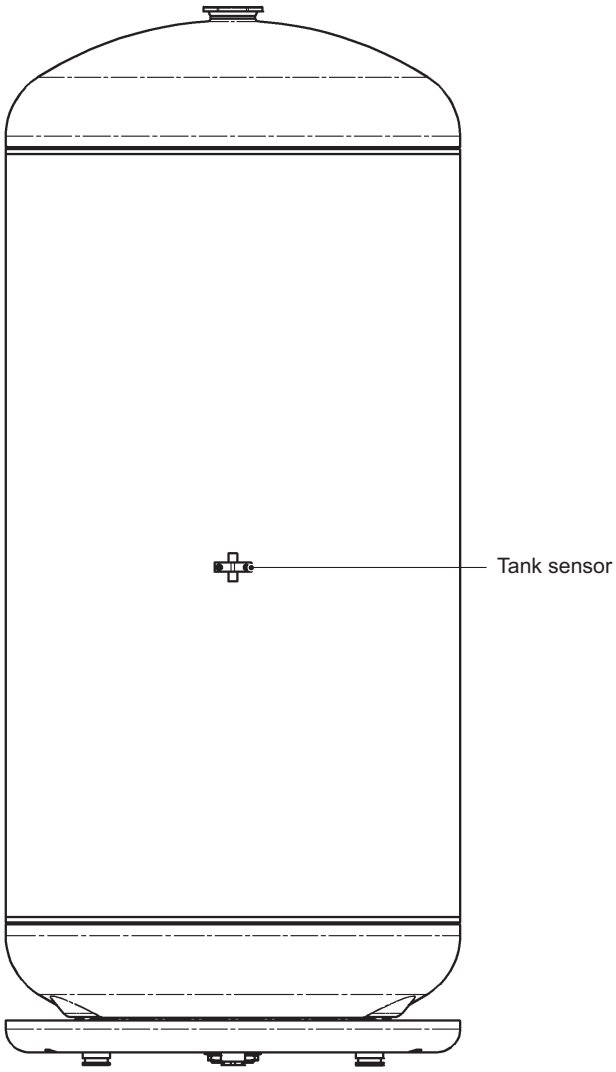
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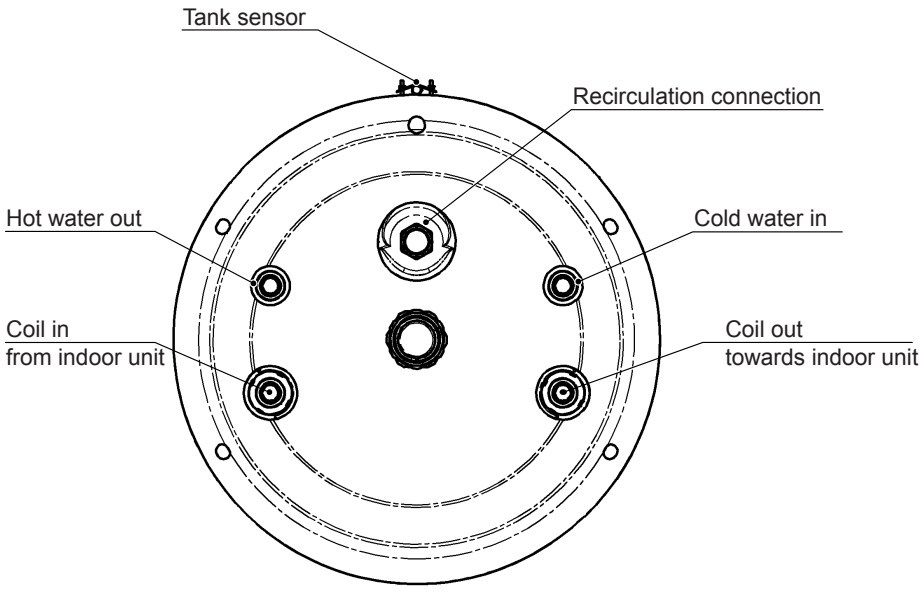
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2.5 EKHTS 200/260 AB/AC

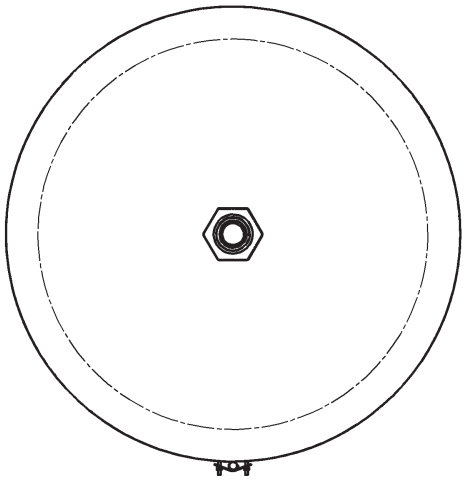
Front view



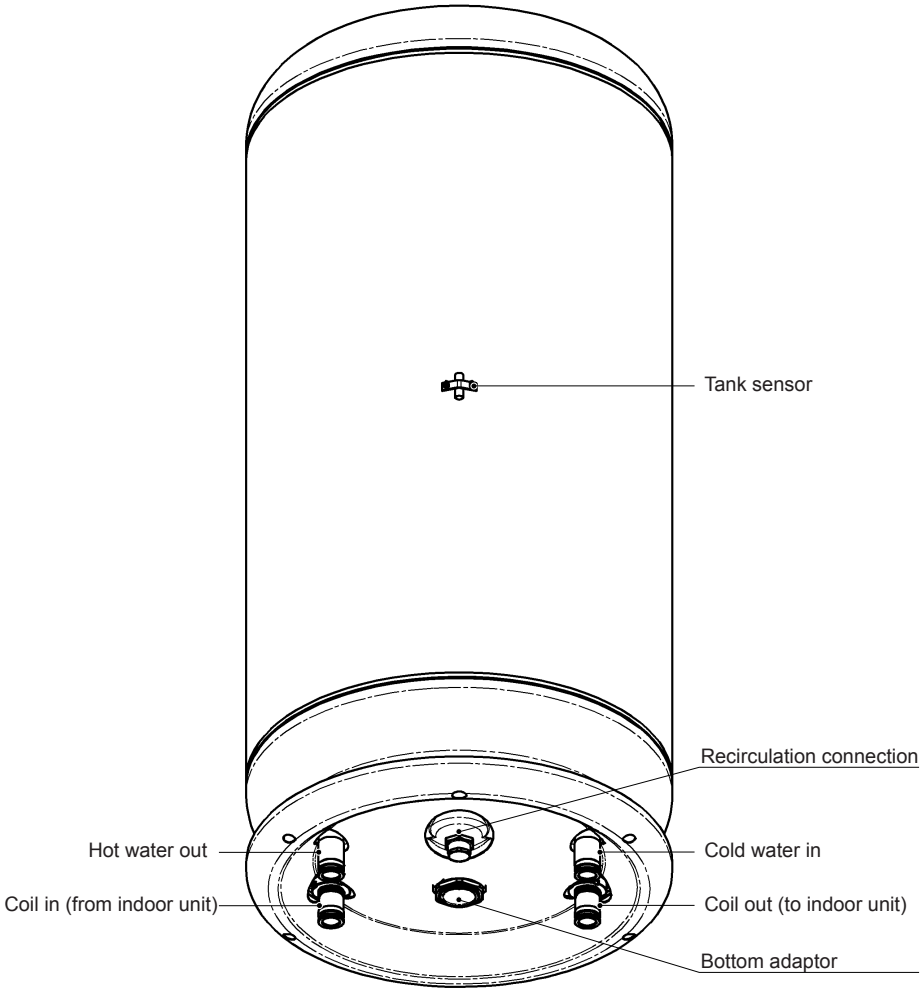
Bottom view



Top view

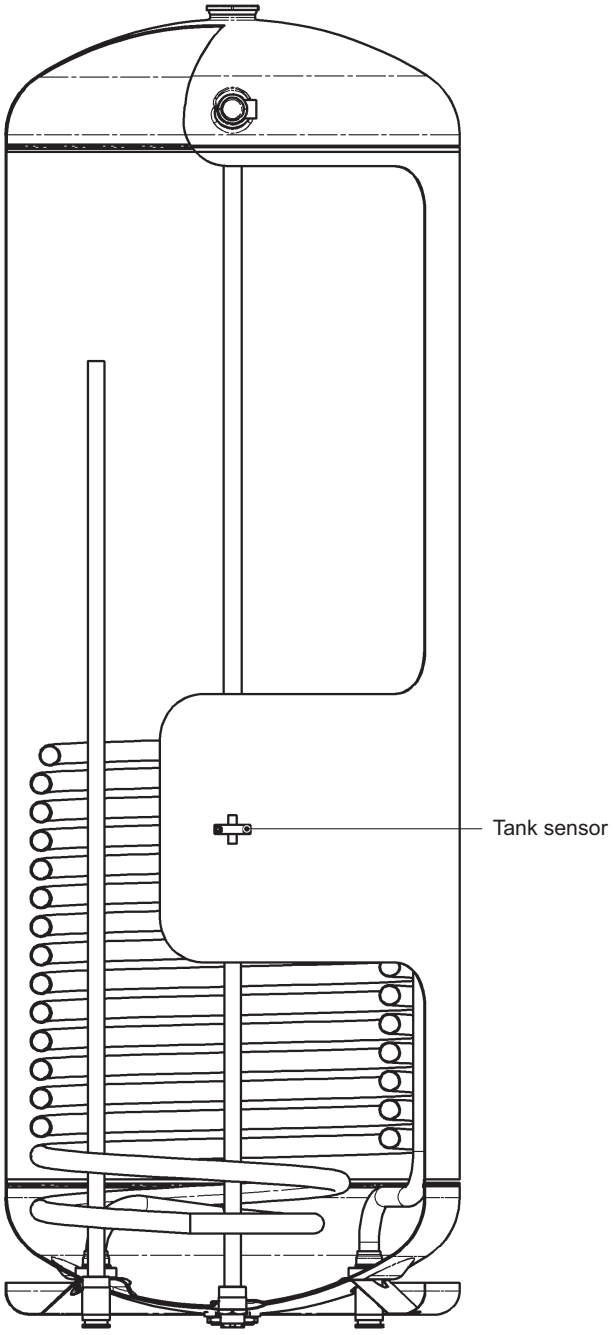


Worm's-eye view

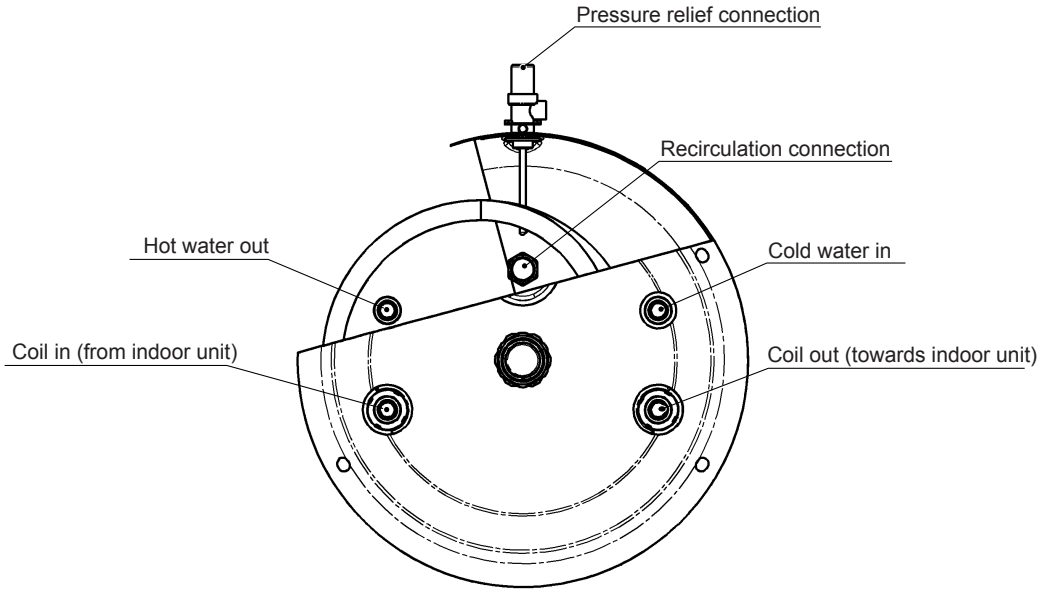


2.6 EKHTSU 200/260 AB/AC

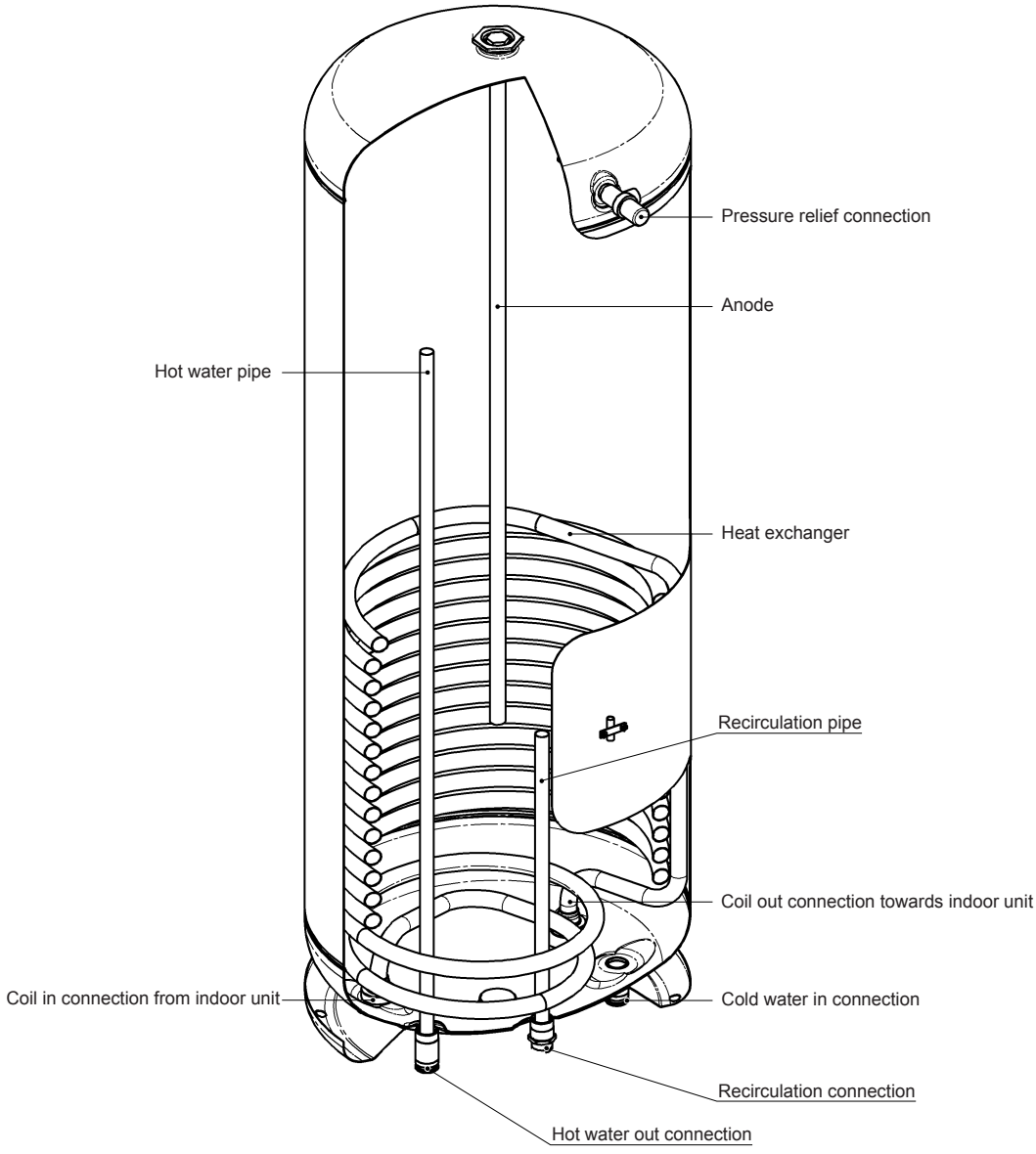
Front view



Bottom view

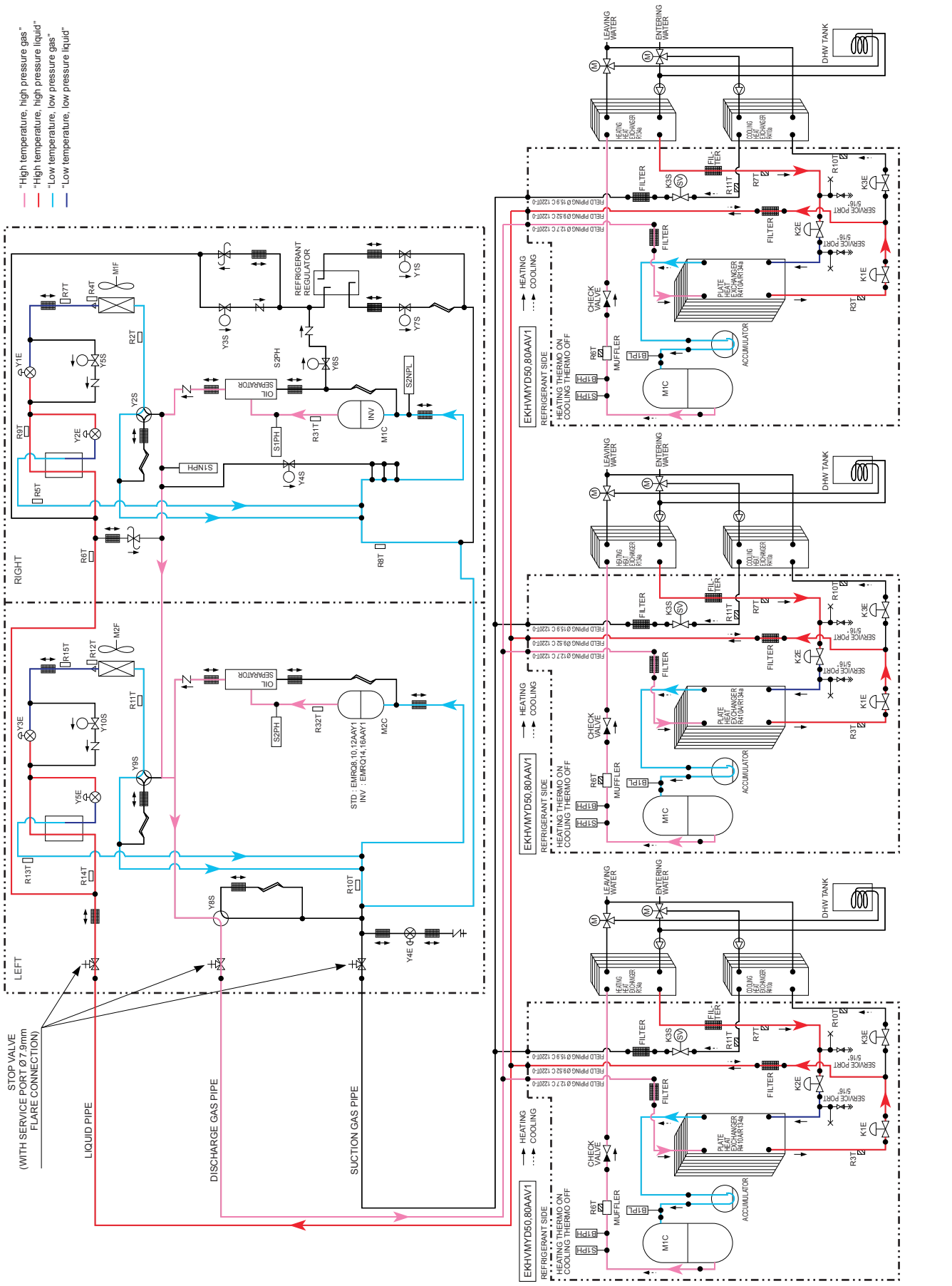


Bird's-eye view

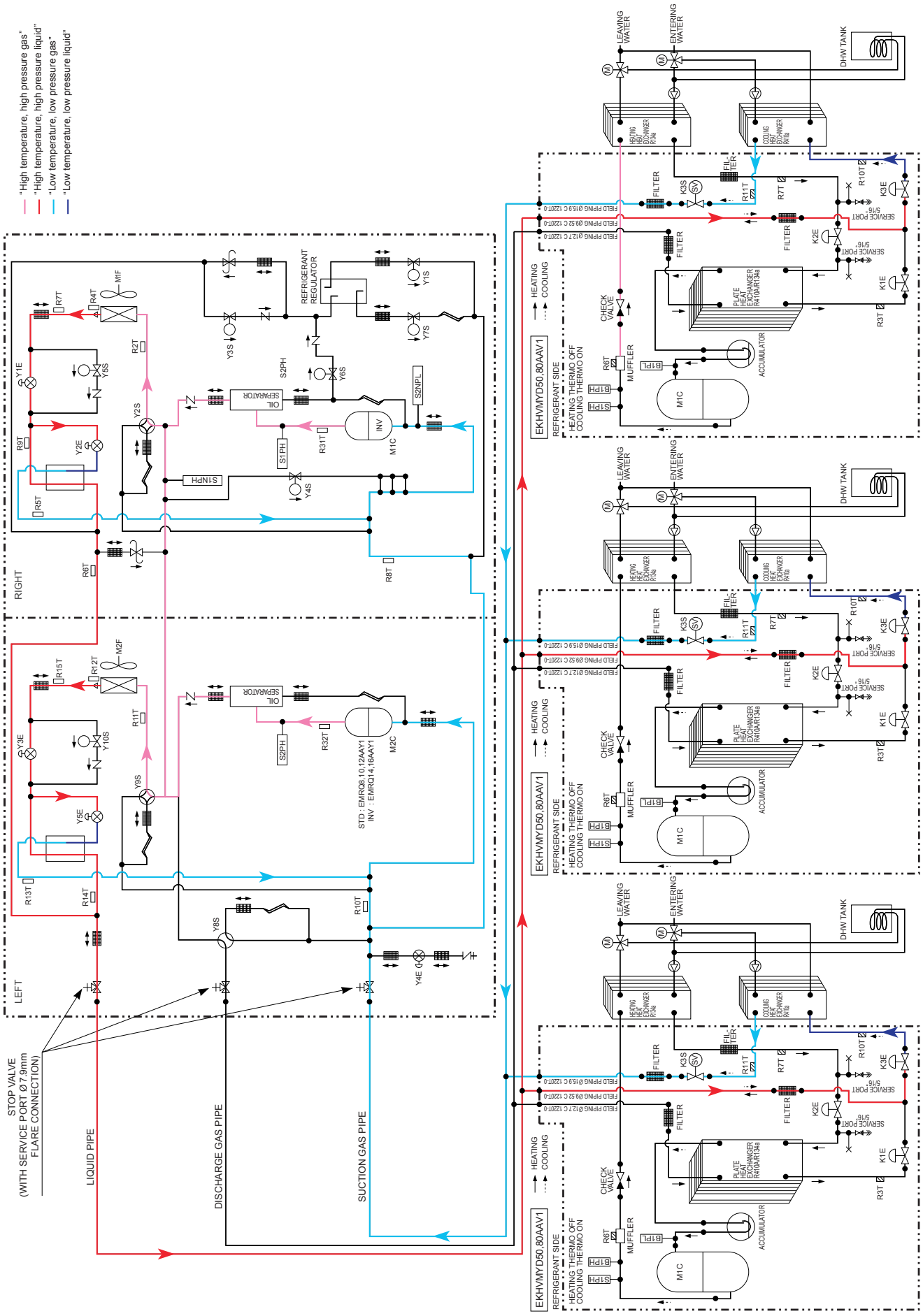


3. Refrigerant Flow for Each Operation Mode

3.1 EMRQ - EKHVMYD Heating Operation



3.2 EMRQ - EKHVMYD Cooling Operation

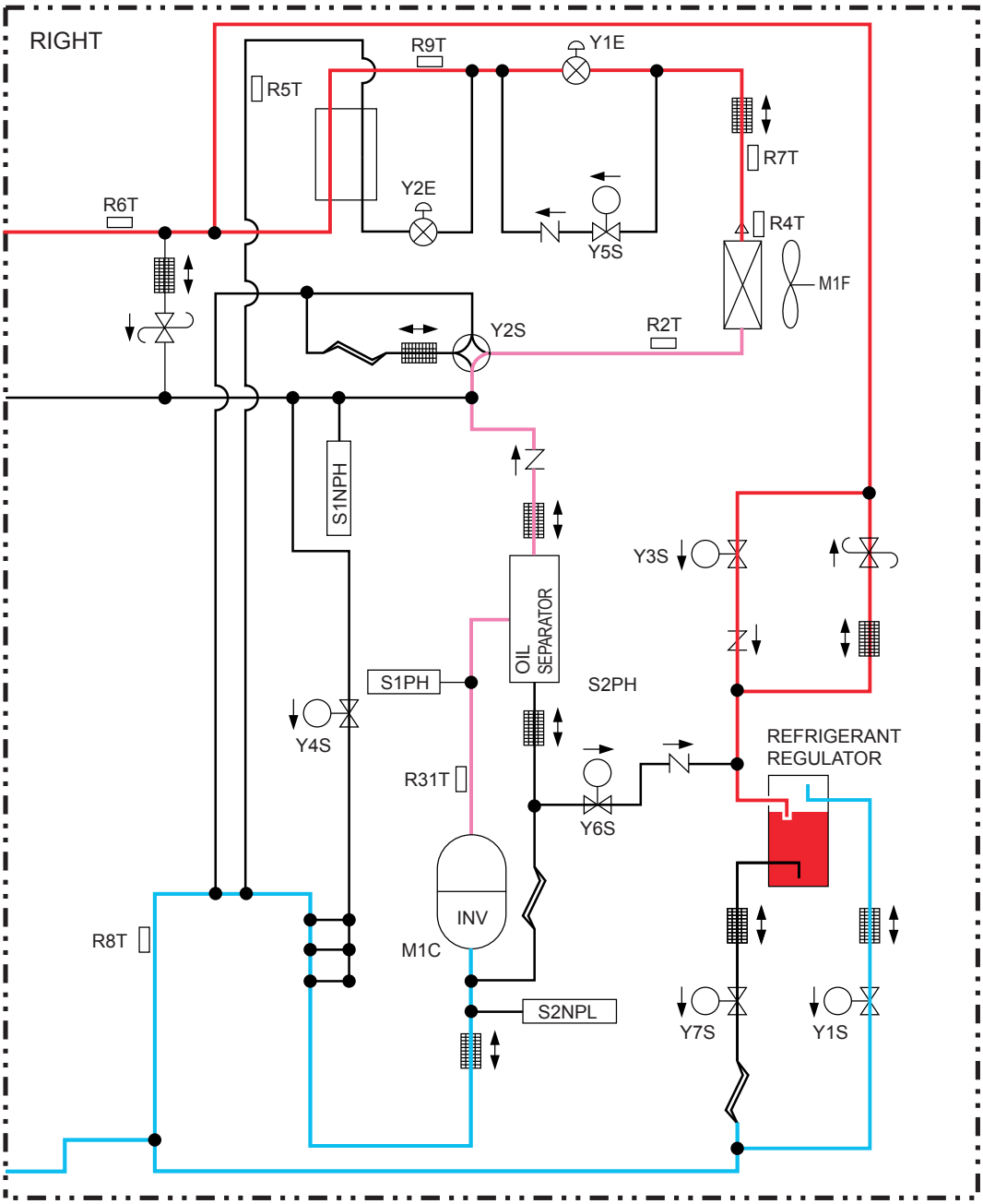


3.3 xxx - other flows

3.4 Operation of Refrigerant Regulator

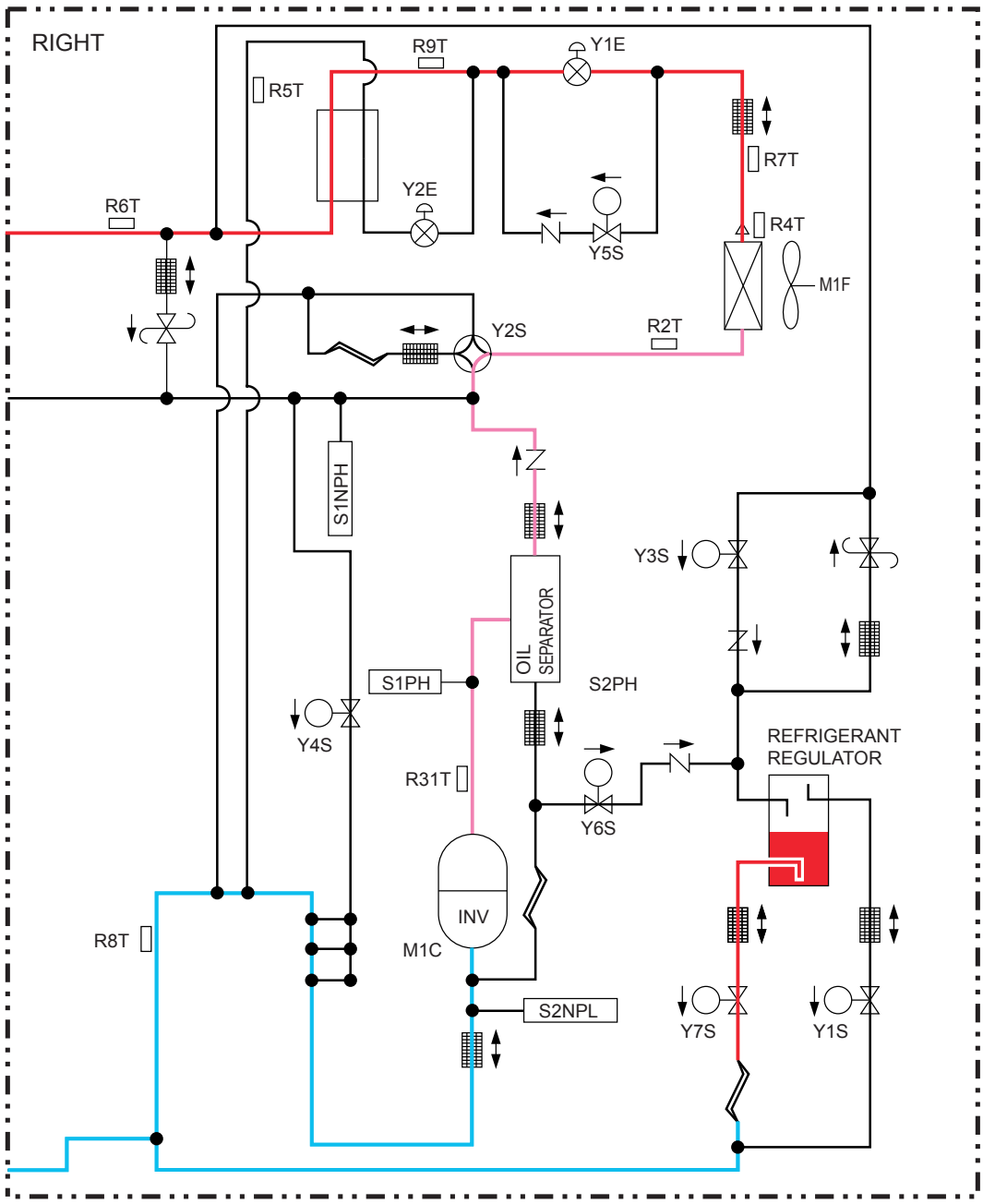
Recovery of Refrigerant

Surplus refrigerant is recovered to refrigerant regulator by opening of SVL and SVG when the indoor unit load is small.



Discharge of refrigerant

Discharge refrigerant from refrigerant regulator by opening of SVO when the load of the outdoor unit is large.



Pressure regulating valve (refrigerant regulator)

The circuit will be closed when SVL, SVO and SVG are all closed. In this case, the increased pressure in the refrigerant regulator will be transferred to the liquid refrigerant pipe side, to regulate the pressure.

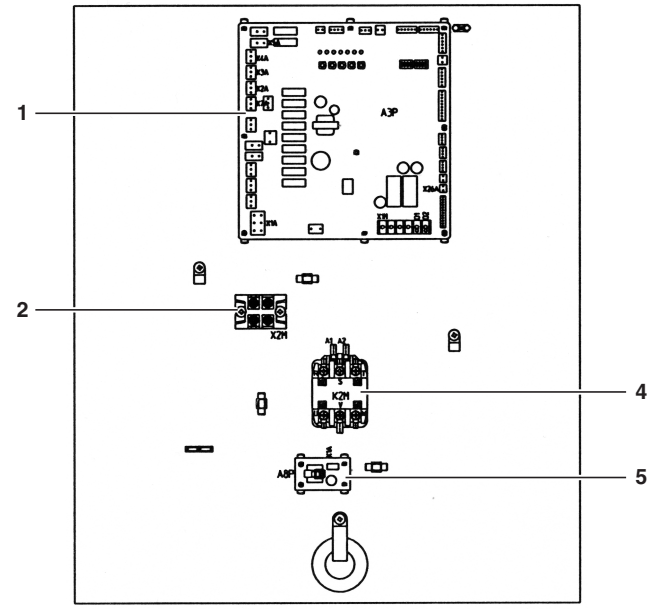
Part 3 - Electrical Circuit

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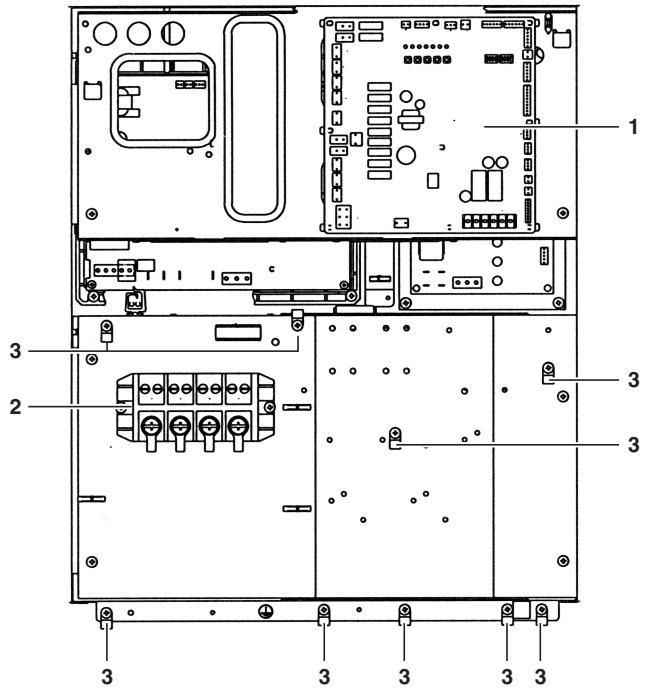
1. Switch Box Layout - Outdoor Unit EMRQ

1.1 Electrical component box (left switch box)

For EMRQ8~12 only



For EMRQ14+16 only

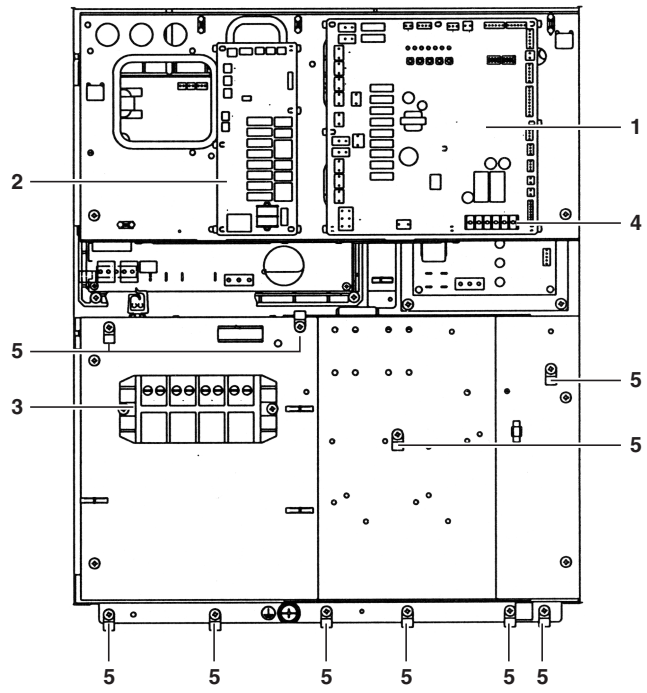


Legend

No.	Name
1	Sub 2 PCB
2	Terminal block X2M
3	Cable tie mountings. The cable tie mountings allow to fix the field wiring with cable ties to the switch box to ensure strain relief.
4	Magnetic contactor K2M
5	Current sensor PCB

1.2 Electrical component box (right switch box)

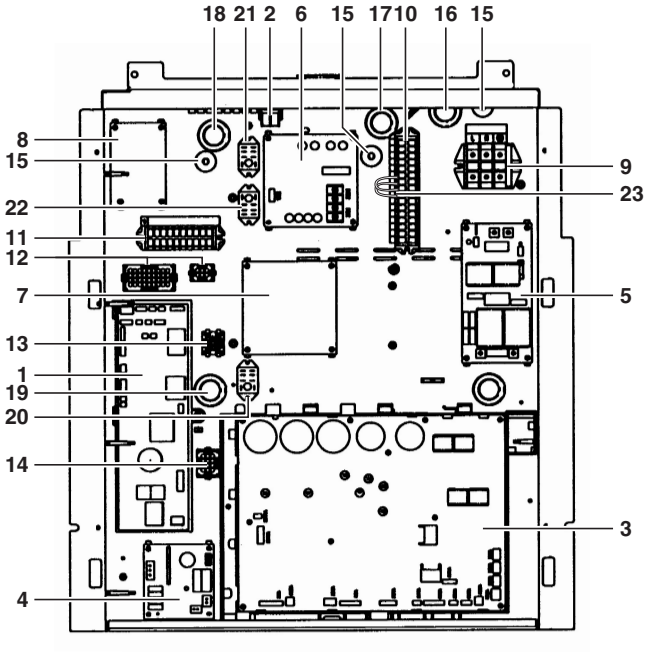
For all models



Legend

No.	Name
1	Main PCB
2	Sub 1 PCB
3	Terminal block X1M Main terminal block which allows easy connection of field wiring for power supply.
4	X1M on main PCB. Terminal block for transmission wiring.
5	Cable tie mountings. The cable tie mountings allow to fix the field wiring with cable ties to the switch box to ensure strain relief.

2. Switch Box Layout - Indoor Unit EKHVM(R\Y)DAAV1



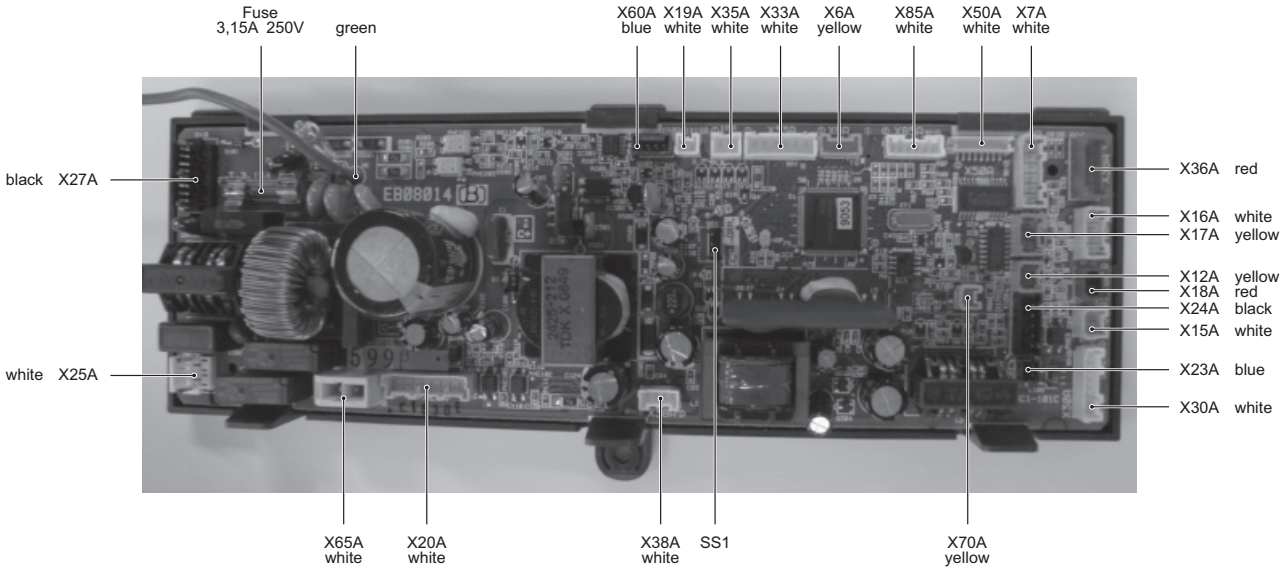
Legend

No.	Name
1	Main PCB - A1P
2	Control PCB - A3P
3	Inverter PCB - A4P
4	QA PCB - A5P
5	Filter PCB - A6P
6	Multi tenant PCB - A9P
7	Digital I/O PCB (optional) - A7P
8	Demand PCB (optional) - A8P
9	Terminal block X1M Main terminal block which allows easy connection of field wiring for power supply.
10	Terminal block X2M Field wiring terminal block for high voltage connections.
11	Terminal block X3M Field wiring terminal block for low voltage connections.
12	DC connector X1Y/X4Y
13	AC connector X3Y
14	Pump connector X2Y
15	Cable tie mountings The cable tie mountings allow to fix the field wiring with cable ties to the switch box to ensure strain relief.
16	Power wiring entry
17	High voltage field wiring entry
18	Low voltage field wiring entry
19	Compressor cable entry
20	Interface relay K1A
21	Interface relay K2A
22	Interface relay K3A
23	Wiring bridges

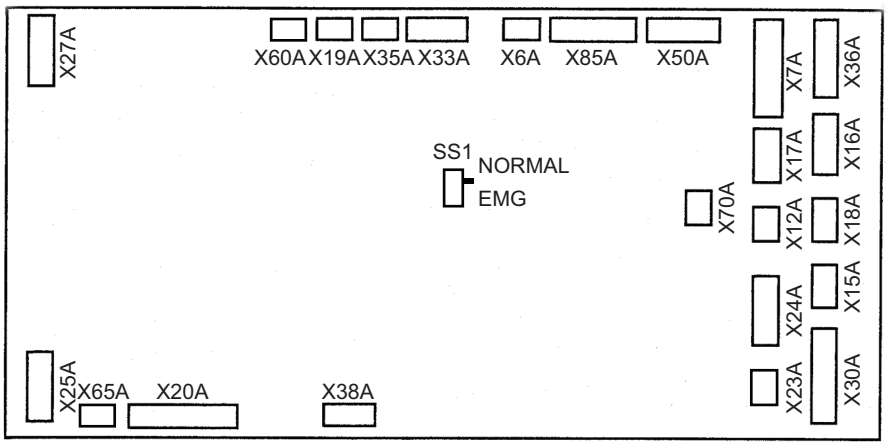
3. PCB Layout

3.1 Main PCB - A1P

Main PCB - single phase



Main PCB - A1P



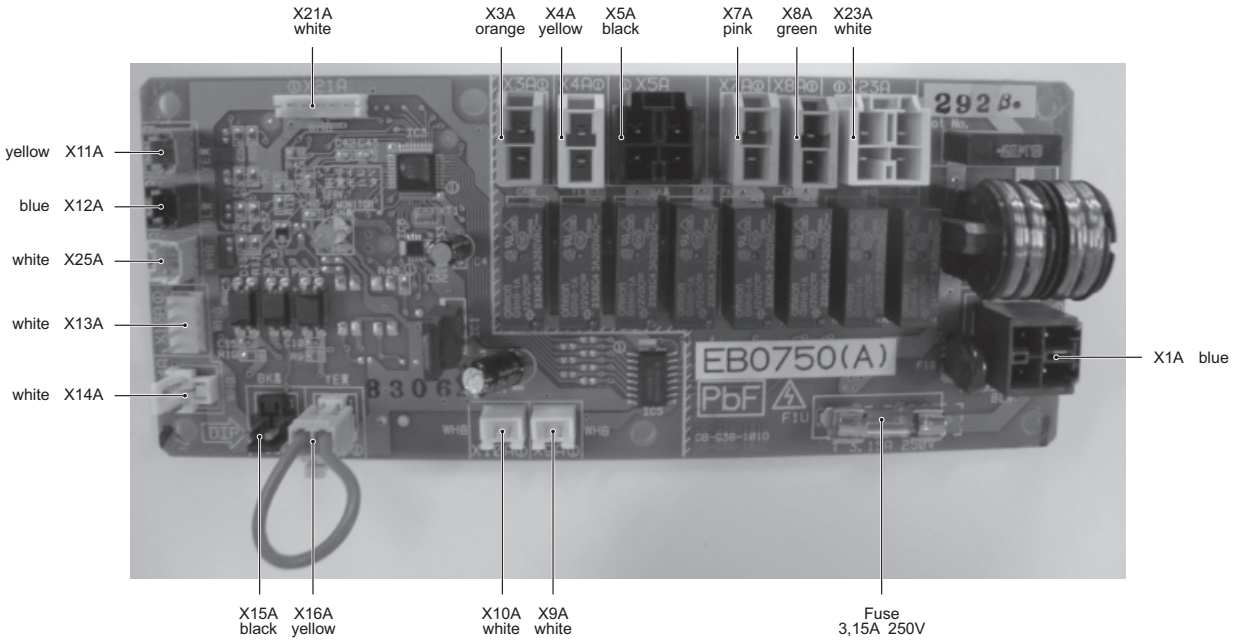
Legend

Connector	Color	Connected to - function
SS1		Emergency switch
X6A	Yellow	-
X7A	White	K1E: electronic expansion valve
X12A	Yellow	R4T: returning water thermistor
X15A	White	X3M: thermostat cooling input
X16A	White	-
X17A	Yellow	R5T: leaving water thermistor
X18A	Red	R3T: liquid thermistor R-410A
X19A	White	X1Y-35&36: S1L: flow switch
X20A	White	M1P: DC inverter pump (heating)
X23A	Blue	-
X24A	Black	-
X25A	White	X2M-17&18: cooling mode ON/OFF output
X27A	Black	X803A of PCB A5P
X30A	White	X3M / K3A
X33A	White	X2A of PCB A7P*
X35A	White	X10A of PCB A3P
X36A	Red	-
X38A	White	X1A of PCB A9P
X50A	White	-
X60A	Blue	-
X65A	White	-
X70A	Yellow	X15A of PCB A3P
X85A	White	X80A of PCB A8P*

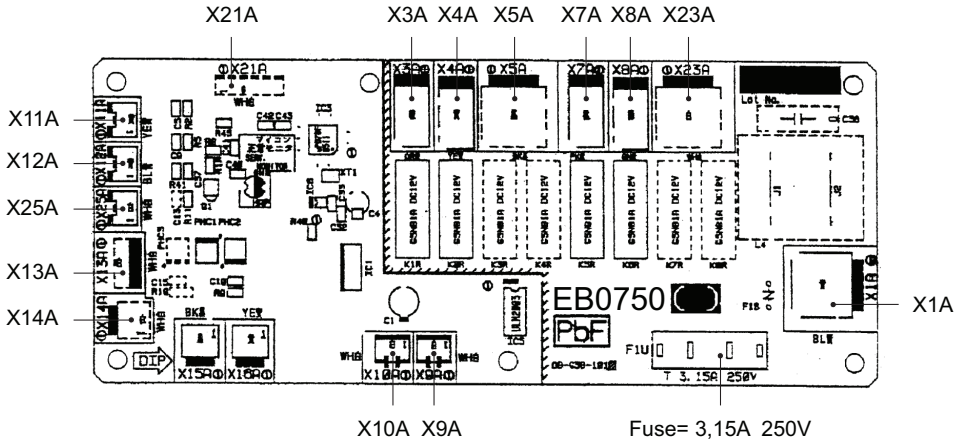
*: A7P, A8P= option PCB; connection not standard

3.2 Control PCB - A3P

Control PCB - single phase



Control PCB - A3P



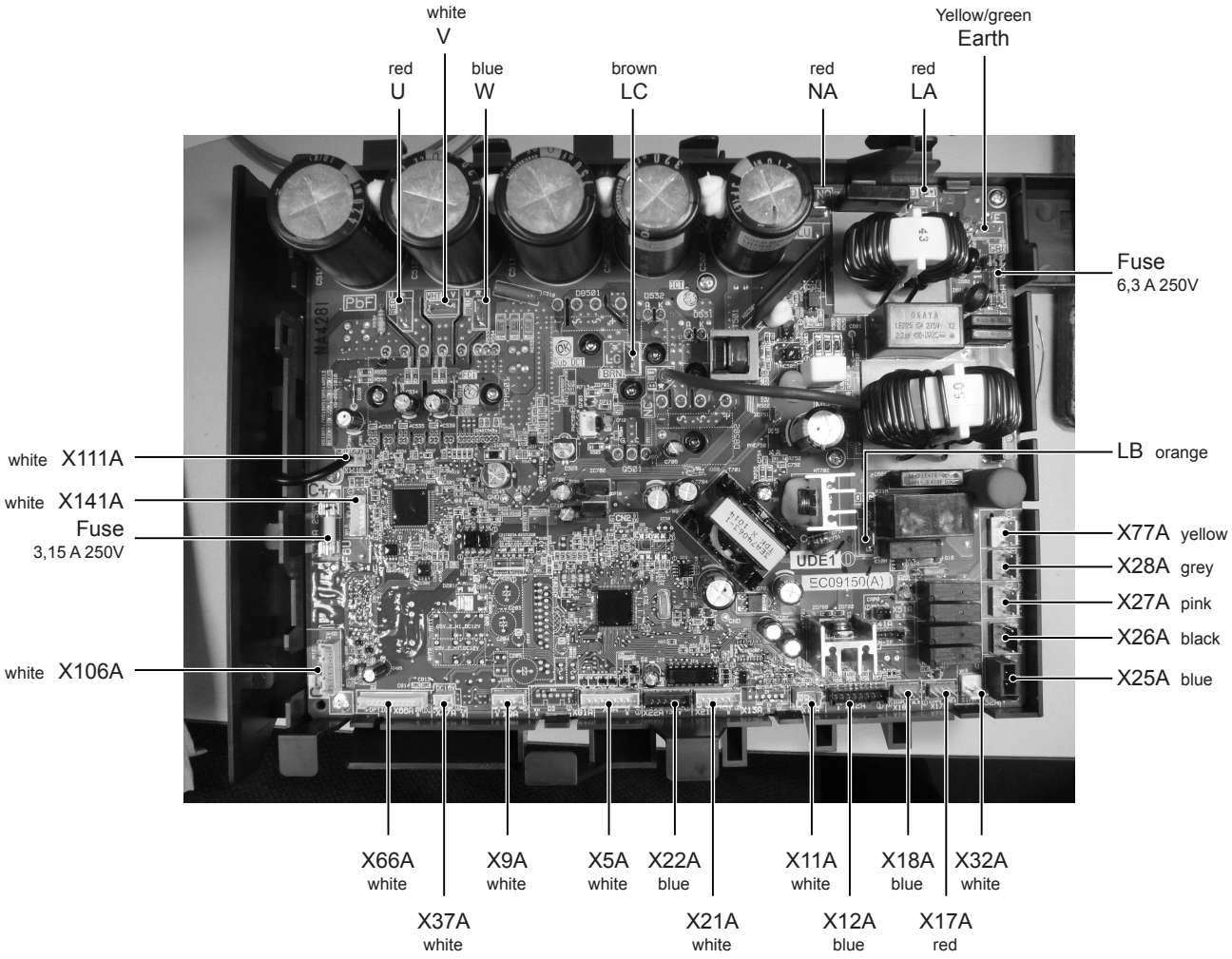
Legend

Connector	Color	Connected to - function
X1A	Blue	X2M [5 - 7] & K2A & K3A
X3A	Orange	-
X4A	Yellow	-
X5A	Black	X2M [3 - 4] / X3Y [1 - 2]
X7A	Pink	-
X8A	Green	Bridge with filter capacitors
X9A	White	-
X10A	White	X35A of PCB A1P -> 16V power supply
X11A	Yellow	R2T*1
X12A	Blue	-
X13A	White	-
X14A	White	X3M [7 - 8]*2
X15A	Black	X15A of PCB A1P
X16A	Yellow	Bridge
X21A	White	-
X23A	White	X2M [14 - 15 -16]*3
X25A	White	X1Y [23 - 24] -> R9T

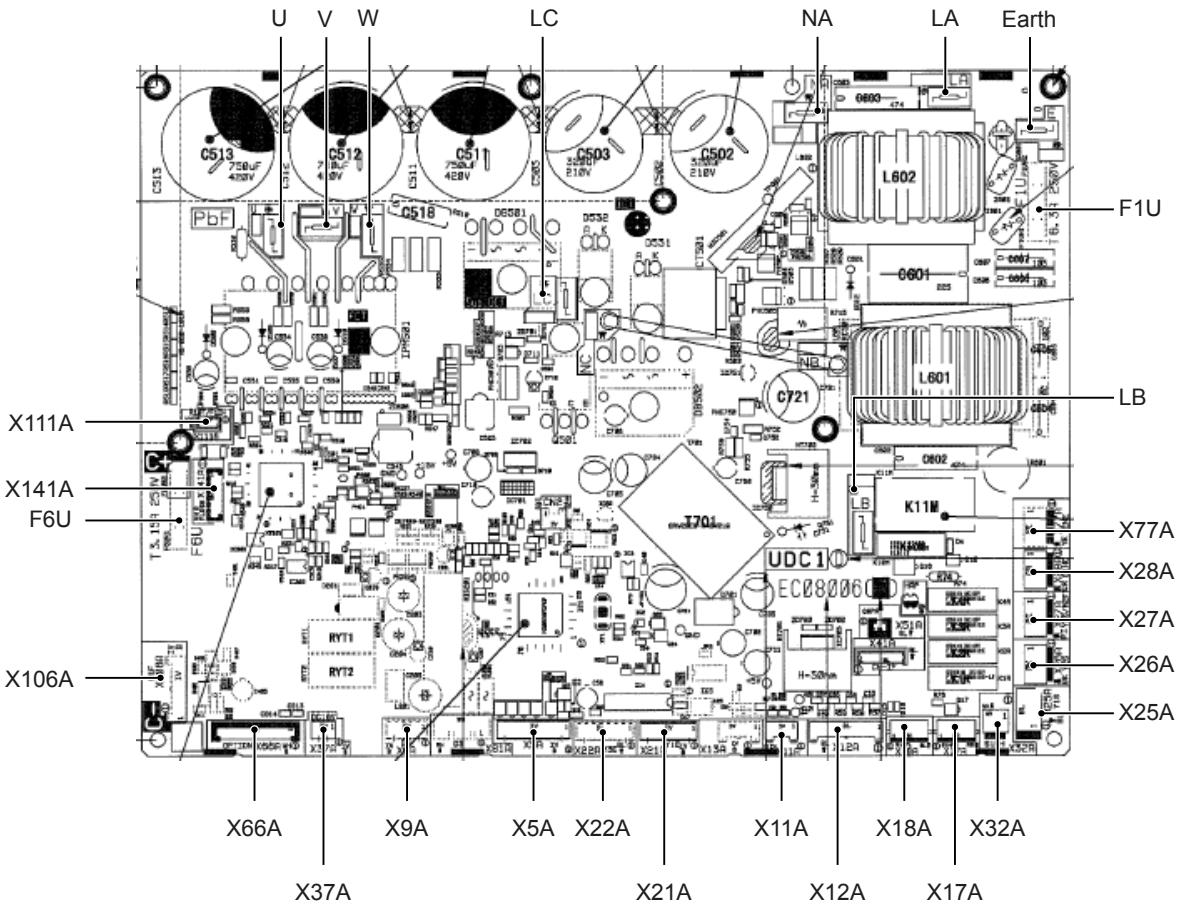
*1: Only for EKHTS
*2: Only for benefit kWh rate power supply installation
*3: Not mentioned on wiring diagram

3.3 Inverter PCB - A4P

Inverter PCB - single phase



Inverter PCB A4P



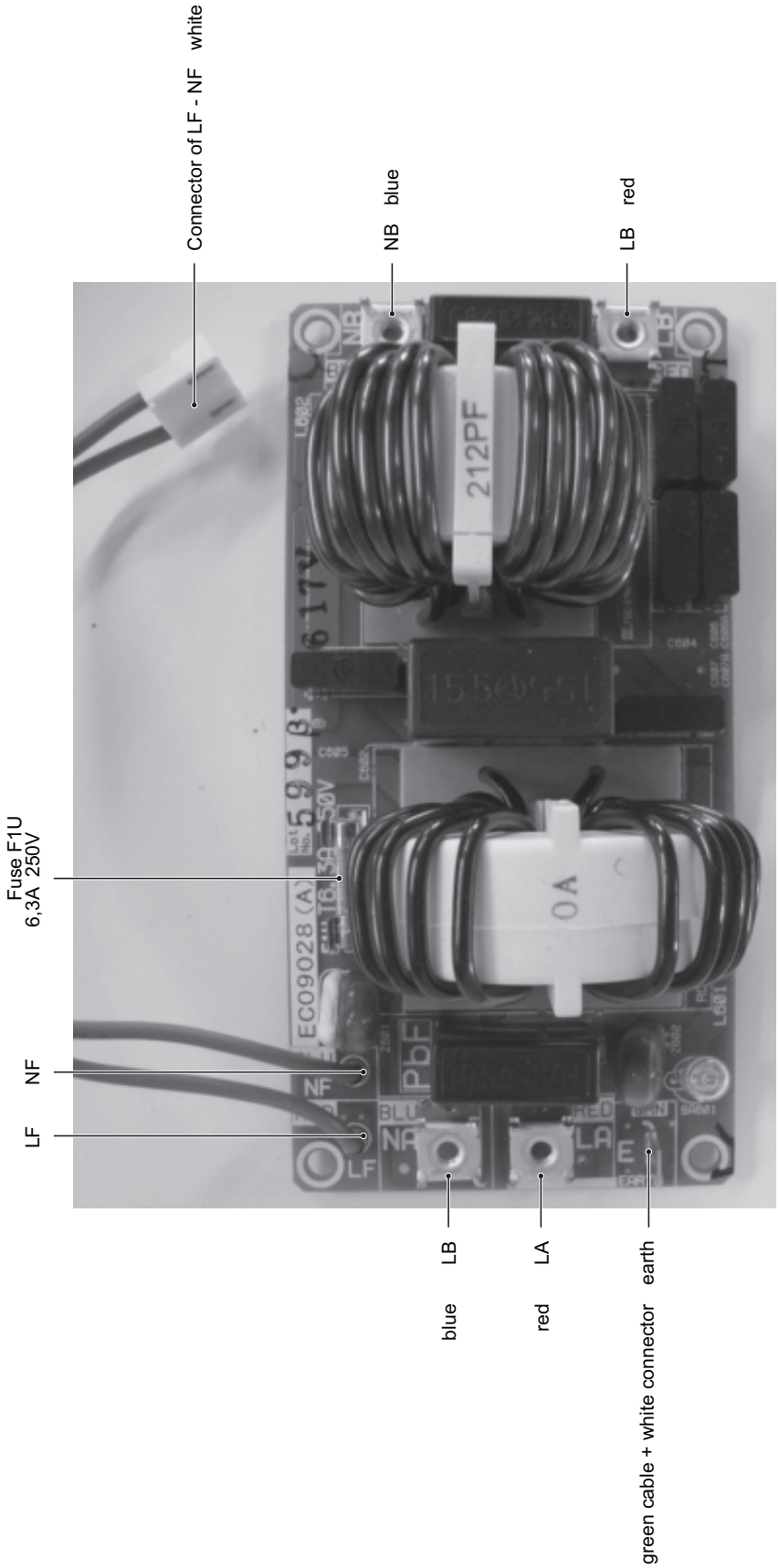
Legend

Connector	Color	Connected to - function
X5A	White	-
X9A	White	X809A of PCB A5P -> communication
X11A	White	-
X12A	Blue	X1Y -> R6T, R7T, R10T, R11T
X17A	Red	X1Y -> B1PH
X18A	Blue	X1Y -> B1PL
X21A	White	X1Y [25 - 30] -> K2E
X22A	Blue	X4Y [1 - 6] -> K3E
X25A	Blue	-
X26A	Black	K3S -> 2-way valve
X27A	Pink	M1F -> sub cooling fan
X28A	Grey	-
X32A	White	K1A -> relay of S1PH & Q2L
X37A	White	-
X66A	White	-
X77A	Yellow	K1A & X3Y
X106A	White	X2Y -> M28
X111A	White	R8T -> fin thermistors
X141A	White	-
Earth	Yellow/ Green	Casing (earth)

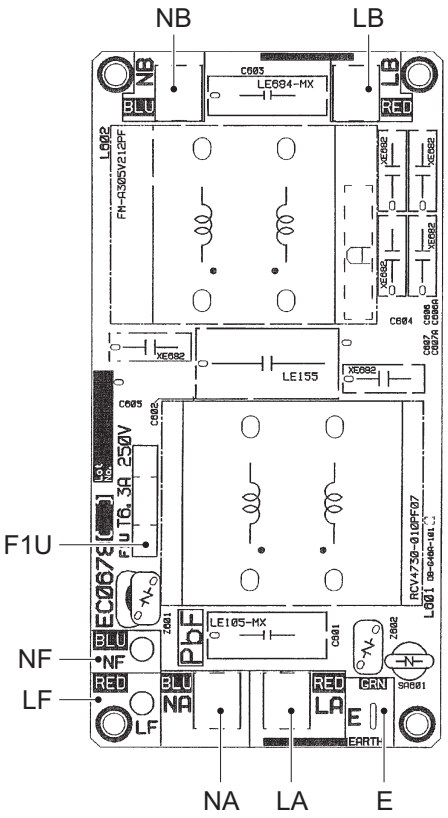
Fuse 1	-	6,30 A, 250V
Fuse 2	-	3,15 A, 250V
LA	Red	LB of A6P
LB	Orange	R1L -> reactor
LC	Brown	
NA	Blue	NB of A6P
U	Red	
V	White	M1C -> compressor
W	Blue	

3.4 Filter PCB - A6P

Filter PCB - single phase



Filter PCB - A6P

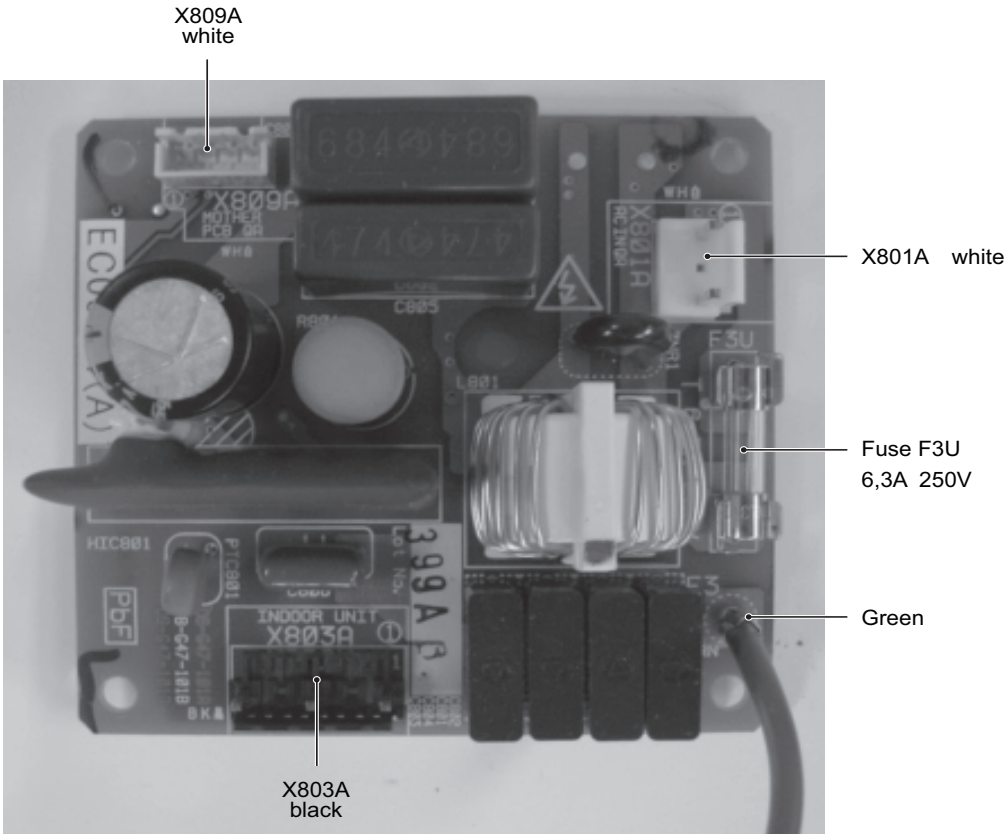


Legend

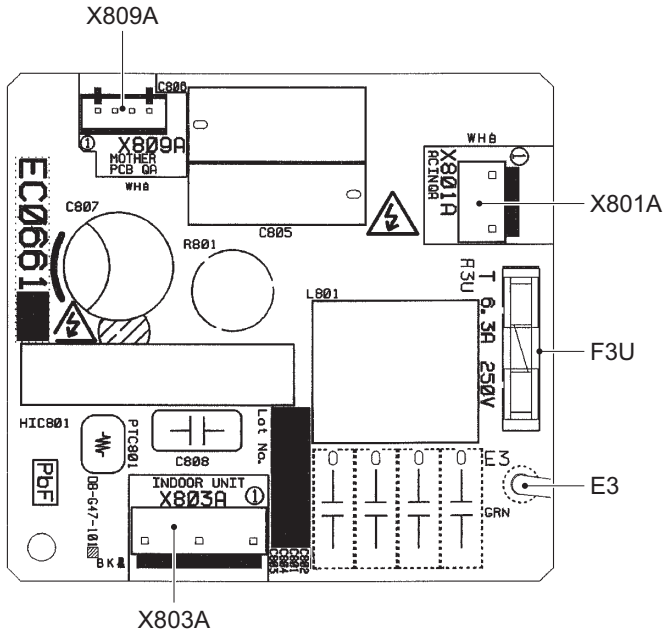
Connector	Color	Connected to - function
LA	Red	X1M [L - N] Power supply 1~230V
NA	Blue	
LB	Red	LC - NC Inverter PCB
NB	Blue	
LF	Red	X2M [10 - 11] via V5C
NF	Blue	
E	Green cable, white connector	Earth
F1U	-	6,3A 250V [fuse]

3.5 QA PCB - A5P

QA PCB - single phase



QA PCB - A5P

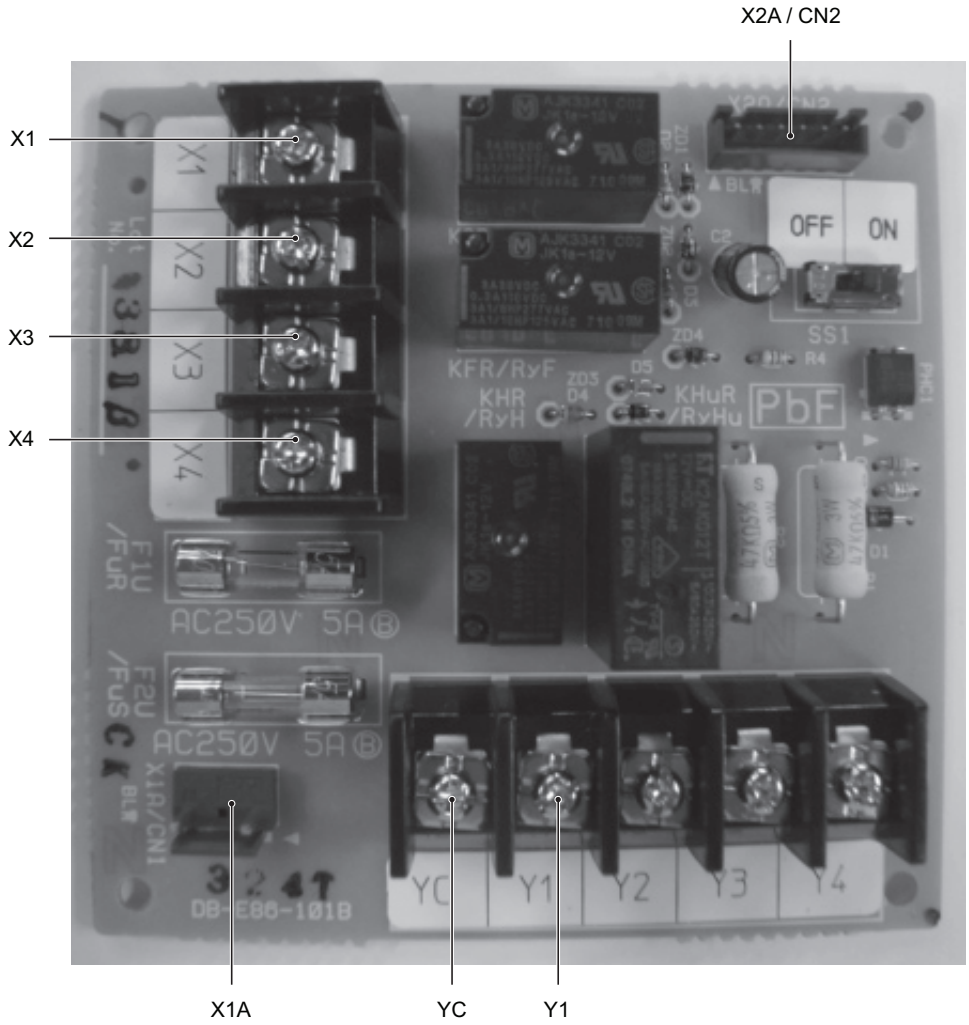


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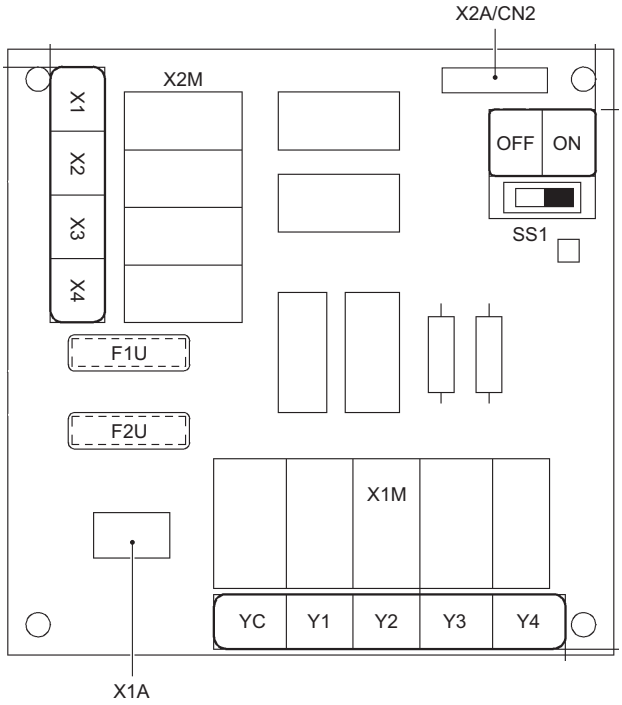
Connector	Color	Connected to - function
X801A	White	X2M [8 - 9] by V5C
X803A	Black	X27A of main PCB A1P
X809A	White	X9A of inverter PCB A4P
F3U	-	Fuse 6,3A / 250V
E3	Green	Earth

3.6 Digital I/O PCB (Option PCB A7P)

Digital I/O PCB (option PCB A7P)



Digital I/O PCB (option PCB A7P)

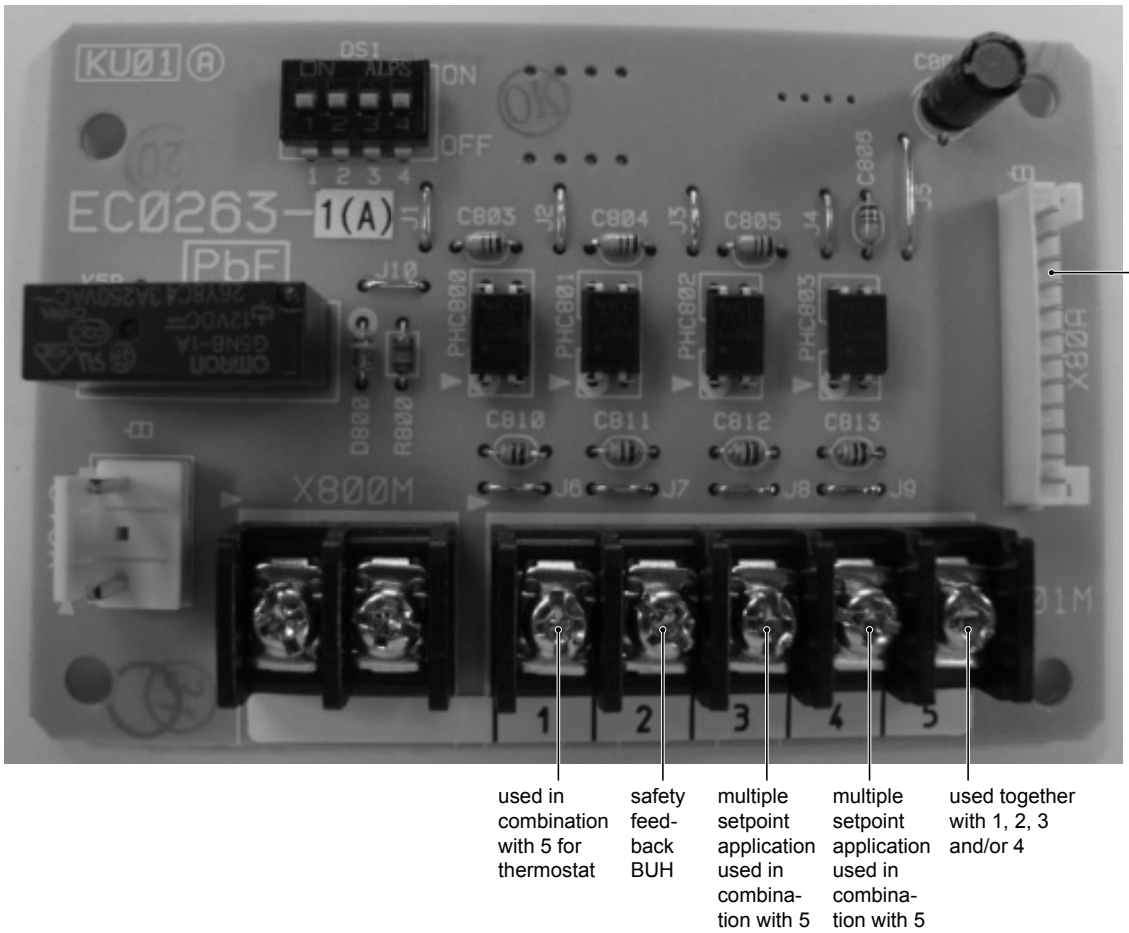


Legend

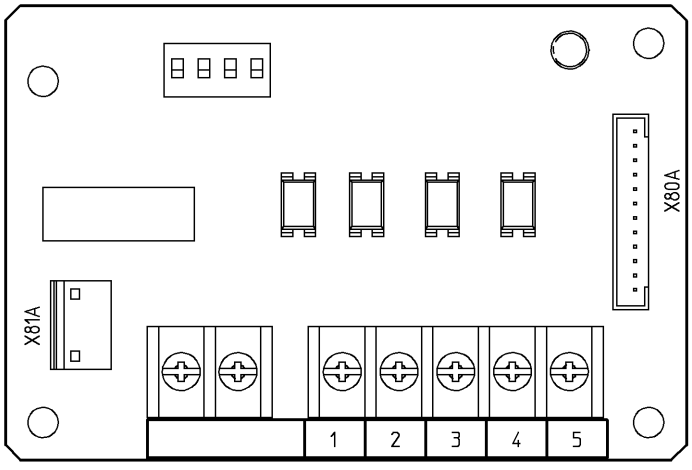
Connector	Color	Connected to - function
X1A	White	X2M [6 - 7]
X2A	White	X33A of main PCB (A1P)
X1	-	Cooling/heating ON/OFF output (optional power supply)
X2	-	
X3	-	Alarm output (optional power supply)
X4	-	
Y1 - YC	-	Domestic hot water mode ON/OFF output
Y3 - YC	-	Solar priority

3.7 Demand PCB (Option PCB A8P)

Demand PCB (option PCB A8P)



Demand PCB (option PCB A8P)

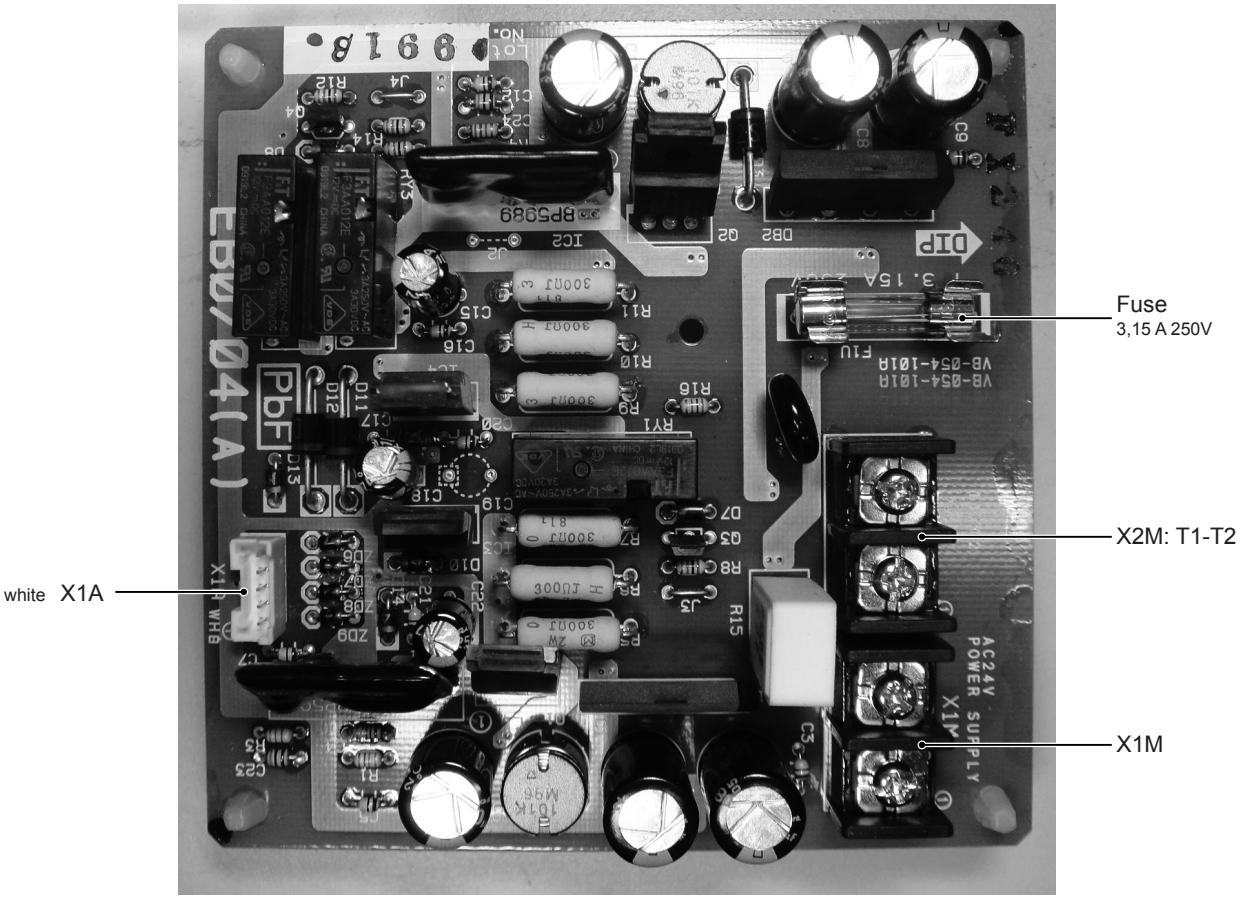


Legend

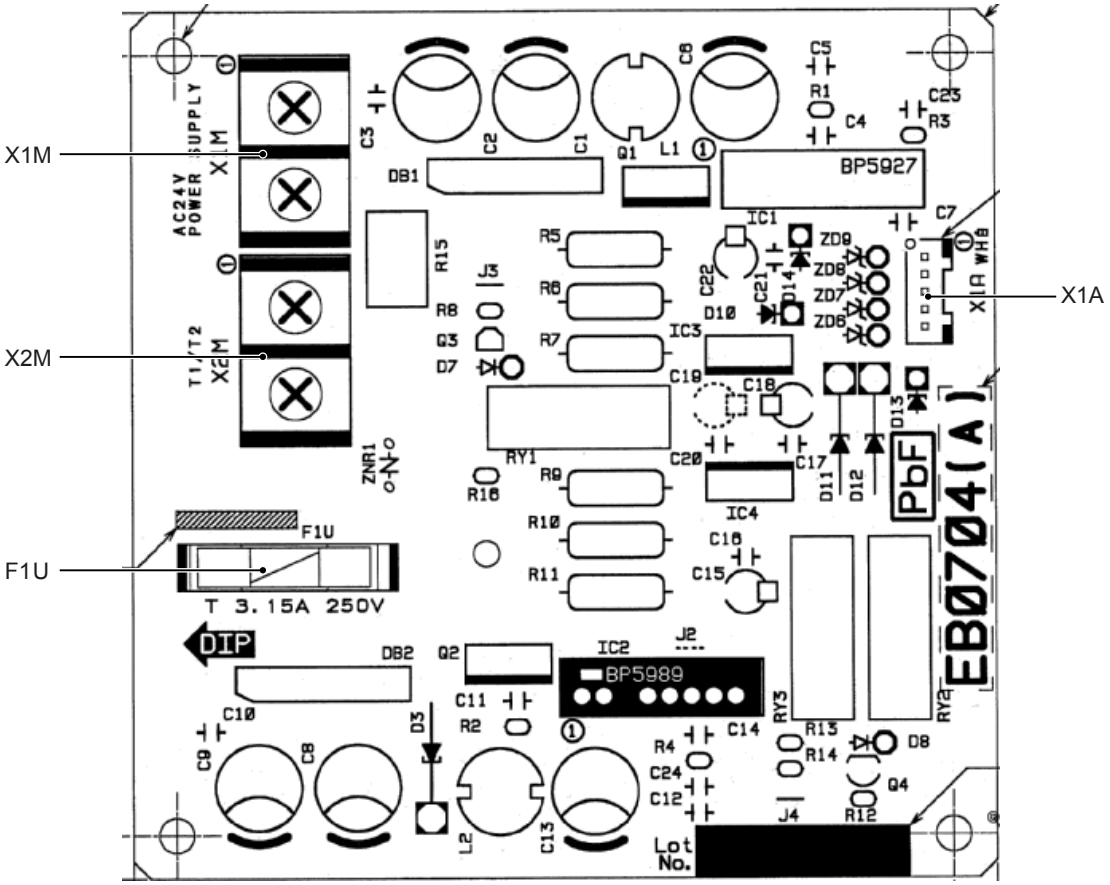
Connector	Color	Connected to - function
X80A	White	X85A of main PCB A1P
1 - 5	-	2 core cable for EKRTW on X1M [H - COM] of PCB A10P
1 - 5	-	2 core cable for EKRTR on X1M [H - COM] of PCB A11P + X2M [6 - 7] to X2M [L - N] of A11P + X1M [1 - 3] of A10P to R2T
2 - 5	-	2 core cable for BUH
3 - 5	-	2 core cable for multiple setpoint application 1
4 - 5	-	2 core cable for multiple setpoint application 2

3.8 Multi tenant PCB (A9P)

Multi tenant PCB - single phase



Multi tenant PCB A9P



Legend

Connector	Color	Connected to - function
X1A	White	X38A of A1P -> Multi tenant power supply
X1M		X2M [19 - 20] -> 24 V AC ±20%
X2M: T1-T2		bridged
Fuse		3,15 A, 250V

Part 4 - Function

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DRAFT - NOT APPROVED -

1. Function General

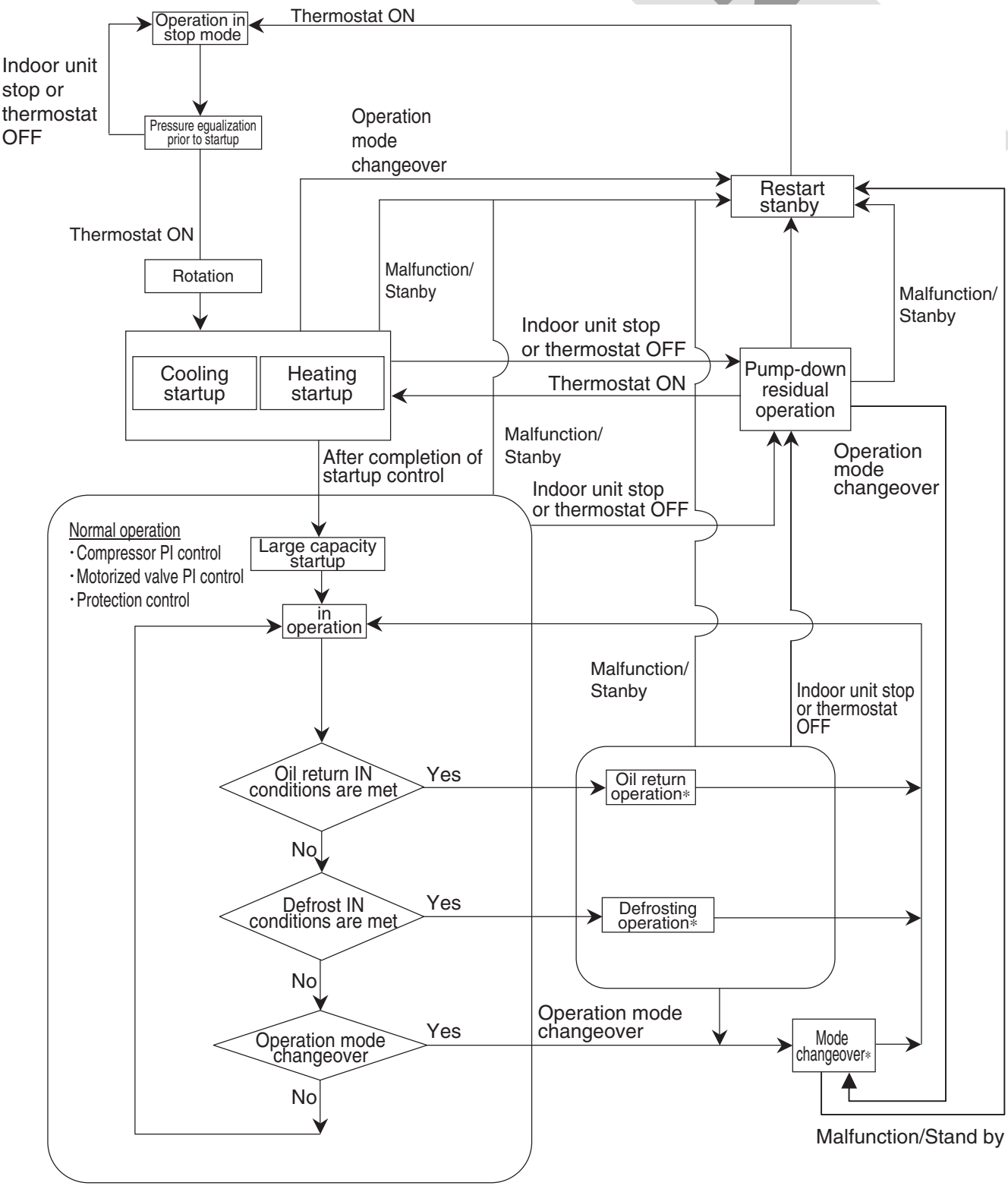
1.1 Symbol

Symbol	Electric symbol EMRQ8~16P	Description or function
20SA	Y2S (Heat exchanger1)	Four way valve (Heat exchanger switch)
	Y9S (Heat exchanger2)	
20SB	Y8S	Four way valve (High/low pressure gas pipe switch)
DSH	–	Discharge pipe superheated degree
DSHi	–	Discharge pipe superheat of inverter compressor
DSHs	–	Discharge pipe superheat of standard compressor
EV	–	Opening of electronic expansion valve
EVM	Y1E (Main1)	Electronic expansion valve for main heat exchanger
	Y3E (Main2)	
EVT	Y2E (Subcooling1)	Electronic expansion valve for sub-cooling heat exchanger
	Y5E (Subcooling2)	
EVJ	Y4E	Electronic expansion valve at the refrigerant charge port
HTDi	–	Value of INV compressor discharge pipe temperature compensated with outdoor air temperature
HTDs	–	Value of STD compressor discharge pipe temperature compensated with outdoor air temperature
Pc	S1NPH	Value detected by high pressure sensor
Pe	S2NPL	Value detected by low pressure sensor
SH	–	Evaporator outlet superheat
SHS	–	Target evaporator outlet superheat
SVE	Y5S (Bypass1)	Main bypass solenoid valve
	Y10S (Bypass2)	
SVP	Y4S	Solenoid valve for hot gas
SVL	Y3S	Refrigerant regulator liquid pipe solenoid valve
SVG	Y1S	Refrigerant regulator gas pipe solenoid valve
SVO	Y7S	Refrigerant regulator exhaust pipe solenoid valve
SVT	Y6S	Refrigerant regulator discharge pipe solenoid valve

DRAFT - NOT APPROVED -

Symbol	Electric symbol EMRQ8~16P	Description or function
Ta	R1T (A1P)	Outdoor air temperature
TsA	R8T (Suction pipe1)	Suction pipe temperature
	R10T (Suction pipe2)	
Tb	R4T (Deicer1)	Heat exchanger outlet temperature at cooling
	R12T (Deicer2)	
Tg	R2T (Gas pipe1)	Heat exchanger gas pipe temperature
	R11T (Gas pipe2)	
Tf	R7T (Liquid pipe1)	Temperature of liquid pipe between heat exchanger and main electronic expansion valve
	R15T (Liquid pipe2)	
Tsh	R5T (Gas pipe1)	Temperature detected with the subcooling heat exchanger outlet thermistor
	R13T (Gas pipe2)	
Tl	R6T (Liquid pipe1)	Liquid pipe temperature detected with the liquid pipe thermistor
	R14T (Liquid pipe2)	
Tsc	R9T, R14T	Temperature of liquid pipe between liquid shutoff valve and supercooled heat exchanger
Tc	–	High pressure equivalent saturation temperature
TcS	–	Target temperature of Tc
Te	–	Low pressure equivalent saturation temperature
TeS	–	Target temperature of Te
Tfin	R1T (A4P) (A5P)	Inverter fin temperature
Tp	–	Calculated value of compressor port temperature
Tdi	R31T (R32T)	Discharge pipe temperature of inverter compressor
Tds	R32T	Discharge pipe temperature of standard compressor

1.2 Operation Mode



* "Oil return", "Defrost" and "Mode changeover" move on to the next process after the completion of above function in progress even if the thermostat is OFF during the operation.

DRAFT - NOT APPROVED

2. Basic Control

2.1 Normal Operation

2.1.1 List of Functions in Normal Operation

Part Name	Symbol	(Electric Symbol)	Function of Functional Part		
			Normal Cooling	Normal Heating	Normal Simultaneous Cooling / Heating
Compressor 1	—	M1C	PI control, High pressure protection, Low pressure protection, Td protection, INV protection,	PI control, High pressure protection, Low pressure protection, Td protection, INV protection,	PI control, High pressure protection, Low pressure protection, Td protection, INV protection,
Compressor 2		M2C			
Outdoor unit fan 1	—	M1F	Cooling fan control	Outdoor unit heat exchanger: Condenser / Cooling fan control Outdoor unit heat exchanger: Evaporator / Fan step	Outdoor unit heat exchanger: Condenser / Cooling fan control Outdoor unit heat exchanger: Evaporator / Fan step
Outdoor unit fan 2		M2F			
Electronic expansion valve (Main)	EVM	Y1E	1375 pls	Outdoor unit heat exchanger: Condenser / Liquid pressure control Outdoor unit heat exchanger: Evaporator / PI control	Outdoor unit heat exchanger: Condenser / Liquid pressure control Outdoor unit heat exchanger: Evaporator / PI control
		Y3E			
Electronic expansion valve (Supercooling)	EVT	Y2E	PI control	PI control	PI control
		Y5E			
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls	80 pls	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S	OFF	Outdoor unit heat exchanger: Condenser / OFF Outdoor unit heat exchanger: Evaporator / ON	Outdoor unit heat exchanger: Condenser / OFF Outdoor unit heat exchanger: Evaporator / ON
		Y9S			
Four way valve (High/low pressure gas pipe switch)	20SB	Y8S	ON	OFF	OFF
Solenoid valve (Main bypass)	SVE	Y5S	ON	OFF	OFF
		Y10S			
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	ON for refrigerant recovery	ON for refrigerant recovery	ON for refrigerant recovery
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	ON for refrigerant recovery	ON for refrigerant recovery	ON for refrigerant recovery
Solenoid valve (Refrigerant regulator exhaust pipe)	SVO	Y7S	ON for refrigerant discharge	ON for refrigerant discharge	ON for refrigerant discharge
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	ON for oil level control	ON for oil level control	ON for oil level control

Indoor unit actuator		Normal cooling	Normal heating
Fan	Thermostat ON unit	Remote controller setting	Remote controller setting
	Stopping unit	OFF	OFF
	Thermostat OFF unit	Remote controller setting	LL
Electronic expansion valve	Thermostat ON unit	Normal opening *1	Normal opening *2
	Stopping unit	0 pls	192 pls
	Thermostat OFF unit	0 pls	192 pls

*1. PI control : Evaporator outlet superheated degree (SH) constant.
*2. PI control : Condenser outlet subcooled degree (SC) constant.
*1 and 2 : Refer to “Electronic Expansion Valve PI Control” on page 62.

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BS unit actuatior	Electronic symbol	Normal cooling	Normal heating / Normal simultaneous Cooling / Heating operation
Electronic expansion valve (EVH)	Y4E	760 pls (fully opened)	760 pls (fully opened)
Electronic expansion valve (EVL)	Y5E	760 pls (fully opened)	0 pls
Electronic expansion valve (EVHS)	Y2E	480 pls (fully opened)	480 pls (fully opened)
Electronic expansion valve (EVLS)	Y3E	480 pls (fully opened)	0 pls
Electronic expansion valve (EVSC)	Y1E	0 pls	0 pls (simultaneous Cooling / Heating operation : PI control)

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2.2 Compressor PI Control

Compressor PI Control

Carries out the compressor capacity PI control to maintain Te at constant during cooling operation and Tc at constant during heating operation to ensure stable unit performance.

[Cooling operation]

Controls compressor capacity to adjust Te to achieve target value (TeS).

Te set value (Make this setting while in Setting mode 2.)

Te setting

L	M (Normal) (factory setting)	H				
3	6	7	8	9	10	11

Te : Low pressure equivalent saturation temperature (°C)

TeS : Target Te value (Varies depending on Te setting, operating frequency, etc.)

*On multi-outdoor-unit systems, this control is made according to values of the first-priority unit, which is detected with the pressure sensor.

[Heating operation]

Controls compressor capacity to adjust Tc to achieve target value (TcS).

Te set value (Make this setting while in Setting mode 2.)

Tc setting

L	M (Normal) (factory setting)	H
43	46	48

Tc : High pressure equivalent saturation temperature (°C)

TcS : Target Tc value (Varies depending on Tc setting, operating frequency, etc.)

*On multi-outdoor-unit systems, this control is made according to values of the first-priority unit, which is detected with the pressure sensor.

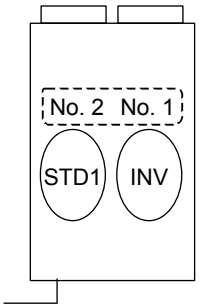
■ Operating Priority and Rotation of Compressors (For multi standard connection system)

Each compressor operates in the following order of priority.

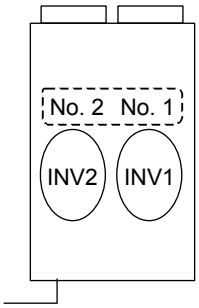
Pattern 1 Pattern 2 Pattern 3

INV: Inverter compressor
STD1: Standard compressor 1
STD2: Standard compressor 2

EMRQ8P, 10P, 12P



EMRQ14P, 16P



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■ Compressor Step Control
Compressor operations vary with the following steps according to information in “Compressor PI Control” on page 59.
Furthermore, the operating priority of compressors is subject to information in “Operating Priority and Rotation of Compressors (For multi standard connection system)” on page 60.

Single unit installation

EMRQ8AAY1, 10AAY1, 12AAY1

STEP No.	INV	STD1	
1	52Hz		← Initial step
2	56Hz		
3	62Hz		
4	68Hz		
5	74Hz		
6	80Hz		
7	88Hz		
8	96Hz		
9	104Hz		
10	110Hz		
11	116Hz		
12	124Hz		
13	132Hz		
14	144Hz		
15	158Hz		
16	166Hz		
17	176Hz		
18	188Hz		
19	202Hz		
20	210Hz		
21	52Hz	ON	
22	62Hz	ON	
23	68Hz	ON	
24	74Hz	ON	
25	80Hz	ON	
26	88Hz	ON	
27	96Hz	ON	
28	104Hz	ON	
29	116Hz	ON	
30	124Hz	ON	← EMRQ8PY1 upper limit
31	132Hz	ON	
32	144Hz	ON	
33	158Hz	ON	
34	176Hz	ON	
35	188Hz	ON	
36	202Hz	ON	
37	210Hz	ON	

EMRQ14AAY1, 16AAY1

STEP No.	INV1	INV2	
1	52Hz	52Hz	← Initial step
2	56Hz	56Hz	
3	62Hz	62Hz	
4	66Hz	66Hz	
5	70Hz	70Hz	
6	74Hz	74Hz	
7	80Hz	80Hz	
8	88Hz	88Hz	
9	92Hz	92Hz	
10	96Hz	96Hz	
11	104Hz	104Hz	
12	110Hz	110Hz	
13	116Hz	116Hz	
14	124Hz	124Hz	
15	132Hz	132Hz	
16	144Hz	144Hz	
17	158Hz	158Hz	
18	166Hz	166Hz	
19	176Hz	176Hz	
20	188Hz	188Hz	
21	202Hz	202Hz	
22	210Hz	210Hz	
23	218Hz	218Hz	
24	232Hz	232Hz	
25	248Hz	248Hz	
26	266Hz	266Hz	

Notes:
1. INV : Inverter compressor
   STD1 : Standard compressor 1
   STD2 : Standard compressor 2
2. Depending on the operating conditions of compressors, the compressors may run in patterns other than those aforementioned.

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2.3 Electronic Expansion Valve PI Control

Main electronic expansion valve EVM control

When the outdoor unit heat exchanging is performed via the evaporator (20SA is set to ON), this function is used to exert PI control on the electronic expansion valve (Y1E) so that the evaporator outlet superheated degree (SH) will become constant.

SH = Tg - Te

SH: Evaporator outlet superheated degree (°C)
Tg : Suction pipe temperature (°C) detected by the heat exchanger gas pipe thermistor R2T.
Te : Low pressure equivalent saturated temperature (°C)

Subcooling electronic expansion valve EVT control

In order to make the maximum use of the subcool heat exchanger, this function is used to exert PI control on the electronic expansion valve (Y3E) so that the evaporator-side gas pipe superheated degree (SH) will become constant.

SH = Tsh - Te

SH: Evaporator outlet superheated degree (°C)
Tsh: Suction pipe temperature (°C) detected by the subcool heat exchanger outlet thermistor R5T
Te: Low pressure equivalent saturated temperature (°C)

Refrigerant charge electronic expansion valve EVJ control

While in automatic refrigerant charge mode, this function is used to exert PI control on the opening degree of the electronic expansion valve (Y2E) in response to outdoor temperature and close the valve after the completion of refrigerant charge.
For normal operation, fully open this electronic expansion valve.

2.4 Step Control of Outdoor Unit Fans

Used to control the revolutions of outdoor unit fans in the steps listed in table below, according to condition changes.

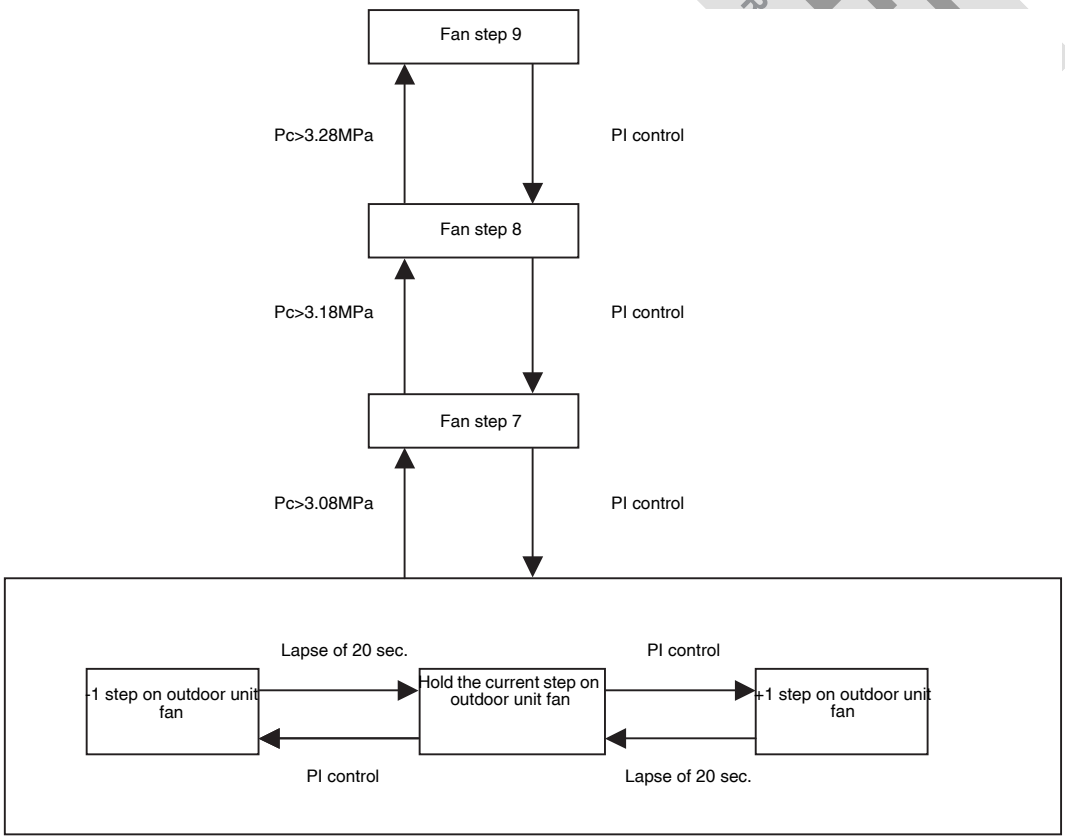
STEP No.	Fan revolutions (rpm)									
	Single type					Multiple type				
	8HP	10HP	12HP	14HP	16HP	M8	M10	M12	M14	M16
0	0	0	0	0	0	0	0	0	0/0	0/0
1	285/255	285/255	285/255	285/255	285/255	350	350	350	230/0	230/0
2	315/285	315/285	315/285	360/315	360/315	370	370	370	380/0	380/0
3	360/330	360/330	360/330	395/365	395/365	400	400	400	290/260	290/260
4	430/400	430/400	430/400	480/440	480/440	450	450	450	375/345	375/345
5	590/560	590/560	590/560	560/530	560/530	540	560	560	570/540	570/540
6	690/660	690/660	690/660	760/730	760/730	610	680	680	720/690	720/690
7	820/790	820/790	820/790	960/930	960/930	680	710	710	910/880	910/880
8	920/890	920/890	951/931	1125/1095	1155/1125	710	750	775	1091/1061	1091/1061
9	920/890	920/890	1020/990	1125/1095	1200/1170	796	821	870	1136/1106	1136/1106
	Fan1/Fan2	Fan1/Fan2	Fan1/Fan2	Fan1/Fan2	Fan1/Fan2				Fan1/Fan2	Fan1/Fan2

* Figures listed above are all those controlled while in standard mode, which vary when the system is set to high static pressure or capacity precedence mode.

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2.5 Outdoor Unit Fan Control in Cooling Operation

While in cooling operation, if the outdoor temperature is low, this mode provides high-pressure control using the outdoor unit fan to retain appropriate liquid pressure, thus ensuring refrigerant circulation rate to be supplied to indoor units.

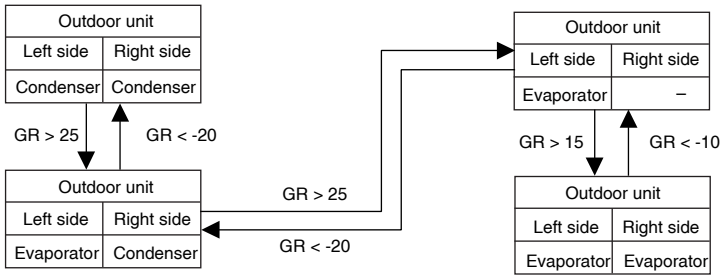


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2.6 Heat Exchanger Control

While in heating or cool/heat simultaneous operation, ensure target condensing and evaporating temperature by changing over the air heat exchange of outdoor unit to the evaporator or the condenser in response to loads.

Single system



Note 1. "GR" is a numeric value representing the current balanced condition and calculated from target condensing temperature, target evaporating temperature, current condensing temperature, and current evaporating temperature.

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3. Special Control

3.1 Startup Control

This control is used to equalize the pressure in the front and back of the compressor prior to the startup of the compressor, thus reducing startup loads. Furthermore, the inverter is turned ON to charge the capacitor.
In addition, to avoid stresses to the compressor due to oil return or else after the startup, the following control is made and the position of the four way valve is also determined. To position the four way valve, the master and slave units simultaneously start up.

3.1.1 Startup Control in Cooling Operation

Actuator	Symbol	Elect. symbol	Control before startup	Startup control	
		EMRQ		STEP1	STEP2
Compressor 1	—	M1C	0 Hz	52 Hz+OFF+OFF	52Hz+OFF+OFF+2STEP / 20 sec. (Until it reaches Pc-Pe>0.39 MPa)
Compressor 2		M2C			
Outdoor unit fan 1	—	M1F	STEP4	Ta<20°C: OFF Ta≥20°C: STEP4	+1step/15 sec. (When Pc_max>2.16 MPa) -1step/15 sec. (When Pc_max<1.77 MPa)
Outdoor unit fan 2		M2F			
Electronic expansion valve (Main)	EVM	Y1E Y3E	0 pls	1375 pls	1375 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls	0 pls	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls	80 pls	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	OFF	OFF	OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	ON	ON	ON
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF	ON	ON
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF	OFF	OFF
Ending conditions			A lapse of 60 sec.	A lapse of 15 sec.	OR • A lapse of 90 sec. • Pc - Pe>0.39 MPa

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3.1.2 Startup Control in Heating Operation

Actuator	Symbol	Elect. symbol	Control before startup	Startup control	
		EMRQ		STEP1	STEP2
Compressor 1	—	M1C	0 Hz	52 Hz+OFF+OFF	52Hz+OFF+OFF+2STEP / 20 sec. (Until it reaches Pc-Pe>0.39 MPa)
Compressor 2		M2C			
Outdoor unit fan 1	—	M1F	STEP4	20SA=ON: STEP7 20SA=OFF +1step/15 sec. (When Pc_max>2.16 MPa) -1step/15 sec. (When Pc_max<1.77 MPa)	20SA=ON: STEP7 20SA=OFF +1step/15 sec. (When Pc_max>2.16 MPa) -1step/15 sec. (When Pc_max<1.77 MPa)
Outdoor unit fan 2		M2F			
Electronic expansion valve (Main)	EVM	Y1E Y3E	0 pls	20SA=ON: SH Control 20SA=OFF: 1375 pls	20SA=ON: SH Control 20SA=OFF: 1375 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls	0 pls	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls	80 pls	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	When outdoor heat exchanger is evaporator: ON When outdoor heat exchanger is condenser: OFF	When outdoor heat exchanger is evaporator: ON When outdoor heat exchanger is condenser: OFF	When outdoor heat exchanger is evaporator: ON When outdoor heat exchanger is condenser: OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	OFF	OFF	OFF
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF	OFF	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF	OFF	OFF
Ending conditions			A lapse of 60 sec.	A lapse of 15 sec.	OR • A lapse of 90 sec. • Pc - Pe>0.39 MPa

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3.2 Oil Return Operation

This function is used to recover refrigerant oil that flows out from the compressor to the system side by conducting oil return operation in order to prevent the compressor from running out of refrigerant oil.

3.2.1 Cooling Oil Return Operation

[Start conditions]

Referring to the following conditions, start cooling oil return operation.

- Integral oil rise rate is reached to specified level.

OR

- When cumulative compressor operating time exceeds 8 hours (2 hours when the power supply turns ON for the first time)

Furthermore, the integral oil rise rate is calculated by Tc, Te, and compressor loads.

The higher the compressor operating step No., the cumulative refrigerant oil consumption increases.

Outdoor unit actuator	Symbol	Elect. symbol	Oil return operation	Operation after oil return
		EMRQ		
Compressor 1	—	M1C	52Hz+ON+ON (Subsequently, constant low pressure control) Maintain the number of compressors that were used before oil return operation)	52Hz+ON+ON (Subsequently, constant low pressure control) Maintain the number of compressors that were used before oil return operation)
Compressor 2		M2C		
Outdoor unit fan 1	—	M1F	Cooling fan control	Cooling fan control
Outdoor unit fan 2		M2F		
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	OFF	OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	ON	ON
Electronic expansion valve (Main)	EVM	Y1E Y3E	1375pls	1375pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	SH control	SH control
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80pls	80pls
Solenoid valve (Main bypass)	SVE	Y5S Y10S	ON	ON
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	0pls	0pls
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	0pls	0pls
End conditions			or • After a lapse of 5 min. • TsA - Te<5°C	or • After a lapse of 3 min. • Pe_min<5°C • Pc_max>3.63MPa • HTdmax>100°C

*1: In case of multi outdoor unit system:

Master unit: It conducts the operation listed in the table above.

Slave units: Operating units conduct the operation listed in the table above.

Non-operating units conduct the operation listed in the table above after the "Oil returning" process. (Non-operating units stop while in "Preparation" mode.)

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Cooling indoor unit actuator		Oil return operation
Fan	Thermo. ON unit	Remote controller setting
	Unit not in operation	OFF
	Thermo. OFF unit	Remote controller setting
Electronic expansion valve	Thermo. ON unit	Normal opening degree
	Unit not in operation	192pls
	Thermo. OFF unit	Normal opening degree for forced thermostat ON

Cooling BS unit actuator	Elect. symbol	Oil return operation
Electronic expansion valve (EVH)	Y4E	600pls
Electronic expansion valve (EVL)	Y5E	760pls
Electronic expansion valve (EVHS)	Y2E	480pls
Electronic expansion valve (EVLS)	Y3E	480pls
Electronic expansion valve (EVSC)	Y1E	0pls

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3.2.2 Heating Oil Return Operation (including cooling / heating simultaneous operation)

[Start conditions]

Referring to the following conditions, start heating oil return operation.

- Integral oil rise rate is reached to specified level.

OR

- When cumulative compressor operating time exceeds 8 hours (2 hours when the power supply turns ON for the first time)

Furthermore, the integral oil rise rate is calculated by Tc, Te, and compressor loads.

The higher the compressor operating step No., the cumulative refrigerant oil consumption increases.

Actuator	Symbol	Elect. symbol EMRQ	Oil return operation
Compressor 1	—	M1C	Maintain load that was applied before oil return operation. When current circulation rate < circulation rate required for oil return operation, turn ON the STD compressor every 10 seconds (up to 3 units at maximum).
Compressor 2		M2C	
Outdoor unit fan 1	—	M1F	When outdoor unit heat exchanger is condenser, the fan will run under cooling fan control. When outdoor unit heat exchanger is evaporator, the fan will run at the fan step 7 or 8.
Outdoor unit fan 2		M2F	
Electronic expansion valve (Main)	EVM	Y1E Y3E	20SA=ON : PI control 20SA=OFF : 418pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	PI control
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	When outdoor unit heat exchanger is condenser, the valve will turn OFF. When outdoor unit heat exchanger is evaporator, the valve will turn ON.
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	OFF
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF
Solenoid valve (Hot gas)	SVP	Y4S	0pls
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	0pls
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	0pls
End conditions			or • Pe_min<0.22MPa • After a lapse of 9 min.

*1: In case of multi outdoor unit system:

Master unit: It conducts the operation listed in the table above.

Slave units: Operating units conduct the operation listed in the table above.

Non-operating units conduct the operation listed in the table above after the "Oil returning" process.

(Non-operating units stop while in "Preparation" mode.)

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Cooling indoor unit actuator		Oil return operation
Fan	Thermo. ON unit	Remote controller setting
	Unit not in operation	OFF
	Thermo. OFF unit	Remote controller setting
Electronic expansion valve	Thermo. ON unit	Normal opening degree
	Unit not in operation	192pls
	Thermo. OFF unit	Normal opening degree for forced thermostat ON

Heating indoor unit actuator		Oil return operation
Fan	Thermo. ON unit	Remote controller setting
	Unit not in operation	OFF
	Thermo. OFF unit	Remote controller setting
Electronic expansion valve	Thermo. ON unit	Normal opening degree
	Unit not in operation	224 pls
	Thermo. OFF unit	Normal opening degree for forced thermostat ON

Cooling BS unit actuator	Elect. symbol	Oil return operation
Electronic expansion valve (EVH)	Y4E	0pls
Electronic expansion valve (EVL)	Y5E	760pls
Electronic expansion valve (EVHS)	Y2E	0pls (60pls when Pc_max>2.85MPa)
Electronic expansion valve (EVLS)	Y3E	480pls
Electronic expansion valve (EVSC)	Y1E	PI control

Heating BS unit actuator	Elect. symbol	Oil return operation
Electronic expansion valve (EVH)	Y4E	760pls
Electronic expansion valve (EVL)	Y5E	0pls
Electronic expansion valve (EVHS)	Y2E	60pls
Electronic expansion valve (EVLS)	Y3E	0pls (60pls when Pc_max>2.85MPa)
Electronic expansion valve (EVSC)	Y1E	PI control

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3.3 Defrost Operation

[Start conditions]

Referring to the following conditions, start defrost operation.

& [• When there is a decrease in the coefficient of heat transfer of outdoor unit heat exchanger
• When there is a drop in the temperature of outdoor unit heat exchanger outlet (Tb)
• When the low pressure stays low for a certain amount of time (2 hours minimum)]

Furthermore, the thermal continuity of outdoor unit heat exchanger is calculated by Tc, Te, and compressor loads.

Defrosting outdoor unit actuator	Symbol	Elect. symbol	Defrost operation	Operation after defrost
		EMRQ		
Compressor 1	—	M1C	EMRQ8•10•12P: 232Hz+ON EMRQ14•16P: 232Hz+232Hz	EMRQ8•10•12P: upper limit 124Hz(STD Holds) EMRQ14•16P: 232Hz+232Hz
Compressor 2		M2C		
Outdoor unit fan 1	—	M1F	OFF Pcmax>2.45MPa ↓ ↑ Pcmax<2.36MPa FANSTEP4 Pcmax>3.04MPa ↓ ↑ Pcmax<2.95MPa FANSTEP6	OFF Pcmax>2.45MPa ↓ ↑ Pcmax<2.36MPa FANSTEP4 Pcmax>3.04MPa ↓ ↑ Pcmax<2.95MPa FANSTEP6
Outdoor unit fan 2		M2F		
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	OFF	OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	Holds	Holds
Electronic expansion valve (Main)	EVM	Y1E Y3E	1375pls	0pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	SH control	0pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80pls	80pls
Solenoid valve (Main bypass)	SVE	Y5S Y10S	ON	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	0pls	0pls
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	0pls	0pls
End conditions			EMRQ8 to 16P (by unit) or [• 6 min. and 30 sec. • Tb > 11°C continues for a period of 90 consecutive sec. • Pc_max > 3.04MPa]	or [• 30 sec. • Pc_max>3.04MPa]

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Evaporating outdoor unit actuator	Symbol	Elect. symbol EMRQ	Defrost operation	Operation after defrost
Compressor 1	—	M1C	EMRQ8•10•12P: 232Hz+ON EMRQ14•16P: 232Hz+232Hz	Upper limit 124Hz (STD Holds) REYP400•480A: 232Hz+232Hz
Compressor 2		M2C		
Outdoor unit fan 1	—	M1F	Fan control	Fan control
Outdoor unit fan 2		M2F		
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	ON	ON
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	Holds	Holds
Electronic expansion valve (Main)	EVM	Y1E Y3E	PI control	PI control
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	SH control	0pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80pls	80pls
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	0pls	0pls
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	0pls	0pls
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	0pls	0pls

Cooling indoor unit actuator		Defrost operation
Fan	Thermo. ON unit	Remote controller setting
	Unit not in operation	OFF
	Thermo. OFF unit	Remote controller setting
Electronic expansion valve	Thermo. ON unit	Normal opening degree
	Unit not in operation	0pls
	Thermo. OFF unit	0pls

Heating indoor unit actuator		Defrost operation
		EMRQ
Fan	Thermo. ON unit	LL
	Unit not in operation	OFF
	Thermo. OFF unit	LL
Electronic expansion valve	Thermo. ON unit	160pls
	Unit not in operation	0pls
	Thermo. OFF unit	160pls

Cooling BS unit actuator	Elect. symbol	Defrost operation
Electronic expansion valve (EVH)	Y4E	0pls
Electronic expansion valve (EVL)	Y5E	760pls
Electronic expansion valve (EVHS)	Y2E	0pls
Electronic expansion valve (EVLS)	Y3E	480pls
Electronic expansion valve (EVSC)	Y1E	0pls

Heating BS unit actuator	Elect. symbol	Defrost operation
Electronic expansion valve (EVH)	Y4E	760pls
Electronic expansion valve (EVL)	Y5E	0pls
Electronic expansion valve (EVHS)	Y2E	60pls
Electronic expansion valve (EVLS)	Y3E	0pls
Electronic expansion valve (EVSC)	Y1E	0pls (PI control for cool/heat concurrent operation)

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3.4 Pump-down Residual Operation

3.4.1 Pump-down Residual Operation in Cooling Operation

If the liquid refrigerant stays in the Evaporator at the startup of a compressor, this liquid refrigerant enters the compressor, thus resulting in diluted oil in the compressor and then degraded lubrication performance. Consequently, in order to recover the refrigerant in the Evaporator while the compressor stops, the pump-down residual operation is conducted.

Actuator	Symbol	Elect. symbol	Master unit operation	Slave unit operation
		EMRQ		
Compressor 1	—	M1C	124 Hz+OFF+OFF	OFF
Compressor 2		M2C		
Outdoor unit fan 1	—	M1F	Fan control	Fan control
Outdoor unit fan 2		M2F		
Electronic expansion valve (Main)	EVM	Y1E Y3E	1375 pls	1375 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	OFF	OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	ON	ON
Solenoid valve (Main bypass)	SVE	Y5S Y10S	ON	ON
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF	OFF
Ending conditions			or • 5 min. • Pe_min<0.49 MPa ∗ • Pc_max<2.94 MPa ∗ • Master unit Tdi>110°C • Master unit Tp>125°C	

∗ Pe_min and Pc_max indicate the minimum and maximum values in the system, respectively.

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3.4.2 Pump-down Residual Operation in Heating Operation and Simultaneous Cooling / Heating Operation

Actuator	Symbol	Elect. symbol	Master unit operation	Slave unit operation
		EMRQ		
Compressor 1	—	M1C	124 Hz+OFF+OFF	OFF
Compressor 2		M2C		
Outdoor unit fan 1	—	M1F	Fan control	Fan control
Outdoor unit fan 2		M2F		
Electronic expansion valve (Main)	EVM	Y1E Y3E	When 20SA=ON: 0 pls When 20SA=OFF: 1375 pls	When 20SA=ON: 0 pls When 20SA=OFF: 1375 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	When outdoor heat exchanger is evaporator: ON When outdoor heat exchanger is condenser: OFF	When outdoor heat exchanger is evaporator: ON When outdoor heat exchanger is condenser: OFF
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	OFF	OFF
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF	OFF
Ending conditions			or • 3 min. • Pe_min<0.25 MPa * • Pc_max<3.13 MPa * • Master unit Tdi>110°C • Master unit Tp>140°C	

* Pe_min and Pc_max indicate the minimum and maximum values in the system, respectively.

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3.5 Standby

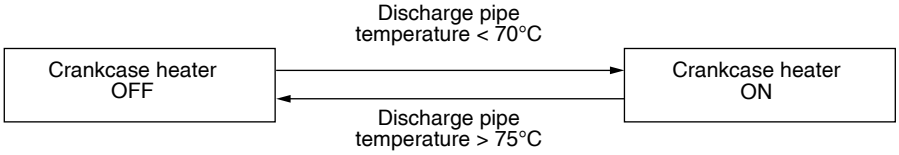
3.5.1 Restart Standby

Used to forcedly stop the compressor for a period of 3 minutes, in order to prevent the frequent ON/OFF of the compressor and equalize the pressure within the refrigerant system.

Actuator	Symbol	Elect. symbol	Operation
		EMRQ	EMRQ8~16P
Compressor1	—	M1C	OFF
Compressor2	—	M2C	OFF
Outdoor unit fan1	—	MF1	Ta>30°C: STEP4 Ta≤ 30°C: OFF
Outdoor unit fan2	—	MF2	Ta>30°C: STEP4 Ta≤ 30°C: OFF
Electronic expansion valve (Main)	EVM	Y1E Y3E	0 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	Holds
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	Holds
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF
Ending conditions	—		2 min.

3.5.2 Crankcase Heater Control

In order to prevent the refrigerant from melting in the compressor oil in the stopped mode, this mode is used to control the crankcase heater.



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3.6 Stopping Operation

3.6.1 When System is in Stop Mode (Normal operation stop)

This mode is used to define actuator operations when the system stops.

Actuator	Symbol	Elect. symbol	Operation
		EMRQ	EMRQ8~16P
Compressor1	—	M1C	OFF
Compressor2	—	M2C	OFF
Outdoor unit fan1	—	M1F	OFF
Outdoor unit fan2	—	M2F	OFF
Electronic expansion valve (Main)	EVM	Y1E Y3E	0 pls
Electronic expansion valve (Subcooling)	EVT	Y2E Y5E	0 pls
Electronic expansion valve (Refrigerant charge)	EVJ	Y4E	80 pls
Four way valve (Heat exchanger switch)	20SA	Y2S Y9S	Holds
Four way valve (Dual pressure gas pipe switch)	20SB	Y8S	Holds
Solenoid valve (Main bypass)	SVE	Y5S Y10S	OFF
Solenoid valve (Hot gas)	SVP	Y4S	OFF
Solenoid valve (Refrigerant regulator liquid pipe)	SVL	Y3S	OFF
Solenoid valve (Refrigerant regulator gas vent pipe)	SVG	Y1S	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVO	Y7S	OFF
Solenoid valve (Refrigerant regulator discharge pipe)	SVT	Y6S	OFF
Ending conditions	—		Indoor unit thermostat is turned ON.

3.6.2 Stop due to Malfunction

In order to protect compressors, if any of the following items has an abnormal value, the system will make "stop with thermostat OFF" and the malfunction will be determined according to the number of retry times.

Item	Judgment Criteria	Malfunction Code
1. Abnormal low pressure level	0.07MPa	E4
2. Abnormal high pressure level	4.0MPa	E3
3. Abnormal discharge pipe temperature level	135°C	F3
4. Abnormal power supply voltage	Reverse-phase power supply	U1
5. Abnormal inverter current level	16.1A: 260 sec.	L8
6. Abnormal radiator fin temperature level	93°C	L4

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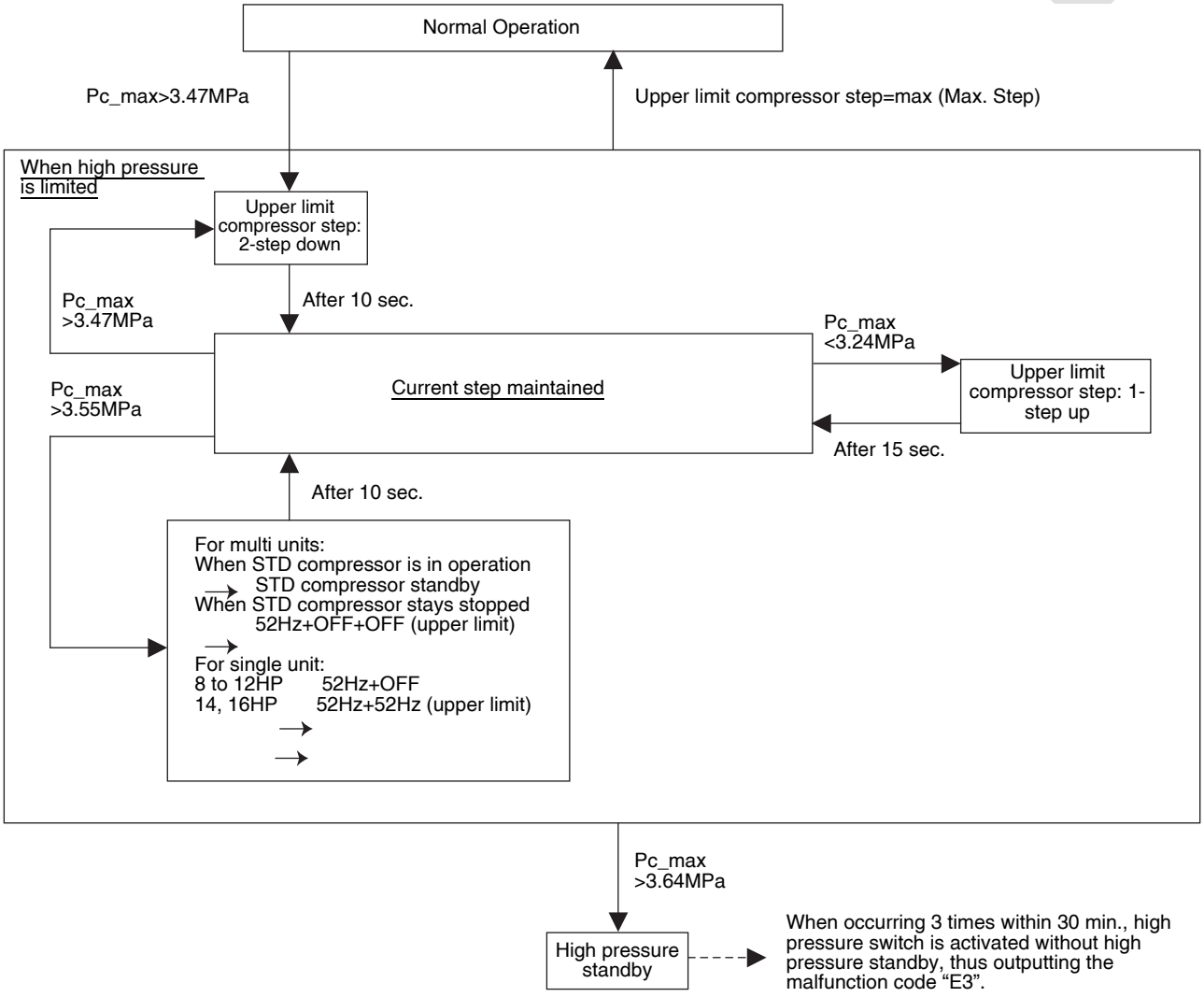
4. Protection Control

4.1 High Pressure Protection Control

This high pressure protection control is used to prevent the activation of protection devices due to abnormal increase of high pressure and to protect compressors against the transient increase of high pressure.

[In cooling operation]

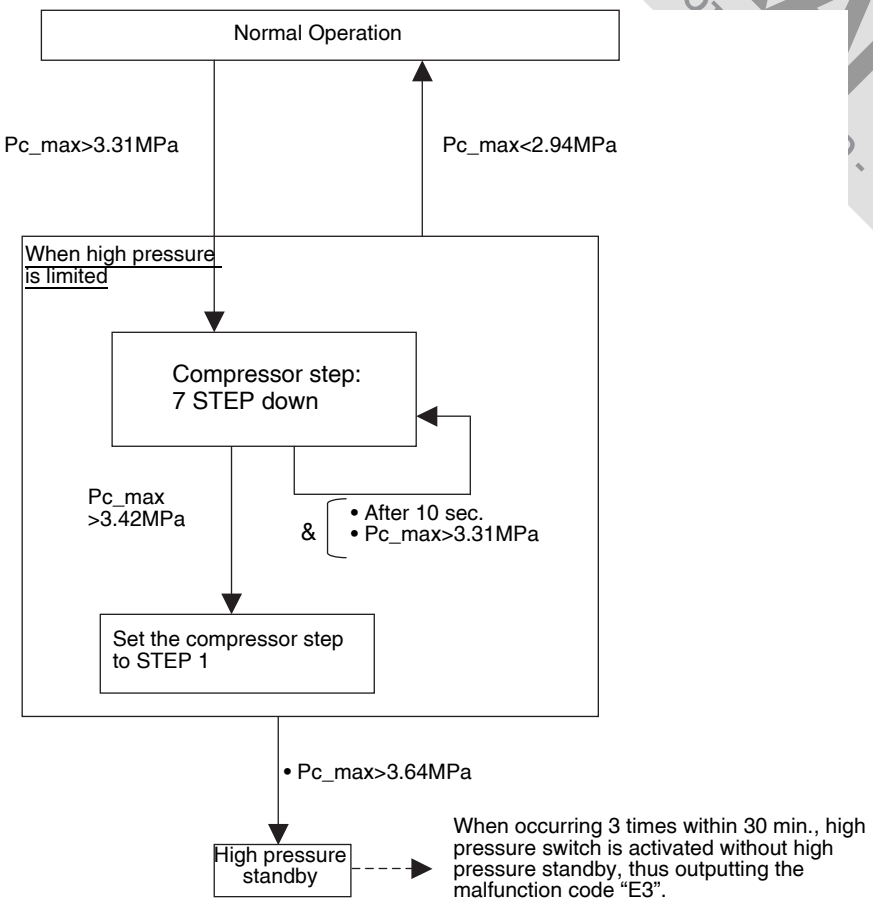
- The following control is performed in the entire system.
  Pc_max indicates the maximum value within the system.



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[Heating Operation and Simultaneous Cooling / Heating Operation]

■ The following control is performed in the entire system.
Pc_max indicates the maximum value within the system.



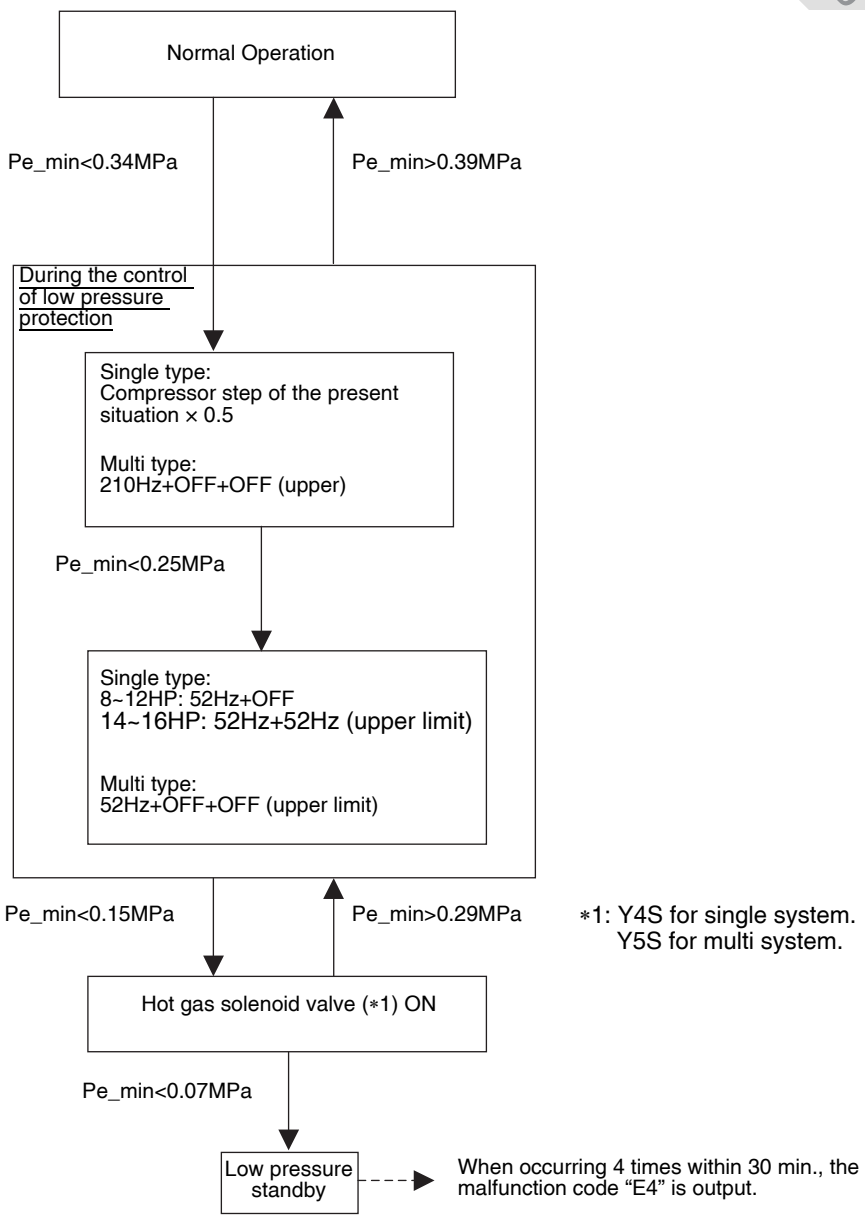
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NOT APPROVED

4.2 Low Pressure Protection Control

This low pressure protection control is used to protect compressors against the transient decrease of low pressure.

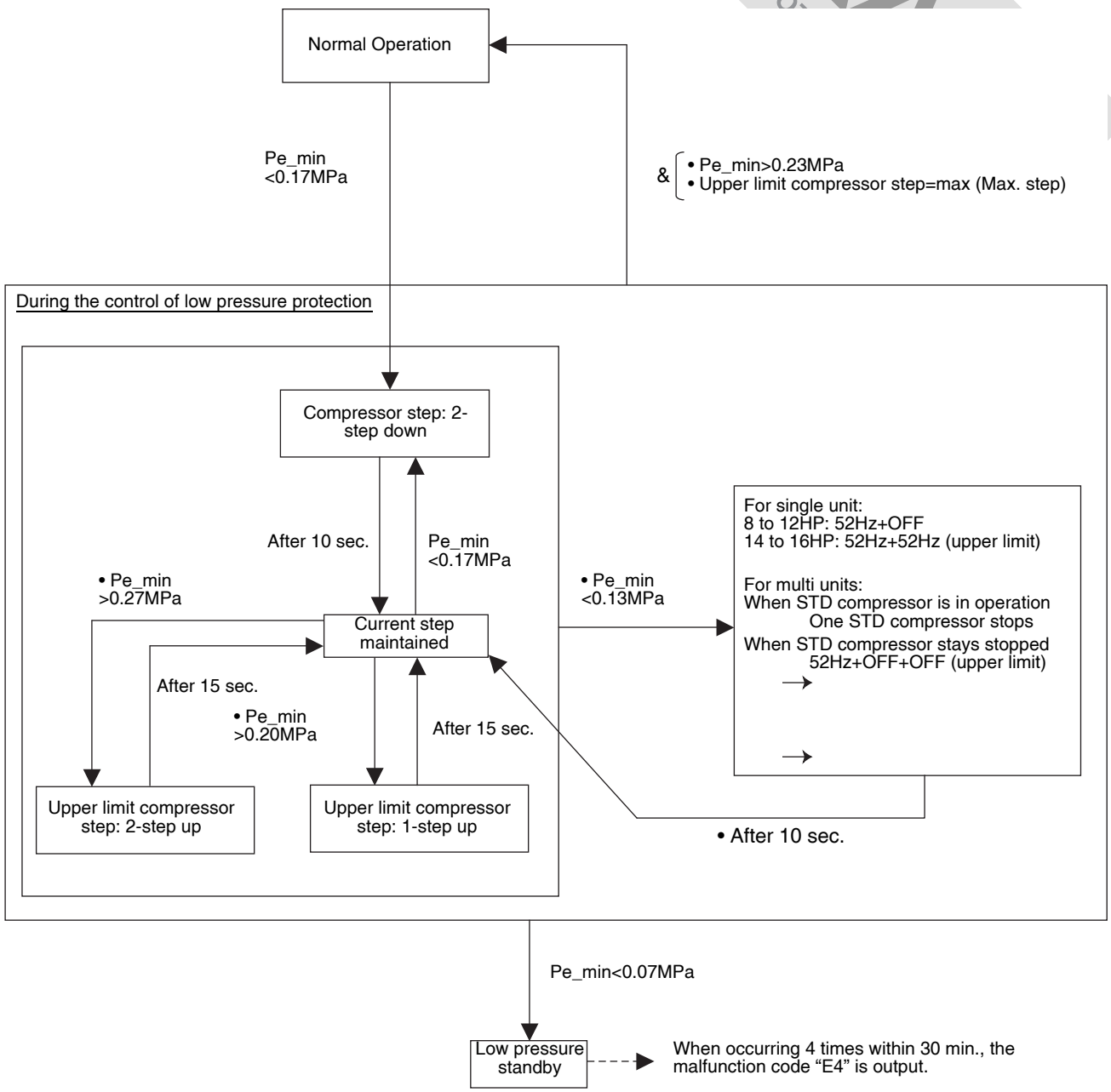
[In cooling operation]

- Because of common low pressure, the following control is performed in the system. Pe_min indicates the minimum value within the system.



[In heating operation and Simultaneous Cooling / Heating Operation]

■ The following control is performed in the system.
Pe_min indicates the minimum value within the system.



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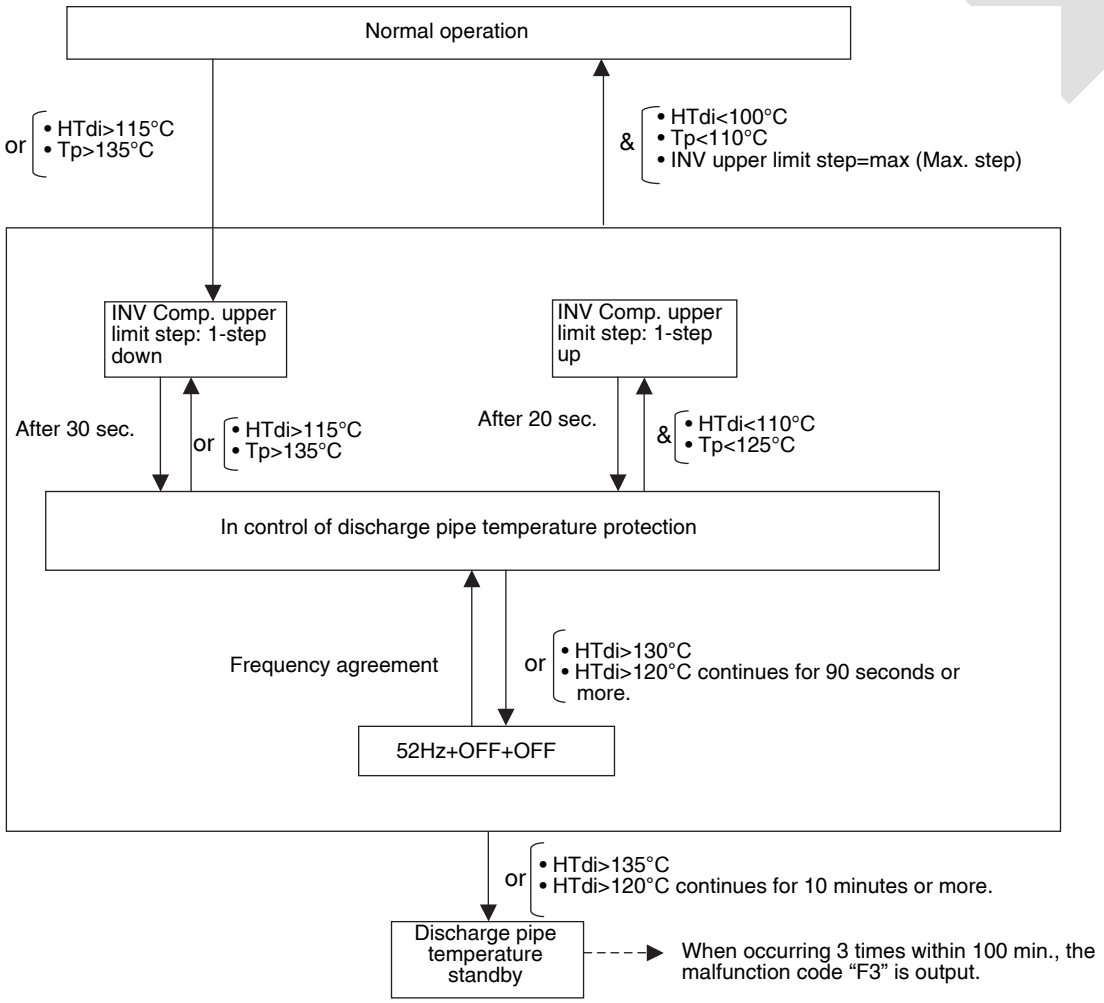
4.3 Discharge Pipe Protection Control

This discharge pipe protection control is used to protect the compressor internal temperature against a malfunction or transient increase of discharge pipe temperature.

[Contents]

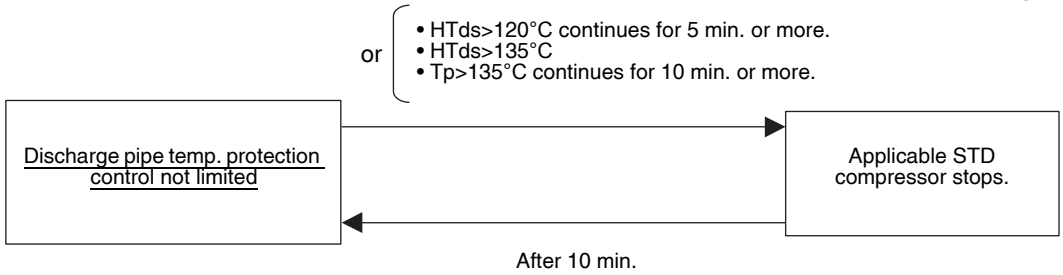
■ The following control is performed for each compressor of single unit as well as multi units.

[INV compressor]



[STD compressor]

HTdi : Value of INV compressor discharge pipe temperature (Tdi) compensated with outdoor air temperature
HTds : Value of STD compressor discharge pipe temperature (Tds) compensated with outdoor air temperature
Tp : Value of compressor port temperature calculated by Tc and Te, and suction superheated degree.



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- NOT APPROVED -

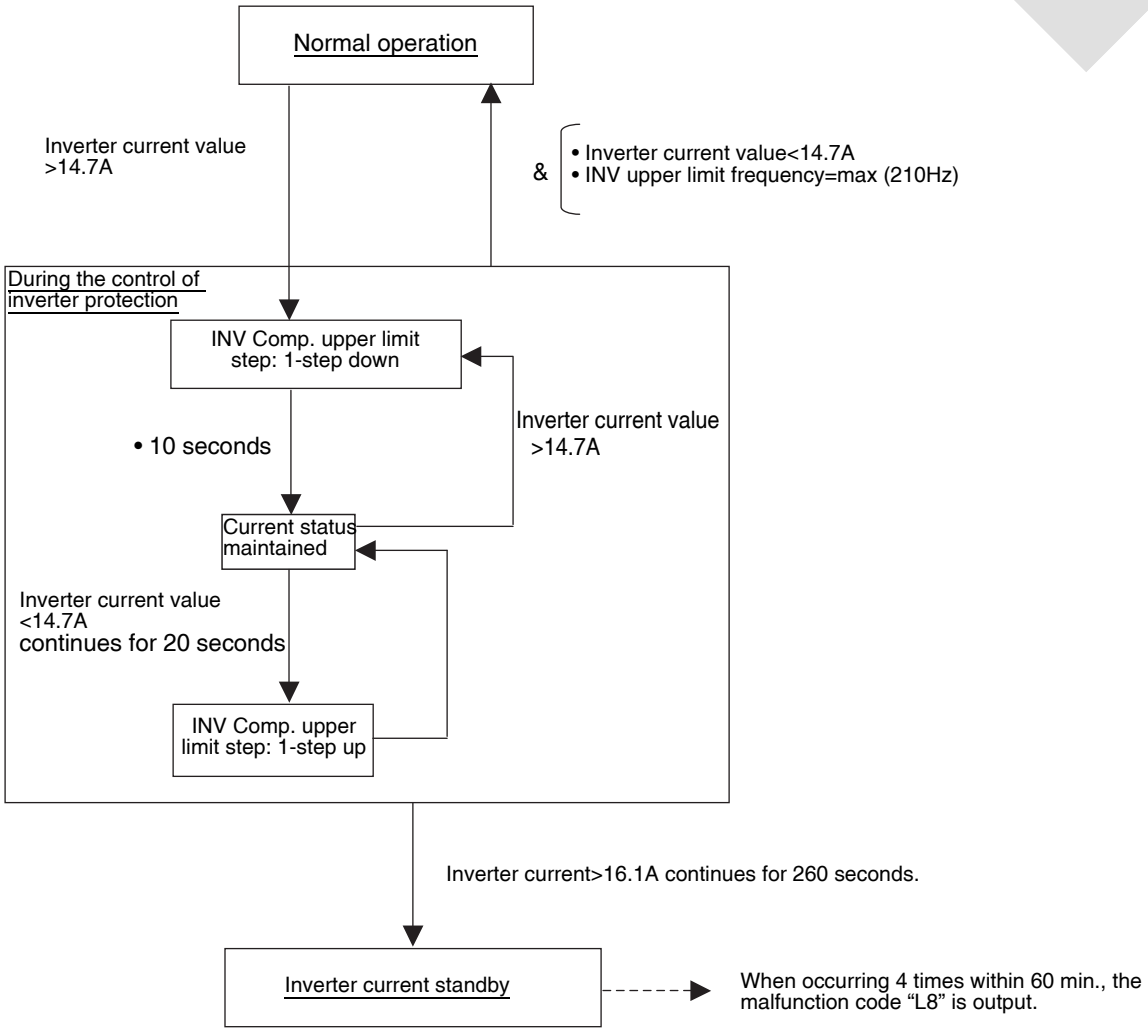
4.4 Inverter Protection Control

Inverter current protection control and inverter fin temperature control are performed to prevent tripping due to a malfunction, or transient inverter overcurrent, and fin temperature increase.

- In the case of multi-outdoor-unit system, each INV compressor performs these controls in the following sequence.

[Inverter overcurrent protection control]

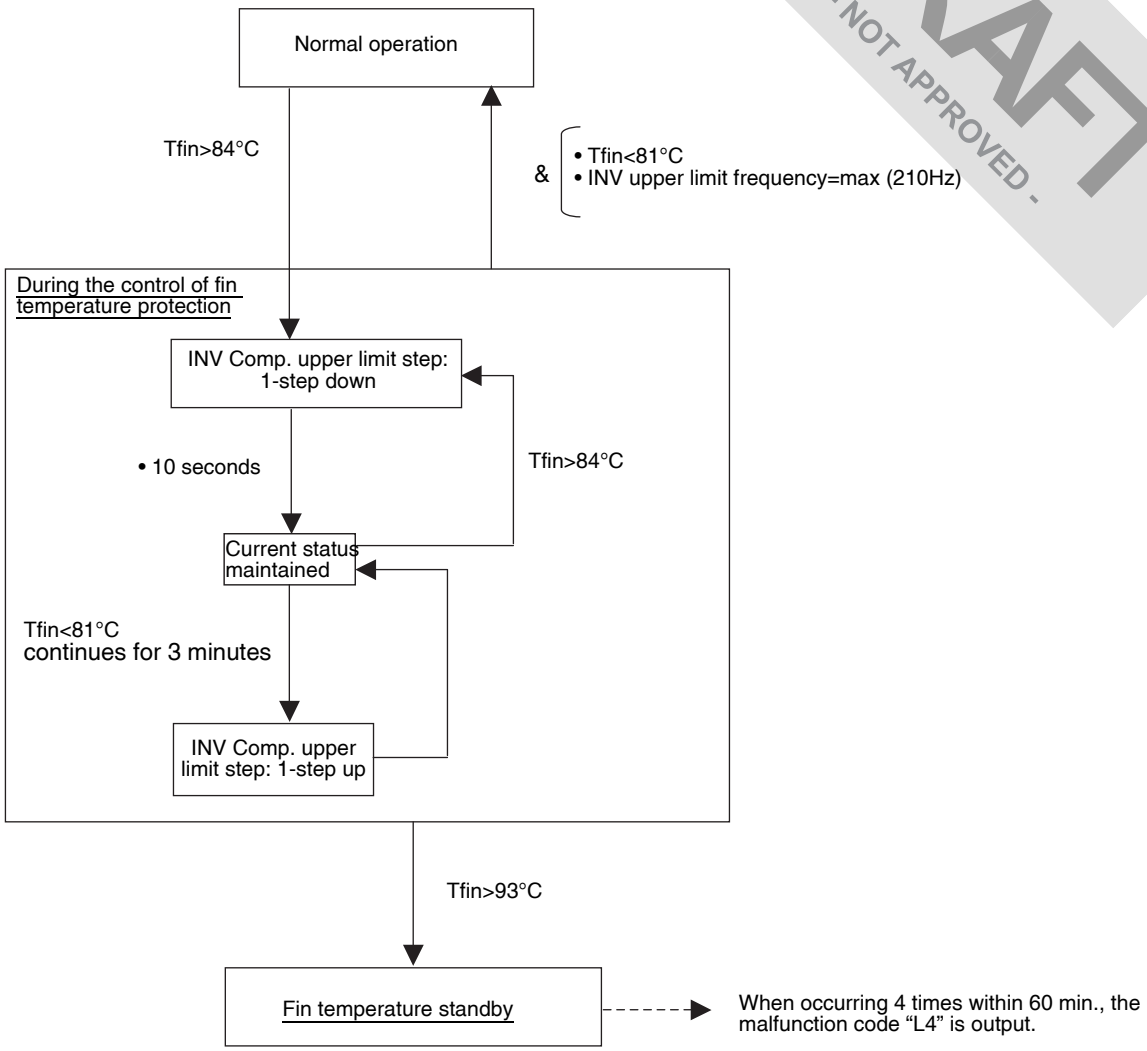
- Perform the following control of integrated as well as multi units for each INV compressor.



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[Inverter fin temperature control]

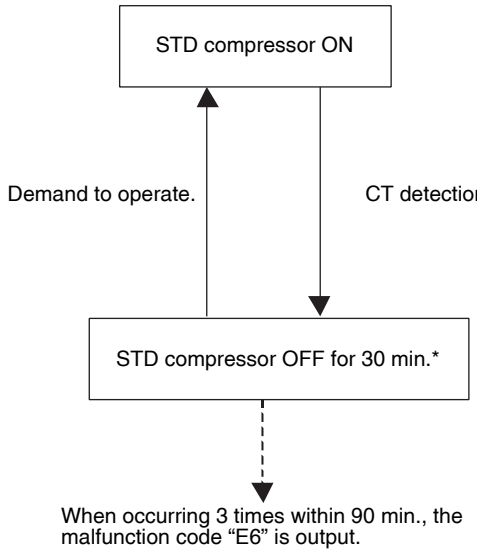
■ Perform the following control of integrated as well as multi units for each INV compressor.



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4.5 STD Compressor Overload Protection

This control is used to prevent abnormal heating due to overcurrent to the compressor resulting from failures of STD compressor such as locking.



* If the power supply is reset while in operation prohibition mode, the prohibition timer will continue counting when the power supply is turned ON.

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5. Other Control

5.1 Backup Operation

If any of the compressors goes wrong, disable the relevant compressor or the relevant outdoor unit from operating, and then conduct emergency operation only with operational compressors or outdoor units.
"Emergency operation with remote controller reset" and "Emergency operation with outdoor unit PCB setting" are available

Operating method / Applicable model	Emergency operation with outdoor unit PCB setting (Manual backup operation)
EMRQ8 ~ 16PY1	Backup operation by the compressor

Emergency operation with outdoor unit PCB setting

[Setting method]

Make setting of the compressor, "the operation of which is to be disabled", in field setting mode (setting mode 2).

[Details of operation]

Disable the compressor with "operation disable setting" made from operating and only operate other compressors.
(On the system with 1 compressor "EMRQ8PY1", this emergency operation is not available.)

5.2 Demand Operation

In order to save the power consumption, the capacity of outdoor unit is saved with control forcibly by using “Demand 1 Setting” or “Demand 2 Setting”.
To operate the unit with this mode, additional setting of “Continuous Demand Setting” or external input by external control adaptor is required.

Set item	Condition	Content
Demand 1	Mode 1	The compressor operates at approx. 60% or less of rating.
	Mode 2	The compressor operates at approx. 70% or less of rating.
	Mode 3	The compressor operates at approx. 80% or less of rating.
Demand 2	—	The compressor operates at approx. 40% or less of rating.

5.3 Heating Operation Prohibition

Heating operation is prohibited above 24°C ambient temperature.

6. Outline of Control (Indoor Unit)

6.1 Freeze Prevention

Freeze-up Prevention by Thermo Off Condition

The freeze-up prevention is only active when the unit is in thermo OFF condition.

[Start condition]

AND/OR*:

- Outdoor ambient temperature < 4°C
- Leaving or return water temperature < 7°C

* AND/OR depending of setting [8 - 04] for further details see chapter of setting.

[Operation]

Pump will operate and if leaving OR return water < 5°C for 5 minutes, the unit will start up the freeze-up prevention function to prevent too low temperatures.

6.2 Simultaneous demand of space heating and domestic water heating

Space heating operation can be executed in 3 different ways:
- Remote controller leaving water temperature control
- External room thermostat
- Remote controller room temperature control

The domestic water heating operation can be controlled in 2 different ways:
- Reheat operation:
  The reheat mode will prevent the domestic hot water from cooling down lower than a certain temperature. When enabled the indoor unit will deliver hot water to the domestic hot water tank if the minimum value is reached and this according below described settings. ***1**
- Storage operation:
  In this mode, the indoor unit will deliver hot water to the domestic hot water tank based on a daily pattern (day and/or night). The heated water is stored at a higher temperature so it can fulfill the domestic hot water requirements throughout the day. ***2**

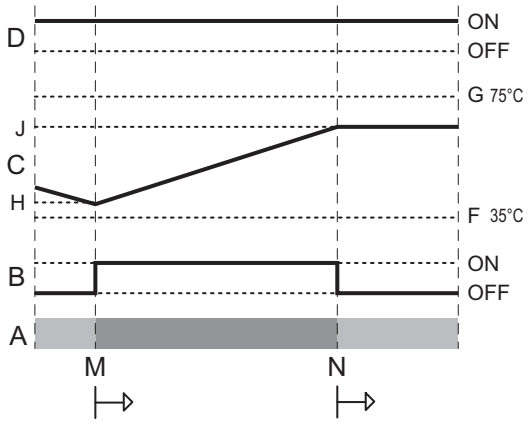
***1 Remark:** This function can only be activated by the shower button. Shower icon should be led.

***2 Remark:** This function can only be set by field settings. This function can only be activated by the schedule timer button and this icon should be led.

Remote controller leaving water temperature control

When the reheat temperature is reached, the further heat up till storage temperature of the domestic hot water tank will be decided by the running timers which are programmed by the installer.

- **Reheat operation**
  When requesting space heating and domestic water heating (reheat) at the same time, this involves that the minimum reheat temperature is reached (setting [b-00]) during space heating operation. The 3-way valve will switch over to the domestic hot water side. Now, the domestic water will be heated till maximum reheat temperature (setting [b-01]). The 3-way valve will switch back to original position, then space heating will start again. When a domestic hot water tank is installed, the reheat function is always available. The minimum domestic hot water reheat temperature is 35°C and the maximum value is 75°C.

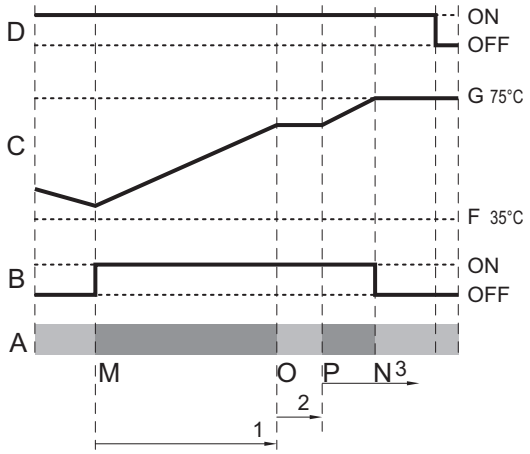


A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water reheat thermo-on request
C	Domestic hot water tank temperature

D	Leaving water thermo-on request
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
H	Domestic hot water reheat minimum temperature [b-00]
J	Domestic hot water reheat maximum temperature [b-01]
M	Simultaneous demand
N	ONLY space heating request
ON	ON
OFF	OFF

■ **Storage operation**

When requesting space heating and domestic water heating (storage) at the same time, this involves that the storage function is active and the start timer is reached (setting 1) during space heating operation. The 3-way valve will switch over to domestic water heating operation. Now domestic water will be produced till set point is reached or according to the running timer (setting [d-01]). The 3-way valve will switch back to space heating mode for the interval period (setting [d-02]). After this interval the 3-way valve will go back to domestic water mode. This will continue till set point is reached. At that moment, simultaneous request is finished and the system goes back to space heating mode.

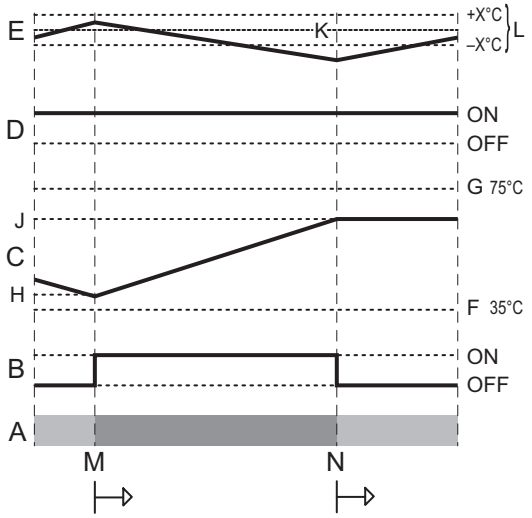


A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water storage thermo-on request
C	Domestic hot water tank temperature
D	Leaving water thermo-on request
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
M	Simultaneous demand
N	ONLY space heating request
O	Start of interval period
P	Stop of interval period
ON	ON
OFF	OFF
1	Maximum operation time for 1 cycle of domestic water heating (initial 30 minutes [d-01])
2	Interval minimum stop time for domestic water heating (initial 15 minutes [d-02])
3	Maximum operation time for domestic water heating (initial 30 minutes [d-01])

External room thermostat

When the reheat temperature is reached, the further heat up of the domestic hot water tank will be decided by the external room thermostat thermo conditions and running timers which are programmed by the installer.

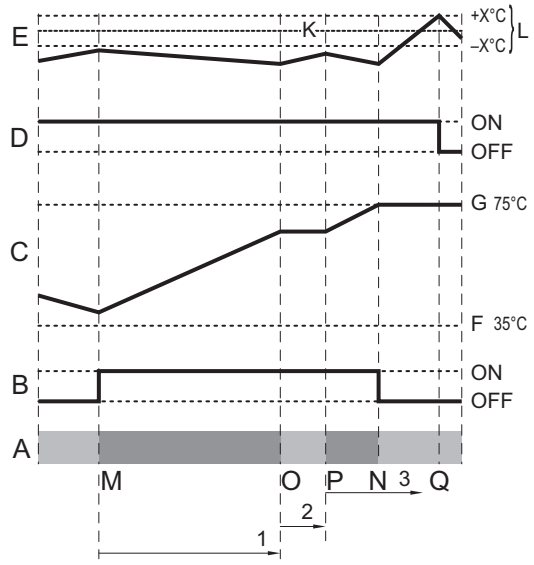
- **Reheat operation**
  When requesting space heating and domestic water heating (reheat) at the same time. This involves that the minimum reheat temperature is reached (setting [b-00]) during space heating operation. The 3-way valve will switch over to the domestic hot water side. The domestic water will be heated till maximum reheat temperature (setting [b-01]). The 3-way valve will switch back to original position, then space heating will start again.
  During the reheat operation, the system does not take care about the room temperature. This means that during simultaneous demand, the reheat operation has priority over the room temperature.



A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water reheat thermo-on request
C	Domestic hot water tank temperature
D	Room temperature thermo-on request
E	Remote controller room temperature
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
H	Domestic hot water reheat minimum temperature [b-00]
J	Domestic hot water reheat maximum temperature [b-01]
K	External room thermostat set point
L	External room thermostat ON/OFF hysteresis
M	Simultaneous demand
N	ONLY space heating request
ON	ON
OFF	OFF

■ **Storage operation**

When requesting space heating and domestic water heating (storage) at the same time, this involves that the storage function is active and the start timer is reached (setting 1) during space heating operation. The 3-way valve will switch over to domestic water heating operation. Now domestic water will be produced till set point is reached or according to the running timer (setting [d-01]). The 3-way valve will switch back to space heating mode for the interval period (setting [d-02]). After this interval the 3-way valve will go back to domestic water mode. This will continue till set point is reached. At that moment, simultaneous request is finished and the system goes back to space heating mode.
During the storage operation, the system does not take care off the room temperature. This means that during simultaneous demand, the space only will be heated during the intervals of domestic water production.

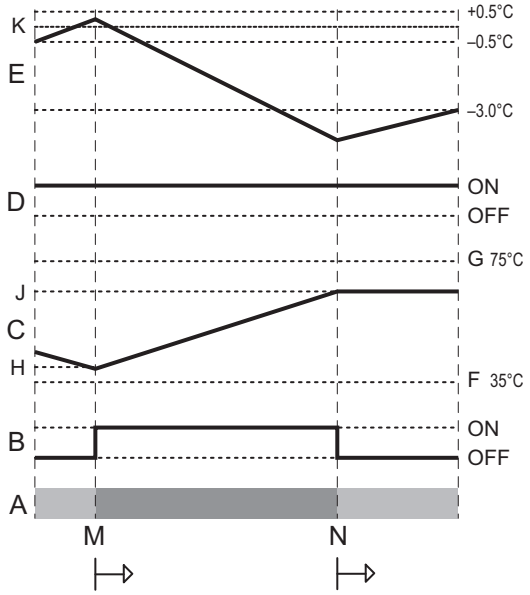


A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water storage thermo-on request
C	Domestic hot water tank temperature
D	Room temperature thermo-on request
E	Remote controller room temperature
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
K	External room thermostat set point
L	External room thermostat ON/OFF hysteresis
M	Simultaneous demand
N	ONLY space heating request
O	Start off interval period
P	Stop off interval period
Q	Space heating OFF
ON	ON
OFF	OFF
1	Maximum operation time for 1 cycle of domestic water heating (initial 30 minutes [d-01])
2	Interval minimum stop time for domestic water heating (initial 15 minutes [d-02])
3	Maximum operation time for domestic water heating (initial 30 minutes [d-01])

Remote controller room temperature control

When the reheat temperature is reached, the further heat up till storage temperature of the domestic hot water tank will be decided by the remote controller room thermostat in order to prevent that the room temperature drops too much.

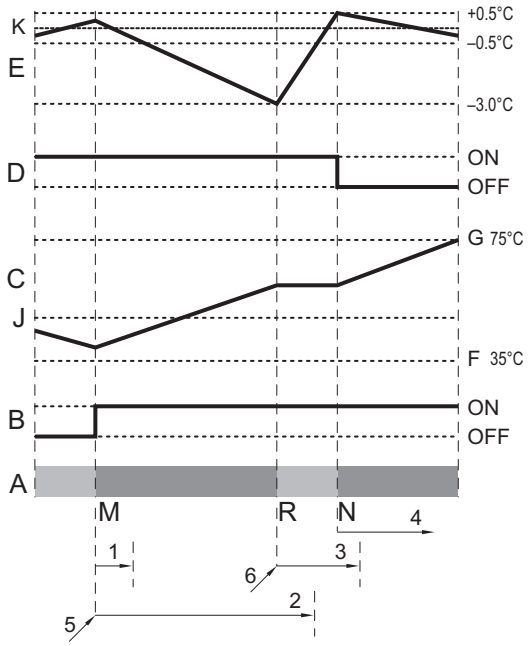
- **Reheat operation**
  When requesting space heating and domestic water heating (reheat) at the same time. This involves that the minimum reheat temperature is reached (setting [b-00]) during space heating operation. The 3-way valve will switch over to the domestic hot water side. The domestic water will be heated till maximum reheat temperature (setting [b-01]). The 3-way valve will switch back to original position, then space heating will start again.
  During the reheat operation, the system does not take care about the room temperature. This means that during simultaneous demand, the reheat operation has priority over the room temperature.



A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water reheat thermo-on request
C	Domestic hot water tank temperature
D	Room temperature thermo-on request
E	Remote controller room temperature
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
H	Domestic hot water reheat minimum temperature [b-00]
J	Domestic hot water reheat maximum temperature [b-01]
K	Remote controller thermostat set point
M	Simultaneous demand
N	ONLY space heating request
ON	ON
OFF	OFF

■ **Storage operation**

When requesting space heating and domestic water heating (storage) at the same time, this involves that the minimum reheat temperature is reached (setting [b-00]) during space heating operation. The 3-way valve will switch over to the domestic hot water side, then the domestic water will be heated, but as soon as the room temperature drops 3°C from set point (smart logic), the 3-way valve will go to original position and start space heating till 0.5°C above set point, then the 3-way valve will switch over to the domestic hot water side and then the domestic water will be heated again till storage set point.



A	Operation
	Space heating
	Domestic water heating
B	Domestic hot water storage thermo-on request
C	Domestic hot water tank temperature
D	Room temperature thermo-on request
E	Remote controller room temperature
F	Domestic hot water lower limit temperature
G	Domestic hot water upper limit temperature (maximum possible storage temperature) [b-03]
J	Domestic hot water reheat maximum temperature [b-01]
K	Remote controller thermostat set point
M	Simultaneous demand
N	ONLY domestic hot water request
R	Point where space heating gets priority
ON	ON
OFF	OFF
1	Minimum operation time for domestic water heating (initial 10 minutes [d-00]) (a)
2	Maximum operation time for domestic water heating (initial 30 minutes [d-01]) (b)
3	Interval minimum stop time for domestic water heating (initial 15 minutes [d-02])
N=4	No simultaneous operation
5	Timers for domestic water heating start
6	Timer for space heating start

Remark:

a. The minimum operation time is only valid when room temperature is more than 3°C lower as set point and set point J is reached.
b. The maximum operation time is only valid when room temperature is more than 0.5°C lower as set point and set point J is reached

Part 5 - Test Operation

1. Test Operation 104
   1.1 Procedure and Outline 104
   1.2 Operation when Power is Turned On 122
2. Outdoor Unit PC Board Layout 123
3. Field Setting 124
   3.1 Field Setting from remote control 124
   3.2 Field Setting from Outdoor Unit 141

1. Test Operation

1.1 Procedure and Outline

Follow the following procedure to conduct the initial test operation after installation.

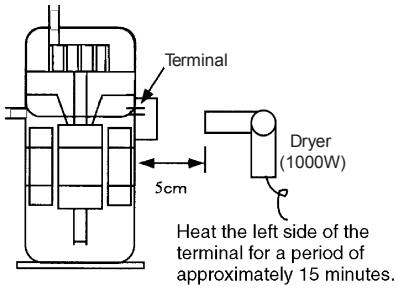
1.1.1 Check Work Prior to Turn Power Supply On

Check the below items.
- Power wiring
- Control transmission wiring between units
- Earth wire

⇩

- ○ Is the wiring performed as specified?
- ○ Is the designated wire used?
- ○ Is the wiring screw of wiring not loose?
- ○ Is the grounding work completed?
- ○ Is the insulation of the main power supply circuit deteriorated?
  Use a 500V megger tester to measure the insulation. (*1)
  - Do not use a megger tester for other circuits than 200V (or 240V) circuit.

*1: Measure to be taken against decreased insulation resistance in the compressor
If the compressor is left to stand for an extended period of time after the refrigerant charge with the stop valve open and the power supply OFF, the refrigerant may be mixed in the compressor, thus decreasing the insulation resistance.
Heat the compressor as shown on the right and then recheck the insulation.



Check on refrigerant piping / insulation materials

⇩

- ○ Is the pipe size proper?
- ○ Is the pipe insulation material installed securely?
  Liquid and gas pipes need to be insulated. (Otherwise causes water leak.)
- ○ Are respective stop valves on liquid and gas line securely open?

Check airtight test and vacuum drying.

⇩

- ○ Have the airtight test and the vacuum drying been conducted according to the procedure in the Installation Manual?
  - If the power has turned on before the vacuuming has been done, you must use the outdoor setting 2-21 to open all necessary values of indoor and outdoor unit. Only then complete vacuuming is possible.
    See "Settings of vacuuming mode" for more details.

Check on amount of refrigerant charge

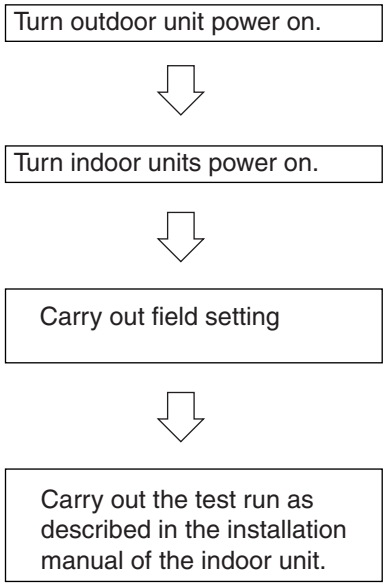
⇩

- ○ Is a proper quantity of refrigerant charged? (see procedure "Calculating additional refrigerant charging amount")
- ○ Has the amount of refrigerant + extra refrigerant piping length charge been recorded on "Record Chart of Additional Refrigerant Charge Amount"?

Check on water piping

- ○ Is the water pressure OK?
- ○ Is all the air removed?
- ○ Is there minimum 20 liters water in the system at all times?
- ○ Is there a bypass installed?
- ○ Are all the valves open, so water flow is guaranteed?
- ○ Is the pre-pressure of the expansion vessel set correctly?

1.1.2 Turn Power On

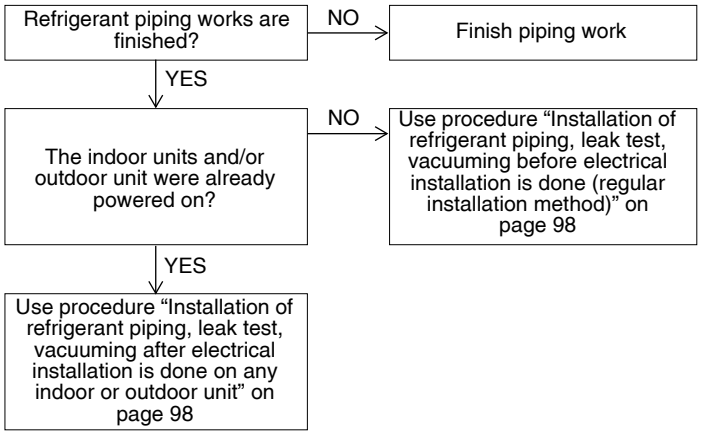


- Be sure to turn the power on 6 hours before starting operation to protect compressors.
- Close outside panels of the outdoor unit.

(V3056)

1.1.3 Leak test and vacuum drying

It is very important that all refrigerant piping work is done before the units (outdoor or indoor) are powered on.
When the units are powered on, the expansion valves will initialize. This means that they will close. Leak test and vacuuming drying of field piping and indoor units is impossible when this happens.
Therefore, there will be explained 2 methods for initial installation, leak test and vacuuming drying.



General guidelines

- Use a 2-stage vacuum pump with a non-return valve which can evacuate to a gauge pressure of –100.7 kPa
  (5 Torr absolute, –755 mm Hg).
- Connect the vacuum pump to the service port of all 3 stop valves to increase efficiency (refer to “Set-up” on page 99).

NOTE Do not purge the air with refrigerants. Use a vacuum pump to evacuate the installation.

Installation of refrigerant piping, leak test, vacuuming before electrical installation is done (regular installation method)

When all piping work is complete, it is necessary to:
- check for any leakages in the refrigerant piping and
- to perform vacuum drying to remove all moisture in the refrigerant piping.

If there is a possibility of moisture being present in the refrigerant piping (for example, rainwater may have entered the piping), first carry out the vacuum drying procedure below until all moisture has been removed and consider the installation of a liquid dryer.
All piping inside the unit has been factory tested for leaks.
Only field installed refrigerant piping needs to be checked. Therefore, make sure that all the outdoor unit stop valves are firmly closed before performing leak test or vacuum drying.

NOTE Make sure that **ALL** indoor unit stop valves are **OPEN** (no outdoor unit stop valves!) before you start leak test and vacuuming.

See “Set-up” on page 99, “Leak test” on page 99, and “Vacuum drying” on page 100.

Installation of refrigerant piping, leak test, vacuuming after electrical installation is done on any indoor or outdoor unit

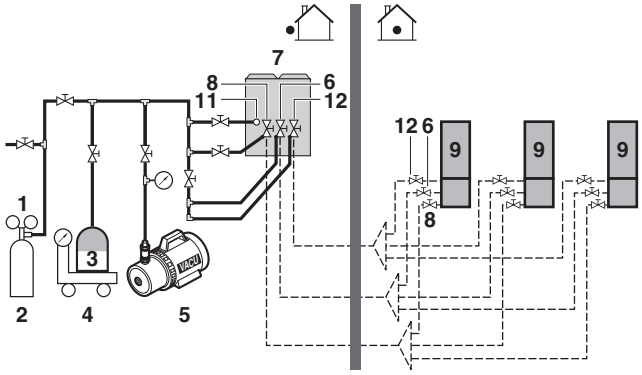
Apply outdoor unit setting 2-21=1 before starting leak test and vacuuming. This setting will open all field expansion valves and solenoid valves to guarantee a R410A piping pathway.

NOTE
- Make sure that **ALL** indoor unit stop valves are **OPEN** (no outdoor unit stop valves!) before you start leak test and vacuuming.
- Make sure that **ALL** indoor units connected to the outdoor unit are powered on.
- Wait untill the outdoor unit has finished the initialisation.

When all piping work is complete, it is necessary to:
- check for any leakages in the refrigerant piping and
- to perform vacuum drying to remove all moisture in the refrigerant piping.

If there is a possibility of moisture being present in the refrigerant piping (for example, rainwater may have entered the piping), first carry out the vacuum drying procedure below until all moisture has been removed and consider the installation of a liquid dryer.
All piping inside the unit has been factory tested for leaks.
Only field installed refrigerant piping needs to be checked. Therefore, make sure that all the stop valves are firmly closed before performing leak test or vacuum drying.
See “Set-up” on page 99, “Leak test” on page 99, and “Vacuum drying” on page 100.

Set-up



1. Pressure reducing valve
2. Nitrogen
3. Refrigerant R410A tank (siphon system)
4. Measuring instrument
5. Vacuum pump
6. Suction pipe stop valve
7. Outdoor unit
8. Liquid pipe stop valve
9. Indoor unit(s)
10. Charge hose
11. Refrigerant charge port
12. Discharge pipe stop valve

⋈ Valve

• Stop valve service port

NOTE The connections to the indoor units and all indoor units should also be leak and vacuum tested. Keep the stop valves of the indoor units open as well.
Refer to the indoor unit installation manual for more details.
Leak test and vacuum drying should be done before the power supply is set to the unit. See also the flow chart earlier described in this chapter.

Leak test

The leak test must satisfy specification EN 378-2.

1. Vacuum leak test
   - 1.1 Evacuate the system from the liquid, gas and high pressure piping to –100.7 kPa (5 Torr) for more than 2 hours.
   - 1.2 Once reached, turn off the vacuum pump and check that the pressure does not rise for at least 1 minute.
   - 1.3 Should the pressure rise, the system may either contain moisture (see vacuum drying below) or have leaks.
2. Pressure leak test
   - 2.1 Break the vacuum by pressurizing with nitrogen gas to a minimum gauge pressure of 0.2 MPa (2 bar).
     Never set the gauge pressure higher than the maximum operation pressure of the unit, i.e. 4.0 MPa (40 bar).

2.2 Test for leaks by applying a bubble test solution to all piping connections.

NOTE Make sure to use a recommended bubble test solution from your wholesaler. Do not use soap water, which may cause cracking of flare nuts (soap water may contain salt, which absorbs moisture that will freeze when the piping gets cold), and/or lead to corrosion of flared joints (soap water may contain ammonia which causes a corrosive effect between the brass flare nut and the copper flare).

2.3 Discharge all nitrogen gas.

Vacuum drying

To remove all moisture from the system, proceed as follows:

1. Evacuate the system for at least 2 hours to a target vacuum of –100.7 kPa.
2. Check that, with the vacuum pump turned off, the target vacuum is maintained for at least 1 hour.
3. Should you fail to reach the target vacuum within 2 hours or maintain the vacuum for 1 hour, the system may contain too much moisture.
4. In that case, break the vacuum by pressurizing with nitrogen gas to a gauge pressure of 0.05 MPa (0.5 bar) and repeat steps 1 to 3 until all moisture has been removed.
5. The stop valves can now be opened, and/or additional refrigerant can be charged (see “Method for adding refrigerant” on page 105).

NOTE After opening the stop valve, it is possible that the pressure in the refrigerant piping does not rise. This might be caused by e.g. the closed state of the expansion valve in the outdoor unit circuit, but does not present any problem for correct operation of the unit.

NOTE The connections to the indoor units and all indoor units should also be leak and vacuum tested. Keep the stop valves of the indoor units open as well.
Refer to the indoor unit installation manual for more details.
Leak test and vacuum drying should be done before the power supply is set to the unit. If not, see “Leak test and vacuum drying” on page 98 for more information.

1.1.4 Pipe insulation

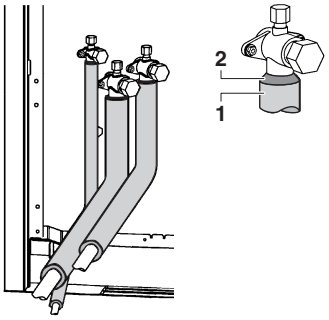
After finishing the leak test and vacuum drying, the piping must be insulated. Take into account the following points:

- Make sure to insulate the connection piping and refrigerant branch kits entirely.
- Be sure to insulate liquid, suction, and discharge piping (for all units).
- Use heat resistant polyethylene foam which can withstand a temperature of 70°C for liquid piping and polyethylene foam which can withstand a temperature of 120°C for gas piping.
- Reinforce the insulation on the refrigerant piping according to the installation environment.

Ambient temperature	Humidity	Minimum thickness
≤ 30°C	75% to 80% RH	15 mm
>30°C	≥80% RH	20 mm

Condensation might form on the surface of the insulation.

- If there is a possibility that condensation on the stop valve might drip down into the indoor unit through gaps in the insulation and piping because the outdoor unit is located higher than the indoor unit, this must be prevented by sealing up the connections. See below.



1. Insulation material
2. Caulking, etc.

1.1.5 Charging refrigerant

Precautions

ATTENTION

- Refrigerant cannot be charged until field wiring has been completed.
- Refrigerant may only be charged after performing the leak test and the vacuum drying.
- When charging a system, care shall be taken that its maximum permissible charge is never exceeded, in view of the danger of liquid hammer.
- Charging with an unsuitable substance may cause explosions and accidents, so always ensure that the appropriate refrigerant R410A is charged.
- Refrigerant containers shall be opened slowly.
- Always use protective gloves and protect your eyes when charging refrigerant.
- When the refrigerant system is to be opened, refrigerant must be treated according to the applicable legislation.

DANGER: ELECTRICAL SHOCK

Switch off all power supply before removing the switchbox service panel or before making any connections or touching electrical parts.

To avoid electric shock, be sure to disconnect the power supply 1 minute or more before servicing the electrical parts. Even after 1 minute, always measure the voltage at the terminals of main circuit capacitors or electrical parts and, before touching, be sure that those voltages are 50 V DC or less.

When service panels are removed, live parts can easily be touched by accident. Never leave the unit unattended during installation or servicing when the service panel is removed.

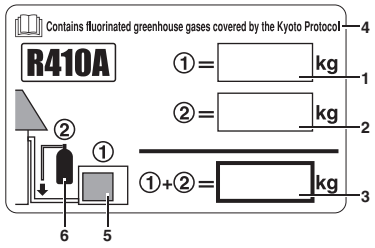
- To avoid compressor breakdown. Do not charge the refrigerant more than the specified amount.
- This outdoor unit is factory charged with refrigerant and depending on pipe sizes and pipe lengths some systems require additional charging of refrigerant. See “Calculating the additional refrigerant charge” on page 103.
- In case re-charge is required, refer to the nameplate of the unit. It states the type of refrigerant and necessary amount.

Important information regarding the refrigerant used

This product contains fluorinated greenhouse gases covered by the Kyoto Protocol. Do not vent gases into the atmosphere.
Refrigerant type: R410A
GWP(1) value: 1975
(1) GWP = global warming potential
Please fill in with indelible ink,

- ① the factory refrigerant charge of the product,
- ② the additional refrigerant amount charged in the field and
- ①+② the total refrigerant charge

on the fluorinated greenhouse gases label supplied with the product.
The filled out label must be adhered on the inside of the product and in the proximity of the product charging port (e.g. on the inside of the service cover).



1. Factory refrigerant charge of the product: see unit name plate
2. Additional refrigerant amount charged in the field
3. Total refrigerant charge
4. Contains fluorinated greenhouse gases covered by the Kyoto Protocol
5. Outdoor unit
6. Refrigerant cylinder and manifold for charging

NOTE National implementation of EU regulation on certain fluorinated greenhouse gases may require to provide the appropriate official national language on the unit. Therefore, an additional multilingual fluorinated greenhouse gases label is supplied with the unit.
Sticking instructions are illustrated on the backside of that label.

Calculating the additional refrigerant charge

NOTE There are 2 methods of calculating the additional refrigerant charge. Please choose the right method below.

[System with the same indoor unit types]

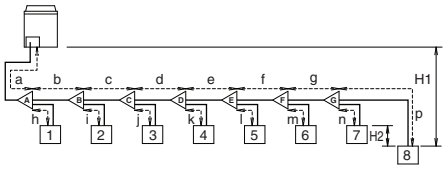
<How to calculate the additional refrigerant to be charged>

- When selecting EKHVMRD as indoor unit type (all indoor units are of this type), select correction factor A=1.
- When selecting EKHVMYD as indoor unit type (all indoor units are of this type), select correction factor A=1.1.

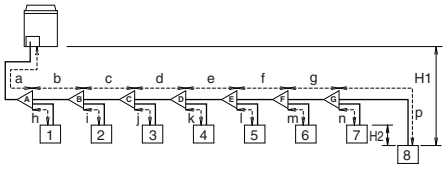
	Indoor unit	
	EKHVMRD	EKHVMYD
A	1	1.1

Additional refrigerant to be charged R (kg)
R should be rounded off in units of 0.1 kg
$R = [((X_1 \times Ø15.9) \times 0.18) + ((X_2 \times Ø12.7) \times 0.12) + ((X_3 \times Ø9.5) \times 0.059)] \times \mathbf{A}$
$\mathbf{X}_{1...3}$= Total length (m) of liquid piping size at **Øa**

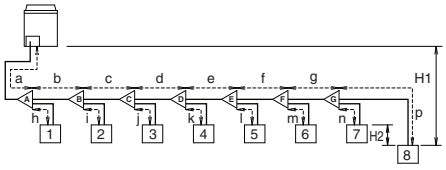
- **For EKHVMRD**
  System liquid piping



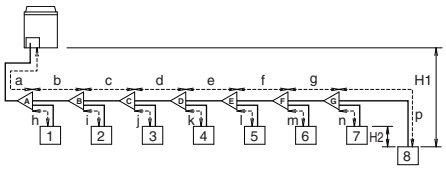
  System discharge piping



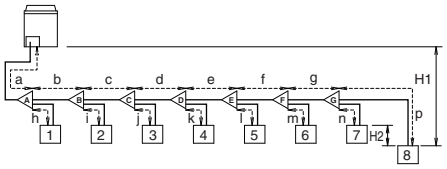
- **For EKHVMYD**
  System liquid piping



  System discharge piping



System suction piping



[System with different indoor unit types]

<How to calculate the additional refrigerant to be charged>

When combining different indoor unit types, additional refrigerant amount calculation should be done based on the used pipe system.

- When using 2 pipe system (for connection of EKHVMRD), please use correction factor A=1.
- When using 3 pipe system (for connection of EKHVMYD), please use correction factor A=1.1.

	Pipe system	
	2 pipe system	3 pipe system
A	1	1.1

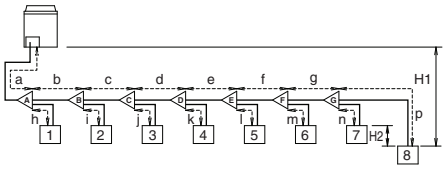
$R = \Sigma R_x$

$R_x = [((X_1 \times Ø15.9) \times 0.18) + ((X_2 \times Ø12.7) \times 0.12) + ((X_3 \times Ø9.5) \times 0.059)] \times \mathbf{A}$

$\mathbf{X}_{1...3}$= Total length (m) of liquid piping size at **Øa**

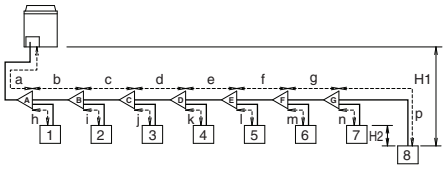
See the example below for more information.

[Example]

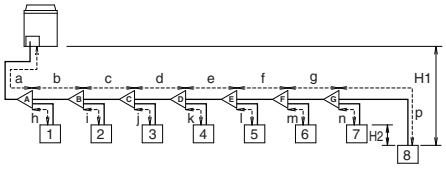


Unit 1~5: EKHVMRD (2 pipe)
Unit 7: EKHVMRD (2 pipe)
Unit 6+8: EKHVMYD (3 pipe)

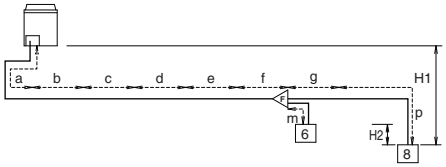
System liquid piping



System discharge piping



System suction piping



Distance	Correction factor (A)	Pipe system
a+b+c+d+e+f+g+p	1.1	3
h+i+j+k+l+n	1	2
m	1.1	3

Refnet	Refnet type
A+B+C+D+E+G	KHRQ22*
F	KHRQ23*

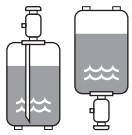
Additional refrigerant to be charged R (kg)
R should be rounded off in units of 0.1 kg
$R = R_1+R_2+R_3$
R_1~(a+b+c+d+e+g)
$R_1 = [((X_1 \times Ø15.9) \times 0.18) + ((X_2 \times Ø12.7) \times 0.12) + ((X_3 \times Ø9.5) \times 0.059)] \times \mathbf{1.1}$
R_2~(h+i+j+k+l+n)
$R_2 = [((X_1 \times Ø15.9) \times 0.18) + ((X_2 \times Ø12.7) \times 0.12) + ((X_3 \times Ø9.5) \times 0.059)] \times \mathbf{1}$
R_3~(m)
$R_3 = [((X_1 \times Ø15.9) \times 0.18) + ((X_2 \times Ø12.7) \times 0.12) + ((X_3 \times Ø9.5) \times 0.059)] \times \mathbf{1.1}$
$\mathbf{X}_{1...3}$= Total length (m) of liquid piping size at **Øa**

Method for adding refrigerant

[Precautions when adding refrigerant]
Be sure to charge the specified amount of refrigerant in liquid state.
Since this refrigerant is a mixed refrigerant, adding it in gas form may cause the refrigerant composition to change, preventing normal operation.

- Before charging, check whether the refrigerant cylinder is equipped with a siphon tube or not.

Charge the liquid refrigerant with the cylinder in upright position.



Charge the liquid refrigerant with the cylinder in up-side-down position.

- Be sure to use tools exclusively for R410A to ensure required pressure resistance and to prevent foreign materials from mixing into the system.

Charging with an unsuitable substance may cause explosions and accidents, so always make sure that the appropriate refrigerant (R410A) is charged.
Refrigerant containers must be opened slowly.

- When charging a system, charging over the permissible quantity can cause liquid hammer.
- Always use protective gloves and protect your eyes when charging refrigerant.

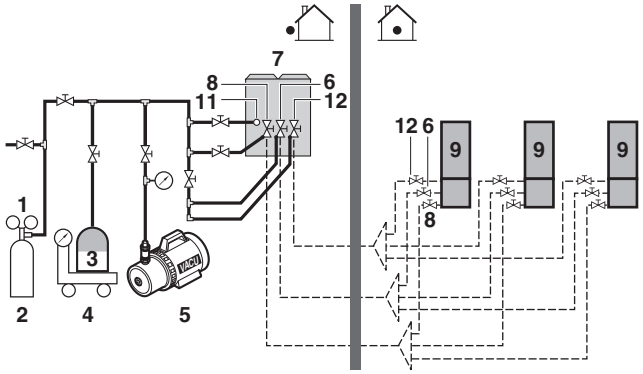
[Charging method]
As explained during vacuum drying method, once vacuum drying is finished, stop valves can be opened.

If the indoor units are all **heating only units**, your system is a 2 pipe system **(no 3 pipe)**. In this case, the suction stop valve should remain closed at all times.

Once the stop valves are opened, the refrigerant charging is possible following the procedure below:

1. Calculate the amount of refrigerant to be added using the formula mentioned in “Calculating the additional refrigerant charge” on page 103.
   The first 10 kg of refrigerant can be charged without outdoor unit operation. If the additional refrigerant amount is smaller than 10 kg, perform the precharging procedure as explained in step 2. below. If the additional refrigerant charge is larger than 10 kg, skip step 2 and perform step 3 till the end of the procedure.

2. Precharging can be done without compressor running by connecting the refrigerant bottle only to the liquid stop valve.
   Make sure that the other stop valves (discharge and suction gas stop valves) are closed:



1. Pressure reducing valve
2. Nitrogen
3. Refrigerant R410A tank (siphon system)
4. Measuring instrument
5. Vacuum pump
6. Gas pipe stop valve
7. Outdoor unit
8. Liquid pipe stop valve
9. Indoor unit(s)
10. Charge hose
11. Refrigerant charge port
12. Discharge pipe stop valve

⋈ Valve

• Stop valve service port

3. If the total amount of refrigerant could not be charged by precharging, then connect the refrigerant bottle to the refrigerant charging port as described in the figure above.
4. Make sure to open all 3 stop valves of the outdoor unit.
5. Turn on the power of the indoor unit and outdoor unit.
   To be able to do this operation, the outdoor unit should be set in mode 2.
6. Push the **BS1 MODE** button for 5 sec, the H1P LED is on ☼.
7. Push the **BS2 SET** button 20 times until following LED combination is reached:

H1P	H2P	H3P	H4P	H5P	H6P	H7P
☼	●	☼	●	☼	●	●

8. Push the **BS3 RETURN** button to confirm setting 2-20 above.
9. Push the **BS2 SET** button to change the charge mode from **OFF** (OFF) to **ON** (ON). LED indication should change as follows

		H1P	H2P	H3P	H4P	H5P	H6P	H7P
OFF	(a)	☼	●	●	●	●	●	◑
ON		☼	●	●	●	●	◑	●

a. This setting = factory setting

10. Push the **BS3 RETURN** button and the setting is defined.
11. Push the **BS3 RETURN** button again, and the refrigerant charging operation will start.
12. After charging the specified quantity of refrigerant, press the **BS3 RETURN** button to stop the operation.

NOTE The operation will automatically stop within 30 minutes. If charging is not completed after 30 minutes, set and perform the additional refrigerant charging operation again.

[Checks after adding refrigerant]

- Are the stop valves for liquid, discharge, and suction open?
- Is the amount of refrigerant, that has been added, recorded on the refrigerant charge label?



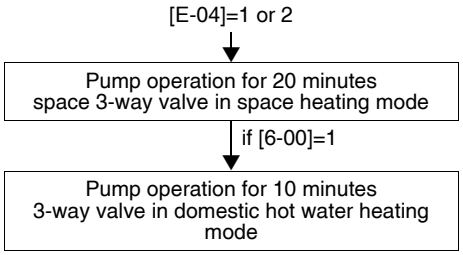
- Make sure to open the stop valves after charging the refrigerant.
- Operating with the stop valves closed will damage the compressor.
- If the indoor units are all **heating only units**, your system is a 2 pipe system **(no 3 pipe)**. In this case, the suction stop valve should remain closed at all times.

1.1.6 Final air purging

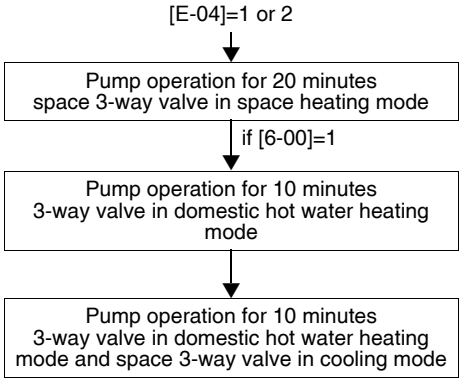
To get rid of all the air in the system, the pump should be operated.
Therefore, change the field setting [E-04] as explained in the chapter “Field settings“.
In case of an optional tank installed with the EKHVMYD units the system includes two 3-way valves (cool/heat and heat/domestic hot water). If no tank is installed, only 1 3-way valve is included.
In case of an optional tank installed with the EKHVMRD units the system includes one 3-way valves (heat/domestic hot water).

- **[E-04]** Pump only operation
  When commissioning and installing the unit it is very important to get all air out of the water circuit.
  Through this field setting the pump can be operated without actual operation of the unit. By doing so this will enhance the air removal from the circuit. The pump can operate at different speed:
  - **[E-04]**=0 normal operation of the unit (default)
  - **[E-04]**=1 low pump speed operation
  - **[E-04]**=2 high pump speed operation
    If you select [E-04]=1 or 2 and [6-00]=1, the unit will activate the domestic hot water 3-way valve and heat/cool 3-way valve. This function is a helpful feature to get all air removed out of the system (as well in space heating/cooling as in domestic hot water heating).

    For EKHVMRD:



    For EKHVMYD:



1.1.7 Test operation

After installation and once the field settings are defined, the installer is obliged to verify correct operation. Therefore a test run must be performed according to the procedures described below.

Precautions before starting test operation

During test operation, the outdoor unit and the indoor units will start up.

- Make sure that the preparations of all indoor units are finished (field piping, electrical wiring, air purge,...). See installation manual of the indoor units.

Do not insert fingers, rods or other objects into the air inlet or outlet. When the fan is rotating at high speed, it will cause injury.

Do not perform the test operation while working on the indoor units.

WARNING

- During tests never pressurize the appliances with a pressure higher than the maximum allowable pressure (as indicated on the nameplate of the unit).
- If refrigerant gas leaks, ventilate the area immediately. Toxic gas may be produced if refrigerant gas comes into contact with fire.
- Never directly touch any accidental leaking refrigerant. This could result in severe wounds caused by frostbite.
- Test run is possible for ambient temperatures between –20°C and 35°C.

DANGER: DO NOT TOUCH PIPING AND INTERNAL PARTS

Do not touch the refrigerant piping, water piping or internal parts during and immediately after operation. The piping and internal parts may be hot or cold depending on the working condition of the unit.

Your hand may suffer burns or frostbite if you touch the piping or internal parts. To avoid injury, give the piping and internal parts time to return to normal temperature or, if you must touch them, be sure to wear protective gloves.

DANGER: ELECTRICAL SHOCK

Switch off all power supply before removing the switchbox service panel or before making any connections or touching electrical parts.

To avoid electric shock, be sure to disconnect the power supply 1 minute or more before servicing the electrical parts. Even after 1 minute, always measure the voltage at the terminals of main circuit capacitors or electrical parts and, before touching, be sure that those voltages are 50 V DC or less.

When service panels are removed, live parts can easily be touched by accident. Never leave the unit unattended during installation or servicing when the service panel is removed.

Provide a logbook and machine card.

In accordance with the applicable legislation, it may be necessary to provide a logbook with the equipment containing at least: info on maintenance, repair work, results of tests, stand-by periods, ….

Also, at least, following information shall be provided at an accessible place of the system:

- instructions for shutting down the system in case of an emergency
- name and address of fire department, police and hospital
- name, address and day and night telephone numbers for obtaining service.

In Europe, EN378 provides the necessary guidance for this logbook.

NOTE Note that during the first running period of the unit, required power input may be higher. This phenomenon originates from the compressor that requires a 50 hour run elapse before reaching smooth operation and stable power consumption. Reason is that the scroll is made out of iron and that it takes some time to smooth the surfaces that make contact.

NOTE To protect the compressor, be sure to turn on the power supply 6 hours before starting operation.

Test operation

The procedure below describes the test operation of the complete system. This operation checks and judges following items:

- Check of the stop valves opening
- Check of wrong wiring
- Check of refrigerant overcharge
- Check of indoor unit operation

On top of this test operation, the indoor unit operation can also be checked separately. Refer to the indoor unit installation manual for more details.

- Make sure to carry out the test operation after the first installation. Otherwise, the malfunction code U3 will be displayed on the remote controller and normal operation can not be carried out.
- Abnormalities on indoor units can not be checked for each unit separately. After the test operation is finished, check the indoor units one by one by performing a normal operation using the remote controller.

1. Close all front panels except the front panel of the electric component box.
2. Turn ON the power to the outdoor unit and the connected indoor units.
   Be sure to turn on the power 6 hours before operation in order to have power running to the crankcase heater and to protect the compressor.
3. Push **BS4 TEST** button for 5 seconds or more. The unit will start test operation.
   - The test operation is automatically carried out in heating mode, the H2P LED will blink and the messages "Test operation" and "Under centralized control" will display on the remote controller.
   - It may take 10 minutes to bring the state of the refrigerant uniform before the compressor starts.
   - During the test operation, the refrigerant running sound or the magnetic sound of a solenoid valve may become loud and the LED display may change, but these are not malfunctions.
   - During the test operation, it is not possible to stop the unit operation from a remote controller. To abort the operation, press the **BS3 RETURN** button. The unit will stop after ±30 seconds.
     Test run may take up to 1 hour or more.
4. Close the front panel in order to let it not be the cause of misjudgement.
5. Check the test operation results by the LED display on the outdoor unit.

	H1P	H2P	H3P	H4P	H5P	H6P	H7P
Normal completion	●	●	☼	●	●	●	●
Abnormal completion	●	☼	☼	●	●	●	●

6. When the test operation is fully completed, normal operation will be possible after 5 minutes. Otherwise, refer to “Correcting after abnormal completion of the test operation” on page 111 to take actions for correcting the abnormality.

Correcting after abnormal completion of the test operation

The test operation is only completed if there is no malfunction code displayed on the remote controller. In case of a displayed malfunction code, perform the following actions to correct the abnormality:

- Confirm the malfunction code on the remote controller

Installation error	Error code	Remedial action
The stop valve of an outdoor unit is left closed.	E3 E4 F3 F6 UF	Open the stop valve.
The phases of the power to the outdoor unit is reversed.	U1	Exchange two of the three phases (L1, L2, L3) to make a positive phase connection.
No power is supplied to an outdoor or indoor unit (including phase interruption).	LC U1 U4	Check if the power wiring for the outdoor unit is connected correctly.
Incorrect interconnections between units.	UF	Check if the refrigerant piping and the unit wiring are consistent with each other.
Refrigerant overcharge.	E3 F6 UF	Recalculate the required amount of refrigerant from the piping length and correct the refrigerant charge level by recovering any excessive refrigerant with a refrigerant recovery machine.
Insufficient refrigerant.	E4 F3	Check if the additional refrigerant charge has been finished correctly. Recalculate the required amount of refrigerant from the piping length and add an adequate amount of refrigerant.
In case the test operation was interrupted or the unit was operating out of the instructed temperature range, the initial refrigerant detection has failed.	U3	In case the test operation was interrupted, perform the test operation again. Perform the test operation again within the instructed temperature range. Test run is possible for ambient temperatures between –20°C and 35°C.

- After correcting the abnormality, press the **BS3 RETURN** button and reset the malfunction code.
- Carry out the test operation again and confirm that the abnormality is properly corrected.
- Refer to the installation manual of the indoor unit for other detailed codes.

1.1.8 Indoor unit individual test run

NOTE When the indoor units and outdoor unit are powered on for the first time, an initialisation takes place. This will take maximum 12 minutes.
When using the remote controller during the initialisation, an error code (UH) can be displayed.

The installer is obliged to verify correct operation of the indoor and outdoor unit after installation. Therefor a test run must be performed according to the procedures described below. At any time it is possible to check correct operation of space heating and domestic water heating.

NOTE
- During the first start up of the unit (the first 48 hours of compressor running), it might happen that the noise level of the unit is higher than mentioned in the technical specifications. This is not an abnormal event.
- Start up of the unit in space heating mode is only possible when the outdoor ambient temperature is lower than 20°C. Refer to “[9-02] Thermo ON/OFF admission” on page 128 how to increase this temperature limit.

Temperature read-out mode

On the remote controller, the actual temperatures can be displayed.
1. Push and hold the button for 5 seconds.
   The leaving water temperature is displayed (icons and and are blinking).
2. Use the and buttons to display:
   - The entering water temperature (icons and are blinking and the icon is flashing slowly).
   - The indoor temperature (icons and are blinking).
   - The outdoor temperature (icons and are blinking).
   - The hot water supply tank temperature (icons and are blinking).
3. Push the button again to leave this mode. If no button is pressed, the remote controller leaves the display mode after 10 seconds.

Procedure for space heating/ cooling

1. Check the leaving water and entering water temperature through the remote controller read-out mode and write down the displayed values. See “Temperature read-out mode” on page 112.
2. Select the operation mode: heating or cooling.
3. Push the button 4 times so the TEST icon will be displayed.
4. Perform the test as follows (when no action is performed, the user interface will return to normal mode after 10 seconds or by pressing the button once):
   To test the space heating/cooling operation push the button to start the test run operation.
5. The test run operation will end automatically after 30 minutes or when reaching the set temperature. The test run operation can be stopped manually by pressing the button once. If there are misconnections or malfunctions, an error code will be displayed on the user interface. Otherwise, the user interface will return to normal operation.
6. To resolve the error codes, see “Troubleshooting by Indication on the Remote Controller” on page 164.
7. Check the leaving water and entering water temperature through the remote controller read-out mode and compare them with the values noted with step 1. After 20 minutes of operation an increase/decrease of the values should confirm the space heating/cooling operation.

NOTE To display the last resolved error code, push the button 1 time. Push the button again 4 times to return to normal mode.

NOTE It is not possible to perform a test run if a forced operation from the outdoor unit is in progress. Should forced operation be started during a test run, the test run will be aborted.

Procedure for domestic water heating

1. Check the domestic hot water tank temperature through the remote controller read-out mode. See “Temperature read-out mode” on page 112.
2. Push the button for 5 seconds.
   The icon will start blinking with 1 second intervals.
3. Keep the unit operating for 20 minutes and check the domestic hot water tank temperature through the remote controller again.
   An increase of the value with 5°C should confirm the domestic water heating operation.
4. The operation will stop if the tank storage temperature has been reached.

1.2 Operation when Power is Turned On

1.2.1 When Turning On Power First Time

The unit cannot be run for up to 12 minutes to automatically set the master power and address (indoor-outdoor address, etc.).

Status

Outdoor unit	Test lamp H2P .... Blinks Can also be set during operation described above.
Indoor unit	If ON button is pushed during operation described above, the "UH" malfunction indicator blinks. (Returns to normal when automatic setting is complete.)

1.2.2 When Turning On Power the Second Time and Subsequent

Tap the RESET button on the outdoor unit PC board. Operation becomes possible for about 2 minutes. If you do not push the RESET button, the unit cannot be run for up to 10 minutes to automatically set master power.

Status

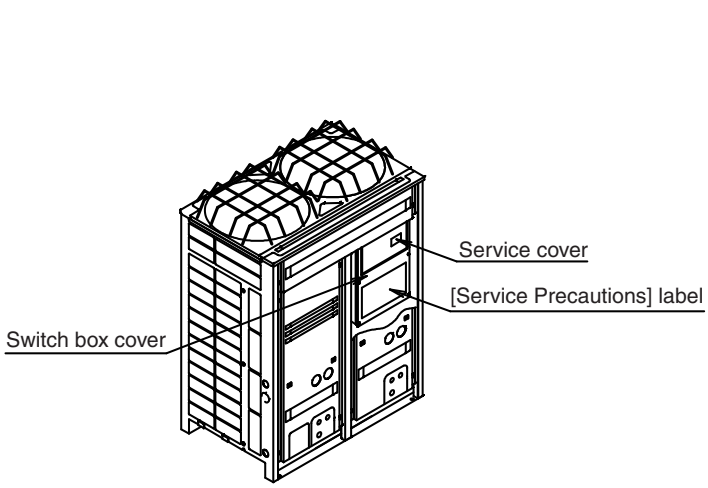
Outdoor unit	Test lamp H2P .... Blinks Can also be set during operation described above.
Indoor unit	If ON button is pushed during operation described above, the operation lamp lights but the compressor does not operate. (Returns to normal when automatic setting is complete.)

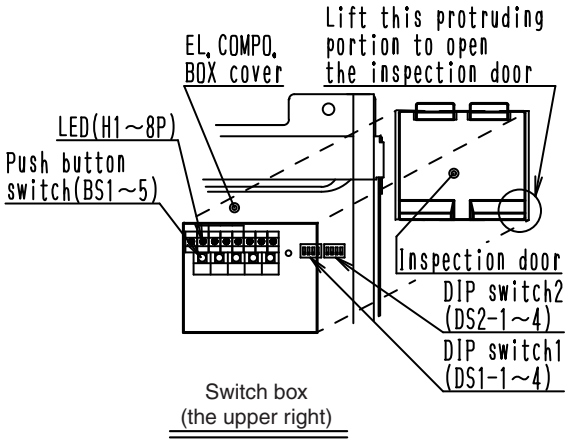
1.2.3 When an Indoor Unit or Outdoor Unit has been Added, or Indoor or Outdoor Unit PC Board has been Changed

Be sure to push and hold the RESET button for 5 seconds. If not, the addition cannot be recognized. In this case, the unit cannot be run for up to 12 minutes to automatically set the address (indoor-outdoor address, etc.)

Status

Outdoor unit	Test lamp H2P .... ON Can also be set during operation described above.
Indoor unit	If ON button is pushed during operation described above, the "UH" or "U4" malfunction indicator blinks. (Returns to normal when automatic setting is complete.)

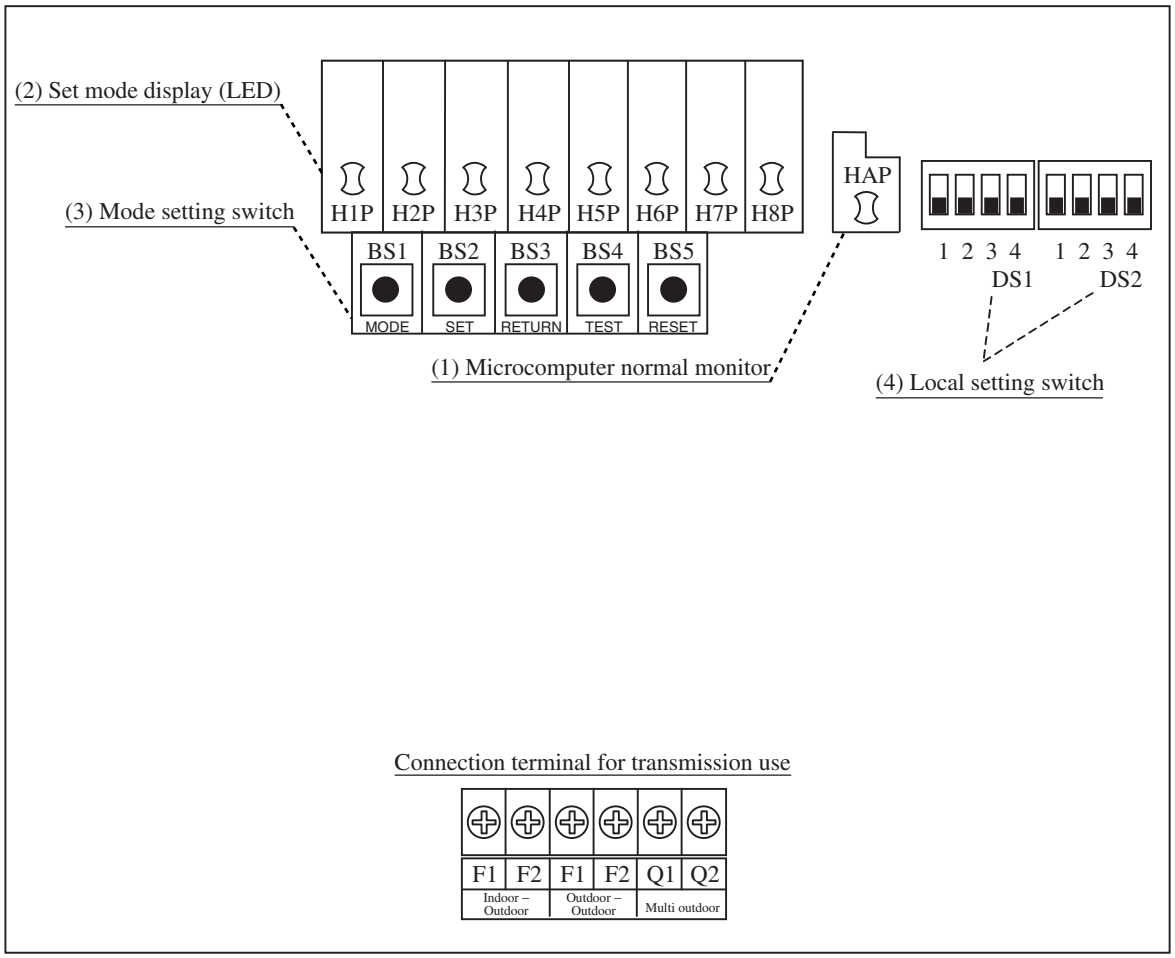




Caution **When the 400 volt power supply is applyed to "N" phase by mistake, replace Inverter PC board (A2P) and control transformer (T1R, T2R) in switch box together.**

2. Outdoor Unit PC Board Layout

Outdoor unit PC board



(V3054)

(1) Microcomputer normal monitor
This monitor blinks while in normal operation, and turns on or off when a malfunction occurs.

(2) Set mode display (LED)
LEDs display mode according to the setting.

(3) Mode setting switch
Used to change mode.

(4) Local setting switch
Used to make field settings.

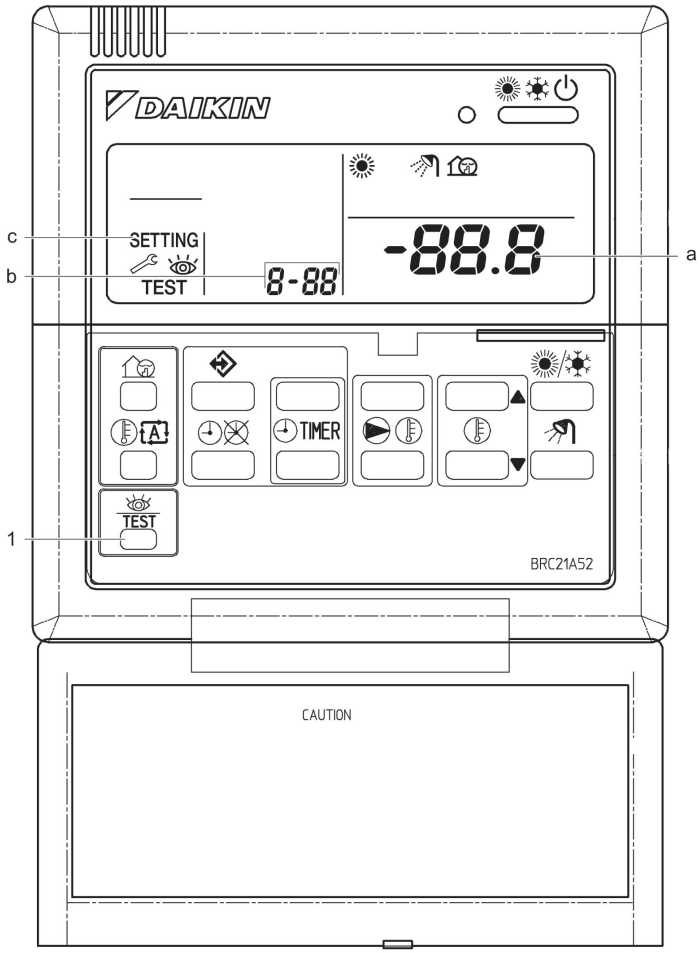
3. Field Setting

3.1 Field Setting from remote control

Individual function of indoor unit can be changed from the remote control. At the time of installation or after service inspection / repair, make the local setting in accordance with the following description.
Wrong setting may cause malfunction.
(When optional accessory is mounted on the indoor unit, setting for the indoor unit may be required to change. Refer to information in the option handbook.)

3.1.1 Wired remote control

EKRUAHTB
(BRC21A52)



To change one or more field settings, proceed as follows.

1. Press the TEST button for a minimum of 5 seconds to enter FIELD SET MODE.
   The SETTING icon (c) will be displayed. The current selected field setting code is indicated 8-88 (b), with the set value displayed to the right -88.8 (a).
2. Press the ▲ button to select the appropriate field setting first code (8-).
3. Press the ▼ button to select the appropriate field setting second code (-88).
4. Press the TIMER ▲ button and TIMER ▼ button to change the set value of the select field setting.
5. Save the new value by pressing the ⊗ button.
6. Repeat step 2 through 4 to change other field settings as required.
7. When finished, press the TEST button to exit FIELD SET MODE.

Notes :

1. Changes made to a field setting are only stored when the ⏲⊗ button is pressed. Pressing the TEST button, without pressing the ⏲⊗ button before, will discard the change made.
2. When you save a field setting by pressing the ⏲⊗ button, the complete field setting group will be saved. For example, when you save field setting 8-00, the other field settings of group 8 (8-01, 8-02, 8-03, 8-04) will be saved as well.
3. Before shipping, the set values have been set as shown in the field settings table.
4. When exiting FIELD SET MODE, "88" may be displayed on the remote controller LCD while the unit initializes itself.
5. When running through the field settings you may notice that there are some more field settings as mentioned in the field settings table. **THESE SETTINGS ARE NOT APPLICABLE AND MAY NOT BE CHANGED!**
6. If you want to leave the setting mode without saving, press the test button.

3.1.2 Setting Contents and Code No. – EKHVM (R/Y) D – Indoor unit

First code	Second code	Setting name	Installer setting at variance with default value				Default value	Range	Step	Unit
			Date	Value	Date	Value				
0	**Remote control setup**									
	00	User permission level					2	2~3	1	—
	01	Room temperature compensation value					0	–5~5	0.5	°C
	02	Not applicable. Do not change the default value.					1	—	—	—
	03	Status: space heating schedule timer mode Method 1=1 / Method 2= 0					1 (ON)	0/1	—	—
	04	Status: space cooling schedule timer mode Method 1=1 / Method 2= 0					1 (ON)	0/1	—	—
1	**Automatic storage timing for domestic water heating**									
	00	Status: night time storage					1 (ON)	0/1	—	—
	01	Night time storage start time					1:00	0:00~23:00	1:00	hour
	02	Status: day time storage					0 (OFF)	0/1	—	—
	03	Day time storage start time					15:00	0:00~23:00	1:00	hour
2	**Automatic setback function**									
	00	Status: setback operation					1 (ON)	0/1	—	—
	01	Setback operation start time					23:00	0:00~23:00	1:00	hour
	02	Setback operation stop time					5:00	0:00~23:00	1:00	hour
3	**Weather dependent set point**									
	00	Low ambient temperature (Lo_A)					–10	–20~5	1	°C
	01	High ambient temperature (Hi_A)					15	10~20	1	°C
	02	Set point at low ambient temperature (Lo_Ti)					70	25~80	1	°C
	03	Set point at high ambient temperature (Hi_Ti)					45	25~80	1	°C
4	**Disinfection function**									
	00	Status: disinfection operation					1 (ON)	0/1	—	—
	01	Disinfection operation day selection					Fri	Mon~Sun	—	—
	02	Disinfection operation start time					23:00	0:00~23:00	1:00	hour
5	**Automatic setback and disinfection set point**									
	00	Set point: disinfection operation temperature					70	60~75	5	°C
	01	Disinfection operation time duration					10	5~60	5	min
	02	Leaving water setback temperature					5	0~10	1	°C
	03	Room setback temperature					18	17~23	1	°C
	04	Not applicable. Do not change the default value.					0	—	—	—
6	**Option setup**									
	00	Domestic hot water tank installed					0 (OFF)	0/1	—	—
	01	Optional room thermostat installed					0 (OFF)	0/1	—	—
	02	Not applicable. Do not change the default value.					0	—	—	—
	03	Not applicable. Do not change the default value.					0	—	—	—
	04	Benefit kWh power supply mode					0	0/2	1	—
7	**Option setup**									
	00	Not applicable. Do not change the default value.					1	—	—	—
	01	Not applicable. Do not change the default value.					0	—	—	—
	02	Multiple set point pattern					0 (A)	0/1	—	—
	03	Multiple set point 1					0 (OFF)	0/1	—	—
	04	Multiple set point 2					0 (OFF)	0/1	—	—

First code	Second code	Setting name	Installer setting at variance with default value				Default value	Range	Step	Unit
			Date	Value	Date	Value				
8	**Option setup**									
	00	Remote controller temperature control					1 (ON)	0/1	—	—
	01	Not applicable. Do not change the default value.					0	—	—	—
	02	Not applicable. Do not change the default value.					0	—	—	—
	03	Status: low noise level					1	1~3	1	—
	04	Status: freeze-up prevention					0	0~2	1	—
9	**Automatic temperature compensation**									
	00	Leaving water temperature compensation value (heating)					0	–2~2	0.2	°C
	01	Domestic hot water tank compensation value					0	–5~5	0.5	°C
	02	Thermo ON/OFF admission					0	–5~5	0.5	°C
	03	Leaving water temperature compensation value (cooling)					0	–2~2	0.2	°C
	04	Not applicable. Do not change the default value.					0	—	—	—
A	**Option setup**									
	00	Current limitation.					0	0~2	1	—
	01	Indoor unit height difference setting					0	0~2	1	—
	02	Set point: heating required temperature difference for leaving and returning water					10	5~15	1	°C
	03	Set point: multiple set point 1 required temperature value					35	25~80	1	°C
	04	Set point: multiple set point 2 required temperature value					65	25~80	1	°C
b	**Domestic hot water set points**									
	00	Set point: reheat minimum temperature					35	35~65	1	°C
	01	Set point: reheat maximum temperature					45	35~75	1	°C
	02	Status: weather dependent domestic water heating					1 (ON)	0/1	—	—
	03	Set point: storage temperature					70	45~75	1	°C
	04	Automatic maximum domestic hot water storage temperature					70	55~75	1	°C
C	**Leaving water temperature limits**									
	00	Set point: heating leaving water maximum temperature					80	37~80	1	°C
	01	Set point: heating leaving water minimum temperature					25	25~37	1	°C
	02	Set point: cooling leaving water maximum temperature					20	18~22	1	°C
	03	Set point: cooling leaving water minimum temperature					5	5~18	1	°C
	04	Not applicable. Do not change the default value.					0	—	—	—

First code	Second code	Setting name	Installer setting at variance with default value				Default value	Range	Step	Unit
			Date	Value	Date	Value				
d	**Domestic water heating retention times**									
	00	Set point: minimum time for domestic water heating					10	5~20	1	—
	01	Set point: maximum time for domestic water heating					30	10~60	5	—
	02	Set point: interval minimum stop time of domestic water heating					15	5~30	5	—
	03	Not applicable. Do not change the default value.					15	—	—	—
	04	Not applicable. Do not change the default value.					40	—	—	—
E	**Service mode**									
	00	Vacuum mode R134a					0	0/1	—	—
	01	Not applicable. Do not change the default value.					0	—	—	—
	02	Not applicable. Do not change the default value.					0	—	—	—
	03	Not applicable. Do not change the default value.					1	—	—	—
	04	Pump only operation					0	0~2	1	—
F	**Option setup continued**									
	00	Set point: cooling required temperature difference for leaving and returning water					5	5~15	1	°C
	01	Not applicable. Do not change the default value.					0	—	—	—
	02	Heat recovery allowance					1	0~2	1	—
	03	Not applicable. Do not change the default value.					10	—	—	—
	04	Not applicable. Do not change the default value.					50	—	—	—

3.1.3 Detailed explanation of setting modes

[0] Remote control setup

- **[0-00]** User permission level
  The remote controller can be programmed to make certain buttons and functions unavailable for the user. There are 2 permission levels defined. Both levels (level 2 and level 3) are basically the same, the only difference is that for level 3 no water temperature settings are possible (see table below).

	Permission	
	level 2	level 3
Operation ON/OFF	Operable	Operable
Domestic water heating operation ON/OFF	Operable	Operable
Setting the leaving water temperature	Operable	—
Setting the room temperature	Operable	Operable
Quiet mode ON/OFF	—	—
Weather dependent set point operation ON/OFF	Operable	—
Setting the clock	—	—
Programming the schedule timer	—	—
Schedule timer operation ON/OFF	Operable	Operable
Field settings	—	—
Error code display	Operable	Operable
Test operation	—	—

  By default no level is defined so all buttons and functions are operable.
  The actual permission level is determined by field setting. For permission level 2, set field setting [0-00] to 2, for permission level 3, set field setting [0-00] to 3.
  Once the field setting is set, the chosen permission level is not yet active. Enabling the selected permission level is done by simultaneously pressing buttons ⏲▲ and ⏲▼ immediately followed by simultaneously pressing buttons 🏠 and 🌡A, and keeping all 4 buttons pressed for at least 5 seconds. Note that no indication on the remote controller is given. After the procedure the blocked buttons will not be available anymore.
  Deactivating the selected permission level is done in the same way.
- **[0-01]** Room temperature compensation value
  If needed, it is possible to adjust some thermistor value of the unit by a correction value. This can be used as countermeasure for thermistor tolerances or capacity shortage.
  The compensated temperature (= measured temperature plus compensation value) is then used for controlling the system and will be displayed in the temperature read-out mode. See also “[9] Automatic temperature compensation” on page 128 for compensation values for leaving water temperature and domestic hot water temperature.
- **[0-02]** Setting not available
- **[0-03]** Status: defines whether the ON/OFF instruction can be used in the schedule timer for space heating.
  Refer to the operation manual for details how to program the schedule timer.
  The schedule timer for space heating can be programmed in 2 different ways: based on the temperature set point (both leaving water temperature and room temperature) and based on the ON/OFF instruction.

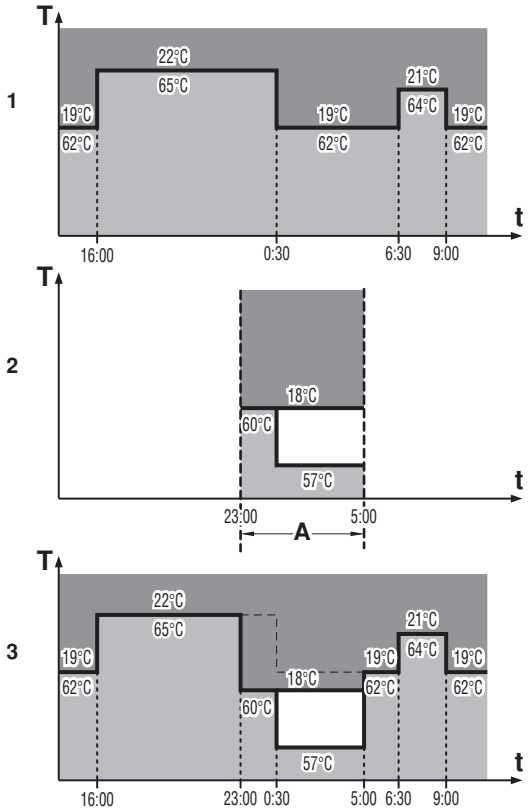
NOTE By default space heating based on temperature set point (method 1) is enabled, so only temperature shifts are possible (no ON/OFF instruction).
Advantage of this method is that you can simply switch off the space heating operation by pushing the ❄☼ button without disabling the automatic domestic hot water storage operation (e.g. during summertime when no space heating is required).

In the following tables both methods on how to interpret the schedule timer are shown.

Method 1	Space heating based on temperature set point[a]
During operation	During schedule timer operation the operation LED is lit continuously.
When pushing the ❀❄⏻ button	The schedule timer for space heating will stop and will not start again. The controller will be switched off (operation LED will stop working). However, the schedule timer icon will stay displayed which means that the domestic water heating stays enabled.
When pushing the ⊗/🕘 button	The schedule timer for space heating **and** domestic water heating along with the quiet mode will be stopped and will not start again. The schedule timer icon will not be displayed anymore.

a. For leaving water temperature and/or room temperature

Operation example: Schedule timer based on temperature set points.
When setback function is enabled, the setback operation will have priority over the scheduled action in the schedule timer.



1 Schedule timer

2 Setback function

3 When both setback function and schedule timer are enabled

A Setback function

t Time

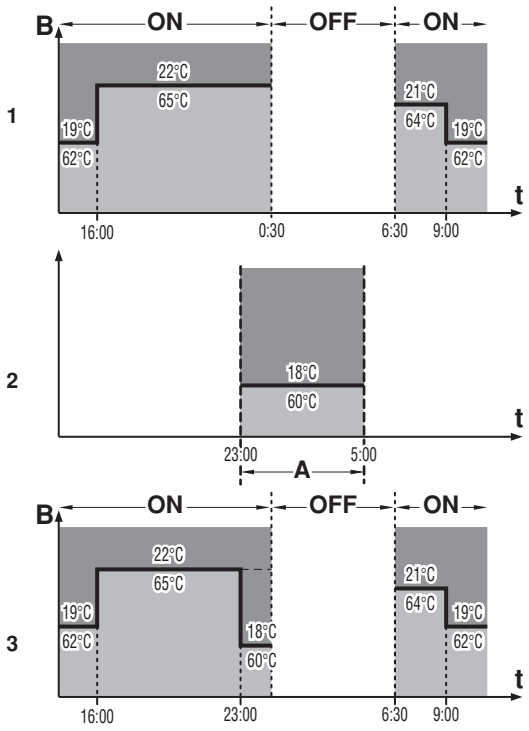
T Temperature set point

Room temperature

Leaving water temperature

Method 2	Space heating based on ON/OFF instruction
During operation	When the schedule timer switches space heating OFF, the controller will be switched off (operation LED will stop working). Note that this has no influence on the domestic water heating.
When pushing the ❀❀ button	The schedule timer for space heating will stop (when active at that moment) and will start again at the next scheduled ON function. The "last" programmed command overrules the "preceding" programmed command and will remain active until the "next" programmed command occurs. Example: imagine the actual time is 17:30 and actions are programmed at 13:00, 16:00 and 19:00. The "last" programmed command (16:00) overruled the "previous" programmed command (13:00) and will remain active until the "next" programmed command (19:00) occurs. So in order to know the actual setting, one should consult the last programmed command. It is clear that the "last" programmed command may date from the day before. Refer to the operation manual. The controller will be switched off (operation LED will stop working). However the schedule timer icon will stay displayed which means that the domestic heating stays enabled.
When pushing the ⊗/🕘 button	The schedule timer for space heating **and** domestic water heating along with the quiet mode will be stopped and will not start again. The schedule timer icon will not be displayed anymore.

Operation example: Schedule timer based on ON/OFF instruction.
When setback function is enabled, the setback operation will have priority over the scheduled action in the schedule timer if ON instruction is active. If OFF instruction is active this will have priority over the setback function. At any time the OFF instruction will have the highest priority.



1 Schedule timer
2 Setback function
3 When both setback function and schedule timer are enabled
A Setback function
B ON/OFF instruction
t Time
T Temperature set point
Room temperature
Leaving water temperature

- **[0-04]** Status: defines whether the ON/OFF instruction can be used in the schedule timer for cooling.

  Same as for [0-03] but for cooling schedule timer.

For cooling, no setback function is available.

[1] Automatic storage timing for domestic water heating

In this mode, the indoor unit will deliver hot water to the domestic hot water tank based on the daily fixed pattern. This mode will continue until storage temperature is reached.
Automatic storage is the advised domestic hot water mode. In this mode water heats up during the night (when space heating requirements are lower) until the storage set point. The heated water is stored in the domestic hot water tank at a higher temperature so it can fulfil the domestic hot water requirements throughout the day.
The storage temperature set point and timing are field settings.

- **[1-00]** Status: defines whether the domestic water heating (storage mode) during night is enabled (1) or not (0).
- **[1-01]** Start time: time of the night at which the domestic water should be heated.
- **[1-02]** Status: defines whether the domestic water heating (storage mode) during daytime is enabled (1) or not (0).
- **[1-03]** Start time: time of the day at which the domestic water should be heated.

NOTE

- Make sure the domestic hot water is only heated up to the domestic hot water temperature you require. Start with a low domestic hot water storage temperature set point, and only increase if you feel that the domestic hot water supply temperature is not sufficient for your needs (this depends on your water using pattern).
- Make sure the domestic hot water is not heated unnecessary. Start with activating automatic storage during night (default setting). If it seems that the domestic hot water night storage operation is not sufficient for your needs, an additional storage during daytime can be set.
- For energy-saving purposes, it is advised to enable the weather dependent domestic water heating. Refer to setting “[b-02]” on page 130.

Refer to “[b] Domestic hot water set points” on page 130 for temperature set points.

[2] Automatic setback function

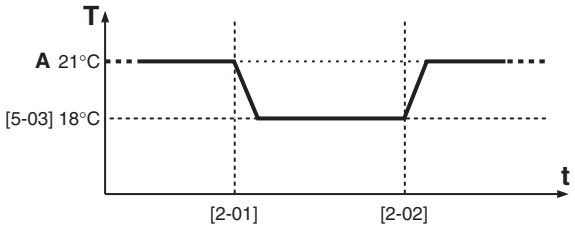
Setback function provides the possibility to lower the room temperature. The setback function can for instance be activated during the night because the temperature demands during night and day are not the same.

NOTE

- By default the setback function is enabled.
- The setback function can be combined with the automatic weather dependent set point operation.
- Setback function is an automatic daily scheduled function.

- **[2-00]** Status: defines whether the setback function is turned ON (1) or OFF (0)
- **[2-01]** Start time: time at which setback is started
- **[2-02]** Stop time: time at which setback is stopped

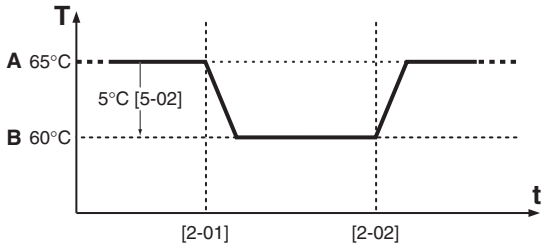
Setback can be configured for both room temperature control and leaving water temperature control.



A Normal room temperature set point

t Time

T Temperature



A Normal leaving water temperature set point

B Leaving water setback temperature

t Time

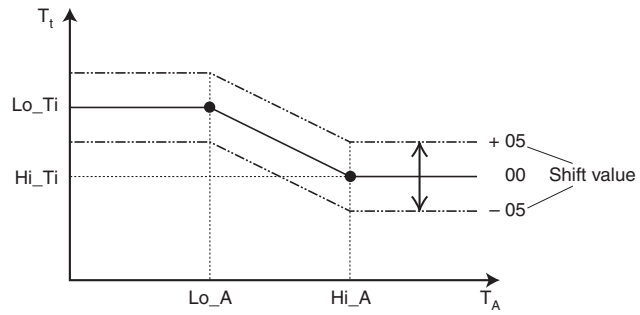
T Temperature

It is advised to set the start time of automatic storage during night [1-01] on the moment that the setback function starts [2-01].
Refer to “[5] Automatic setback and disinfection set point” on page 126 for temperature set points.

NOTE Setback function for cooling does not exist.

[3] Weather dependent set point

When weather dependent operation is active, the leaving water temperature is determined automatically depending on the outdoor temperature: colder outdoor temperatures will result in warmer water and vice versa. The unit has a floating set point. Activating this operation will result in a lower power consumption than use with a manually fixed leaving water set point. During weather dependent operation, the user has the possibility to shift up or down the target water temperature by a maximum of 5°C. This "Shift value" is the temperature difference between the temperature set point calculated by the controller and the real set point. E.g. a positive shift value means that the real temperature set point will be higher than the calculated set point.
It is advised to use the weather dependent set point because it adjusts the water temperature to the actual needs for space heating. It will prevent the unit from switching too much between thermo ON operation and thermo OFF operation when using the remote controller room thermostat.



T_t Target water temperature

T_A Ambient (outdoor) temperature

Shift value = Shift value

- **[3-00]** Low ambient temperature (Lo_A): low outdoor temperature.
- **[3-01]** High ambient temperature (Hi_A): high outdoor temperature.
- **[3-02]** Set point at low ambient temperature (Lo_Ti): the target outgoing water temperature when the outdoor temperature equals or drops below the low ambient temperature (Lo_A). Note that the Lo_Ti value should be higher than Hi_Ti, as for colder outdoor temperatures (i.e. Lo_A) warmer water is required.
- **[3-03]** Set point at high ambient temperature (Hi_Ti): the target outgoing water temperature when the outdoor temperature equals or rises above the high ambient temperature (Hi_A). Note that the Hi_Ti value should be lower than Lo_Ti, as for warmer outdoor temperatures (i.e. Hi_A) less warm water suffices.

NOTE If by mistake the value of [3-03] is set higher than the value of [3-02], the value of [3-03] will always be used.

[4] Disinfection function

This mode will disinfect the domestic hot water tank by periodically heating the domestic water to a specific temperature.

NOTE If a domestic hot water tank is installed, the disinfection function is enabled by default.

- **[4-00]** Status: defines whether the disinfection function is turned ON (1) or OFF (0).
- **[4-01]** Operation interval: day of the week at which the domestic water should be heated.
- **[4-02]** Start time: time at which the disinfection operation is started

Even if all schedule timers are de-activated and there is no reheat function active, the disinfection function will operate if a domestic hot water tank is installed and field setting [4-00] is set to ON.

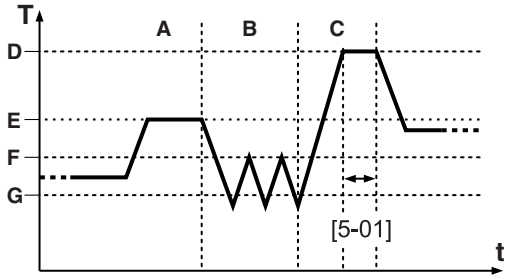
The disinfection function field settings must be configured by the installer according to national and local regulations.

Refer to “[5] Automatic setback and disinfection set point” on page 126 for temperature set points.

[5] Automatic setback and disinfection set point

See also “[4] Disinfection function” on page 126 for more information about the disinfection operation.

- **[5-00]** Set point: disinfection water temperature to be reached
- **[5-01]** Interval: time period defining how long the disinfection temperature set point should be maintained



A Storage operation (if activated)

B Reheat operation (if activated)

C Disinfection operation (if activated)

Field settings

D Disinfection operation temperature [5-00] (e.g. 70°C)

E Hot water storage temperature [b-03] (e.g. 60°C)

F Reheat maximum water temperature [b-01] (e.g. 45°C)

G Reheat minimum water temperature [b-00] (e.g. 35°C)

t Time

T Domestic hot water tank temperature

See also “[2] Automatic setback function” on page 124 for more information about setback operation.

- **[5-02]** Leaving water setback temperature.
- **[5-03]** Room setback temperature.
- **[5-04]** Setting not available

[6] Option setup

- **[6-00]** Domestic hot water tank option
  If the domestic hot water tank is installed, its operation must be enabled by field setting. Default [6-00]=0 which means no tank is installed. Set [6-00] to 1 if the optional domestic hot water tank is installed.

  NOTE When enabling the domestic hot water tank option be aware that the advised default settings become active:
  - **[1-00]**=1=automatic night storage
  - **[4-00]**=1=disinfection function

- **[6-01]** External room thermostat option
  If the optional external room thermostat is installed, its operation must be enabled by field setting. Default [6-01]=0, which means no external room thermostat is installed. Set [6-01] to 1 if the optional external room thermostat is installed.
  The external room thermostat only gives an ON/OFF signal to the heat pump based on the room temperature. Because it does not give continuous feedback information to the heat pump, it is supplementary to the remote controller room thermostat function. To have a good control of the system and avoiding frequent ON/OFF it is advised to use the automatic weather dependent set point operation.
- **[6-02]** Setting not available
- **[6-03]** Setting not available
- **[6-04]** Benefit kWh rate power supply mode
  If benefit kWh rate power supply is used, the mode must be selected. Default [6-04]=0 which means no benefit kWh rate power supply is used.
  Set [6-04] to 1 to use benefit kWh rate power supply mode 1 (normally closed contact which will open when the power supply is interrupted), or set [6-04] to 2 to use benefit kWh rate power supply mode 2 (normally opened contact which will close when the power supply is interrupted).

[7] Option setup

- **[7-00]** Setting not available.
- **[7-01]** Setting not available.
- **[7-02]** See chapter "Multiple set point control" in the Installation manual.
- **[7-03]** See chapter "Multiple set point control" in the Installation manual.
- **[7-04]** See chapter "Multiple set point control" in the Installation manual.

[8] Option setup

- **[8-00]** Remote controller temperature control
  When using the remote control delivered with the unit, 2 types of temperature control are possible. Default [8-00]=1 which means that the remote controller is used as room thermostat, so the remote controller can be placed in the living room to control the room temperature. Set [8-00] to 0 to use the unit in leaving water temperature control.
- **[8-01]** Setting not available
- **[8-02]** Setting not available
- **[8-03]** Quiet mode
  The unit has a quiet mode functionality for which 3 levels can be selected:
  [8-03]=1 low noise level 1 (default)
  [8-03]=2 low noise level 2
  [8-03]=3 low noise level 3
  Activating this quiet mode is done by pushing the QUIET MODE button on the remote controller or through the schedule timer.
- **[8-04]** Freeze-up prevention
  The unit has a freeze-up prevention functionality for which 3 levels can be selected:
  [8-04]=0 prevention level 0 (default: no prevention)
  [8-04]=1 prevention level 1
  [8-04]=2 prevention level 2
  The freeze-up prevention is only active when the unit is in thermo OFF condition. If prevention level 1 is enabled, the freeze-up prevention will start if the outdoor ambient temperature <4°C and if leaving or return water temperature <7°C. For prevention level 2, the freeze-up prevention will start as soon as the ambient temperature <4°C.
  For both cases the pump will operate and if leaving or return water <5°C for 5 minutes the unit will start up to prevent too low temperatures.

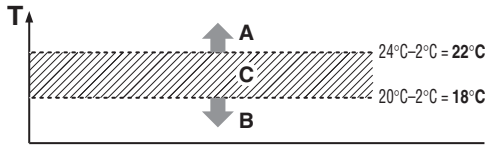
It is advised to enable freeze-up prevention if the indoor unit is located in a colder ambient room (e.g. garage, ...) to prevent water freeze-up.

[9] Automatic temperature compensation

If needed, it is possible to adjust some thermistor value of the unit by a correction value. This can be used as countermeasure for thermistor tolerances or capacity shortage.
The compensated temperature (= measured temperature plus compensation value) is then used for controlling the system and will be displayed in the temperature read-out mode.

- **[9-00]** Leaving water temperature compensation value for heating operation.
- **[9-01]** Domestic hot water tank compensation value.
- **[9-02]** Thermo ON/OFF admission
  By changing this value the operation range for space heating operation can be modified.
  If the ambient temperature becomes higher than (24°C + the value of [9-02]) no space heating is possible.
  Space heating can be requested as long as the ambient temperature is lower than (20°C + the value of [9-02]).

Example:
[9-02]=–2°C



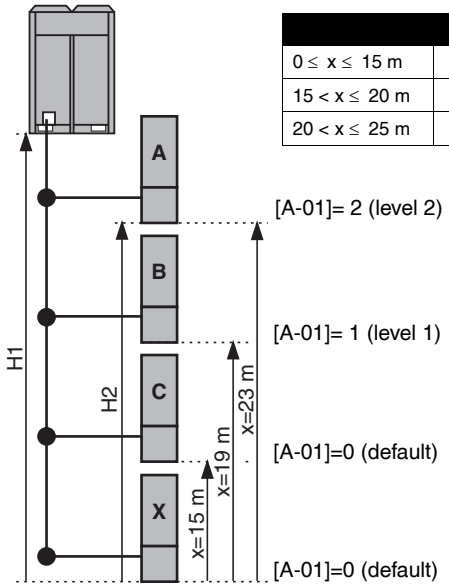
A No space heating operation possible
B Request for space heating possible
C Hysteresis area
T Ambient temperature

- **[9-03]** Leaving water temperature compensation value for cooling operation. Not available for heating only model.
- **[9-04]** Setting not available.

[A] Option setup

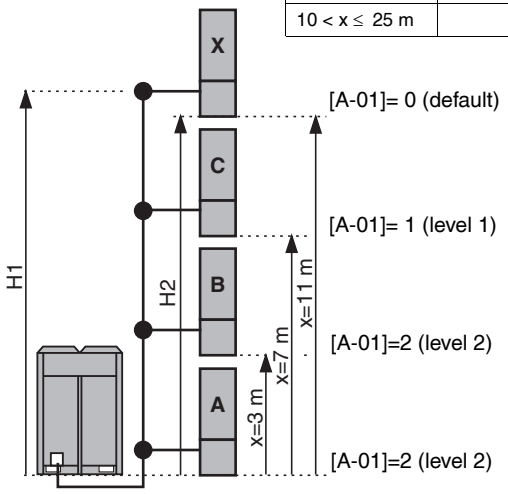
- **[A-00]** Current limitation.
  This setting provides the possibility to limit the power consumption of the indoor unit as follows:
  [A-00]=0 16.5 A (default)
  [A-00]=1 13.2 A (±80%)
  [A-00]=2 10.7 A (±65%)
  The indoor unit current is limited, the outdoor unit is slave and will also reduce its power consumption consequently (if other indoor units loads correspond). However, transient conditions with higher power consumption are possible.
- **[A-01]** Change setting for allowable height difference between the highest and lowest installed indoor units.
  Difference in height between outdoor and indoor units H1 ≤ 40 m
  Difference in height between lowest and heighest indoor unit H2 ≤ 15 m.
  If setting [A-01] is changed, maximum H2 difference can be increased to 25 m. Depending on H2 level, use the settings in the table for designated indoor units.

Example 1:



	[A-01] setting
0 ≤ x ≤ 15 m	0
15 < x ≤ 20 m	1
20 < x ≤ 25 m	2

Example 2:



	[A-01] setting
0 ≤ x ≤ 5 m	2
5 < x ≤ 10 m	1
10 < x ≤ 25 m	0

- **[A-02]** Temperature difference for leaving and returning water in heating mode.
  The unit is designed to support radiator operation. The advised leaving water temperature (set by the remote controller) for radiators is 65°C. In such a case the unit will be controlled to realize a temperature difference (ΔT) of 10°C, which means that the returning water to the unit is around 55°C.
  Depending on the installed application (radiators, fan coil units, ...) or situation, it can be required to change the ΔT. This can be done by changing field setting [A-02].
- **[A-03]** See chapter "Multiple set point control" in the Installation manual.
- **[A-04]** See chapter "Multiple set point control" in the Installation manual.

[b] Domestic hot water set points

The reheat mode will prevent the domestic hot water from cooling down lower than a certain temperature. When enabled the indoor unit will deliver hot water to the domestic hot water tank if the reheat minimum value is reached. The domestic water heating will continue until the reheat maximum temperature is reached. In this way always a minimum of domestic hot water is available.

- **[b-00]** Set point: reheat minimum temperature (see figure below).
- **[b-01]** Set point: reheat maximum temperature (see figure below).

A Storage operation (if activated)

B Reheat operation (if activated)

C Disinfection operation (if activated)

Field settings

D Disinfection operation temperature [5-00] (e.g. 70°C)

E Hot water storage temperature [b-03] (e.g. 60°C)

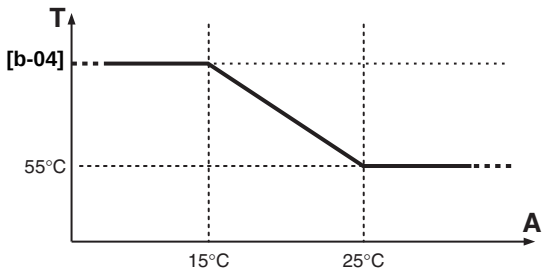
F Reheat maximum water temperature [b-01] (e.g. 45°C)

G Reheat minimum water temperature [b-00] (e.g. 35°C)

t Time

T Domestic hot water tank temperature

- **[b-02]**
  Status: defines whether the weather dependent domestic water heating is turned ON (1) or OFF (0).
  If enabled, the storage set point will be set weather dependent.
  In case of a higher ambient temperature (e.g. during summertime), the cold supply water to the mixing tap (e.g. shower, bath) will also have a higher temperature. This makes that the temperature of the hot water from the domestic hot water tank may be lower to reach the same water mixing temperature from the shower or bath mixing tap. In this way, with a lower domestic hot water tank temperature setting the comfort level can be kept the same but with a lower energy consumption.



A Ambient temperature

T Domestic hot water storage temperature

NOTE The maximum setting temperature for domestic hot water can be changed with field setting [b-04]. Other settings are fixed

- **[b-03]** Set point: storage temperature (see figure above)

NOTE If weather dependent domestic water heating is enabled [b-02], the storage temperature will be set automatically and the field setting [b-03] will be of no importance.

- **[b-04]** Maximal domestic hot water setting during weather depending domestic hot water setpoint.
  Refer to the figure above.

[C] Leaving water temperature limits

To prevent misuse concerning leaving water temperatures, it is possible to limit the set points.

- **[C-00]** Maximum leaving water setpoint in heating operation.
- **[C-01]** Minimum leaving water setpoint in heating operation.
- **[C-02]** Maximum leaving water setpoint in cooling operation.
- **[C-03]** Minimum leaving water setpoint in cooling operation.
- **[C-04]** Field setting not available.

[d] Domestic water heating retention times

The heat pump can only work in either space heating operation or domestic water heating operation. No simultaneous operation is possible, except when using multiple set point control.

- **[d-00]** Set point: minimum operation time for domestic water heating
- **[d-01]** Set point: maximum operation time for domestic water heating
- **[d-02]** Set point: interval minimum stop time of domestic water heating

Changing the timer values can have an impact on space heating and domestic water heating heat up timers. The default values are proposed but can be changed depending on the complete system installation.

- **[d-03]** Setting not available.
- **[d-04]** Setting not available.

[E] Service mode

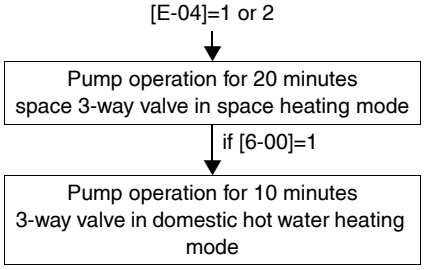
- **[E-00]** Vacuum mode
  When recovering/vacuuming of the indoor unit is needed, field setting [E-00] can be activated. It will force the unit into thermo OFF and will open the expansion valve of the indoor unit R134a circuit so full vacuuming is possible.
  By default [E-00]=0, set to 1 to enable the vacuum mode.

NOTE Do not forget to restore the field setting [E-00] to the default value when vacuuming is finished!

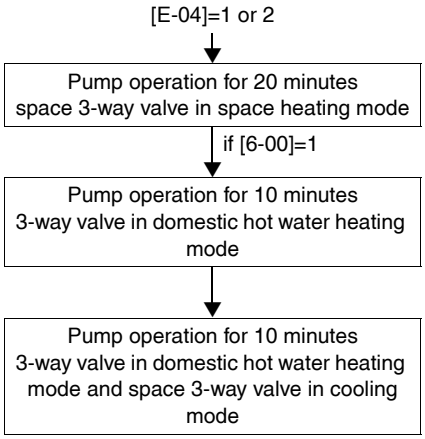
- **[E-01]** Setting not available.
- **[E-02]** Setting not available.
- **[E-03]** Setting not available.
- **[E-04]** Pump only operation
  When commissioning and installing the unit it is very important to get all air out of the water circuit.
  Through this field setting the pump can be operated without actual operation of the unit. By doing so this will enhance the air removal from the circuit. The pump can operate at different speed:

  [E-04]=0 normal operation of the unit (default)
  [E-04]=1 low pump speed operation
  [E-04]=2 high pump speed operation
  If you select [E-04]=1 or 2 and [6-00]=1, the unit will activate the domestic hot water 3-way valve and heat/cool 3-way valve. This function is a helpful feature to get all air removed out of the system (as well in space heating/cooling as in domestic hot water heating).

For EKHVMRD:



For EKHVMYD:



[F] Option setup

- **[F-00]** Temperature difference for leaving and returning water in cooling mode.
  Depending on the type of heat emitter in cooling mode (fan coil, floor heating, etc) the difference in temperature between entering and leaving water in cooling mode can be modified by changing setting [F-00]
  This setting is only applicable for EKHVMYD-units.
- **[F-01]**: Setting not available
- **[F-02]**: Heat recovery setting.
  Unit heat recovery = heat recovery within 1 indoor unit (the energy recovered in cooling mode will be used to warm-up the domestic hot water)
  System heat recovery = heat recovery between multiple indoor units (the energy recovered in cooling mode from the indoor units, will be used to warm-up the domestic hot water for multiple indoor units)
  [F-02]=0 system and unit heat recovery is allowed for this unit
  [F-02]=1 unit heat recovery is allowed for this unit (default)
  [F-02]=2 no heat recovery is allowed for this unit

NOTE Cooling to heating heat recovery is judged by the outdoor unit logic.

- **[F-03]**: Setting not available
- **[F-04]**: Setting not available

3.2 Field Setting from Outdoor Unit

3.2.1 Field Setting from Outdoor Unit

■ **List of Field Setting Items**

This following section indicates the list of field setting items. For the lists of dip switch contents, Setting mode 1, and Setting mode 2, refer to information in tables shown on the following page onward.

Setting item			Content and objective of setting	Overview of setting procedure	Reference page
Function setting	1	Setting of high static pressure	■ Make this setting to operate a system with diffuser duct while in high static pressure mode. (Use this setting mode when shields are installed on upper floors or balconies.) * In order to mount the diffuser duct, remove the cover from the outdoor unit fan.	■ Set No. 18 of "Setting mode 2" to ON.	page 140 ~141
Service setting	1	Emergency operation (*1)	■ If the compressor has a failure, used to prohibit the operation of outdoor unit(s) concerned and to conduct emergency operation of the system only with operable or outdoor unit(s).	■ Make this setting while in "Setting mode 2". For system with multiple outdoor units: Set with No. 38, 39, or 40.	146
	2	Additional refrigerant charging (*1)	■ If a necessary amount of refrigerant cannot be charged due to the stop of outdoor unit, operate the outdoor unit and then refill refrigerant.	■ Set No. 20 of "Setting mode 2" to ON and then charge refrigerant.	105
	3	Refrigerant recovery mode (*1)	■ Used to recover refrigerant on site. With operations of indoor and outdoor units prohibited, open the outdoor/indoor expansion valve fully while indoor/ outdoor operation is prohibited and turn ON some of the solenoid valves.	■ Set No. 21 of "Setting mode 2" to ON.	144
	4	Vacuuming mode (*1)	■ Used to conduct vacuuming on site. Open the outdoor/indoor expansion valve fully while indoor/outdoor operation is prohibited and turn ON some of the solenoid valves. Use a vacuum pump to conduct vacuuming.	■ Set No. 21 of "Setting mode 2" to ON.	145
	5	Power transistor check mode	■ Used for the troubleshooting of DC compressors. Inverter waveform output makes it possible to judge whether a malfunction results from the compressor or the PCB.	■ Set No. 28 of "Setting mode 2" to ON.	page 140 ~141
	6	Setting of model with spare PCB	■ In order to replace the PCB by a spare one, be sure to make model setting.	■ For this setting, set the DS2-2, -3, and-4 switches on the PCB to the model concerned.	134

For setting items of (*1), refer to detailed information provided on page 139 onward.

3.2.2 Setting by Dip Switches

(1) Factory setting of initial PCB.

Do not make any changes in all factory settings of the DIP switches on the control PCB.

Status of DIP switches



■ : Represents the factory setting positions of the switches.

Setting at replacement by spare PCB

Caution

DIP switch Setting after changing the main PCB(A1P) to spare parts PCB

After the replacement by the spare PCB, be sure to make settings shown below.
When you change the main PCB(A1P) to spare parts PCB, please carry out the following setting.

Initial conditions of dip switches



DIP Switch Detail

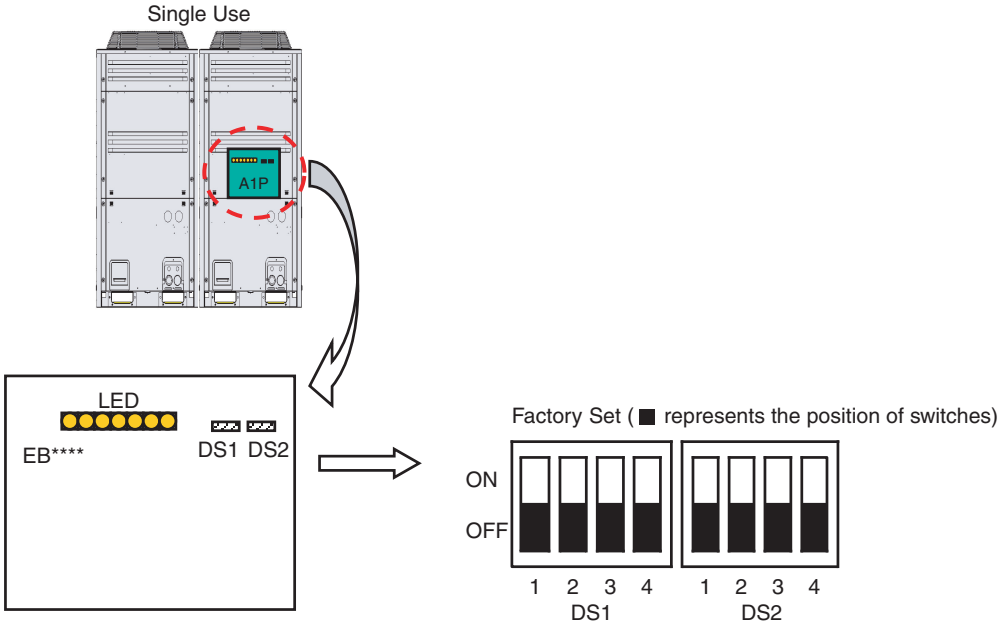
DS No.	Item	Contents	
DS1-2	Power supply specification	ON	200V class (220V)
		OFF (Factory setting of spare PCB)	400V class (380V)
DS1-3 DS1-4 DS2-1	Unit allocation setting for Europe models	Make the following settings according to allocation of unit. (All models are set to OFF at factory.)	

PCB	Compressors	DS1-3	DS1-4	DS2-1
Main	INV + STD	OFF	ON	OFF
	INV + INV	ON		
Sub	INV + STD	ON	OFF	OFF
	INV + INV			ON

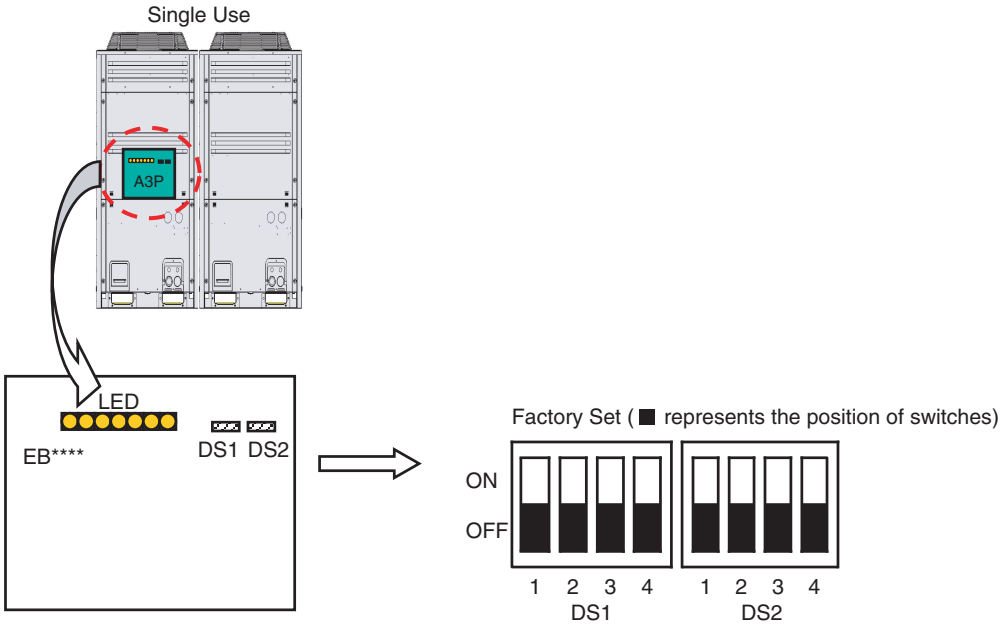
DS2-2 DS2-3 DS2-4	Model setting	Make the following settings according to models of outdoor units. (All models are set to OFF at factory.) * Refer to following pages for setting detail.

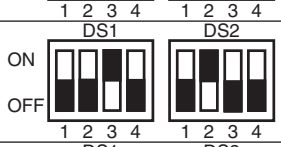
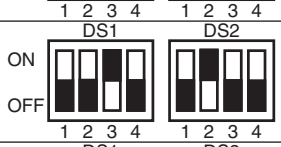
* For detail of the setting procedure, refer to information on the following pages.
While the PCB assembly is replaced, the "U3" malfunction (Test run not carried out yet) code is displayed. In this case, carry out the test run again.
If the "PJ", "UA", or "U7" malfunction code is displayed, recheck for DIP switch settings.
After the completion of rechecking for the settings, turn ON the power supply again.

Detail of DS1-1~4, DS2-1~4 setting”



Allocation	Application model	Setting method (■ represents the position of switches)	
For Europe	HEAT RECOVERY(8HP) EMRQ8AAY1		Set DS1-4 and DS2-3 to ON.
	HEAT RECOVERY(10HP) EMRQ10AAY1		Set DS1-4 to ON.
	HEAT RECOVERY(12HP) EMRQ12AAY1		Set DS1-4 and DS2-2 to ON.
	HEAT RECOVERY(14HP) EMRQ14AAY1		Set DS1-3, DS1-4 and DS2-2 to ON.
	HEAT RECOVERY(16HP) EMRQ16AAY1		Set DS1-3, DS1-4 and DS2-3 to ON.



Allocation	Application model	Setting method (■ represents the position of switches)	
For Europe	HEAT RECOVERY(8HP) EMRQ8AAY1		Set DS1-3 and DS2-2 to ON.
	HEAT RECOVERY(10HP) EMRQ10AAY1		Set DS1-3 and DS2-2 to ON.
	HEAT RECOVERY(12HP) EMRQ12AAY1		Set DS1-3 and DS2-2 to ON.
	HEAT RECOVERY(14HP) EMRQ14AAY1		Set DS1-3, DS2-1 and DS2-4 to ON.
	HEAT RECOVERY(16HP) EMRQ16AAY1		Set DS1-3, DS2-1 and DS2-3 to ON.

3.2.3 Setting by Push Button Switches

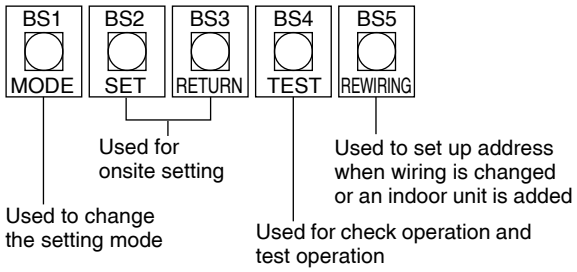
The following settings are made by push button switches on PCB.

LED display

	MODE H1P	TEST H2P	COOL/HEAT select			Low noise H6P	Demand H7P	Multi H8P
			IND H3P	MASTER H4P	SLAVE H5P			
Single-outdoor-unit system	●	●	○	●	●	●	●	●

(Factory setting)

Pushbutton switches



There are the following three setting modes.

① **Setting mode 1 (H1P off)**

Initial status (when normal).

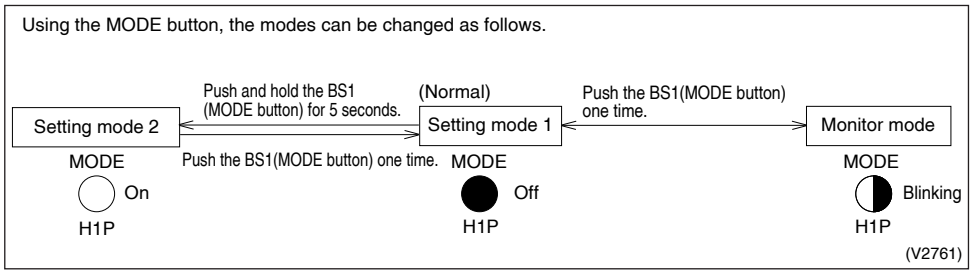
✍ **Setting mode 2 (H1P on)**

Used to modify the operating status and to set program addresses, etc. Usually used in servicing the system.

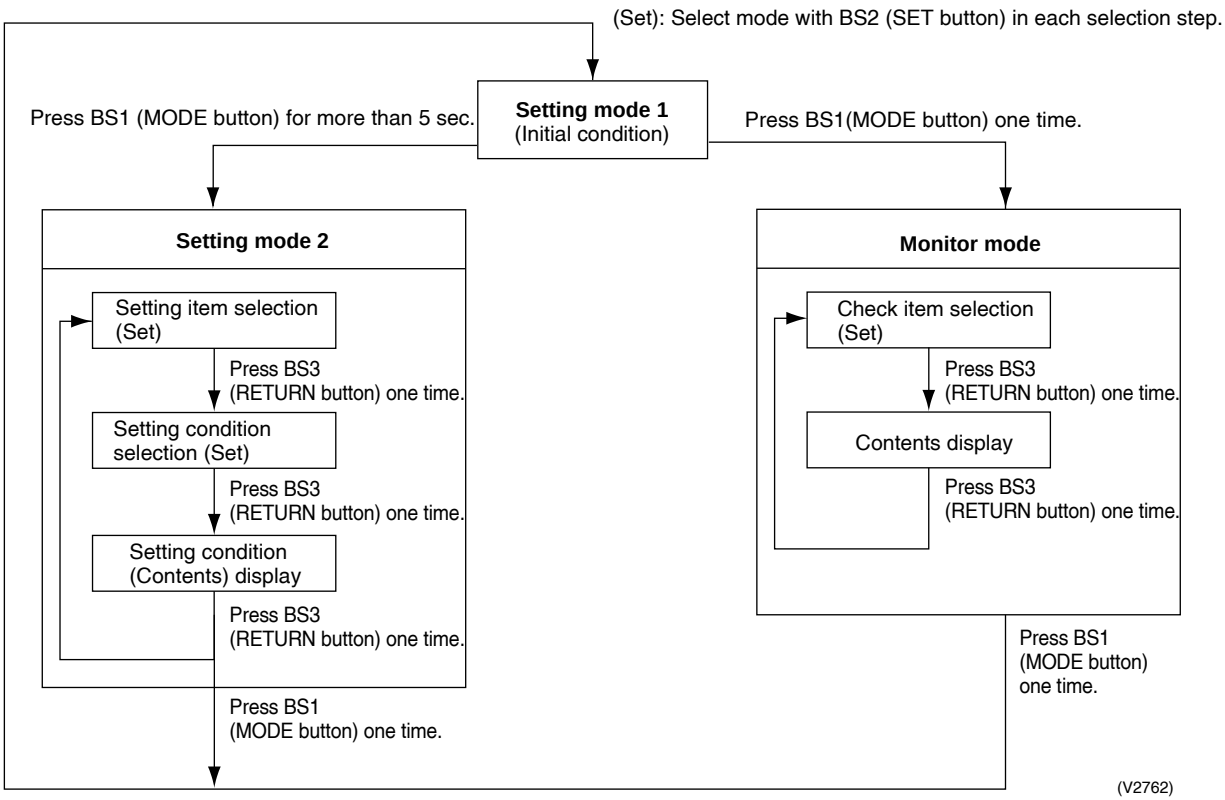
✍ **Monitor mode (H1P blinks)**

Used to check the program made in Setting mode 2.

■ **Mode changing procedure 1**



■ **Mode changing procedure 2**



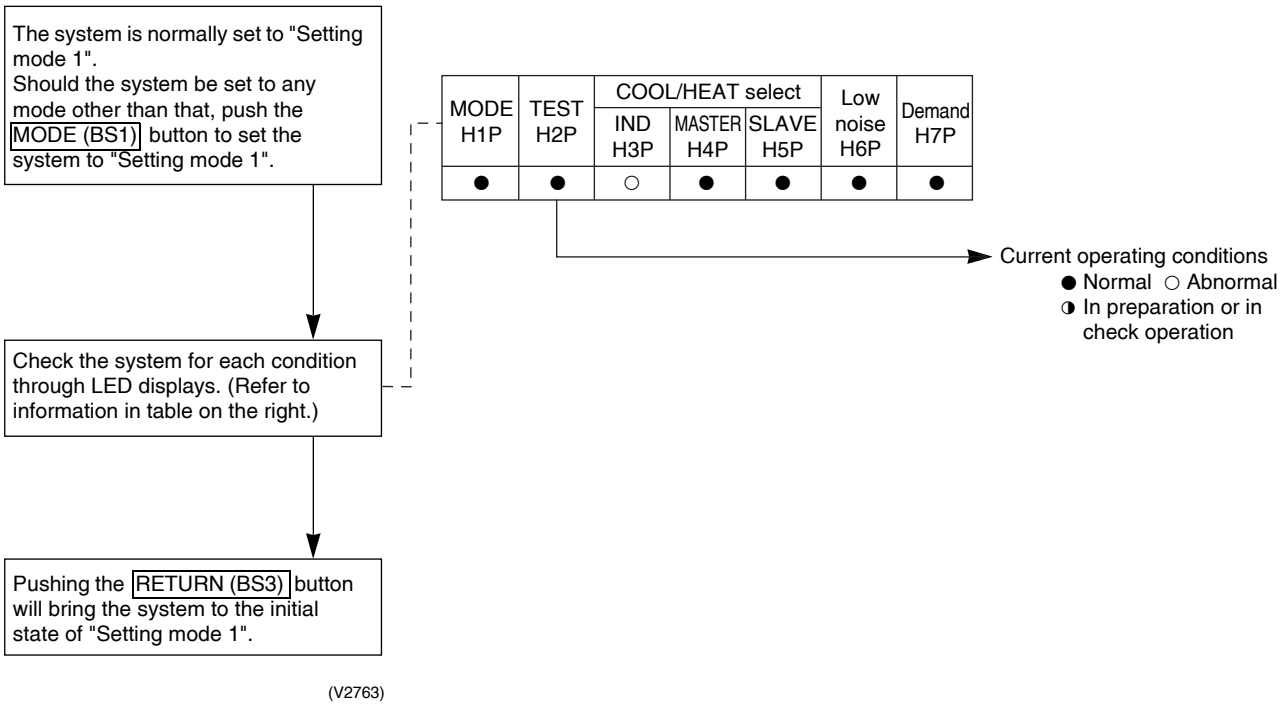
a. “Setting mode 1”

This mode is used to set and check the following items.

Check items ····· The following items can be checked.

(1) Current operating conditions (Normal / Abnormal / In check operation)

Procedure for checking check items



(V2763)

b. “Setting mode 2”

Push and hold the MODE (BS1) button for 5 seconds and set to “Setting mode 2”.

<Selection of setting items>

Push the SET (BS2) button and set the LED display to a setting item shown in the table on the right.
↓
Push the RETURN (BS3) button and decide the item. (The present setting condition is blinked.)

<Selection of setting conditions>

Push the SET (BS2) button and set to the setting condition you want.
↓
Push the RETURN (BS3) button and decide the condition.

Push the RETURN (BS3) button and set to the initial status of “Setting mode 2”.

* If you become unsure of how to proceed, push the MODE (BS1) button and return to setting mode 1.

(V2764)

No.	Setting item	Description
18	High static pressure setting	Make this setting in the case of operating in high static pressure mode with diffuser duct mounted. (In order to mount the diffuser duct, remove the cover from the outdoor unit fan.)
20	Additional refrigerant charge operation setting	Carries out additional refrigerant charge operation.
21	Refrigerant recovery/ vacuuming mode setting	Sets to refrigerant recovery or vacuuming mode.
28	Power transistor check mode ∗Check after disconnection of compressor wires	Used for trouble diagnosis of DC compressor. Since the waveform of inverter is output without wiring to the compressor, it is convenient to probe whether the trouble comes from the compressor or PCB.
38	Emergency operation (Setting for the compressor 1 (master) operation prohibition)	Used to temporarily prohibit the applicable compressor from operating. Since the comfortable environment is extremely impaired, prompt replacement of the part is required.
39	Emergency operation (Setting for the compressor 2 (slave) operation prohibition)	

The numbers in the "No." column represent the number of times to press the SET (BS2) button.

No.	Setting item display								Setting condition display
	Setting item	MODE H1P	TEST H2P	C/H selection			Low noise H6P	Demand H7P	∗ Factory setting
				IND H3P	Master H4P	Slave H5P			
18	High static pressure setting	○	●	○	●	●	○	●	High static pressure setting: OFF ○●●●●●○ ∗ High static pressure setting: ON ○●●●●○●
20	Additional refrigerant charge operation setting	○	●	○	●	○	●	●	Refrigerant charging: OFF ○●●●●●○ ∗ Refrigerant charging: ON ○●●●●○●
21	Refrigerant recovery/vacuuming mode setting	○	●	○	●	○	●	○	Refrigerant recovery / vacuuming: OFF ○●●●●●○ ∗ Refrigerant recovery / vacuuming: ON ○●●●●○●
28	Power transistor check mode	○	●	○	○	○	●	●	OFF ○●●●●●○ ∗ ON ○●●●●○●
38	Emergency operation (Compressor 1 (master) is inhibited to operate.)	○	○	●	●	○	○	●	OFF ○●●●●●○ ∗ Compressor 1 (master) operation: Inhibited ○●●●●○●
39	Emergency operation (Compressor 2 (slave) is inhibited to operate.)	○	○	●	●	○	○	○	OFF ○●●●●●○ ∗ Compressor 2 (slave) operation: Inhibited ○●●●●○●

↑ The numbers in the "No." column represent the number of times to press the SET (BS2) button.

c. Monitor mode

To enter the monitor mode, push the MODE (BS1) button when in "Setting mode 1".

<Selection of setting item>

Push the SET (BS2) button and set the LED display to a setting item.

<Confirmation on setting contents>

Push the RETURN (BS3) button to display different data of set items.

Push the RETURN (BS3) button and switches to the initial status of "Monitor mode".

* Push the MODE (BS1) button and returns to "Setting mode 1".

(V2765)

No.	Setting item	LED display							Data display
		H1P	H2P	H3P	H4P	H5P	H6P	H7P	
0	Various settings	◑	●	●	●	●	●	●	
5	Number of connected indoor units *1	◑	●	●	●	○	●	○	
14	Contents of malfunction (the latest)	◑	●	●	○	○	○	●	Malfunction code table
15	Contents of malfunction (1 cycle before)	◑	●	●	○	○	○	○	Refer page 160.
16	Contents of malfunction (2 cycle before)	◑	●	○	●	●	●	●	
20	Contents of retry (the latest)	◑	●	○	●	○	●	●	
21	Contents of retry (1 cycle before)	◑	●	○	●	○	●	○	
22	Contents of retry (2 cycle before)	◑	●	○	●	○	○	●	

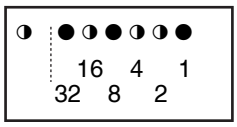
The numbers in the "No." column represent the number of times to press the SET (BS2) button.

*1: Number of connected indoor units
Used to make setting of the number of indoor units connected to an outdoor unit.

Setting item 0 Display contents of “Number of units for various settings”

Emergency operation	ON	◑	●	●	○	●	●	●
	OFF	◑	●	●	●	●	●	●

★ Data such as addresses and number of units is expressed as binary numbers; the two ways of expressing are as follows:



The No. 1 cool/heat unified address is expressed as a binary number consisting of the lower 6 digits. (0 - 63)

In ① the address is 010110 (binary number), which translates to 16 + 4 + 2 = 22 (base 10 number). In other words, the address is 22.

★ See the preceding page for a list of data, etc. for No. 0 - 25.

3.2.4 Setting of Refrigerant Recovery Mode

When carrying out the refrigerant collection on site, fully open the respective expansion valve of outdoor unit and all indoor units.
All indoor and outdoor unit's operation are prohibited.

[Operation procedure]

① In **setting mode 2**, set "Refrigerant Recovery / Vacuuming mode" to ON. The respective expansion valve of outdoor unit and all indoor units are fully opened. (H2P turns to display "TEST OPERATION" (blinks), "TEST OPERATION" and "UNDER CENTRALIZED CONTROL" are displayed on the remote controller, and the all indoor / outdoor unit operation is prohibited.
After setting, do not cancel "Setting Mode 2" until completion of refrigerant recovery operation.

✍ Collect the refrigerant using a refrigerant recovery unit. (See the instruction attached to the refrigerant recovery unit for more detail.)

✍ Press Mode button "BS1" once and reset "Setting Mode 2".

3.2.5 Setting of Vacuuming Mode

In order to perform vacuuming operation at site, fully open the expansion valves of outdoor unit and all indoor units and turn on some solenoid valves.

[Operating procedure]

① With **Setting Mode 2**, set “Refrigerant recovery / Vacuuming mode” to ON. The expansion valves of outdoor unit and all indoor units fully open and some of solenoid valves open. (H2P blinks to indicate the test operation, and the remote controller displays "Test Operation" and "Under centralized control", thus prohibiting operation.)
After setting, do not cancel “Setting Mode 2” until completion of Vacuuming operation.

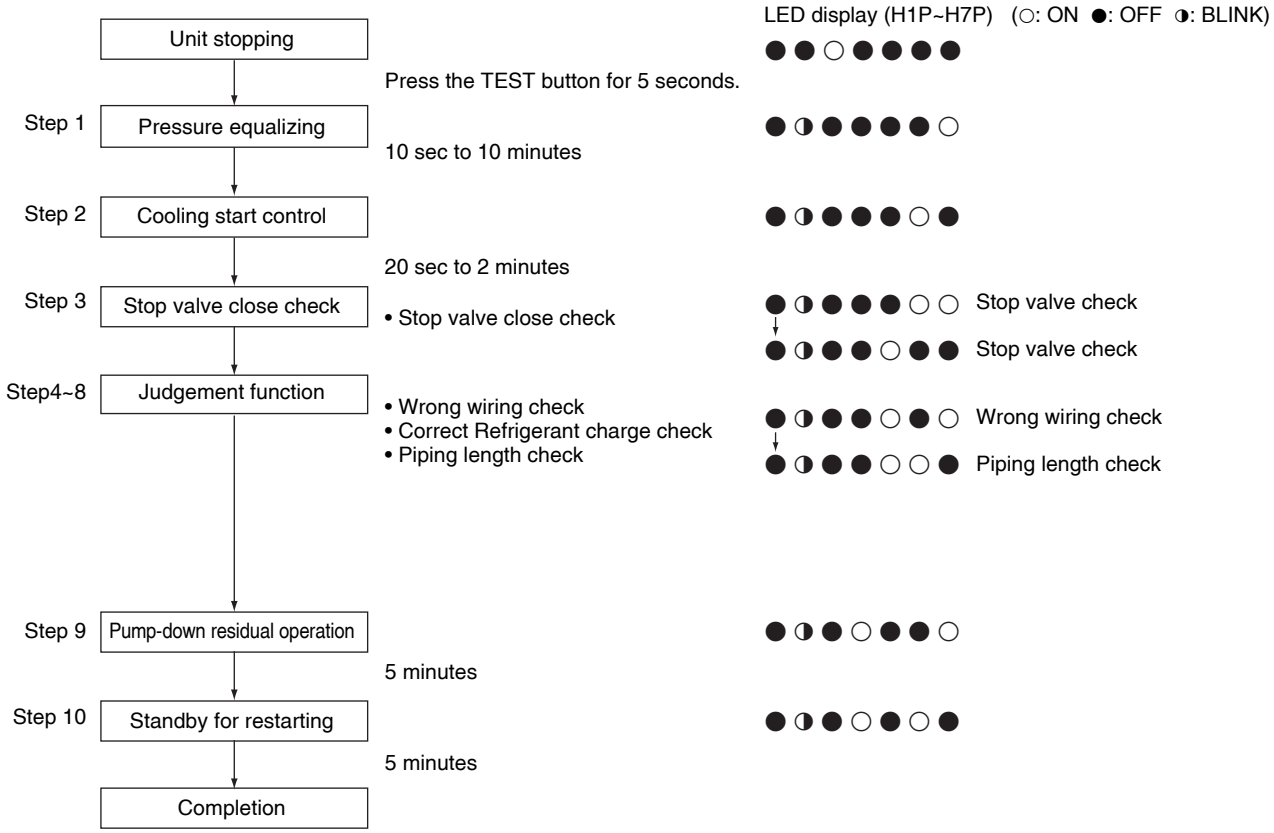
✍ Use the vacuum pump to perform vacuuming operation.

✍ Press Mode button “BS1” once and reset “Setting Mode 2”.

3.2.6 Check Operation Detail

CHECK OPERATION FUNCTION

(Press the MODE button BS1 once and set to SETTING MODE 1 (H1P: OFF))



3.2.7 Emergency Operation

If any of the compressors goes wrong, disable the relevant compressor or the relevant outdoor unit from operating, and then conduct emergency operation only with operational compressors or outdoor units.

There are two ways of conducting the Emergency operation : ① with remote controller reset and ✍ by setting outdoor unit PCB.

Operating method / Applicable model/ defective compressor	① Emergency operation with remote controller reset (Auto emergency operation)	✍ Emergency operation with outdoor unit PCB setting (Manual emergency operation)
EMRQ8/10/12AAY1 compressor 1 (INV)	–	Emergency operation by the operational compressor (*)
EMRQ8/10/12AAY1 compressor 2 (STD) EMRQ14/16AAY1 compressor 1 (INV) EMRQ14/16AAY1 compressor 2 (INV)	Emergency operation by the operational compressor	Emergency operation by the operational compressor

(*) Operational compressor (STD) will only start when 50% of indoor units are thermo ON.

① **Emergency operation with remote controller reset**

If the compressor causes a malfunction (in this case, the system will stop and the relevant malfunction code will be displayed on all indoor remote controllers), disable only the relevant compressor from operating for a 8 hours using an indoor remote controller, and then conduct emergency operation with the operational compressor.

[Emergency operation method]

- Reset the remote controller (i.e., press the ON/OFF button on the remote controller for 4 seconds or more) when the outdoor unit stops because of malfunction state.

[Details of operation]

- Automatically disable the defective compressor from operating, and then operate the other compressor.
- Outdoor unit will do every 25 minutes a forced defrost operation.
- The following section shows malfunction codes on which this emergency operation is possible.

E3, E4, E5, E7
F3
H7, H9
J2, J3, J5, J6, J7, J9, JA, JC
L1, L4, L5, L8, L9, LC
U2

✍ **Emergency operation by setting outdoor unit PCB**

In malfunction stop state of the outdoor unit due to defective compressor, by setting the relevant compressor to "Disabling operation setting", the emergency operation is conducted with the operational compressor.

[Manual, Activation of emergency operation]

○ Disabling the compressor 1 (on the right side) from operating:

Set No. 38 of setting mode 2 to "Disable-compressor-1 operation".

(Step)	LED display (○: ON, ●: OFF, ◑: Blink) H1P----------H7P
(1) Press and hold the MODE button (BS1) for 5 sec. or more.	○●●●●●●
(2) Press the SET button (BS2) 38 times.	○○●●○○●
(3) Press the RETURN button (BS3) once.	○●●●●●◑ (Factory setting)
(4) Press the SET button (BS2) once.	○●●●●◑●
(5) Press the RETURN button (BS3) twice.	○●●●●●●
(6) Press the MODE button (BS1) once.	●●○●●●●

○ Disabling the compressor 2 (on the left side) from operating:
Set No. 39 of setting mode 2 to "Disable-compressor-2 operation".

(Step)	LED display (○: ON, ●: OFF, ◑: Blink) H1P----------H7P
(1) Press the MODE button (BS1) for 5 seconds or more.	○●●●●●●
(2) Press the SET button (BS2) 39 times.	○○●●○○○
(3) Press the RETURN button (BS3) once.	○●●●●●◑ (Factory setting)
(4) Press the SET button (BS2) once.	○●●●●◑●
(5) Press the RETURN button (BS3) twice.	○●●●●●●
(6) Press the MODE button (BS1) once.	●●○●●●●

[Cancel of Emergency Operation]
To cancel the emergency operation, conduct the following setting. (Return to Factory setting.)

○ Cancel disabling the compressor 1 (on the right side) from operating:
Set No. 38 "Disable-compressor-1 operation" of setting mode 2 to "OFF".

(Step)	LED display (○: ON, ●: OFF, ◑: Blink) H1P----------H7P
(1) Press and hold the MODE button (BS1) for 5 sec. or more.	○●●●●●●
(2) Press the SET button (BS2) 38 times.	○○●●○○●
(3) Press the RETURN button (BS3) once.	○●●●●◑●
(4) Press the SET button (BS2) once.	○●●●●●◑ (Factory setting)
(5) Press the RETURN button (BS3) twice.	○●●●●●●
(6) Press the MODE button (BS1) once.	●●○●●●●

○ Cancel disabling the compressor 2 (on the left side) from operating:
Set No. 39 "Disable-compressor-2 operation" of setting mode 2 to "OFF".

(Step)	LED display (○: ON, ●: OFF, ◑: Blink) H1P----------H7P
(1) Press the MODE button (BS1) for 5 seconds or more.	○●●●●●●
(2) Press the SET button (BS2) 39 times.	○○●●○○○
(3) Press the RETURN button (BS3) once.	○●●●●◑●
(4) Press the SET button (BS2) once.	○●●●●●◑ (Factory setting)
(5) Press the RETURN button (BS3) twice.	○●●●●●●
(6) Press the MODE button (BS1) once.	●●○●●●●

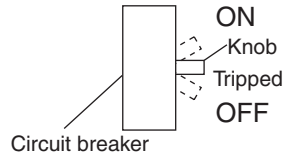
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1. Symptom-based Troubleshooting

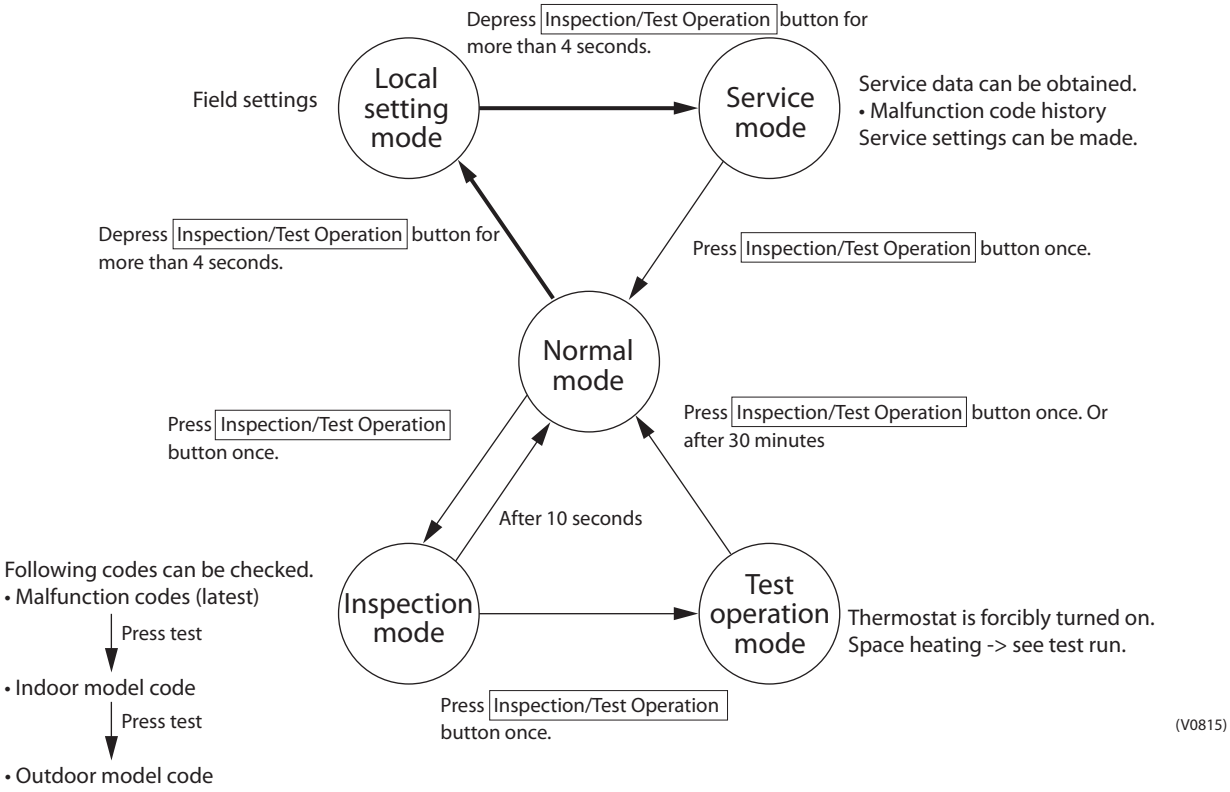
	Symptom		Supposed Cause	Countermeasure
1	The system does not start operation at all.		Blowout of fuse(s)	Turn Off the power supply and then replace the fuse(s).
			Cutout of breaker(s)	• If the knob of any breaker is in its OFF position, turn ON the power supply. • If the knob of any circuit breaker is in its tripped position, do not turn ON the power supply. 
			Power failure	After the power failure is reset, restart the system.
			Open phase in power supply cable	Check power supply. After that, properly connect the power supply cable, and then turn ON the power supply.
2	The system starts operation but makes an immediate stop.		Blocked air inlet or outlet of outdoor unit	Remove obstacle(s).
3	The unit is turned on but is not heating/cooling as expected.		The temperature setting is not correct.	Check the controller set point.
			Capacity shortage.	Check if the cooling fan at the rear of the switch box is working properly. Check if the unit is not installed in a too hot location (> 30°C).
			The water volume in the installation is too low.	Make sure that the water volume in the installation is above the minimum required value.
			The water flow is too low.	• Check that all shut-off valves of the water circuit are completely open. • Check if the water filter needs cleaning. • Make sure there is no air in the system (purge air). • Make sure that the expansion vessel is not broken. • Check on the manometer that there is sufficient water pressure. The water pressure must be > 0,3 bar (water is cold); >> 0,3 bar (water is hot)
4	The system does not operate.	The system stops and immediately restarts operation.	If the OPERATION lamp on the remote control turns ON, the system will be normal. These symptoms indicate that the system is controlled so as not to put unreasonable loads on the system.	Normal operation. The system will automatically start operation after a lapse of five minutes.
		Pressing the TEMP ADJUST button immediately resets the system.		
		The remote control displays "UNDER CENTRALIZED CONTROL", which blinks for a period of several seconds when the OPERATION button is depressed.	The system is controlled with centralized control.	Recovery/vacuum mode is active (higher priority mode).
		The system stops immediately after turning ON the power supply.	The system is in preparation mode of micro computer operation.	Wait for a period of approximately one minute.
5	The system makes intermittent stops.	The remote control displays malfunction codes "U4" and "U5", and the system stops but restarts after a lapse of several minutes.	The system stops due to an interruption in communication between units caused by electrical noises coming from equipment other than air conditioners.	Remove causes of electrical noises. If these causes are removed, the system will automatically restart operation.

	Symptom		Supposed Cause	Countermeasure
6	The system produces sounds.	<Indoor unit> Immediately after turning ON the power supply, indoor unit produces "ringing" sounds.	These are operating sounds of the electronic expansion valve of the indoor unit.	Normal operation. This sound becomes low after a lapse of approximately one minute.
		<Indoor and outdoor units> "Hissing" sounds are continuously produced while in cooling or defrosting operation.	These sounds are produced from gas (refrigerant) flowing respectively through the indoor and outdoor units.	Normal operation.
		<Indoor and outdoor units> "Hissing" sounds are produced immediately after the startup or stop of the system, or the startup or stop of defrosting operation.	These sounds are produced when the gas (refrigerant) stops or changes flowing.	Normal operation.
		<Indoor unit> Faint sounds are continuously produced while in cooling operation or after stopping the operation.	These sounds are produced from the drain discharge device in operation.	Normal operation.
		<Indoor unit> "Creaking" sounds are produced while in heating operation or after stopping the operation.	These sounds are produced from resin parts expanding and contracting with temperature changes.	Normal operation.
		<Outdoor unit> Pitch of operating sounds changes.	The reason is that the compressor changes the operating frequency.	Normal operation.
		The pump is making noise (cavitation).	There is air in the system.	Purge air.
			Water pressure at pump inlet is too low.	• Check on the manometer that there is sufficient water pressure. The water pressure must be > 0,3 bar (water is cold); >> 0,3 bar (water is hot) • Check that the manometer is not broken. • Check that the expansion vessel is not broken. • Check that the setting of the pre-pressure of the expansion vessel is correct.
7	Outdoor unit fan does not rotate.	In operation	The reason is that fan revolutions are controlled to put the operation to the optimum state.	Normal operation.
8	LCD display "88" appears on the remote control.	Immediately after turning ON the power supply	The reason is that the system is checking to be sure the remote control is normal.	Normal operation. This code is displayed for a period of approximately one minute at maximum.
9	The outdoor gets hot.	While stopping operation	The reason is that the compressor is warmed up to provide smooth startup of the system.	Normal operation.
10	The water pressure relief valve opens.		The expansion vessel is broken.	Replace the expansion vessel.
			The water volume in the installation is too high.	Make sure that the water volume in the installation is under the maximum allowed value.
11	The water pressure relief valve leaks.		Dirt is blocking the water pressure relief valve.	Check for correct operation of the pressure relief valve by turning the red knob on the valve counter clockwise: • You should hear a clocking sound. • In case the water keeps running out of the unit, close both the water inlet and outlet shut-off valves first and then replace the relief valve.
12	Malfunction of the schedule timer.		The schedule timer does not work but the programmed actions are executed at the wrong time.	Check if the clock and the day of the week are set correctly, correct if necessary.

2. Troubleshooting by Remote Control

2.1 The INSPECTION / TEST Button

The following modes can be selected by using the [Inspection/Test Operation] button on the remote control.

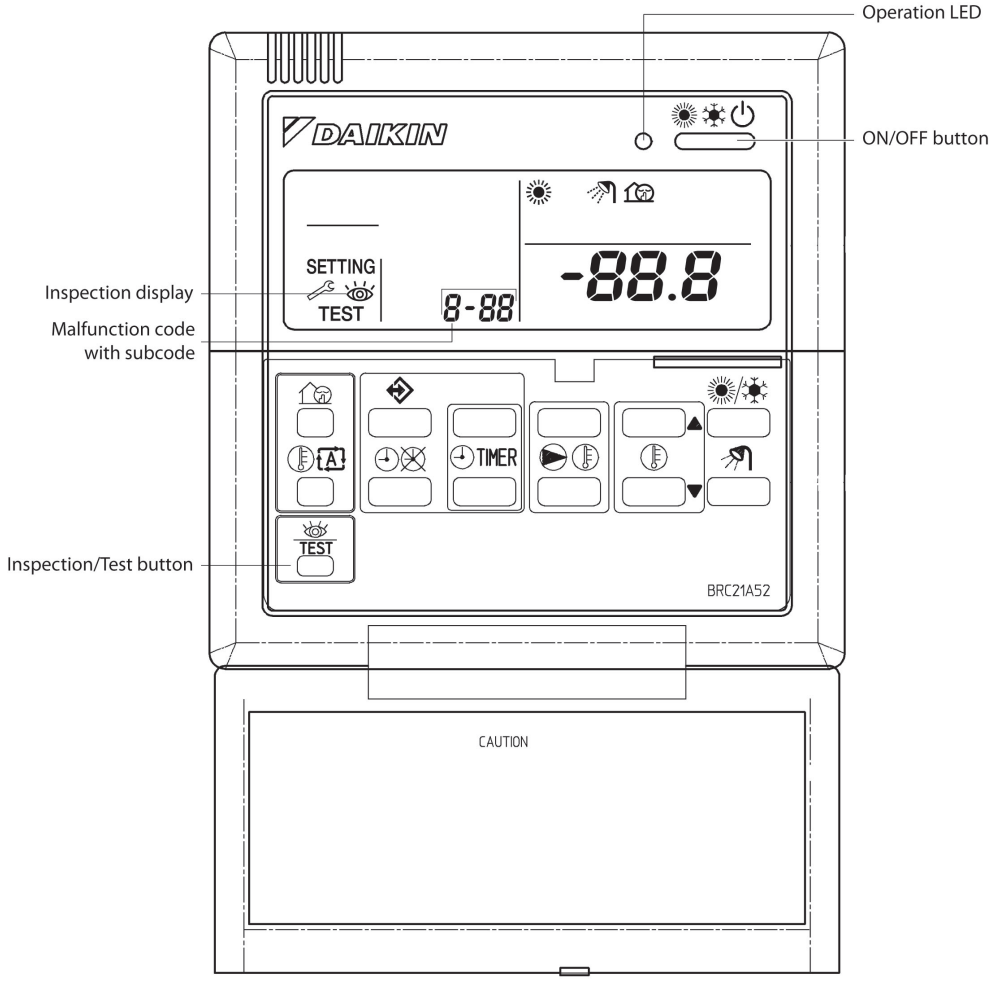


See "Operation of the Remote Controller's Inspection / Test Operation Button".

2.2 Self-diagnosis by Wired Remote Control

Explanation

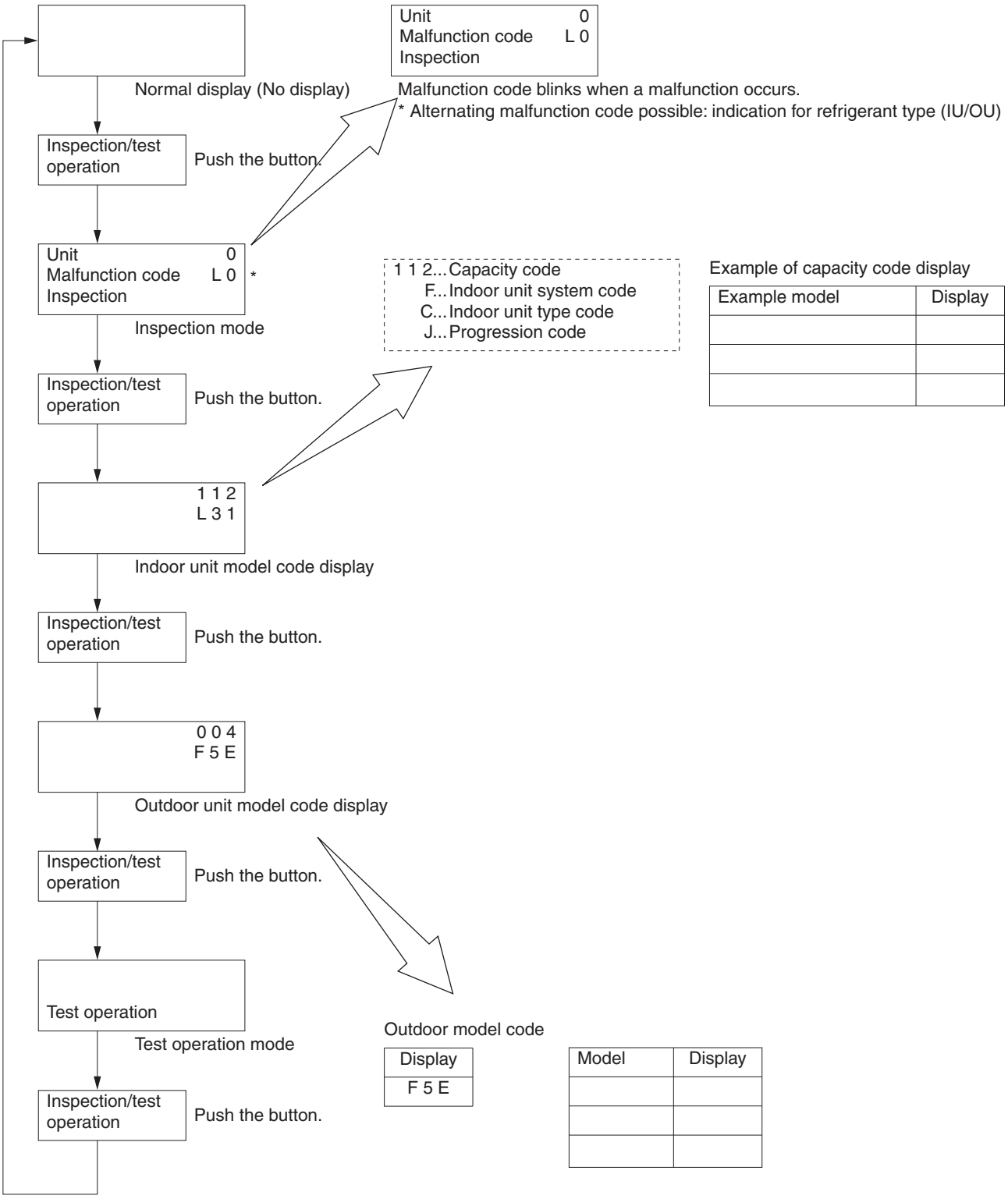
If operation stops due to malfunction, the remote control's operation LED blinks, and malfunction code is displayed. (Even if stop operation is carried out, malfunction contents are displayed when the inspection mode is entered.) The malfunction code enables you to tell what kind of malfunction caused operation to stop. See page 159 for malfunction code and malfunction contents.



Note:

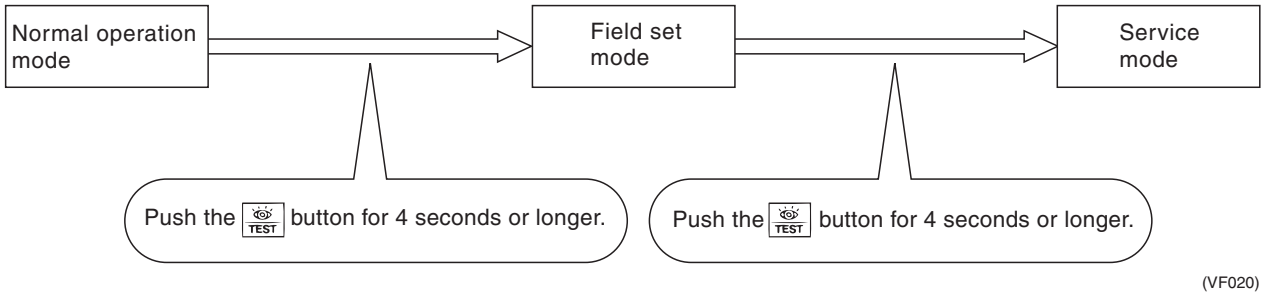
1. Pressing the INSPECTION/TEST button will blink the check indication.
2. While in check mode, pressing and holding the ON/OFF button for a period of five seconds or more will clear the failure history indication shown above. In this case, on the codes display, the malfunction code will blink twice and then change to "00" (=Normal), the Unit No. will change to "0", and the operation mode will automatically switch from check mode to normal mode (displaying the set temperature).
3. Subcode is needed to indicate which refrigerant system is causing the error.

2.3 Operation of the Remote Controller's Inspection / Test Operation Button



2.4 Remote Control Service Mode

How to Enter the Service Mode



Service Mode Operation Method

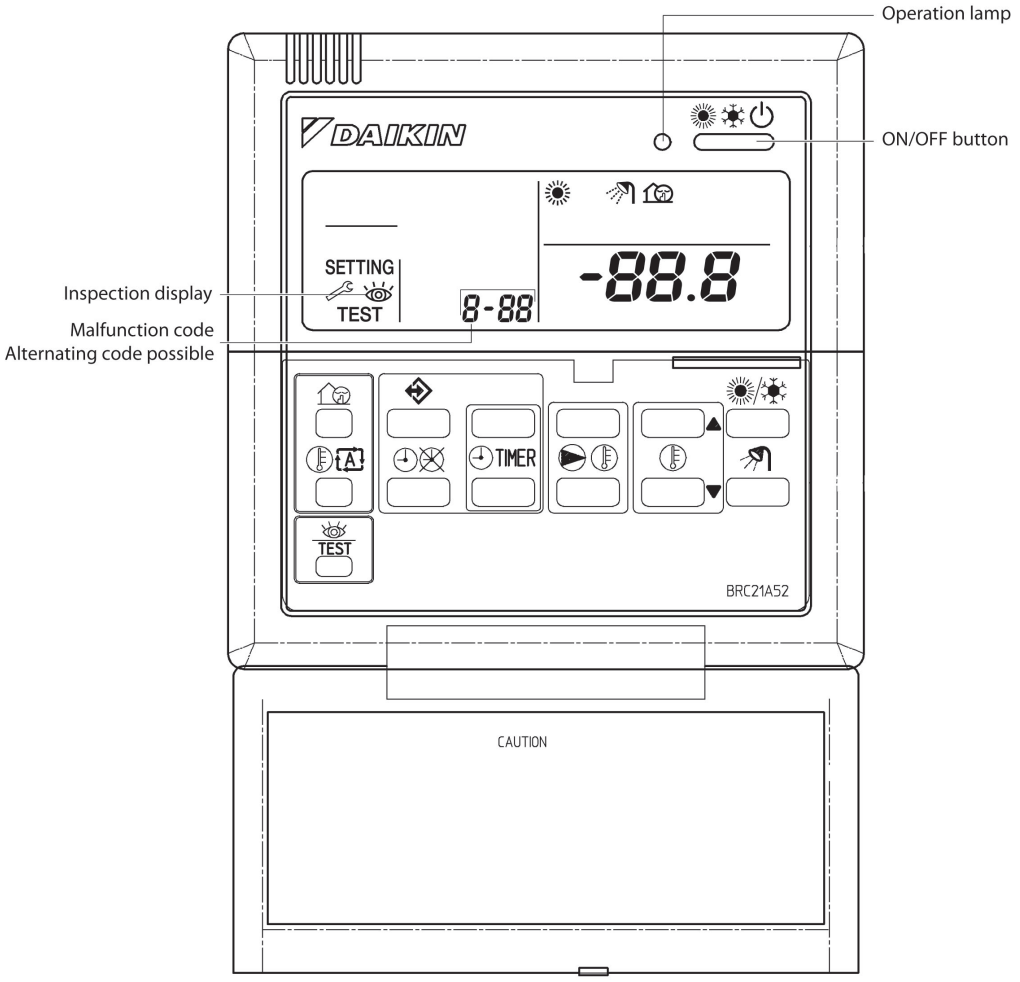
1. Select the mode No.
Only Mode 40 can be set.

Mode No	Function	Contents and operation method	Remote control display example
40	Malfunction hysteresis display	Display malfunction hysteresis. The history No. can be changed with the button.	Unit 1 Malfunction code 40 2-U4 Malfunction code Hystory No: 1 - 5 1: Latest (VE007)

Remark: The malfunction code can give also an extra subcode (alternating). With this subcode we can distinguish if the error is related to the R-410A or R-134a circuit.

2.5 Remote Controller Self-Diagnosis Function

The remote controller switches are equipped with a self diagnosis function so that more appropriate maintenance can be carried out. If a malfunction occurs during operation, the operation lamp, malfunction code and display of malfunctioning unit No. let you know the contents and location of the malfunction.
When there is a stop due to malfunction, the contents of the malfunction given below can be diagnosed by a combination of operation lamp, INSPECTION display of the liquid crystal display and display of malfunction code. It also lets you know the unit No. during group control.

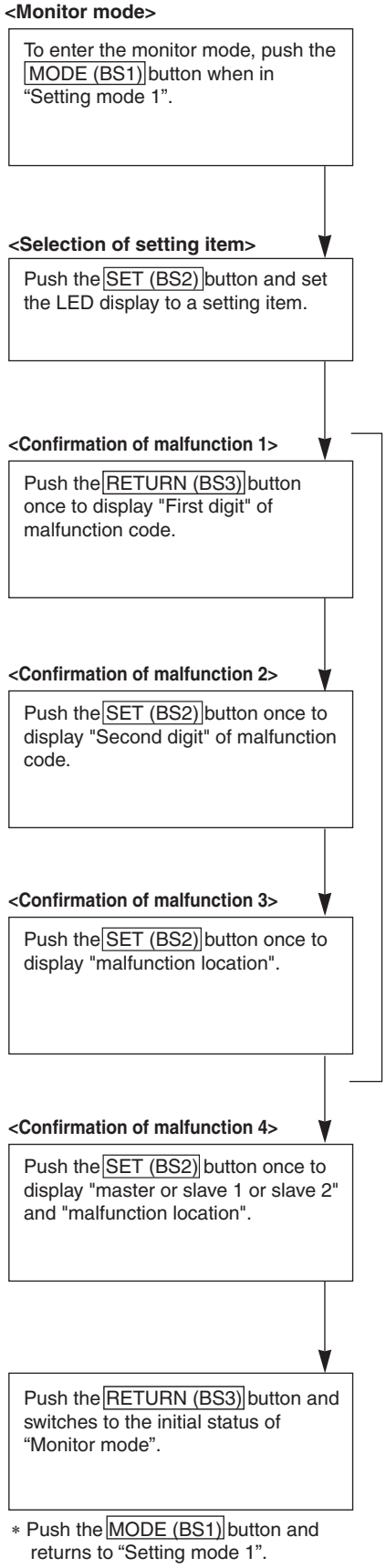


○: ON ●: OFF ☼: Blink

	Malfunction code	Operation lamp	Malfunction contents	Page Referred
	E1	☼	PC board defect	180
	E3	☼	Actuation of high pressure switch	182
	E4	☼	Actuation of low pressure sensor	187
	E5	☼	Inverter compressor motor lock	191
	E9	☼	Malfunction of moving part of electronic expansion valve (Y1E~Y5E)	198
	F3	☼	Abnormal discharge pipe temperature	204
	J3	☼	Malfunction of discharge pipe thermistor (R31, R32T)	212
	J5	☼	Malfunction of thermistor (R8T or R10T) for suction pipe	215
	J6	☼	Malfunction of thermistor (R4T or R12T) for outdoor unit heat exchanger	217
	J7	☼	Malfunction of thermistor (R7T) for outdoor unit liquid pipe	219
	JA	☼	Malfunction of high pressure sensor	223
	JC	☼	Malfunction of low pressure sensor	226
	L1	☼	Defective inverter PC board	229
	L4	☼	Malfunction of inverter radiating fin temperature rise	232
	L5	☼	Momentary overcurrent of inverter compressor	236
	L8	☼	Momentary overcurrent of inverter compressor	239
	L9	☼	Inverter compressor starting failure	242
	LC	☼	Malfunction of transmission between inverter and control PC board	246
	P1	☼	Inverter over-ripple protection	251
	PJ		Faulty field setting after replacing main PCB or faulty combination of PCB	256
System	U2	☼	Power supply insufficient or instantaneous failure	262
	U3		Check operation not executed	267
	U4	☼	Malfunction of transmission between indoor units and outdoor units	268
	UA	☼	Improper combination of indoor and outdoor unit, indoor units and remote controller	279
	UF	☼	System is not set yet	282
	UH	☼	Malfunction of system, refrigerant system address undefined	283

The system operates for malfunction codes indicated in black squares, however, be sure to check and repair.

Malfunction code indication by outdoor unit PC board



Detail description on next page.

Contents of malfunction		Malfunction code
In-phase malfunction of DIII Net	Detection of DIII Net	E1
Abnormal discharge pressure	HPS activated	E3
Abnormal suction pressure	Abnormal Pe	E4
Compressor lock	Detection of INV compressor lock	E5
Malfunction of electronic expansion valve	EV1	E9
	EV3	
Faulty sensor of outdoor air temperature	Faulty Ta sensor (short)	H9
Abnormal discharge pipe temperature	Abnormal Td	F3
Abnormal heat exchanger temperature	Refrigerant over charge	F6
Faulty sensor of discharge pipe temperature	Faulty Tdi sensor (short)	J3
Faulty sensor of suction pipe temperature	Faulty Ts1 sensor (short)	J5
	Faulty Ts2 sensor (short)	
Faulty sensor of heat exchanger temperature	Faulty Tb sensor (short)	J6
Malfunction of the liquid pipe	Faulty Tl sensor (short)	J7
Faulty sensor of discharge pressure	Faulty Pc sensor (short)	JA
Faulty sensor of suction pressure	Faulty Pe sensor (short)	JC
Inverter radiation fin temperature rising	Over heating of inverter radiation fin temperature	L4
DC output over current	Inverter instantaneous over current	L5
Electronic thermal	Electronic thermal switch 1	L8
	Electronic thermal switch 2	
	Out-of-step	
	Speed down after startup	
	Lightening detection	
Stall prevention (Limit time)	Stall prevention (Current increasing)	L9
	Stall prevention (Faulty start up)	
	Abnormal wave form in startup	
	Out-of-step	
Transmission error between inverter and outdoor unit	Inverter transmission error	LC

○: ON ●: OFF ☼:Blink

Malfunction code	Confirmation of malfunction 1							Confirmation of malfunction 2							Confirmation of malfunction 3							Confirmation of malfunction 4						
	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P
E1	☼			●	●	☼	☼	☼			●	●	●	☼	☼	○	●	●	●	●	●	☼	○	○	●	●	☼	☼
E3								☼			●	●	☼	☼	☼			●	●	●	●	☼			●	●		
E4								☼			●	☼	●	●	☼			●	●	●	●	☼			●	●		
E5								☼			●	☼	●	☼	☼			●	●	●	●	☼			●	●	∗1	
E9								☼			☼	●	●	☼	☼			●	●	●	●	☼			●	●		
															☼			●	●	●	●	☼			☼	●		
H9								☼			☼	●	●	☼	☼			●	●	●	●	☼			●	●	∗1	
F3	☼			●	☼	●	☼	☼			●	●	☼	☼	☼			●	●	●	●	☼			●	●	∗1	
F6								☼			●	☼	☼	●	☼			●	●	●	●	☼			●	●	☼	☼
J3	☼			●	☼	☼	●	☼			●	●	☼	☼	☼			●	●	●	●	☼			●	●		
J5								☼			●	☼	●	☼	☼			●	●	●	●	☼			●	●		
															☼			●	●	●	●	☼			●	☼		
J6								☼			●	☼	☼	●	☼			●	●	●	●	☼			●	●	∗1	
J7								☼			●	☼	☼	☼	☼			●	●	●	●	☼			●	●		
JA								☼			☼	●	☼	●	☼			●	●	●	●	☼			●	●		
JC								☼			☼	☼	●	●	☼			●	●	●	●	☼			●	●		
L4								☼			●	☼	●	●	☼			●	●	●	●	☼			●	●		
L5								☼			●	☼	●	☼	☼			●	●	●	●	☼			●	●		
L8								☼			☼	●	●	●	☼			●	●	●	●	☼			●	●		
															☼			●	●	●	●	☼			●	☼		
																		●	●	●	●							
															☼			●	●	●	●	☼			☼	●		
															☼			●	●	●	☼	☼			●	●	∗1	
L9								☼			☼	●	●	☼	☼			●	●	●	●	☼			●	●		
															☼			●	●	●	●	☼			●	☼		
															☼			●	●	●	●	☼			☼	●		
LC								☼			☼	☼	●	●	☼			●	●	●	●	☼			●	☼		

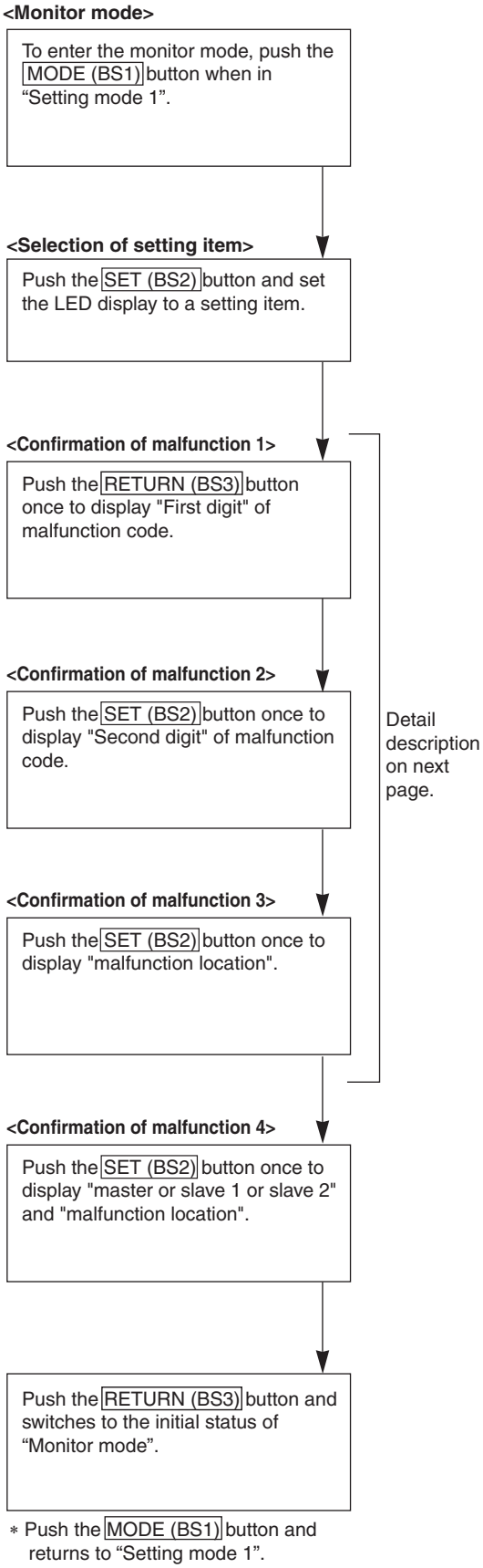
Display of contents of malfunction (first digit)

Display of contents of malfunction (second digit)

Display 1 of malfunction in detail

Display 2 of malfunction in detail

∗1			
	●	●	Master
	●	☼	Slave1
	☼	●	Slave2
	☼	☼	System



Contents of malfunction		Malfunction code
Open phase/Power supply imbalance	Imbalance of inverter power supply voltage	P1
Refrigerant shortage	Refrigerant shortage alarm	U0
Abnormal power supply voltage	Insufficient Inverter voltage	U2
	Faulty charge of capacitor in main inverter circuit	
	Malfunction due to SP-PAM overvoltage	
	Malfunction due to P-N short circuit	
Transmission error between indoor and outdoor unit	I/O transmission error	U4
	I/O transmission error	
Incorrect setting in "setting mode 1"	COOL/HEAT selector is not set to IND	U7
Transmission error of other system	Indoor unit system abnormal in other system or other indoor unit system abnormal in own system	U9
Erroneous field setting	System transmission malfunction	UA
	Overconnection malfunction of indoor units	
	Malfunction of field setting	
	Refrigerant abnormal	
	Connection error (BP unit)	
Faulty system malfunction	Wiring error (Auto-address error)	UH
Conflict in wiring and piping, no setting for system	Conflict in wiring and piping	UF

○: ON ●: OFF ☼:Blink

Malfunction code	Confirmation of malfunction 1							Confirmation of malfunction 2							Confirmation of malfunction 3								Confirmation of malfunction 4						
	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P	H1P	H2P	H3P	H4P	H5P	H6P	H7P
P1	☼			☼	●	●	●	☼			●	●	●	☼	☼			●	●	●	●	☼			●	●	∗1		
U0	☼			☼	●	●	☼	☼			●	●	●	●	☼			●	●	●	●	☼			●	●	☼	☼	
U2								☼			●	●	☼	●	☼			●	●	●	●	☼			●	●	∗1		
															☼			●	●	●	●				●	☼			
															☼			●	●	●	●	☼			●	●	☼	●	
															☼			●	●	●	●	☼			●	●	●	☼	
U3								☼			●	●	☼	☼	☼			●	●	●	●	☼			●	●	☼	☼	
															☼			●	●	●	●	☼			●	☼	☼	☼	
U4								☼			●	☼	●	●	☼			●	●	●	●	☼			●	●	☼	☼	
															☼			●	●	●	●	☼			●	☼	☼	☼	
U5																													
U7								☼			●	☼	☼	☼				●	●	●	●	☼			●	☼	☼	☼	
U9								☼			☼	●	●	☼	☼			●	●	●	●	☼			●	●	☼	☼	
UA								☼			☼	●	☼	●	☼			●	●	●	●	☼			●	●	☼	☼	
															☼			●	●	●	●	☼			●	☼	☼	☼	
															☼			●	●	●	●	☼			☼	●	☼	☼	
															☼			●	●	●	☼	☼			●	●	☼	☼	
															☼			●	●	☼	●	☼			●	☼	☼	☼	
UH								☼			☼	●	☼	☼	☼			●	●	●	●	☼			●	●	☼	☼	
UF								☼			☼	☼	☼	☼	☼			●	●	●	●	☼			●	●	☼	☼	

Display of contents of malfunction (first digit)

Display of contents of malfunction (second digit)

Display 1 of malfunction in detail

Display 2 of malfunction in detail

∗1			
	●	●	Master
	●	☼	Slave1
	☼	●	Slave2
	☼	☼	System

3. Troubleshooting by Indication on the Remote Controller

3.1 "A1" Indoor Unit: PC Board Defect

Remote Control Display

A1

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Check data from E²PROM.

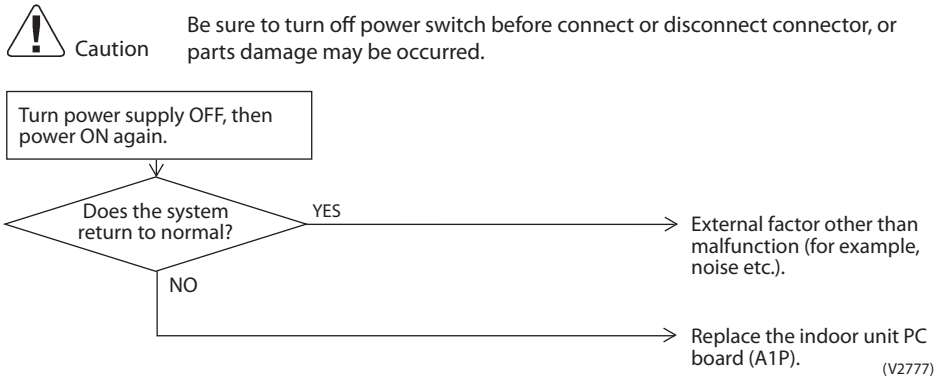
Malfunction Decision Conditions

When data could not be correctly received from the E²PROM
E²PROM: Type of nonvolatile memory. Maintains memory contents even when the power supply is turned off.

Supposed Causes

- Defect of indoor unit PC board

Troubleshooting



3.2 "A6" Indoor Unit: Heating Pump Error (M1P) or Other Water System Error

Remote Control Display

A6

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Detection by failure of signal for detecting number of turns to come from the heating pump motor.
Detection by failure ref. sensors.

Malfunction Decision Conditions

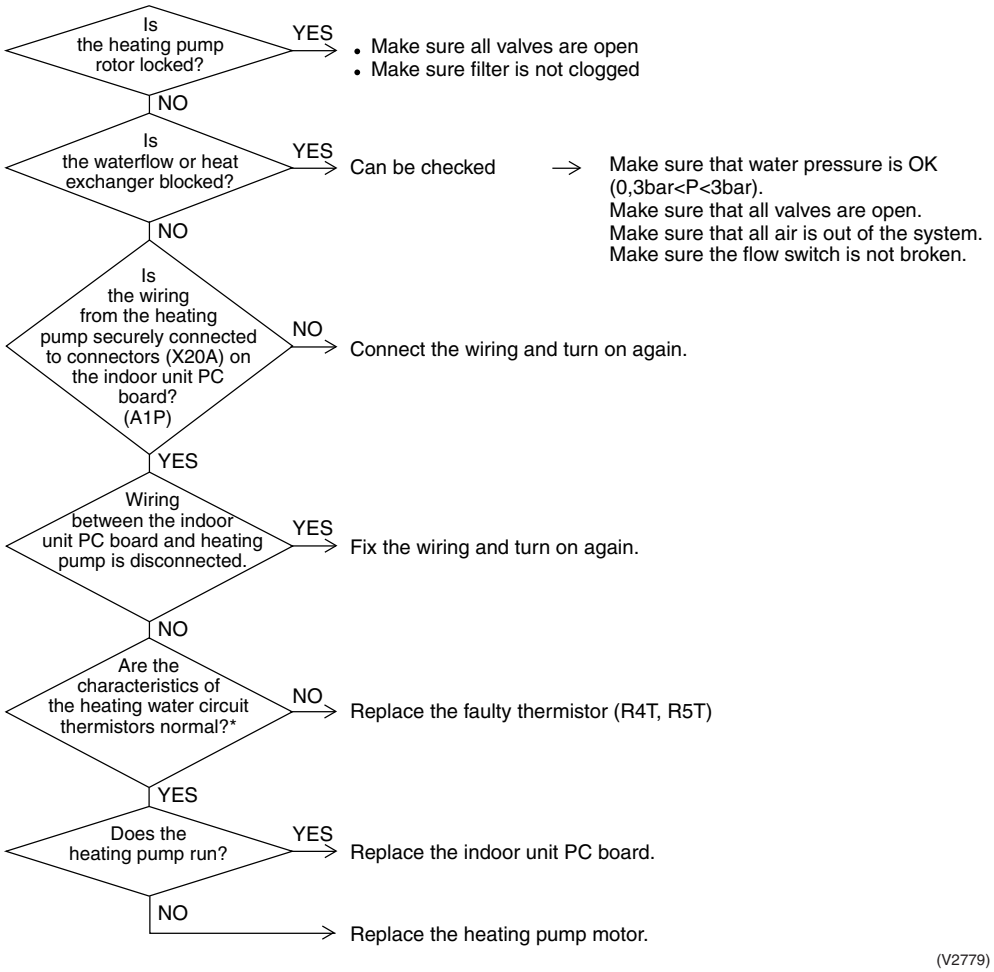
When number of turns can't be detected even when output voltage to the heating pump motor is maximum. When water sensors are not within expected range.

Supposed Causes

- Heating pump rotor locked
- Disconnected or faulty wiring between heating pump connector and PC board (A1P)
- Blocked waterflow or heat exchanger (waterside)
- Faulty thermistor (R4T, R5T)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may occur.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.3 "A6" Indoor Unit: Cooling Pump Error (M2P) or Other Water System Error

Remote Control Display

A6

Subcode 3

Applicable Models

EKHVMYD indoor units

Method of Malfunction Detection

Detection by failure of signal for detecting number of turns to come from the cooling pump motor.
Detection by failure ref. sensors.

Malfunction Decision Conditions

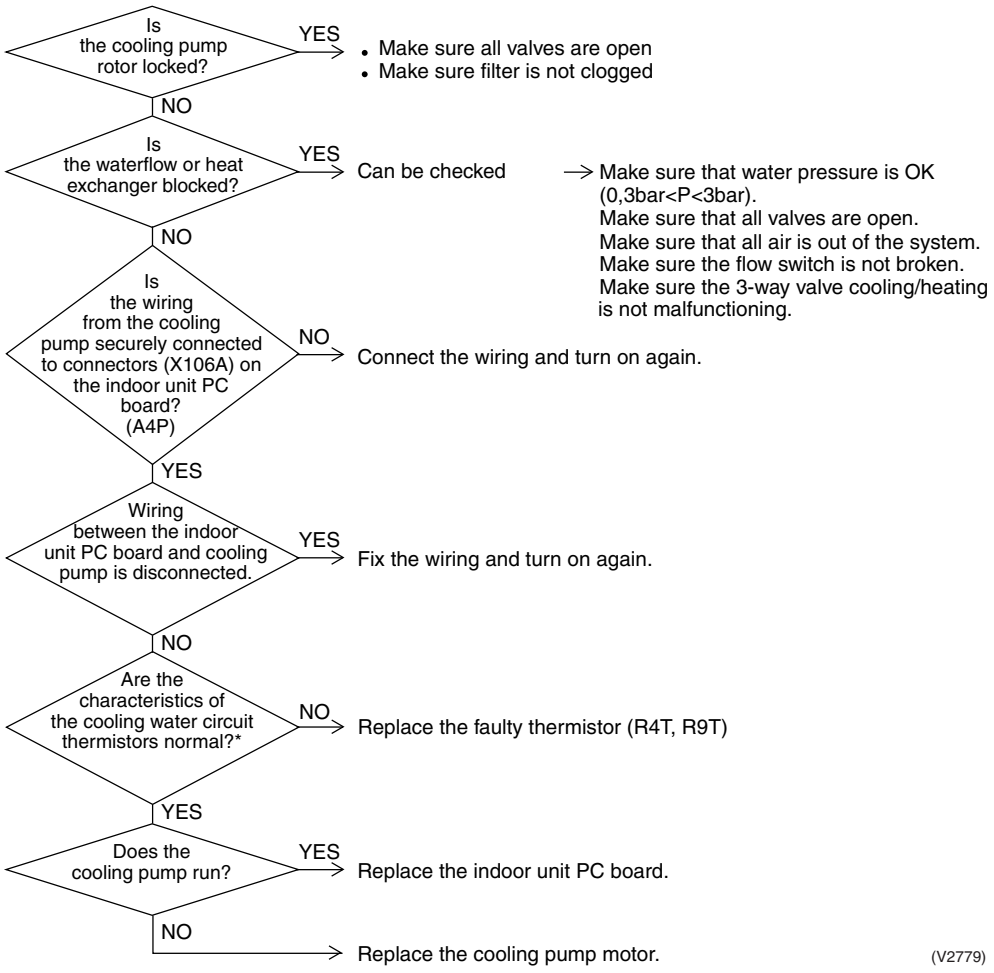
When number of turns can't be detected even when output voltage to the cooling pump motor is maximum. When water sensors are not within expected range.

Supposed Causes

- Cooling pump rotor locked
- Disconnected or faulty wiring between cooling pump connector and PC board (A1P)
- Blocked waterflow or heat exchanger (waterside)
- Faulty thermistor (R4T, R9T)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may occur.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.4 "A9" Indoor Unit: Malfunction of Moving Part of Electronic Expansion Valve (K1E) R-410A circuit

Remote Control Display

A9

Subcode 0

Applicable Models

All indoor and outdoor unit models
Expansion valve on R-410A

Method of Malfunction Detection

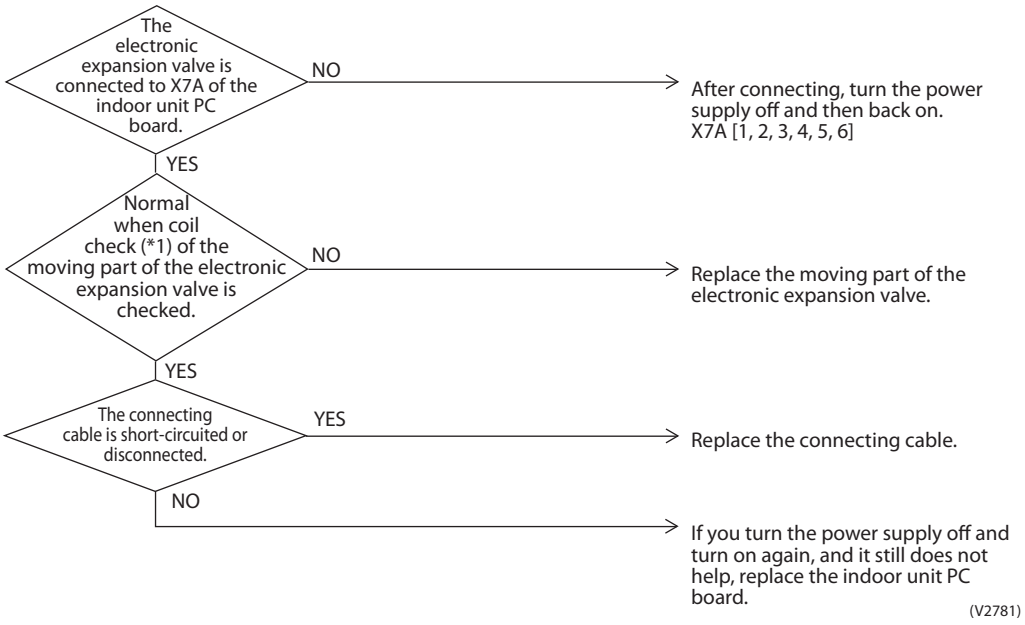
Malfunction Decision Conditions

Supposed Causes

- Malfunction of moving part of electronic expansion valve
- Defect of indoor unit PC board
- Defect of connecting cable, bad wire

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



∗1: Coil check method for the moving part of the electronic expansion valve
Discount the electronic expansion valve from the PC board and check the continuity between the connector pins.

(Normal)

Pin No.	1. White	2. Yellow	3. Orange	4. Blue	5. Red	6. Brown
1. White		×	○ Approx. 300Ω	×	○ Approx. 150Ω	×
2. Yellow			×	○ Approx. 300Ω	×	○ Approx. 150Ω
3. Orange				×	○ Approx. 150Ω	×
4. Blue					×	○ Approx. 150Ω
5. Red						×
6. Brown						

○: Continuity
×: No continuity

3.5 "AE" Indoor Unit: Water Circuit Error

Remote Control Display

AE

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

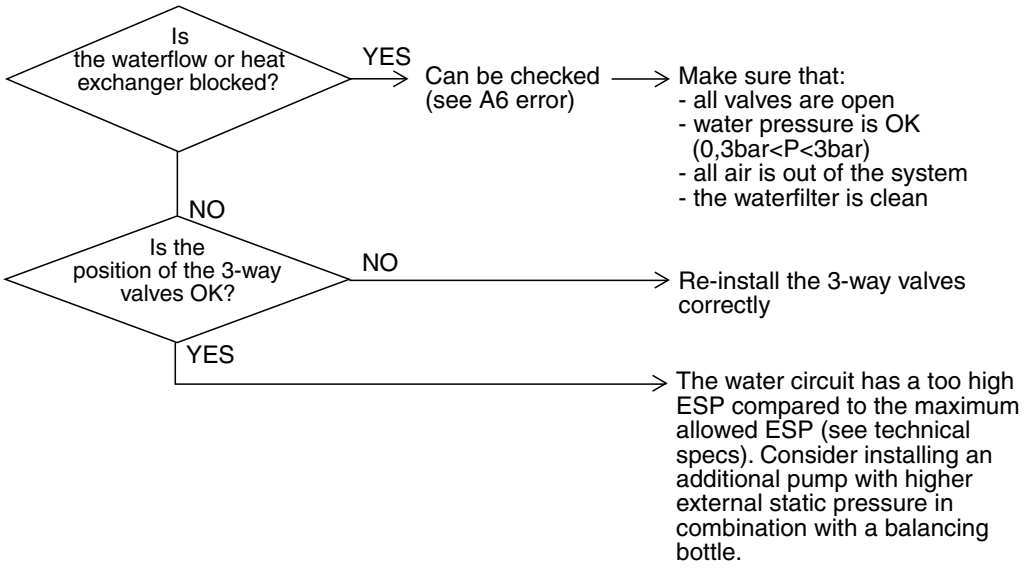
Malfunction Decision Conditions

Supposed Causes

- Blocked waterflow or heat exchanger (waterside).
- The water circuit has a too high ESP (external static pressure).

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

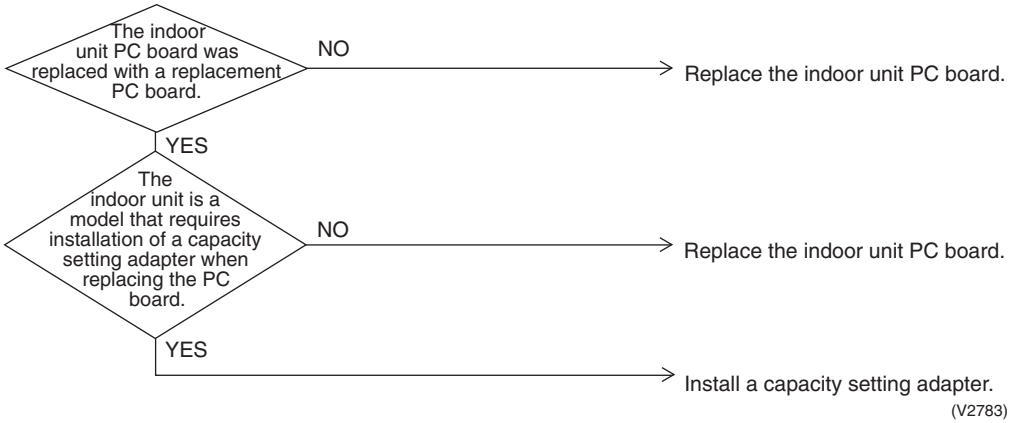


3.6 "AJ" Indoor Unit: Malfunction of Capacity Determination Device

Remote Control Display	AJ Subcode 0
Applicable Models	All indoor unit models
Method of Malfunction Detection	Capacity is determined according to resistance of the capacity setting adapter and the memory inside the IC memory on the indoor unit PC board, and whether the value is normal or abnormal is determined.
Malfunction Decision Conditions	Operation and: 1. When the capacity code is not contained in the PC board's memory, and the capacity setting adapter is not connected. 2. When a capacity that doesn't exist for that unit is set.
Supposed Causes	■ You have forgotten to install the capacity setting adapter. ■ Defect of indoor unit PC board

Troubleshooting

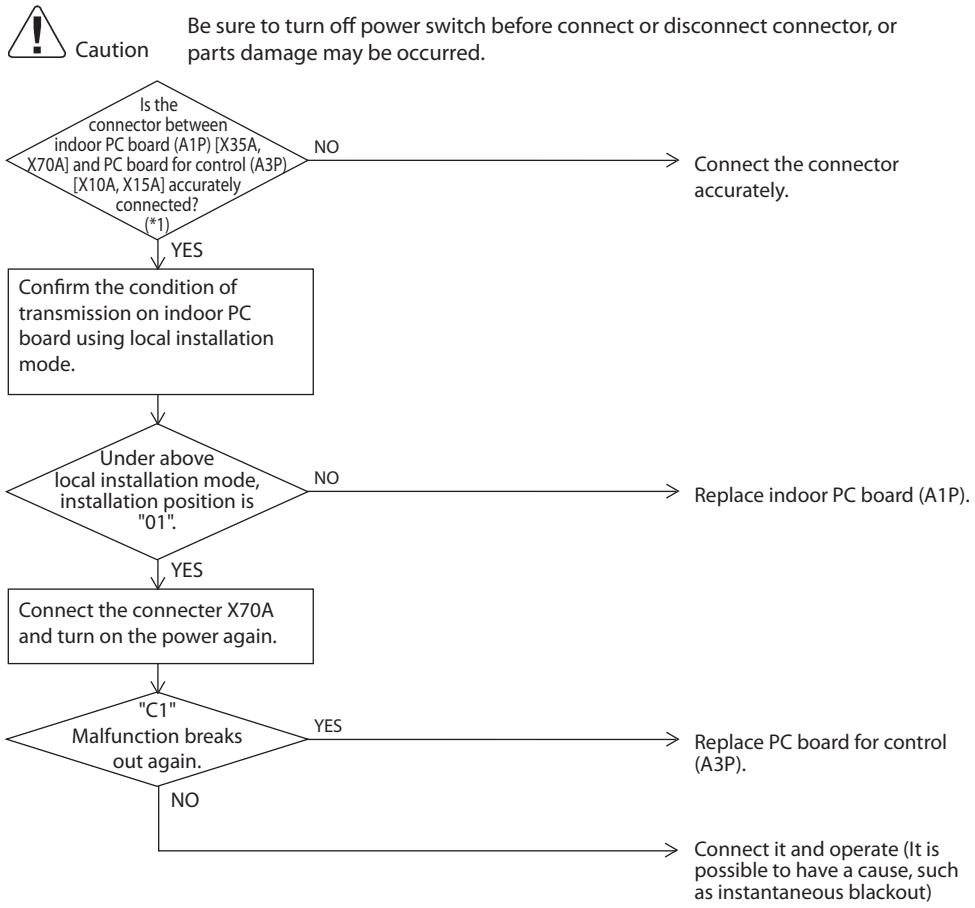
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



3.7 "C1" Indoor Unit: Failure of Transmission (Between Indoor unit PC Board and Control PC Board)

Remote Control Display	C1 Subcode 0
Applicable Models	All indoor unit models
Method of Malfunction Detection	Check the condition of transmission between indoor PC board (A1P) and PC board for control (A3P) using computer.
Malfunction Decision Conditions	When normal transmission is not conducted for certain duration.
Supposed Causes	■ Connection defect of the connecter between indoor PC board (A1P) and PC board for control (A3P) (communication problem). ■ Malfunction of indoor PC board (A1P). ■ Malfunction of PC board for control (A3P). ■ External factor, such as instantaneous blackout.

Troubleshooting



∗1. Pull out and insert the connecter once and check it is absolutely connected.

3.8 "C4" Indoor Unit: Malfunction of Thermistor (R3T) Liquid Thermistor R-410A

Remote Control Display

C4

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by liquid thermistor.

Malfunction Decision Conditions

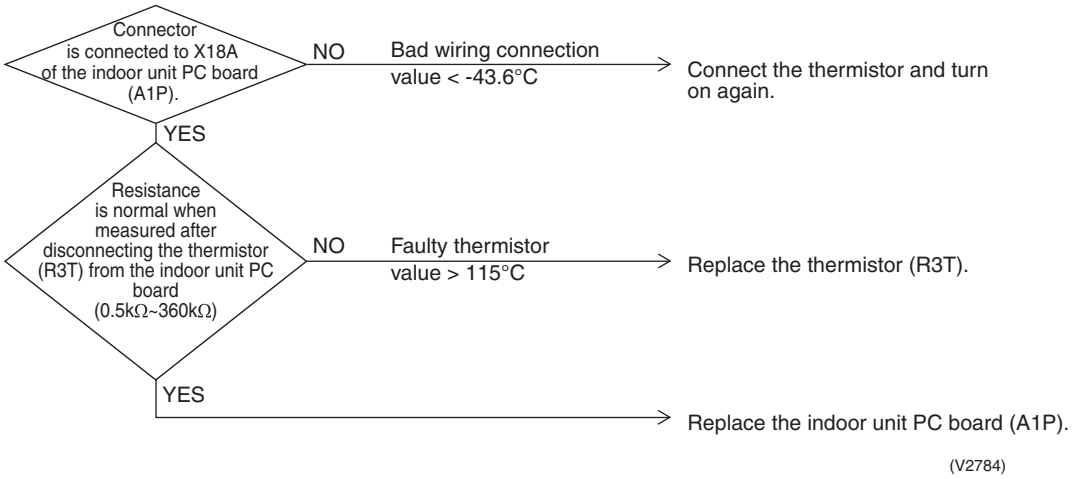
When the liquid thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of thermistor (R3T) for liquid pipe
- Defect of indoor unit PC board (A1P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.9 "C5" Indoor Unit: Malfunction of Tank Thermistor (R2T)

Remote Control Display

C5

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by tank thermistor.

Malfunction Decision Conditions

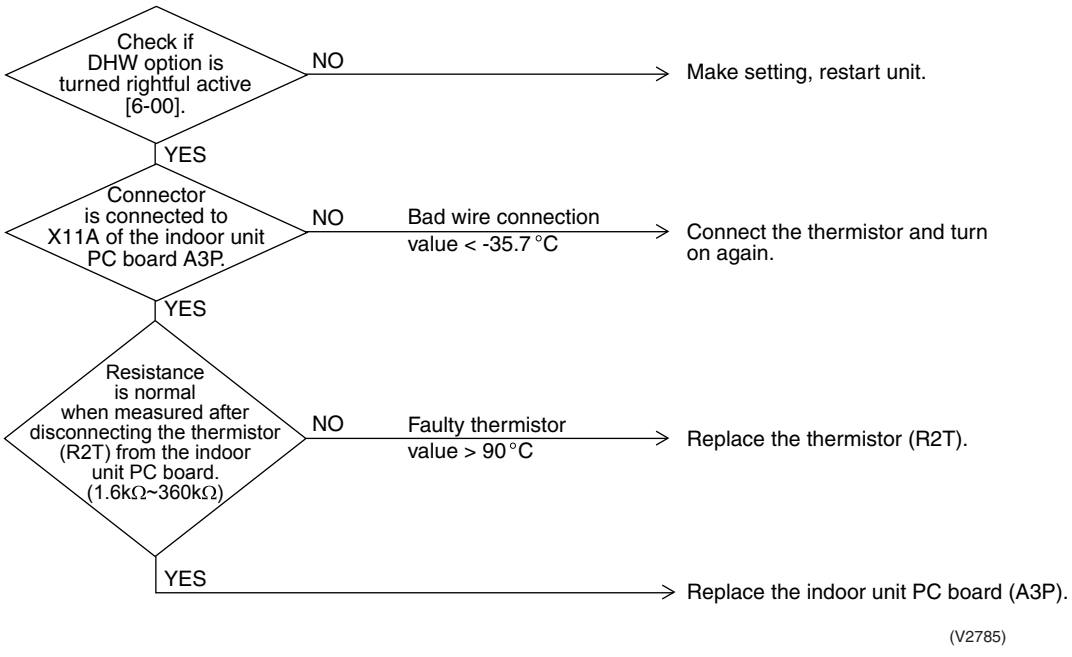
When the tank thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of indoor unit tank thermistor (R2T)
- Defect of indoor unit PC board (A3P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.10 "C9" Indoor Unit: Return Water Thermistor (R4T)

Remote Control Display

C9

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by return water temperature thermistor.

Malfunction Decision Conditions

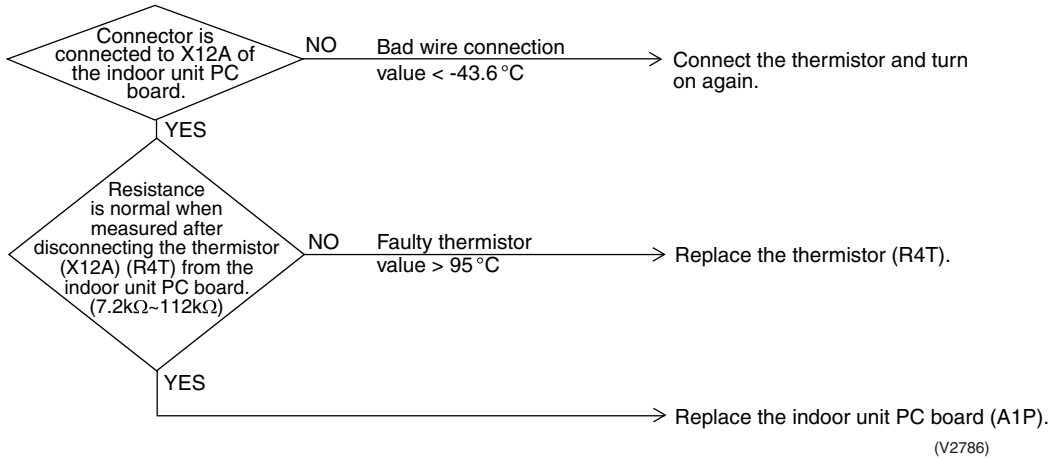
When the return water temperature thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of indoor unit thermistor (R4T) for water return
- Defect of indoor unit PC board (A1P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.11 "CA" Indoor Unit: Heating Leaving Water Thermistor Error (R5T)

Remote Control Display

CA

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by heating leaving water thermistor.

Malfunction Decision Conditions

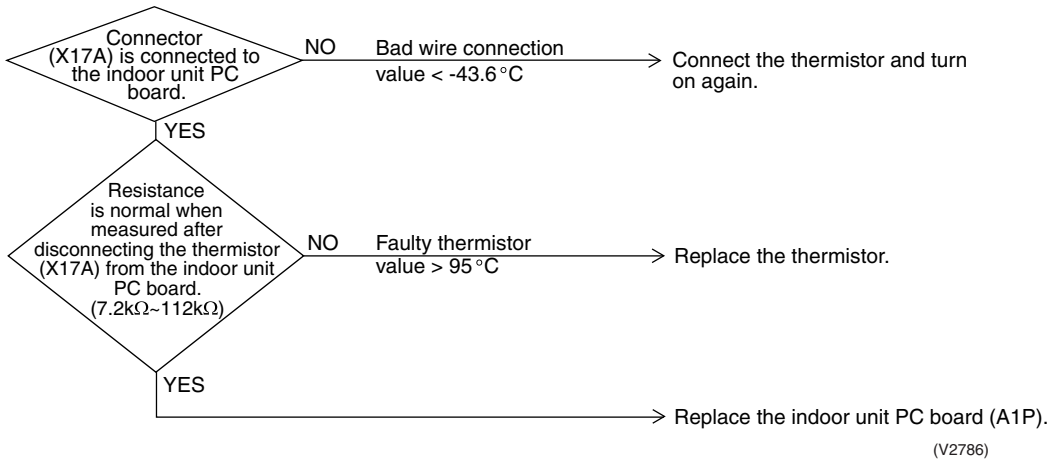
When the heating leaving water thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of indoor unit heating thermistor for leaving water (R5T)
- Defect of indoor unit PC board

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.12 "CE" Indoor Unit: Cooling Leaving Water Thermistor Error (R9T)

Remote Control Display

CE

subcode 0

Applicable Models

EKHVMYD units

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by cooling leaving water thermistor.

Malfunction Decision Conditions

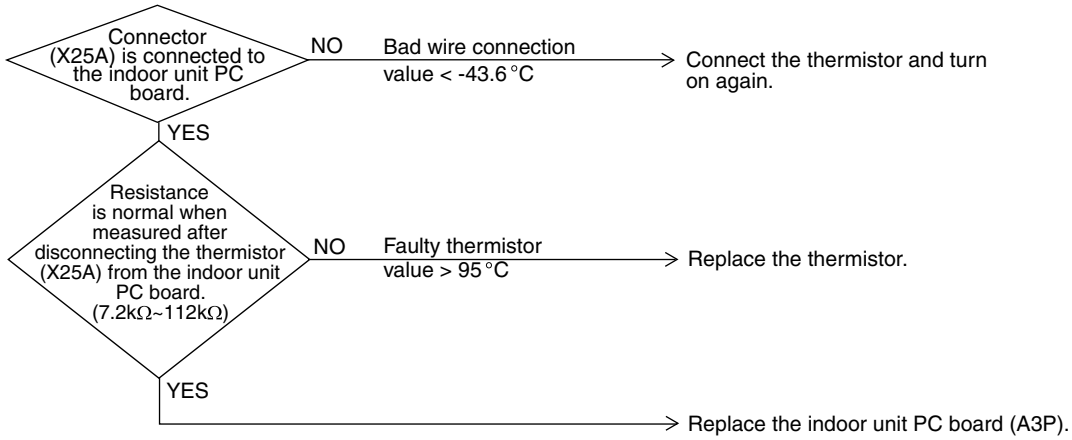
When the cooling leaving water thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of indoor unit cooling thermistor for leaving water (R9T)
- Defect of indoor PC board
- Heating only indoor unit is programmed as a reversible (heating/cooling) indoor unit

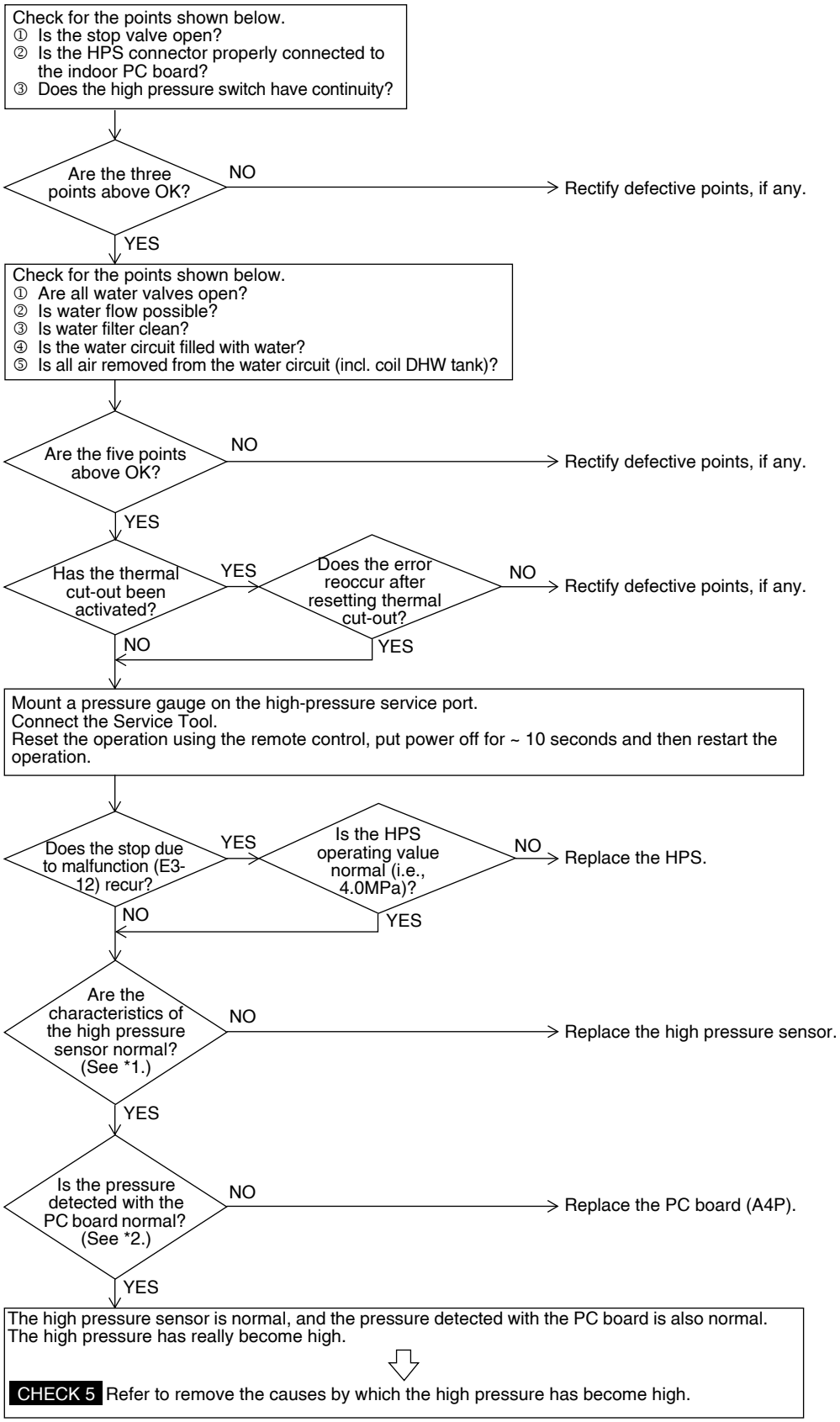
Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



Check No.5: Refer to information on page 288.

3.13 "CJ" Indoor Unit: Malfunction of Thermostat Sensor in Remote Controller

Remote Control Display

CJ

Subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

Malfunction detection is carried out by temperature detected by remote control air temperature thermistor.

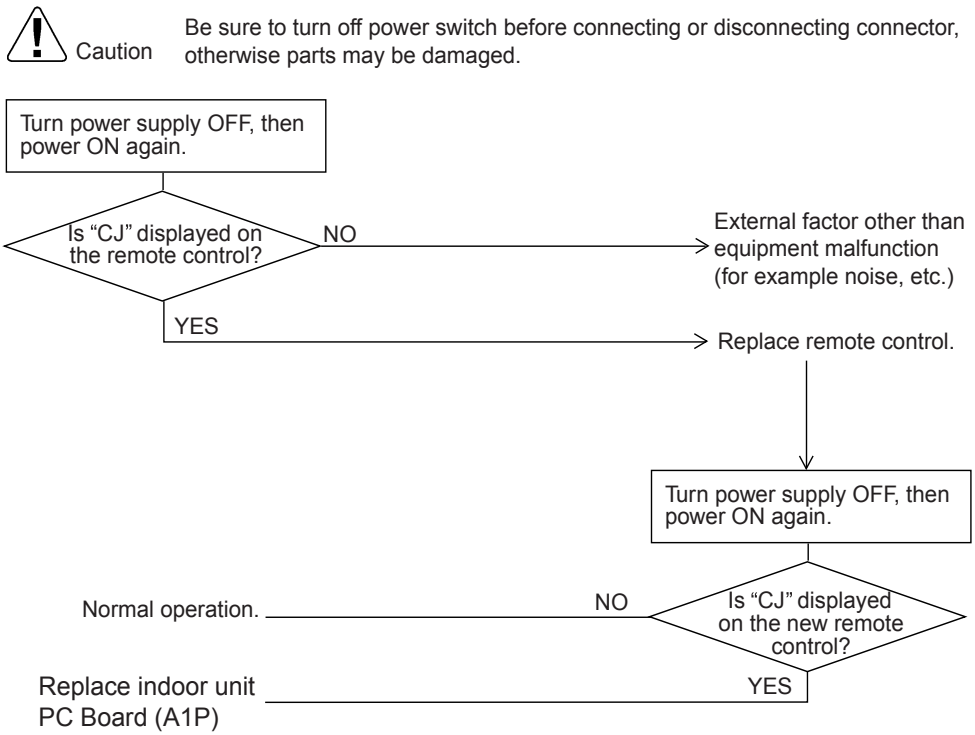
Malfunction Decision Conditions

When the remote control air temperature thermistor becomes disconnected or shorted while the unit is running.

Supposed Causes

- Defect of remote control thermistor
- Defect of remote control PC board
- Defect of indoor PC board (A1P)

Troubleshooting



3.14 "E1" Outdoor Unit: PC Board Defect

Remote Control Display

E1

Applicable Models

EMRQ*
Related to: R-410A compressor
Subcode 3: see next page

Method of Malfunction Detection

Check data from E²PROM

Malfunction Decision Conditions

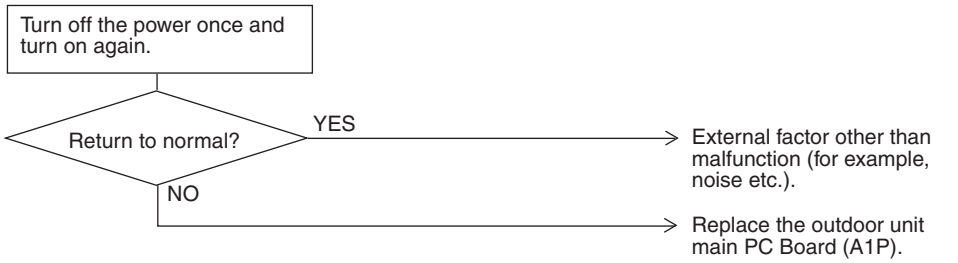
When data could not be correctly received from the E²PROM
E²PROM: Type of nonvolatile memory. Maintains memory contents even when the power supply is turned off.

Supposed Causes

- Defect of outdoor unit PC board (A1P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



(V3064)

3.15 "E1" Indoor Unit: PC Board Defect

Remote Control Display

E1

Subcode 3

Applicable Models

All indoor units
Related to: R-134a compressor

Method of Malfunction Detection

Check data from E²PROM

Malfunction Decision Conditions

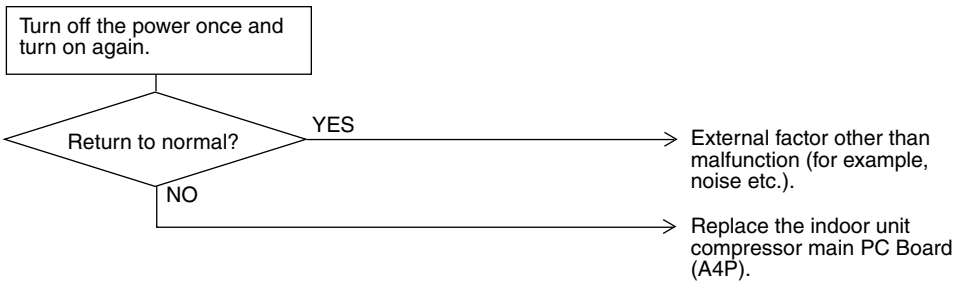
When data could not be correctly received from the E²PROM
E²PROM: Type of nonvolatile memory. Maintains memory contents even when the power supply is turned off.

Supposed Causes

- Defect compressor main PC board (A4P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



CE Indoor Unit: Leaving water thermistor (c) error (R9T)

3.16 "E3" Outdoor Unit: Actuation of High Pressure Switch

Remote Control Display	E3 Subcode 1
Applicable Models	EMRQ*
Method of Malfunction Detection	Abnormality is detected when the contact of the high pressure protection switch opens.
Malfunction Decision Conditions	Error is generated when the HPS activation count reaches the number specific to the operation mode. (Reference) Operating pressure of high pressure switch Operating pressure: 4.0MPa Reset pressure: 2.85MPa
Supposed Causes	■ Actuation of outdoor unit high pressure switch ■ Defect of High pressure switch ■ Defect of outdoor unit PC board (A1P) ■ Instantaneous power failure ■ Faulty high pressure sensor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

Check for the points shown below.
(1) Is the stop valve open?
(2) Is the high pressure switch connector properly connected to the main PCB?
(3) Does the high pressure switch have continuity?

↓

Are the three points above OK? — NO → Rectify defective points, if any.

↓ YES

(1) Mount a pressure gauge on the high pressure service port.
(2) Reset the operation using the remote controller, and then restart the operation.

↓

Does the stop due to malfunction (E3) recur? — YES → Is the high pressure switch operating value normal (i.e., 4.0MPa)? — NO → Replace the high pressure switch.

NO ↓ (from first) YES ↓ (from second)

Are the characteristics of the high pressure sensor normal? (See *1.) — NO → Replace the high pressure sensor.

↓ YES

Service Checker
Connect the service checker to compare the “high pressure” value and the actual measurement value by pressure sensor (Refer to *1) by using the service checker.

↓

Check if the “high pressure” value and the actual measurement value by pressure sensor are the same. — NO → Replace the main PCB (A1P).

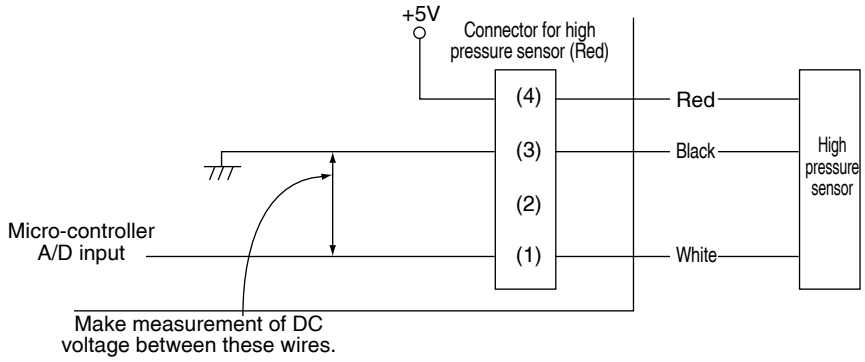
↓ YES

· The high pressure sensor is normal, and the pressure detected with the PCB is also normal.
· The high pressure has really become high.

⇩

CHECK 5 Remove the causes by which the high pressure has become high.

*1: Make a comparison between the voltage of the pressure sensor and that read by the pressure gauge.
(As to the voltage of the pressure sensor, make measurement of voltage at the connector, and then convert it to pressure according to information on page 310.)
*2: Make measurement of voltage of the pressure sensor.



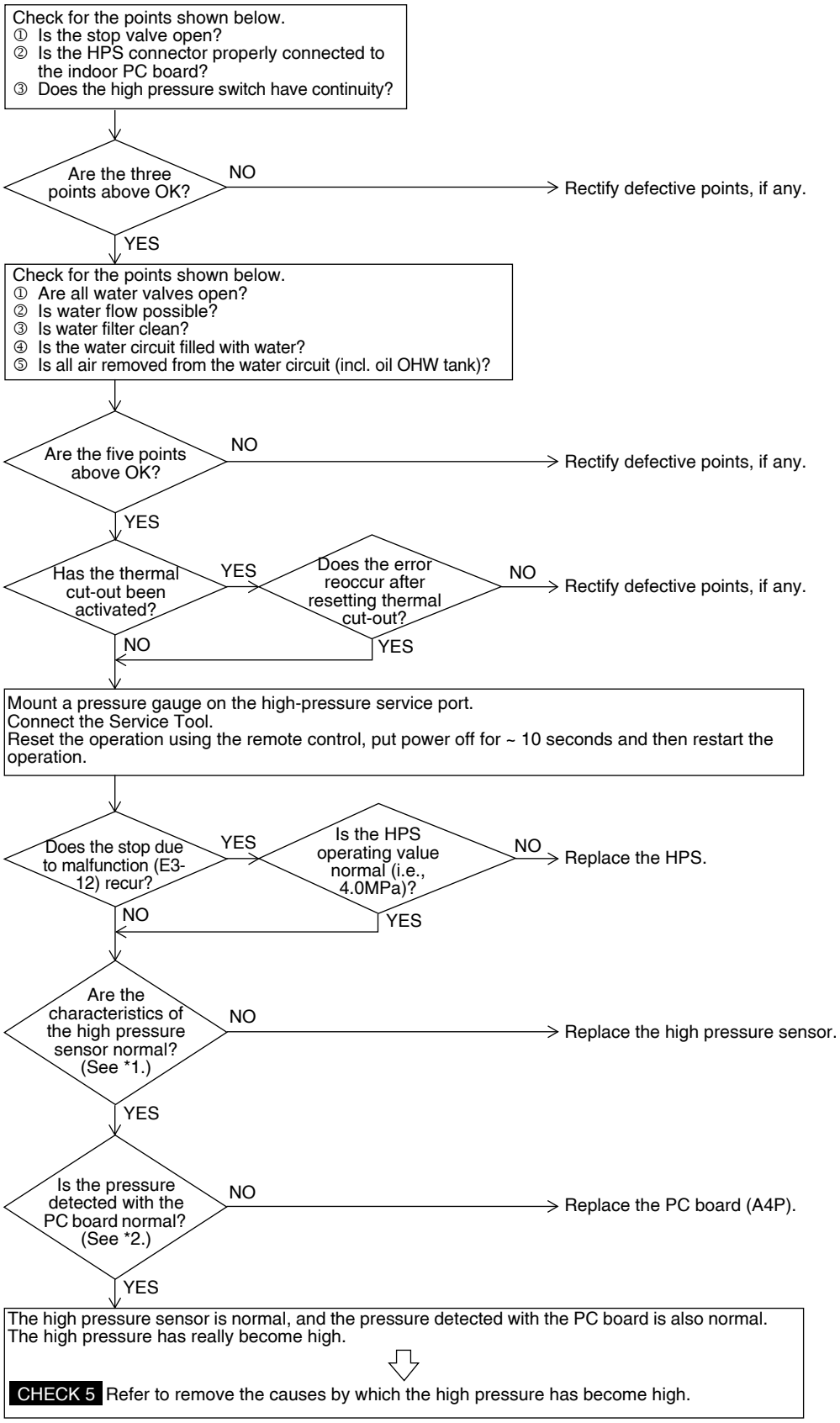
Check No.5: Refer to information on page 288.

3.17 "E3" Indoor Unit: Actuation of High Pressure Switch

Remote Control Display	E3 Subcode 12
Applicable Models	All indoor units
Method of Malfunction Detection	Abnormality is detected when the contact of the high pressure protection switch opens.
Malfunction Decision Conditions	Error is generated when the HPS activation count reaches the number specific to the operation mode. (Reference) Operating pressure of high pressure switch Operating pressure: 3.8MPa Reset pressure: 2.7MPa
Supposed Causes	■ Actuation of indoor unit high pressure switch ■ Defect of High pressure switch ■ Defect of Indoor unit PC board (A4P) ■ Faulty high pressure sensor ■ Refrigerant blockage ■ Water blockage ■ Thermal cut out error (Q2L) ⚠ **Warning**: CAPACITOR SHOCK HAZARD. The capacitors (top surfaces) can hold up to 220V. Use correct precautions when servicing.

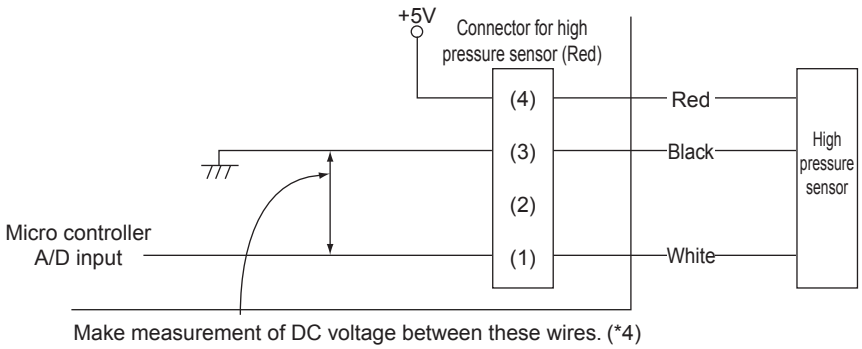
Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



Check No.5: Refer to information on page 288.

*1: Make a comparison between the voltage of the pressure sensor (*4) and that read by the pressure gauge.(As to the voltage of the pressure sensor, make measurement of voltage at the connector, and then convert it to pressure.)
*2: Make a comparison between the high pressure value checked with the Service Tool and the voltage of the pressure sensor (see *1)
*3: Make measurement of voltage of the pressure sensor.

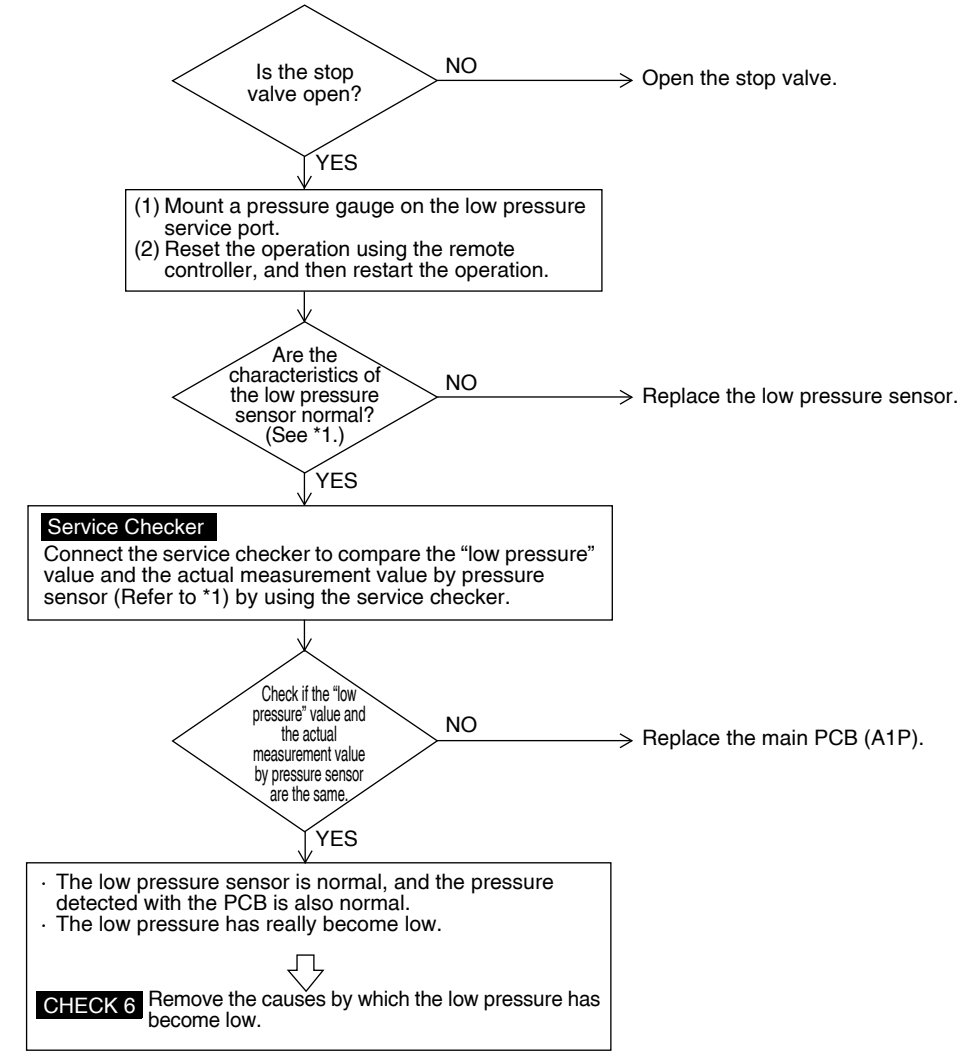


3.18 "E4" Outdoor Unit: Actuation of Low Pressure Sensor

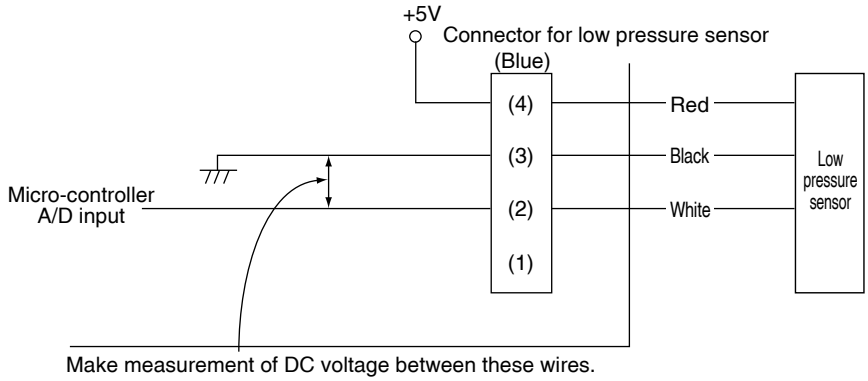
Remote Control Display	E4
Applicable Models	EMRQ*
Method of Malfunction Detection	Abnormality is detected by the pressure value with the low pressure sensor.
Malfunction Decision Conditions	Error is generated when the low pressure is dropped under specific pressure. Operating pressure: 0.07MPa
Supposed Causes	■ Abnormal drop of low pressure (Lower than 0.07MPa) ■ Defect of low pressure sensor ■ Defect of outdoor unit PC board (A1P) ■ Stop valve is not opened.

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



*1: Make a comparison between the voltage of the pressure sensor and that read by the pressure gauge.
(As to the voltage of the pressure sensor, make measurement of voltage at the connector, and then convert it to pressure according to information on page 310.)
*2: Make measurement of voltage of the pressure sensor.



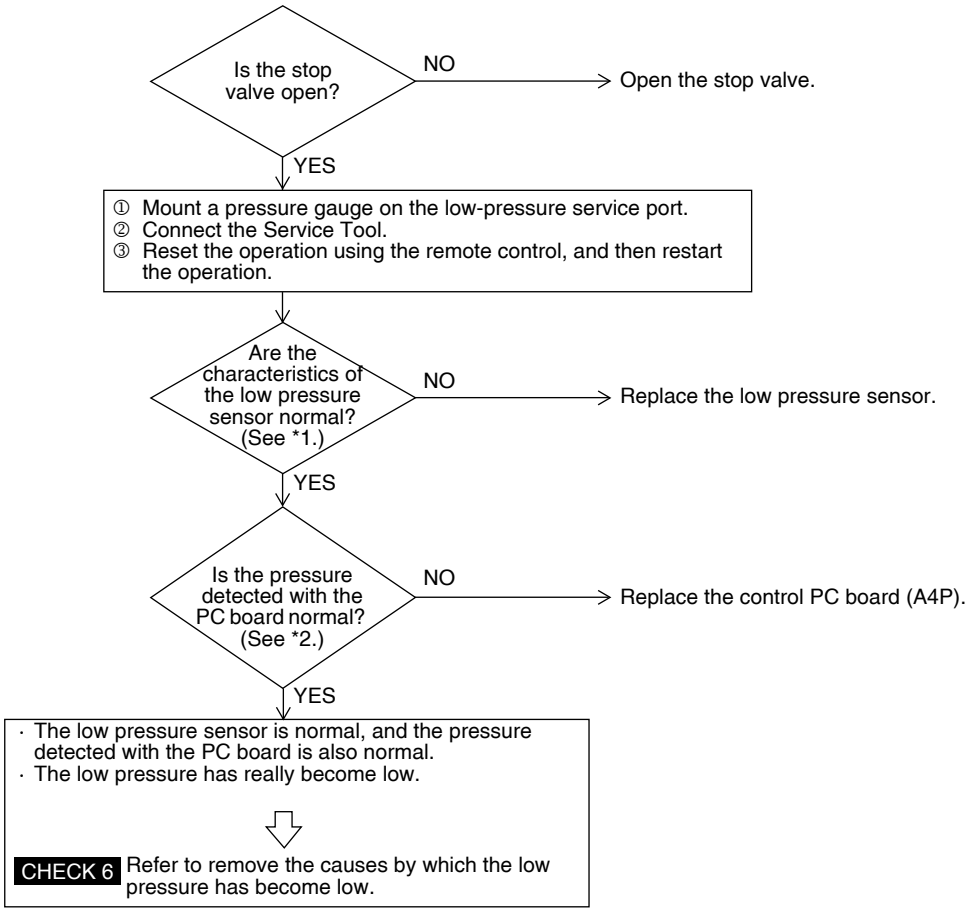
Check No.6: Refer to information on page 289.

3.19 "E4" Indoor Unit: Actuation of Low Pressure Sensor

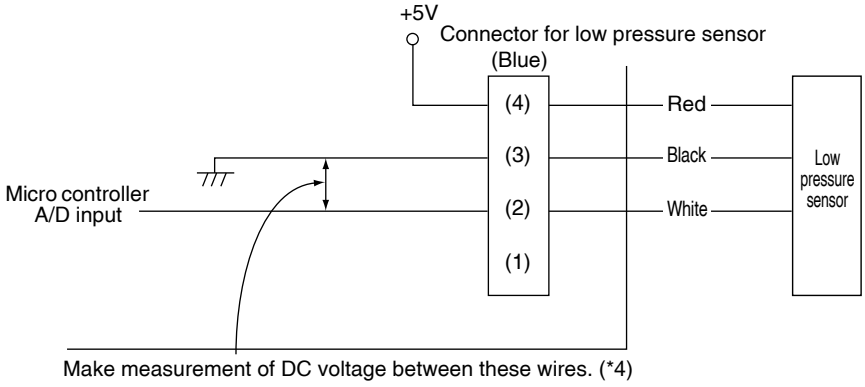
Remote Control Display	E4 Subcode 06
Applicable Models	All indoor units
Method of Malfunction Detection	Abnormality is detected by the pressure value with the low pressure sensor.
Malfunction Decision Conditions	Error is generated when the low pressure is dropped under specific pressure. Operating pressure: 0.07MPa
Supposed Causes	■ Abnormal drop of low pressure (Lower than 0.07MPa) ■ Defect of low pressure sensor ■ Defect of control PC board (A4P) ■ Stop valve is not opened. ⚠ **Warning**: CAPACITOR SHOCK HAZARD. The capacitors (top surfaces) can hold up to 220V. Use correct precautions when servicing.

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



*1: Make a comparison between the voltage of the pressure sensor (*4) and that read by the pressure gauge.
(As to the voltage of the pressure sensor, make measurement of voltage at the connector, and then convert it to pressure.)
*2: Make a comparison between the low pressure value checked with the Service Tool and the voltage of the pressure sensor (see *1).
*3: Make measurement of voltage of the pressure sensor.



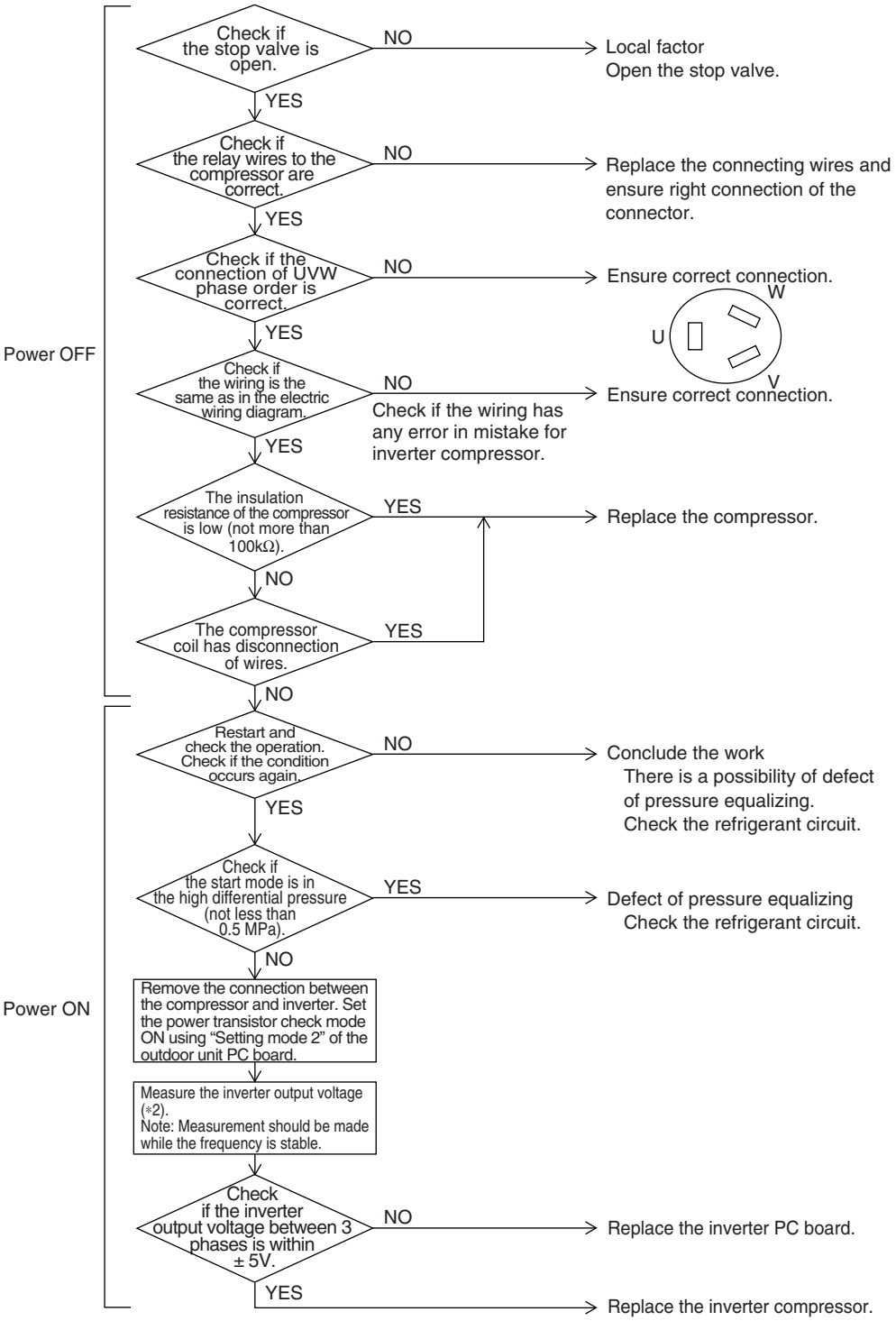
Check No.6: Refer to information on page 289.

3.20 "E5" Outdoor Unit: Inverter Compressor Motor Lock

Remote Control Display	E5
Applicable Models	EMRQ*
Method of Malfunction Detection	Inverter PC board takes the position signal from UVW line connected between the inverter and compressor, and the malfunction is detected when any abnormality is observed in the phase-current waveform.
Malfunction Decision Conditions	This malfunction will be output when the inverter compressor motor does not start up even in forced startup mode.
Supposed Causes	■ Compressor lock ■ High differential pressure (0.5MPa or more) ■ Incorrect UVW wiring ■ Faulty inverter PC board ■ Stop valve is left in closed.

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



∗1: Pressure difference between high pressure and low pressure before starting.
∗2: The quality of power transistors/ diode modules can be judged by executing Check 4 (P339).

3.21 "E5" Indoor Unit: Inverter Compressor Motor Lock

Remote Control Display

E5

Subcode 6

Applicable Models

All indoor units

Method of Malfunction Detection

Inverter PC board takes the position signal from UVW line connected between the inverter and compressor, and the malfunction is detected when any abnormality is observed in the phase-current waveform.

Malfunction Decision Conditions

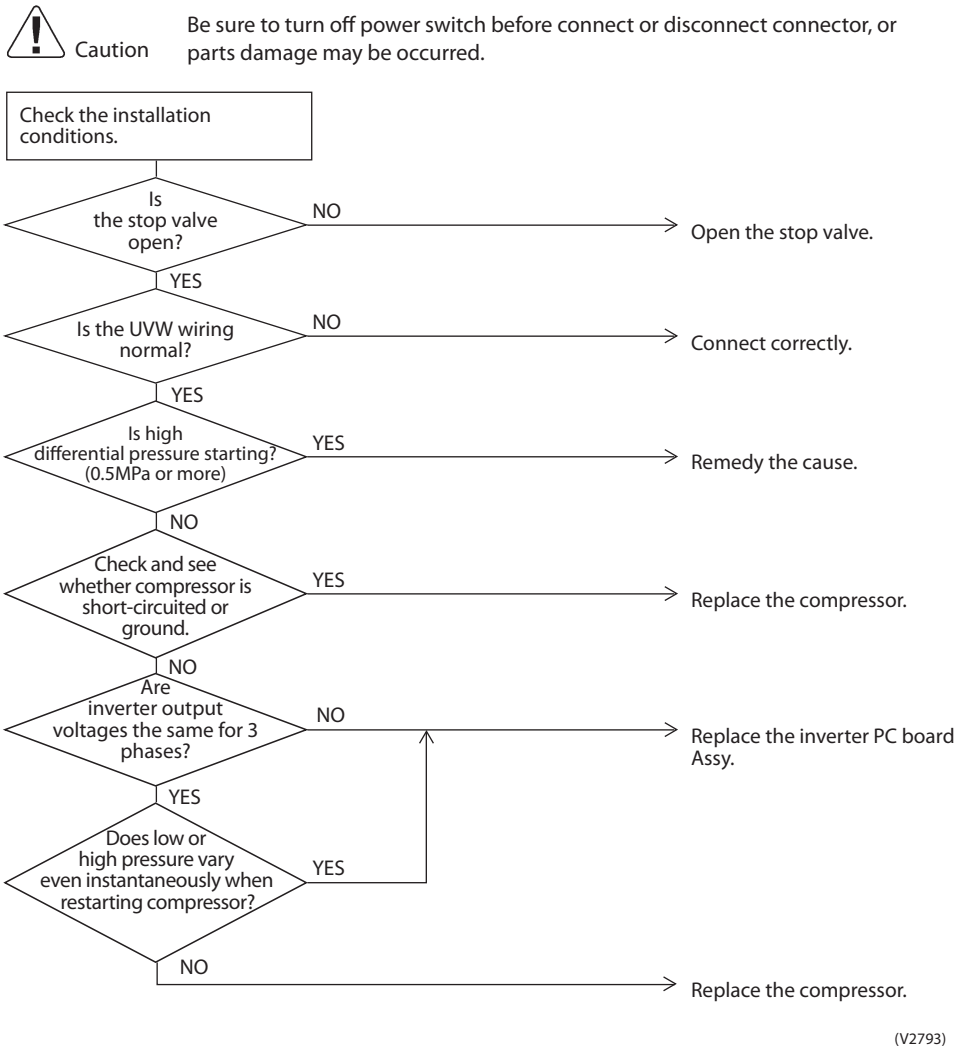
This malfunction will be output when the inverter compressor motor does not start up even in forced startup mode.

Supposed Causes

- Compressor lock (liquid suction (oil shortage))
- High differential pressure (0.5MPa or more)
- Incorrect UVW wiring
- Faulty inverter PC board
- Stop valve is left in closed.

⚠ **Warning**: CAPACITOR SHOCK HAZARD. The capacitors (top surfaces) can hold up to 220V. Use correct precautions when servicing.

Troubleshooting



3.22 "E6" Outdoor Unit: STD Compressor Motor Overcurrent/ Lock

Remote Controller Display

E6

Applicable Models

EMRQ*

Method of Malfunction Detection

Detects the overcurrent with current sensor (CT).

Malfunction Decision Conditions

Malfunction is decided when the detected current value exceeds the below mentioned value for 2 seconds.

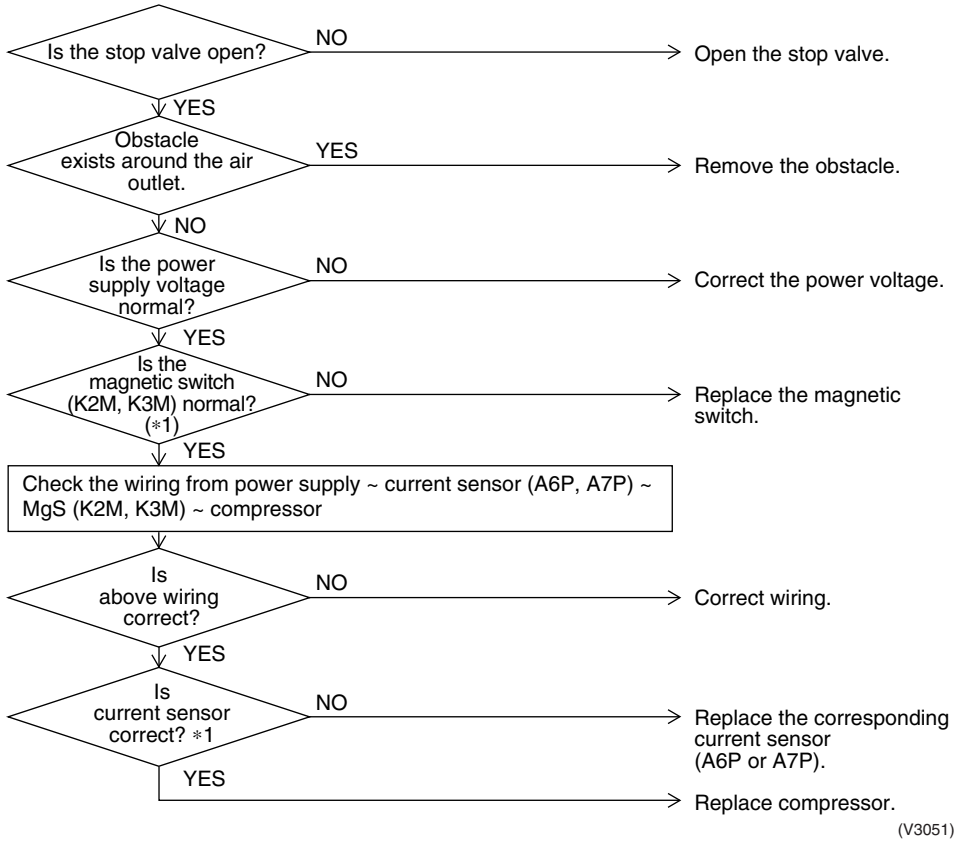
- 400 V unit : 15.0 A

Supposed Causes

- Closed stop value
- Obstacles at the air outlet
- Improper power voltage
- Faulty magnetic switch
- Faulty compressor
- Faulty current sensor (A6P, A7P)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



(V3051)

Note: ∗1 One of the possible factors may be chattering due to rough MgS contact.
∗2 Abnormal case

- The current sensor value is 0 during STD compressor operation.
- The current sensor value is more than 15.0A during STD compressor stop.

3.23 "E7" Outdoor Unit: Malfunction of Outdoor Unit Fan Motor

Remote Controller Display	E7
Applicable Models	EMRQ*
Method of Malfunction Detection	Detect a malfunction based on the current value in the INVERTER PC board (as for motor 2, current value in the fan PC board). Detect a malfunction for the fan motor circuit based on the number of rotation detected by hole IC during the fan motor operation.
Malfunction Decision Conditions	■ Overcurrent is detected for INVERTER PC board (A2P) or fan INVERTER PC board (A5P) (System down is caused by 4 times of detection.) ■ In the condition of fan motor rotation, the number of rotation is below the fixed number for more than 6 seconds. (System down is caused by 4 times of detection.)
Supposed Causes	■ Failure of fan motor ■ Defect or connect ion error of the connectors/ harness between the fan motor and PC board ■ The fan can not rotate due to any foreign substances entangled. ■ Clear condition: Continue normal operation for 5 minutes

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

Check in the monitor mode
Check electric motor (electric motor 1 or 2) corresponding to malfunction code E7 in the monitor mode of outdoor unit PC board.

↓

Cut the power supply OFF and wait for 10 minutes.

↓

Check if any foreign substances around the fan. → YES → Remove the foreign substances.

↓ NO

Check the connection status of the connectors
- Fan motor 1: relay connector or X1A, X2A of compressor inverter PC board.
- Fan motor 2: relay connector or X1A, X2A of fan inverter PC board.

↓

Check if any connector is disconnected. → YES → Insert the connector.

↓ NO

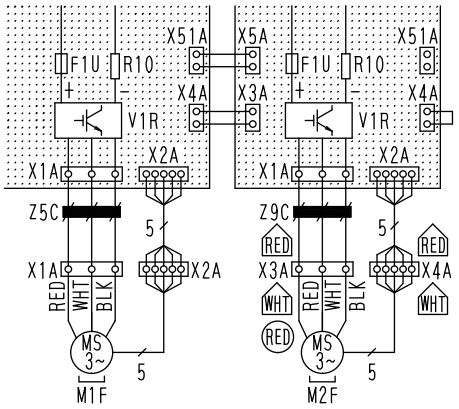
Check the color of relay connectors
- Fan motor 1: Both power supply wire and signal wire are all white.
- Fan motor 2: Both power supply wire and signal wire are red in the PC board side and white in the motor side.

↓

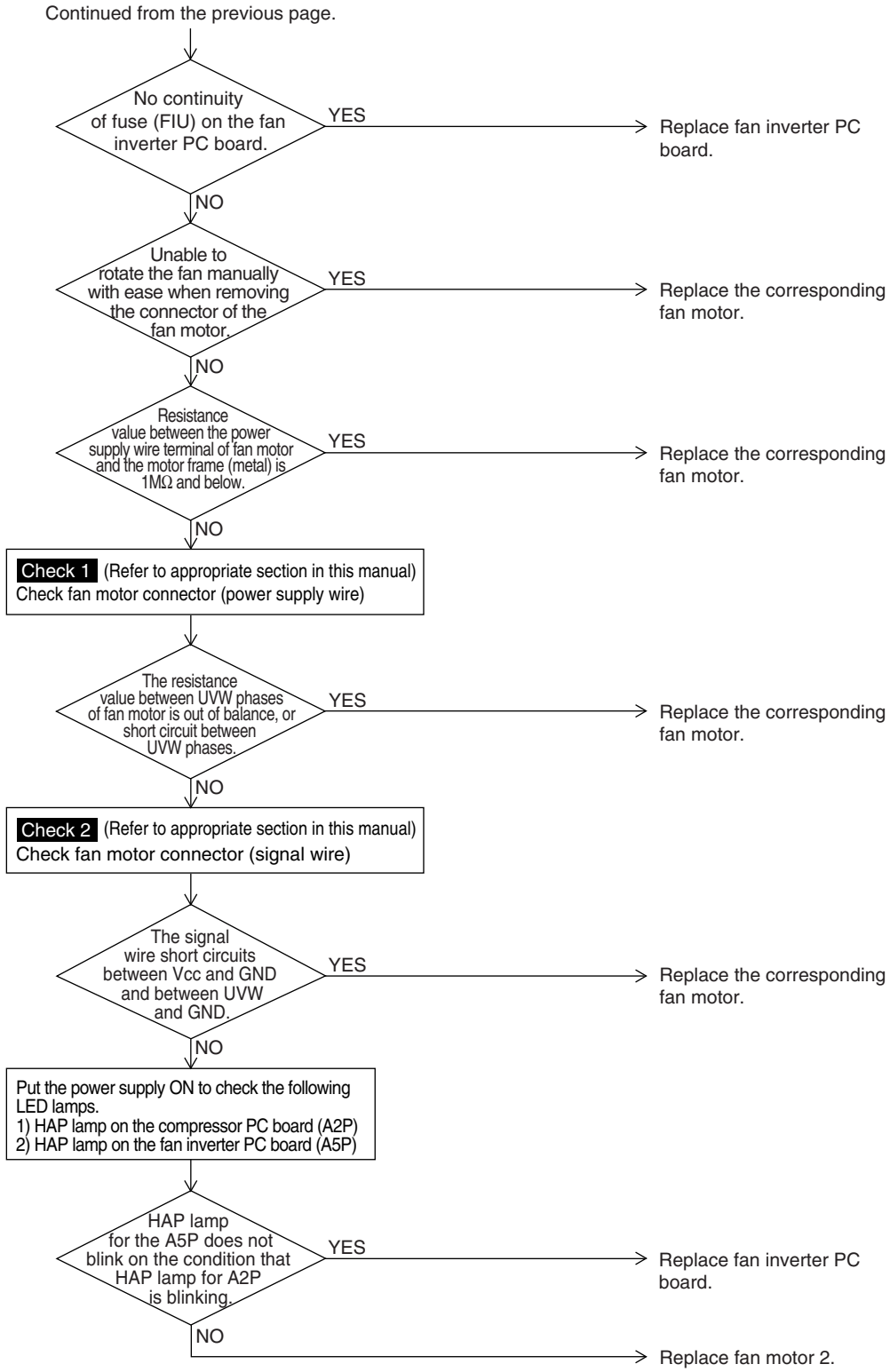
Relay connectors have any connection error. → YES → Correct the connection of the relay connectors.

↓ NO

Go on to the next page.



Troubleshooting

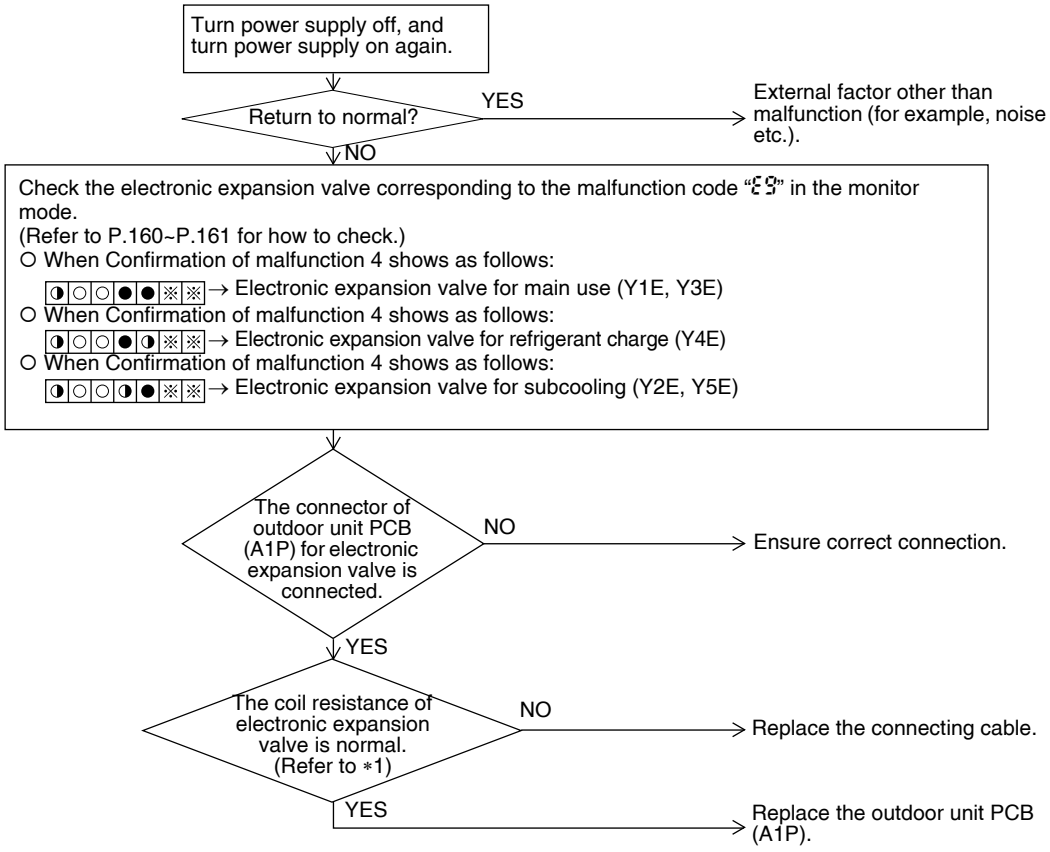


3.24 "E9" Outdoor Unit: Malfunction of Moving Part of Electronic Expansion Valve (Y1E~Y5E)

Remote Controller Display	E9
Applicable Models	EMRQ*
Method of Malfunction Detection	Check disconnection of connector To be detected based on continuity existence of coil of electronic expansion valve
Malfunction Decision Conditions	No current is detected in the common (COM [+]) when power supply is ON.
Supposed Causes	■ Disconnection of connectors for electronic expansion valve (Y1E) ■ Defect of moving part of electronic expansion valve ■ Defect of outdoor unit main PCB (A1P)

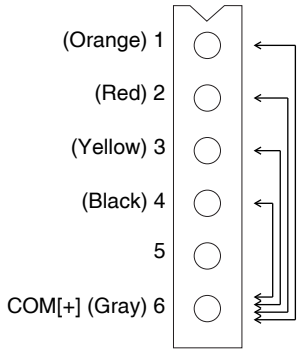
Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



(V3067)

∗ Make measurement of resistance between the connector pins, and then make sure the resistance falls in the range of 40 to 50Ω.



Measuring points	Judgement criteria
1 - 6	40~50Ω
2 - 6	
3 - 6	
4 - 6	

(V3067)

3.25 "E9" Indoor Unit: Malfunction of Moving Part of Electronic Expansion Valve (K2E) R-134a circuit

Remote Control Display

E9

Subcode 17 (K2E)

Applicable Models

All indoor units

Method of Malfunction Detection

Check disconnection of connector
Check continuity of expansion valve coil

Malfunction Decision Conditions

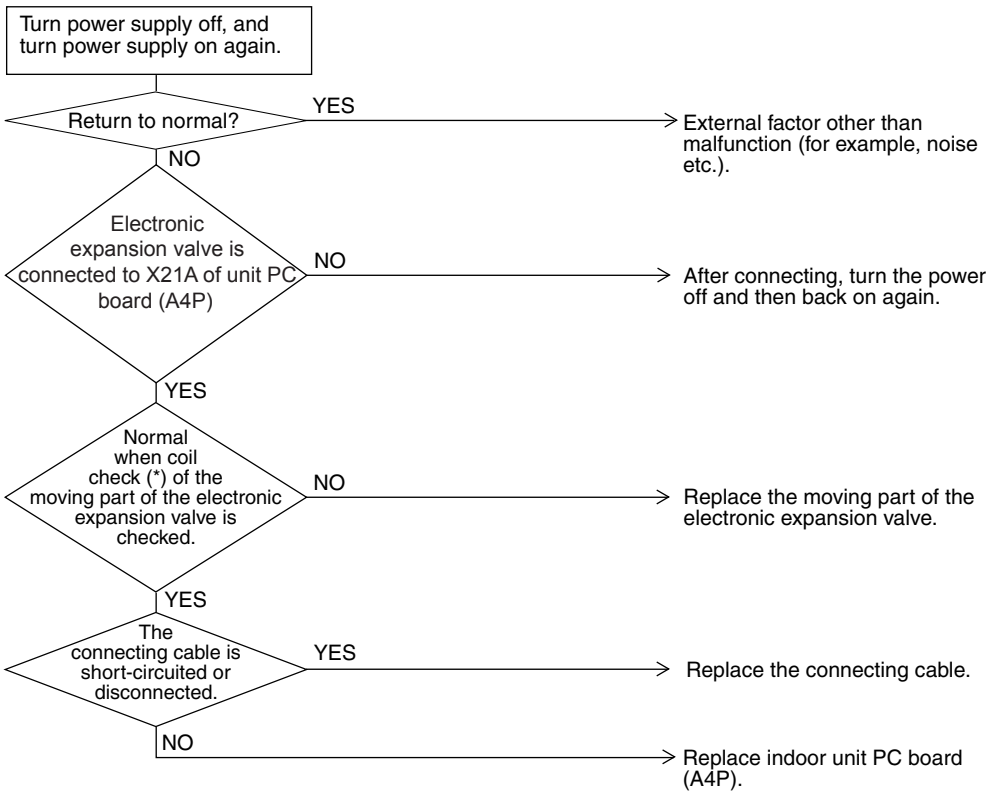
Error is generated under no common power supply when the power is on.

Supposed Causes

- Defect of moving part of electronic expansion valve
- Defect of indoor unit PC board (A4P)
- Defect of connecting cable

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗1: Coil check method for the moving part of the electronic expansion valve
Discount the electronic expansion valve from the PC board and check the continuity between the connector pins.



(V3067)

(Normal)

Pin No.	1. White	2. Yellow	3. Orange	4. Blue	5. Red	6. Brown
1. White		×	○ Approx. 300Ω	×	○ Approx. 150Ω	×
2. Yellow			×	○ Approx. 300Ω	×	○ Approx. 150Ω
3. Orange				×	○ Approx. 150Ω	×
4. Blue					×	○ Approx. 150Ω
5. Red						×
6. Brown						

○: Continuity
×: No continuity

3.26 "E9" Indoor Unit: Malfunction of Moving Part of Electronic Expansion Valve (K3E) R-410a circuit

Remote Control Display

E9

Subcode 19 (K3E)

Applicable Models

EKHVMYD units

Method of Malfunction Detection

Check disconnection of connector
Check continuity of expansion valve coil

Malfunction Decision Conditions

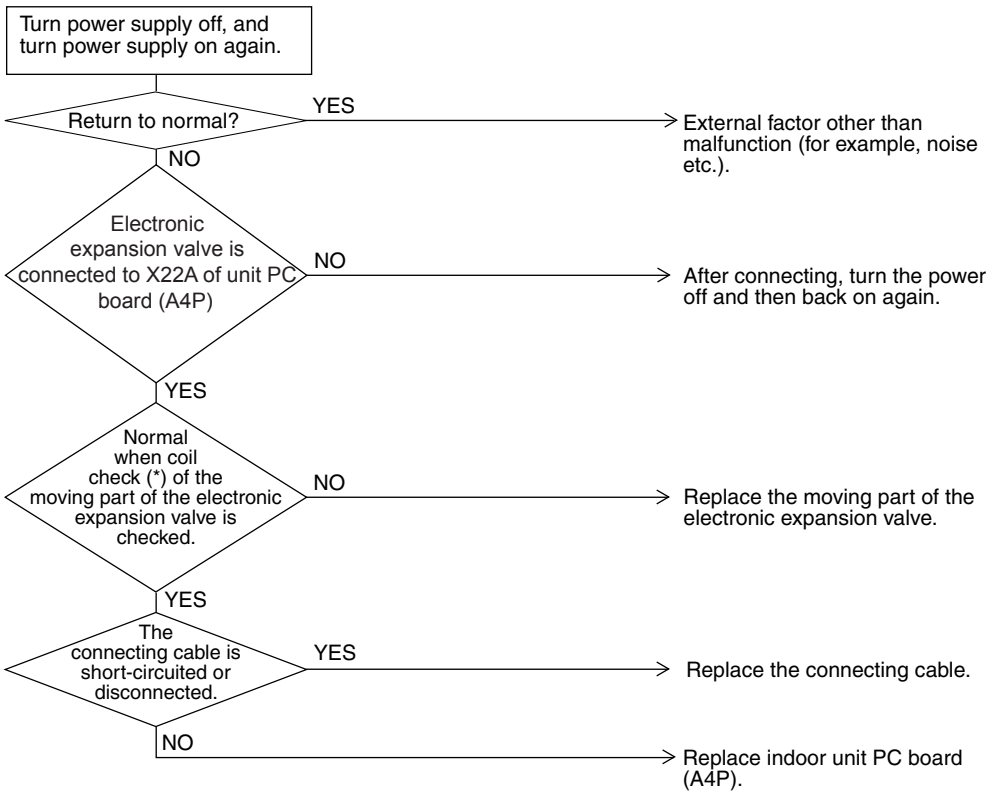
Error is generated under no common power supply when the power is on.

Supposed Causes

- Defect of moving part of electronic expansion valve
- Defect of indoor unit PC board (A4P)
- Defect of connecting cable

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗1: Coil check method for the moving part of the electronic expansion valve
Discount the electronic expansion valve from the PC board and check the continuity between the connector pins.



(V3067)

(Normal)

Pin No.	1. White	2. Yellow	3. Orange	4. Blue	5. Red	6. Brown
1. White		×	○ Approx. 300Ω	×	○ Approx. 150Ω	×
2. Yellow			×	○ Approx. 300Ω	×	○ Approx. 150Ω
3. Orange				×	○ Approx. 150Ω	×
4. Blue					×	○ Approx. 150Ω
5. Red						×
6. Brown						

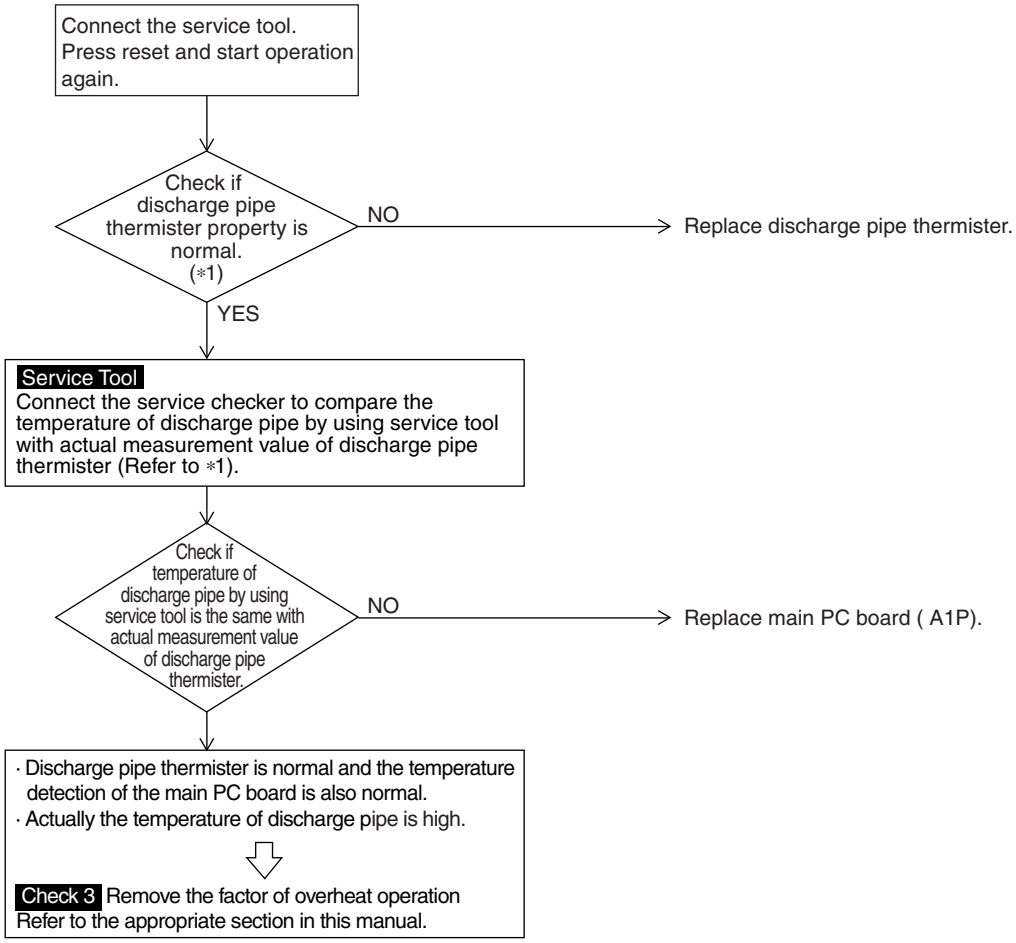
○: Continuity
×: No continuity

3.27 "F3" Outdoor Unit: Abnormal Discharge Pipe Temperature

Remote Controller Display	F3
Applicable Models	EMRQ*
Method of Malfunction Detection	Abnormality is detected according to the temperature detected by the discharge pipe temperature sensor.
Malfunction Decision Conditions	When the discharge pipe temperature rises to an abnormally high level (135 °C and above) When the discharge pipe temperature rises suddenly (120 °C and above for 10 successive minutes)
Supposed Causes	■ Faulty discharge pipe temperature sensor ■ Faulty connection of discharge pipe temperature sensor ■ Faulty outdoor unit PC board

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



*1: Compare the resistance value of discharge pipe thermister and the value based on the surface thermometer.

* Refer to “Thermistor Resistance / Temperature Characteristics” table on page 307.

3.28 "F3" Indoor Unit: Abnormal Discharge Pipe Temperature

Remote Control Display

F3

Subcode 19

Applicable Models

All indoor units

Method of Malfunction Detection

Abnormality is detected according to the temperature detected by the discharge pipe temperature sensor.

Malfunction Decision Conditions

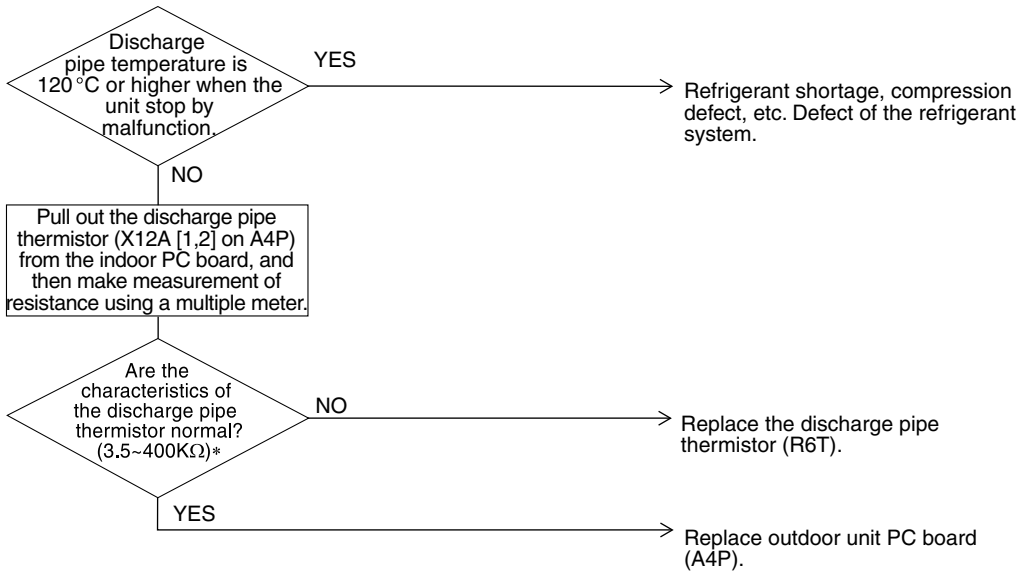
When the discharge pipe temperature rises to an abnormally high level
When the discharge pipe temperature rises suddenly

Supposed Causes

- Faulty discharge pipe temperature sensor
- Faulty connection of discharge pipe temperature sensor
- Faulty outdoor unit PC board

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.29 "F6" Outdoor Unit: Refrigerant Overcharged

Remote Controller Display

F6

Applicable Models

EMRQ*

Method of Malfunction Detection

Excessive charging of refrigerant is detected by using the outside air temperature, heat exchanging deicer temperature and liquid pipe temperature during a check run.

Malfunction Decision Conditions

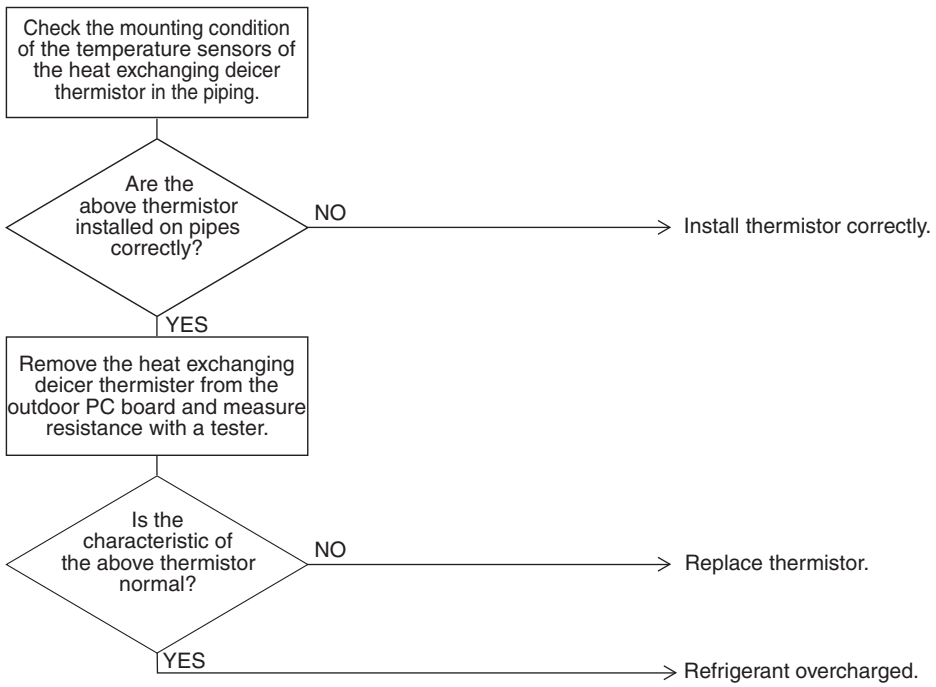
When the amount of refrigerant, which is calculated by using the outside air temperature, heat exchanging deicer temperature and liquid pipe temperature during a check run, exceeds the standard.

Supposed Causes

- Refrigerant overcharge
- Misalignment of the outside air thermistor
- Misalignment of the heat exchanging deicer thermistor
- Misalignment of the liquid pipe thermistor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



(V2797)

∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.30 “H7” Outdoor Unit: Abnormal Outdoor Fan Motor Signal

Remote Controller Display	H7
Applicable Models	EMRQ*
Method of Malfunction Detection	Detection of abnormal signal from fan motor.
Malfunction Decision Conditions	In case of detection of abnormal signal at starting fan motor.
Supposed Causes	■ Abnormal fan motor signal (circuit malfunction) ■ Broken, short or disconnection connector of fan motor connection cable ■ Fan Inverter PC board malfunction (A2P)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

Check the fan motor corresponding to the malfunction code "H7" in the monitor mode.

When check 3 shows as follows:
◑○●●●●● →Fan motor 1 (M1F)
When check 3 shows as follows:
◑○●●●●◑ →Fan motor 2 (M2F)

↓

Cut the power supply off.

↓

Check if signal wire connector for the corresponding fan motor is normal.

NO → Ensure correct connection.

YES ↓

Check the connector of the fan motor (*1).

↓

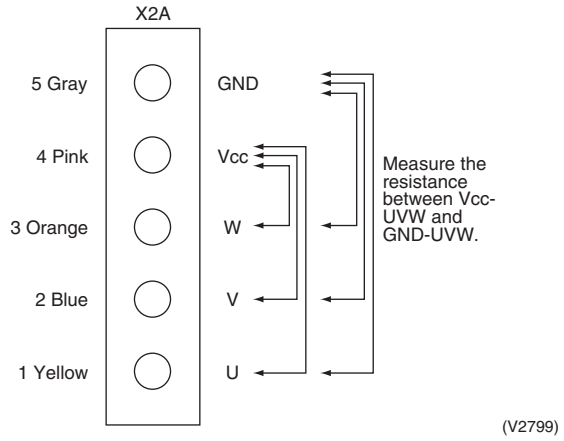
Check if the resistance of the fan motor lead wire between Vcc and UVW and between GND and UVW are balanced.

NO → Replace fan motor.

YES → Replace inverter PC board.
- For fan motor 1: replace inverter PC board (A2P)
- For fan motor 2: replace fan inverter PC board (A5P)

*1. Check procedure for fan motor connector
(1) Power OFF the fan motor.
(2) Remove the connector (X2A or X4A) on the PC board to measure the following resistance value.
Judgment criteria: resistance value between each phase is within ±20%

Connector for signal wires (X2A or X4A)



3.31 "H9" Outdoor Unit: Malfunction of Thermistor (R1T) for Outdoor Air

Remote Controller Display

H9

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected from the temperature detected by the outdoor air thermistor.

Malfunction Decision Conditions

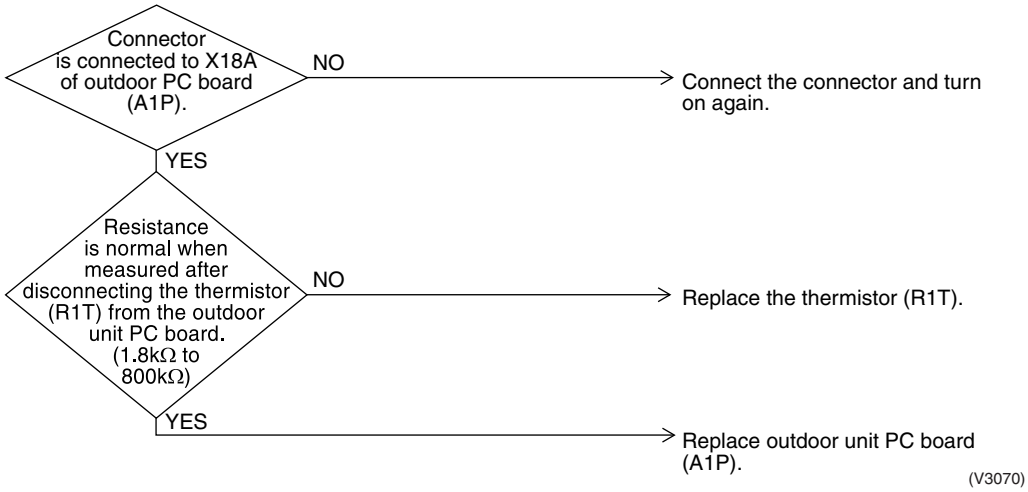
When the outside air temperature thermistor has short circuit or open circuit.

Supposed Causes

- Defective thermistor connection
- Defect of thermistor (R1T) for outdoor air
- Defect of outdoor unit PC board (A1P)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.32 "J2" Outdoor Unit: Current Sensor Malfunction

Remote Controller Display

J2

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected according to the current value detected by current sensor.

Malfunction Decision Conditions

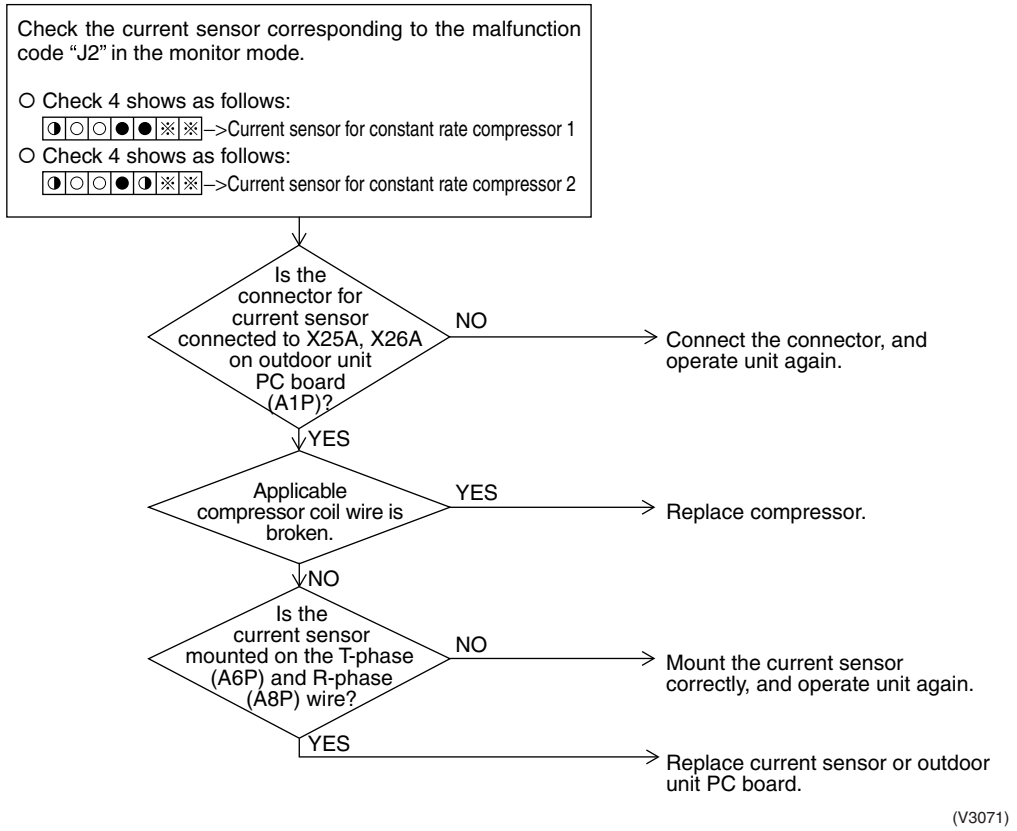
When the current value detected by current sensor becomes 5A or lower, or 40A or more during standard compressor operation.

Supposed Causes

- Faulty current sensor (A6P, A8P)
- Faulty outdoor unit PC board
- Defective compressor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



(V3071)

3.33 "J3" Outdoor Unit: Malfunction of Discharge Pipe Thermistor (R31, R32T)

Remote Controller Display

J3

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected from the temperature detected by discharge pipe temperature thermistor.

Malfunction Decision Conditions

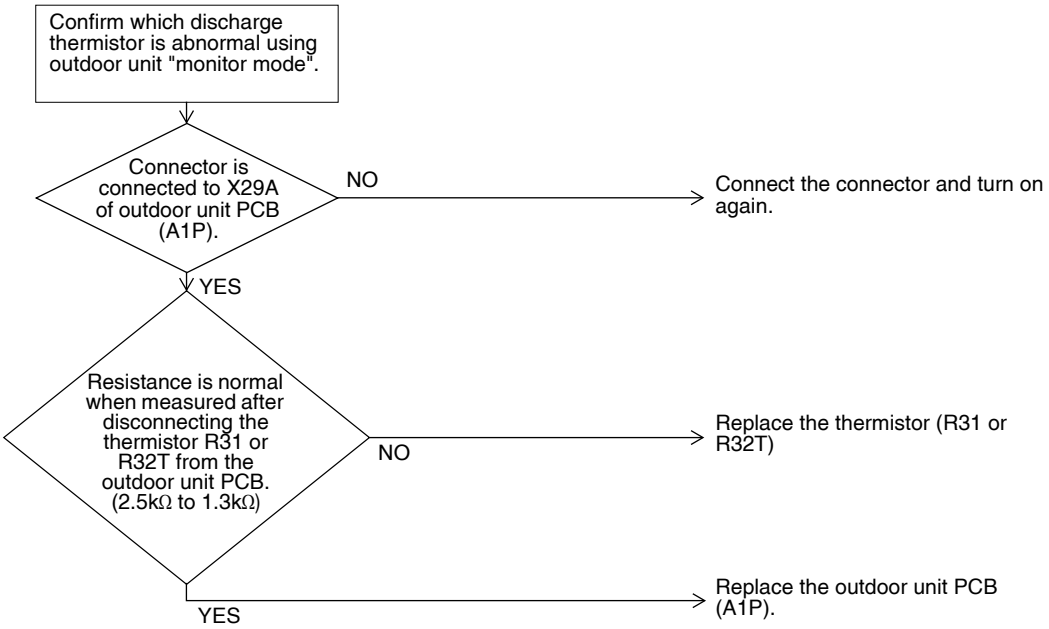
When a short circuit or an open circuit in the discharge pipe temperature thermistor is detected.

Supposed Causes

- Defect of thermistor (R31T, R32T) for outdoor unit discharge pipe
- Defect of outdoor unit PC board (A1P)
- Defect of thermistor connection

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



The alarm indicator is displayed when the fan is being used also.

∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.34 "J3" Indoor Unit: Malfunction of Discharge Pipe Thermistor (R6T)

Remote Control Display

J3

Subcode 46

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected from the temperature detected by discharge pipe temperature thermistor.

Malfunction Decision Conditions

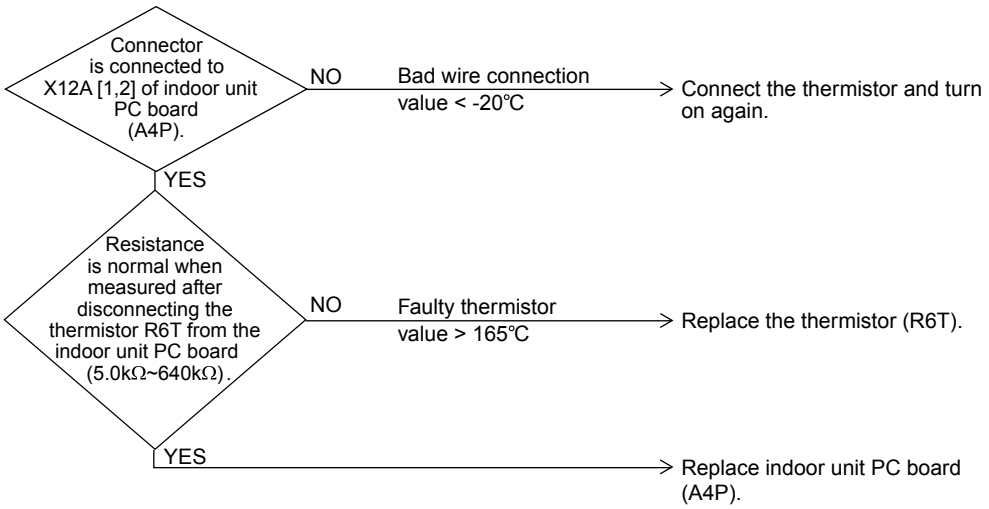
When a short circuit or an open circuit in the discharge pipe temperature thermistor is detected.

Supposed Causes

- Defect of thermistor (R6T) for outdoor unit discharge pipe
- Defect of indoor unit PC board (A4P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.35 "J4" Outdoor Unit: Malfunction of Temperature Sensor for Heat Exchanger Gas (R2T or R11T)

Remote Controller Display

J4

Applicable Models

EMRQ*

Method of Malfunction Detection

Detect malfunction based on the temperature detected by each thermistor.

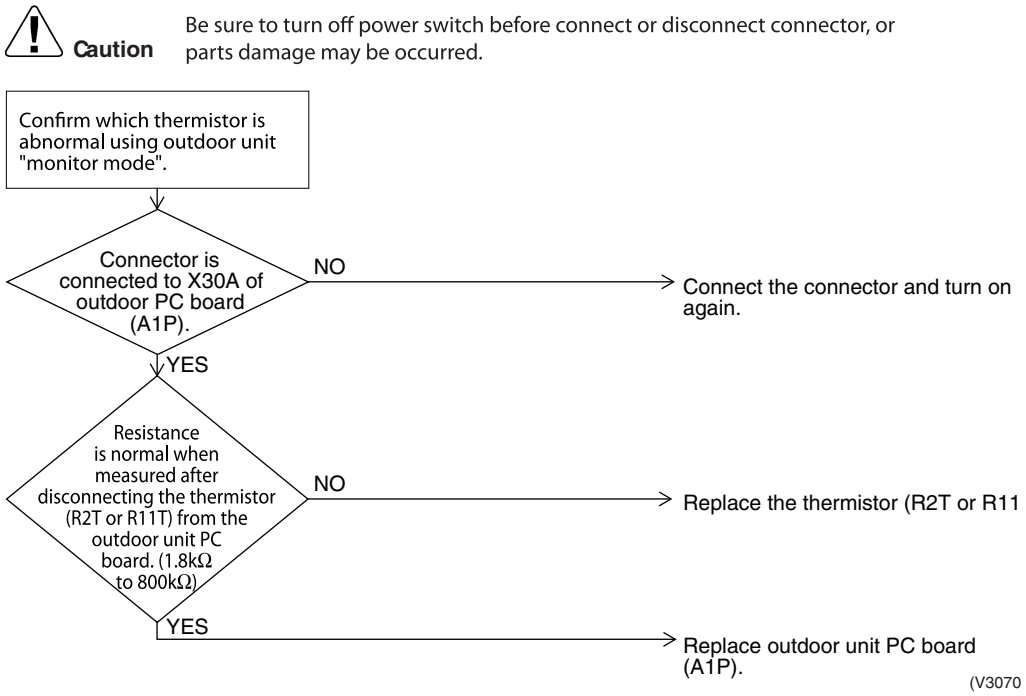
Malfunction Decision Conditions

In operation, when a thermistor is disconnected or short circuits.

Supposed Causes

- Defective connection of thermistor
- Defective thermistor
- Defective outdoor unit PC board

Troubleshooting



∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.36 "J5" Outdoor Unit: Malfunction of Thermistor (R8T or R10T) for Suction Pipe

Remote Controller Display

J5

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected from the temperature detected by the suction pipe temperature thermistor.

Malfunction Decision Conditions

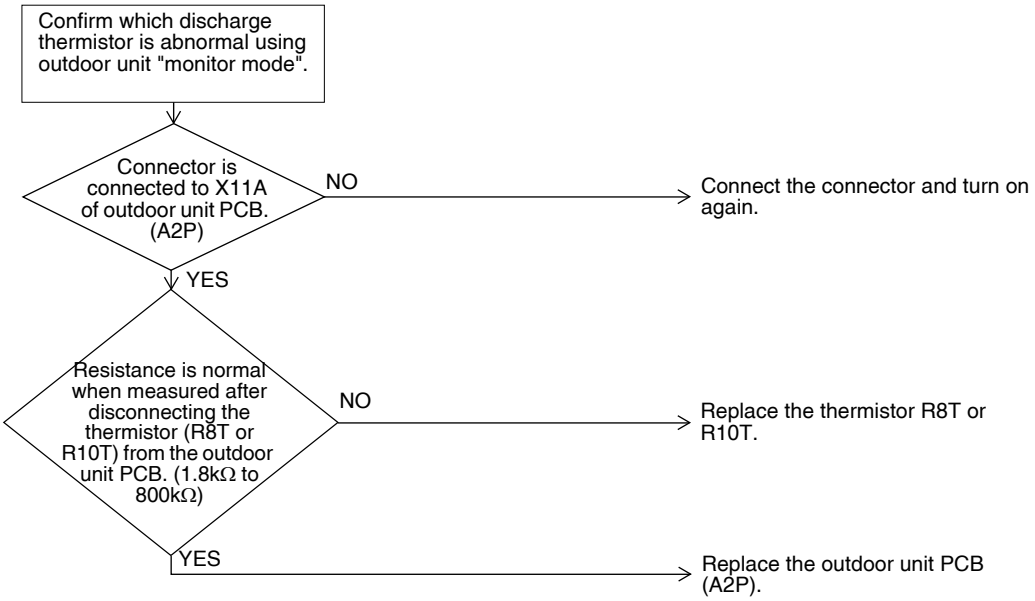
When a short circuit or an open circuit in the suction pipe temperature thermistor is detected.

Supposed Causes

- Defect of thermistor (R8T or R10T) for outdoor unit suction pipe
- Defect of outdoor unit PCB (A2P)
- Defect of thermistor connection

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



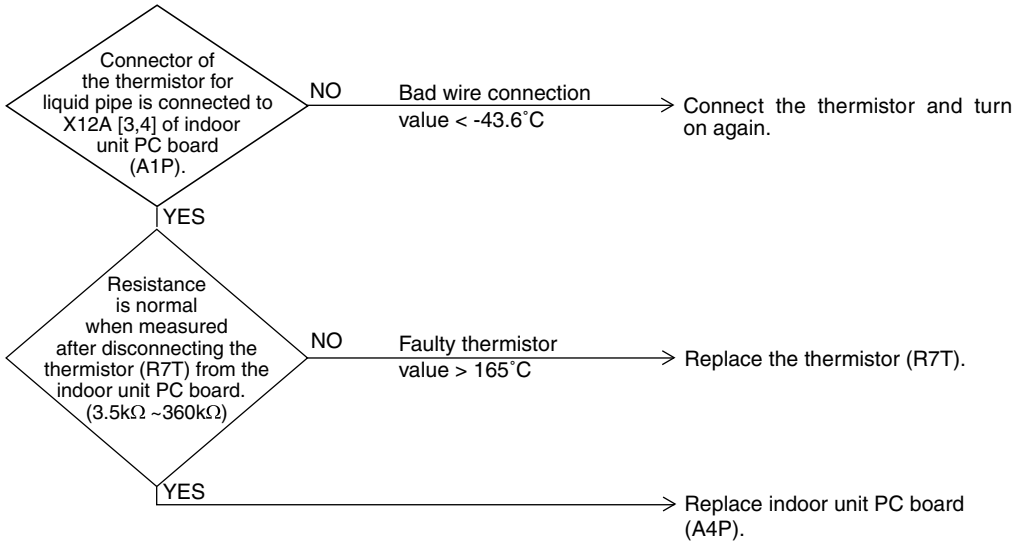
∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.37 "J5" Indoor Unit: Malfunction of Thermistor (R7T) for Liquid R-134a

Remote Control Display	J5 Subcode 11
Applicable Models	All indoor units
Method of Malfunction Detection	Malfunction is detected from the temperature detected by the thermistor for liquid pipe.
Malfunction Decision Conditions	When a short circuit or an open circuit in the thermistor for liquid pipe are detected.
Supposed Causes	■ Defect of thermistor (R7T) for liquid R134a ■ Defect of indoor unit PC board (A4P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗ Refer to thermistor resistance / temperature characteristics table on page 307.

3.38 "J6" Outdoor Unit: Malfunction of Thermistor (R4T or R12T) for Outdoor Unit Heat Exchanger

Remote Controller Display

J6

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected from the temperature detected by the heat exchanger thermistor.

Malfunction Decision Conditions

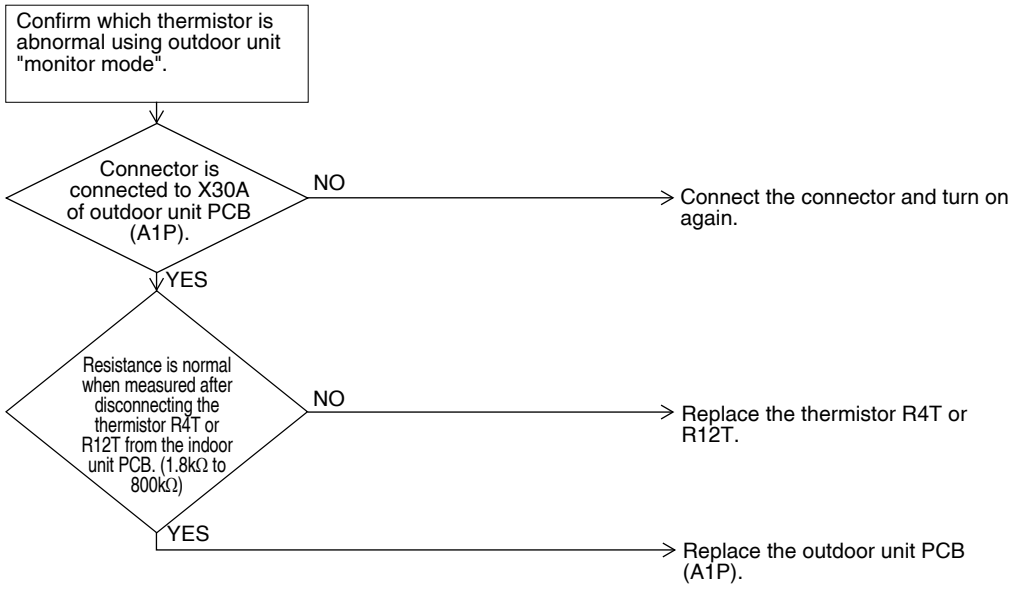
When a short circuit or an open circuit in the heat exchanger thermistor is detected.

Supposed Causes

- Defect of thermistor (R4T or R12T) for outdoor unit coil
- Defect of outdoor unit PCB (A1P)
- Defect of thermistor connection

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.39 "J6" Indoor Unit: Malfunction of Liquid Pipe Thermistor R-410A (R10T)

Remote Controller Display

J6

Subcode --

Applicable Models

EKHVMYD units

Method of Malfunction Detection

Malfunction is detected according to the temperature detected by liquid pipe thermistor.

Malfunction Decision Conditions

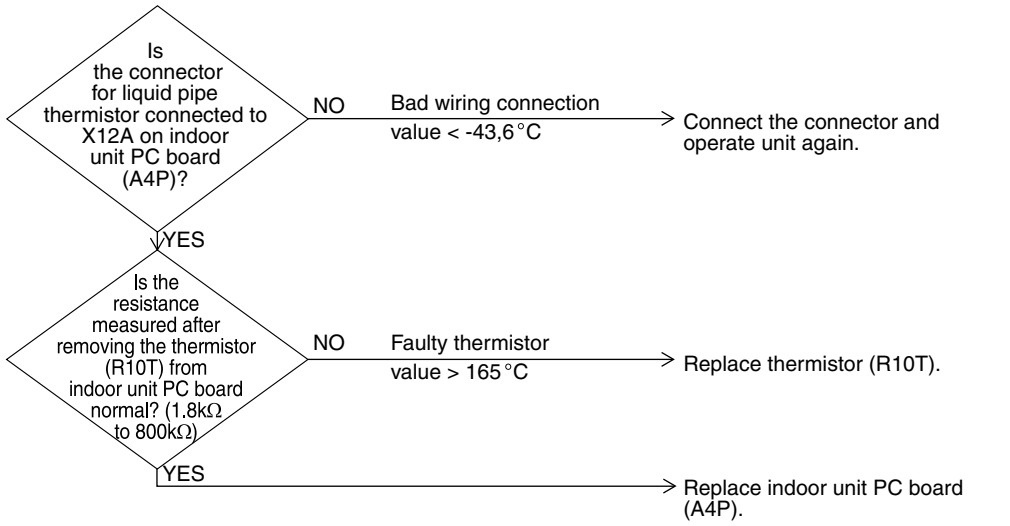
When the liquid pipe thermistor is short circuited or open.

Supposed Causes

- Faulty liquid pipe thermistor (R10T)
- Faulty outdoor unit PC board
- Defect of thermistor connection
- Reversible indoor unit is programmed as heating only indoor unit

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.40 "J7" Outdoor Unit: Malfunction of Liquid Pipe Thermistor 1 (R6T), (R9T) or (R14T)

Remote Controller Display

J7

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected according to the temperature detected by liquid pipe thermistor.

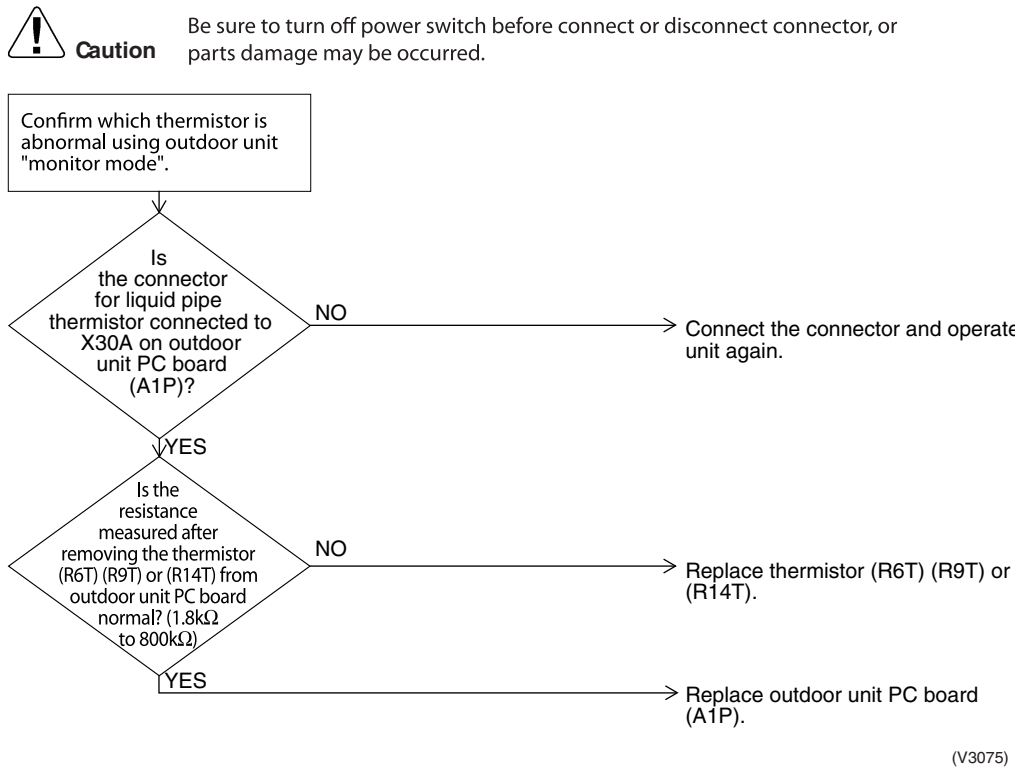
Malfunction Decision Conditions

When the liquid pipe thermistor is short circuited or open.

Supposed Causes

- Faulty liquid pipe thermistor 1 (R6T), (R9T) or (R14T)
- Faulty outdoor unit PC board
- Defect of thermistor connection

Troubleshooting



* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.41 "J7" Indoor Unit: Malfunction of Thermistor (R11T) for Suction Pipe R-410A

Remote Controller Display

J7

Subcode --

Applicable Models

EKHVMYD units

Method of Malfunction Detection

Malfunction is detected from the temperature detected by the suction pipe temperature thermistor.

Malfunction Decision Conditions

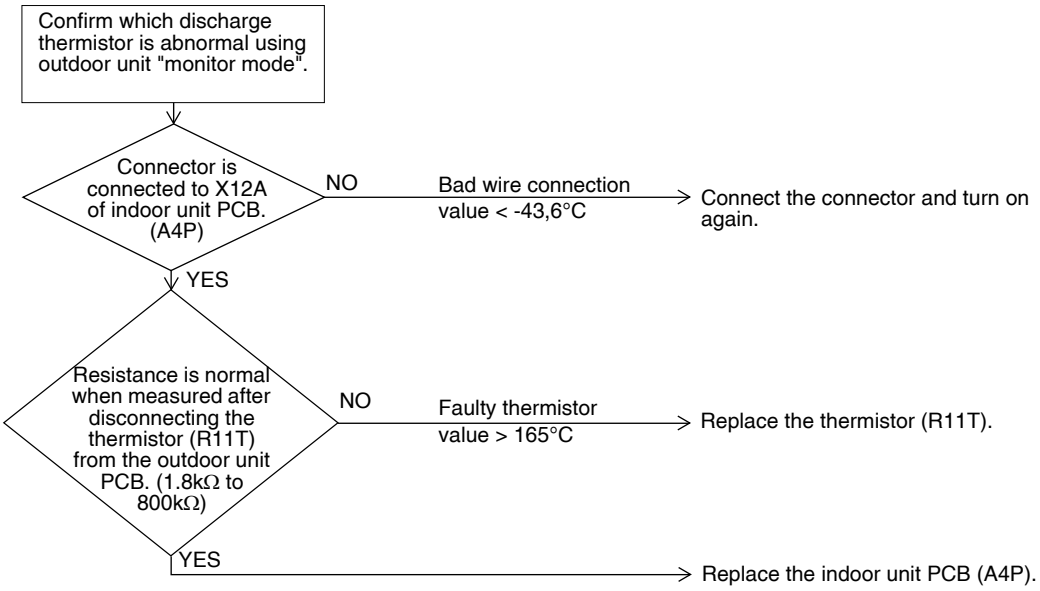
When a short circuit or an open circuit in the suction pipe temperature thermistor is detected.

Supposed Causes

- Defect of thermistor (R11T) for indoor unit suction pipe
- Defect of indoor unit PCB (A4P)
- Defect of thermistor connection
- Reversible indoor unit is programmed as heating only indoor unit

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



∗ Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.42 "J8" Outdoor Unit: Malfunction of Liquid Pipe Thermistor 2 (R7T or R15T)

Remote Controller Display

J8

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected according to the temperature detected by liquid pipe thermistor.

Malfunction Decision Conditions

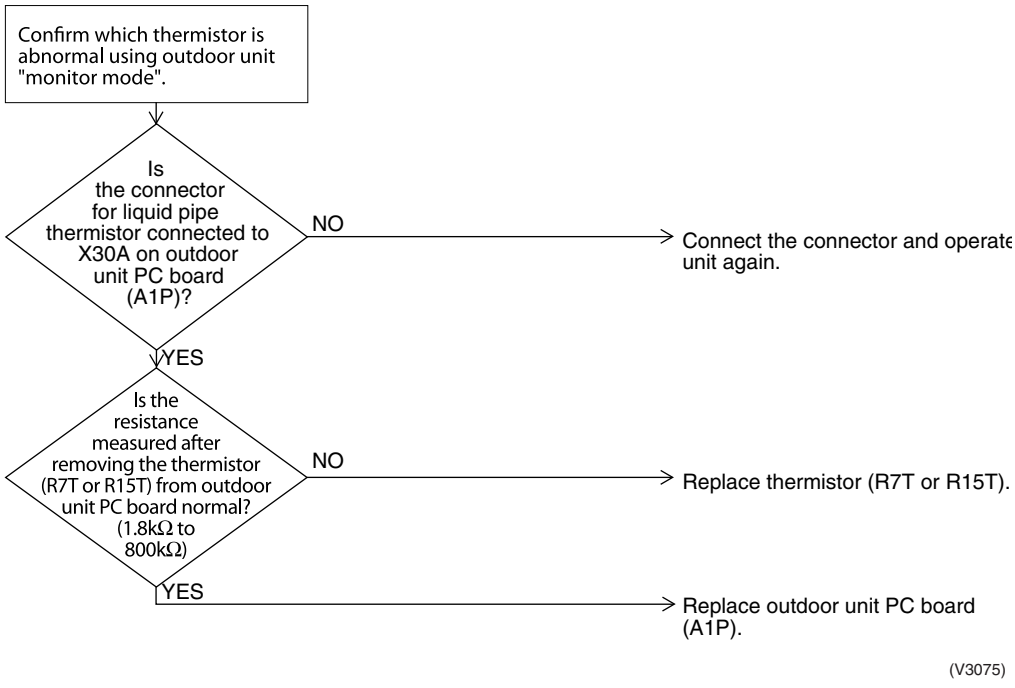
When the liquid pipe thermistor is short circuited or open.

Supposed Causes

- Faulty liquid pipe thermistor 2 (R7T or R15T)
- Faulty outdoor unit PC board
- Defect of thermistor connection

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.43 "J9" Outdoor Unit: Malfunction of Subcooling Heat Exchanger Gas Pipe Thermistor (R5T or R13T)

Remote Controller Display

J9

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected according to the temperature detected by subcooling heat exchanger gas pipe thermistor.

Malfunction Decision Conditions

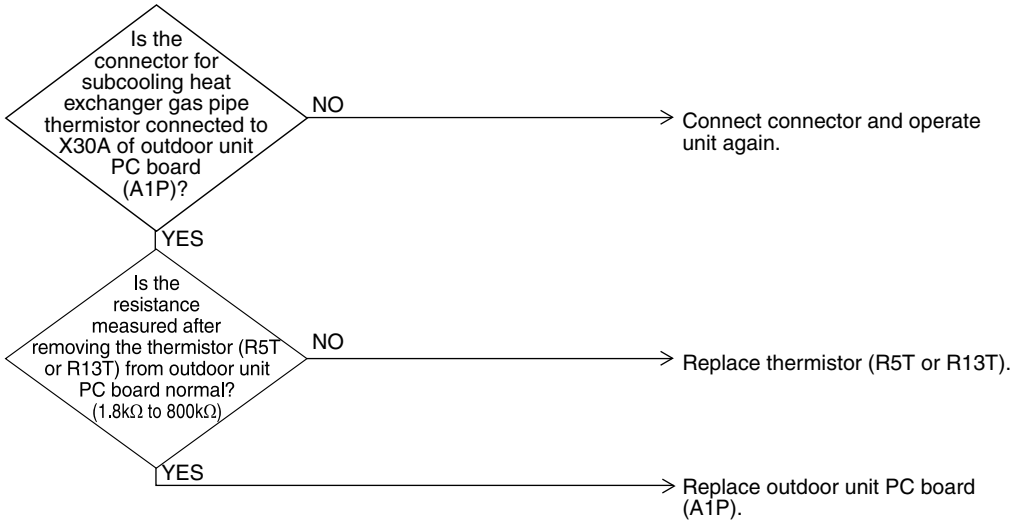
When the subcooling heat exchanger gas pipe thermistor is short circuited or open.

Supposed Causes

- Faulty subcooling heat exchanger gas pipe thermistor (R5T or R13T)
- Faulty outdoor unit PC board

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



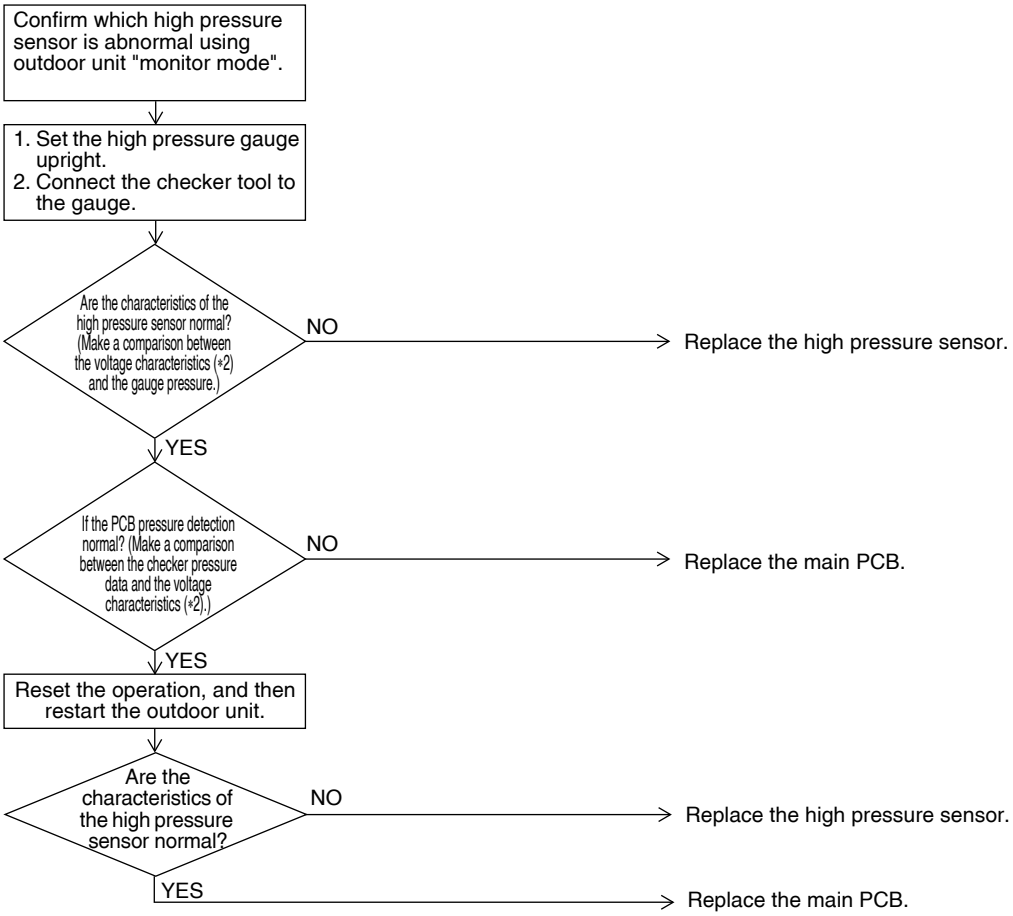
* Refer to "Thermistor Resistance / Temperature Characteristics" table on page 307.

3.44 "JA" Outdoor Unit: Malfunction of High Pressure Sensor

Remote Controller Display	JA
Applicable Models	EMRQ*
Method of Malfunction Detection	Malfunction is detected from the pressure detected by the high pressure sensor.
Malfunction Decision Conditions	When the high pressure sensor is short circuit or open circuit. (Not less than 4.22MPa, or 0.01MPa and below)
Supposed Causes	■ Defect of high pressure sensor system ■ Connection of low pressure sensor with wrong connection. ■ Defect of outdoor unit PCB. ■ Defective connection of high pressure sensor

Troubleshooting

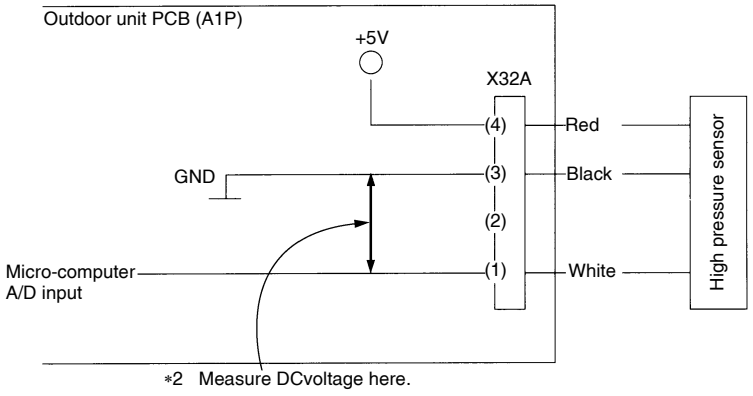
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



*1: Pressure sensor subject to malfunction code

Malfunction code	Pressure sensor subject to malfunction code	Electric symbol
JA	High pressure sensor	S1NPH

*2: Voltage measurement point



*2: Refer to “Pressure Sensor, Pressure / Voltage Characteristics” table on P310.

3.45 “JA” Indoor Unit: Malfunction of High Pressure Sensor

Remote Control Display

JA

Subcode 16

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected from the pressure detected by the high pressure sensor.

Malfunction Decision Conditions

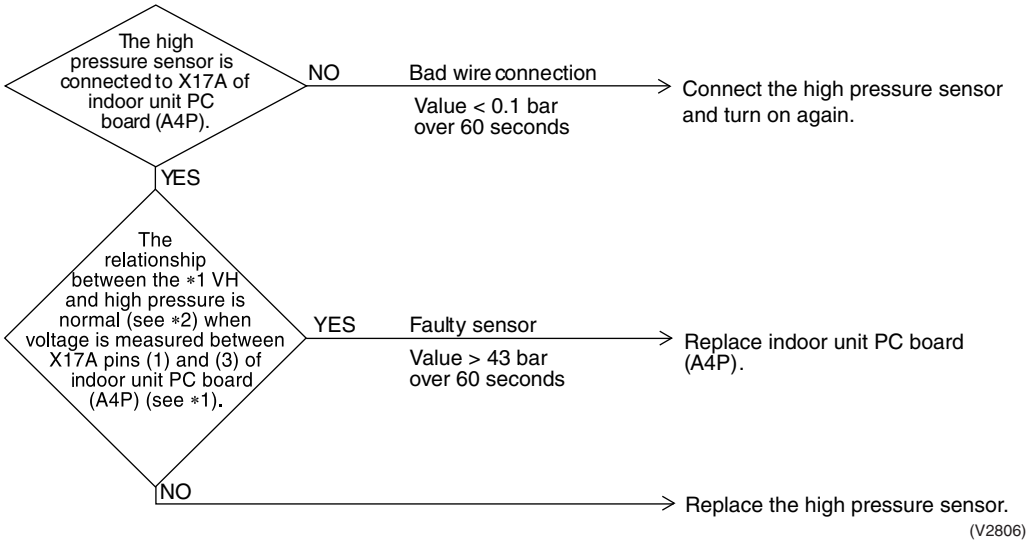
When the high pressure sensor is short circuit or open circuit.

Supposed Causes

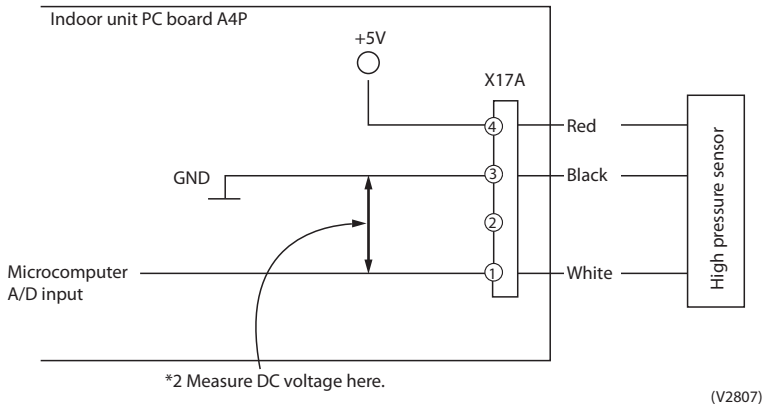
- Defect of high pressure sensor
- Connection of low pressure sensor with wrong connection
- Defect of indoor unit PC board (A4P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged



∗1: Voltage measurement point



∗2: Refer to “Pressure Sensor”, pressure / voltage characteristics table on P310.

3.46 "JC" Outdoor Unit: Malfunction of Low Pressure Sensor

Remote Control Display

JC

Applicable Models

EMRQ*

Method of Malfunction Detection

Malfunction is detected from the pressure detected by the low pressure sensor.

Malfunction Decision Conditions

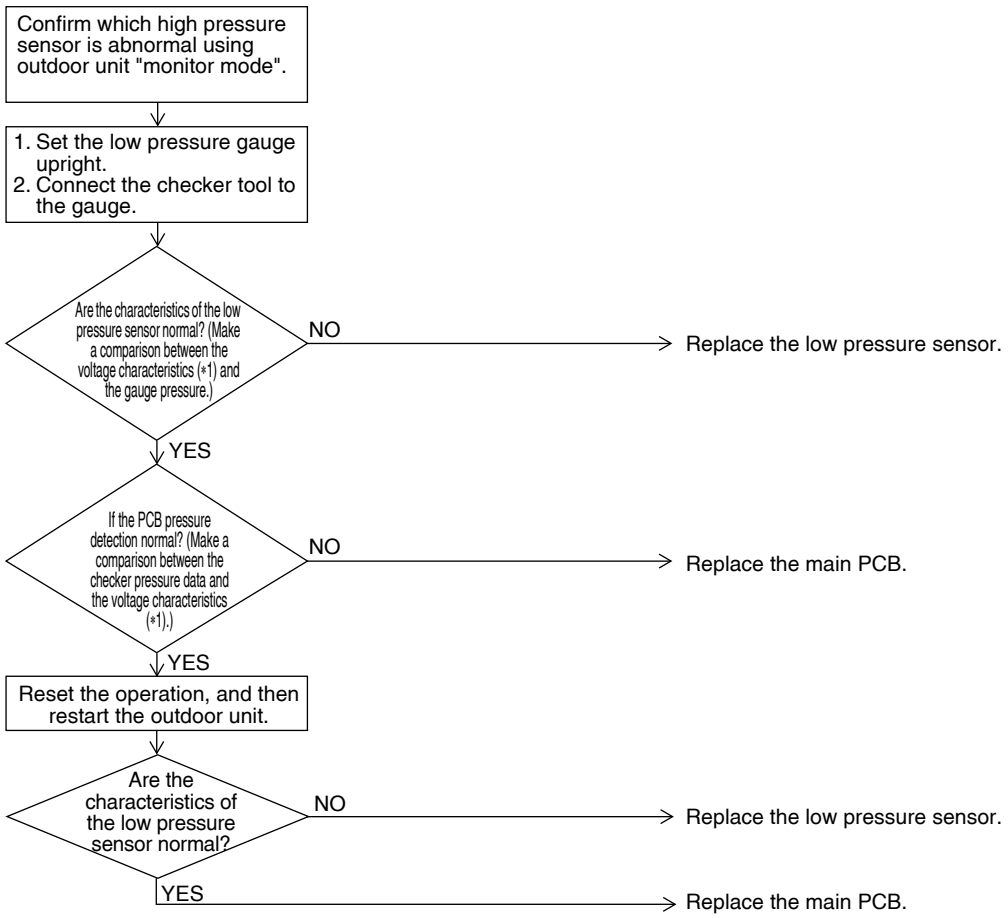
When the low pressure sensor is short circuit or open circuit.
(Not less than 1.77MPa, or -0.01MPa and below)

Supposed Causes

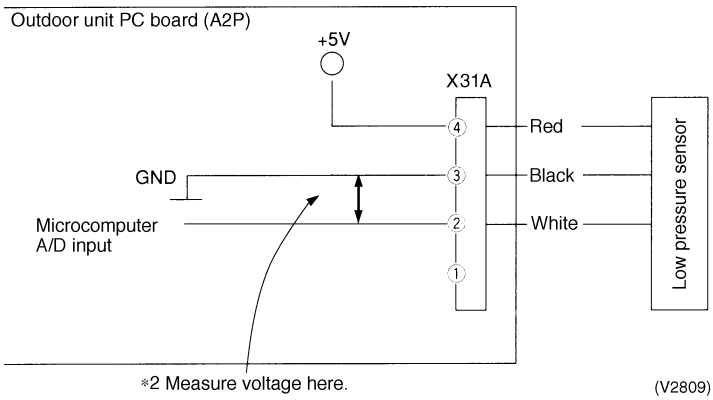
- Defect of low pressure sensor system
- Connection of high pressure sensor with wrong connection.
- Defect of outdoor unit PCB.
- Defective connection of low pressure sensor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



∗1: Voltage measurement point



∗2: Refer to “Pressure Sensor, Pressure / Voltage Characteristics” table on P310.

3.47 “JC” Indoor Unit: Malfunction of Low Pressure Sensor

Remote Control Display

JC

Subcode 16

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected from pressure detected by low pressure sensor.

Malfunction Decision Conditions

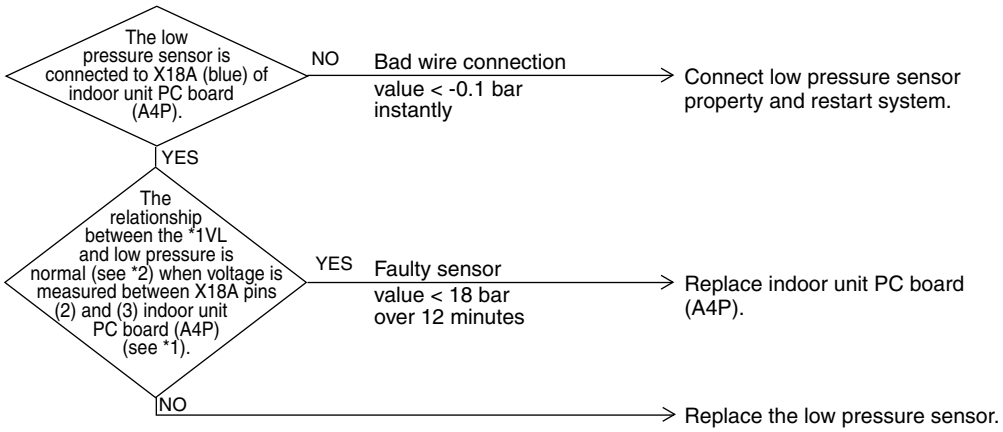
When the low pressure sensor is short circuit or open circuit.

Supposed Causes

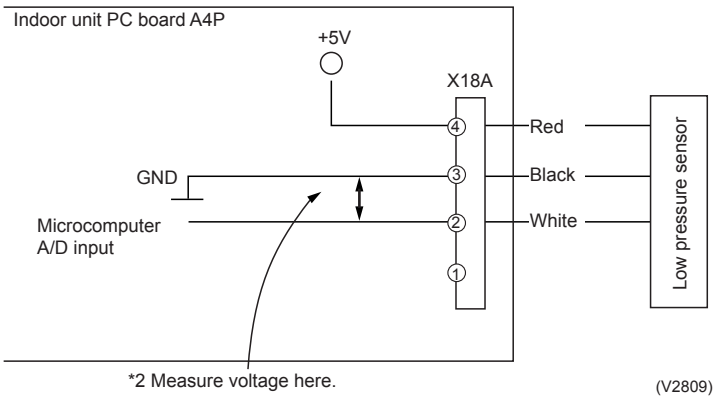
- Defect of low pressure sensor
- Connection of high pressure sensor with wrong connection
- Defect of indoor unit PC board (A4P)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



∗1: Voltage measurement point



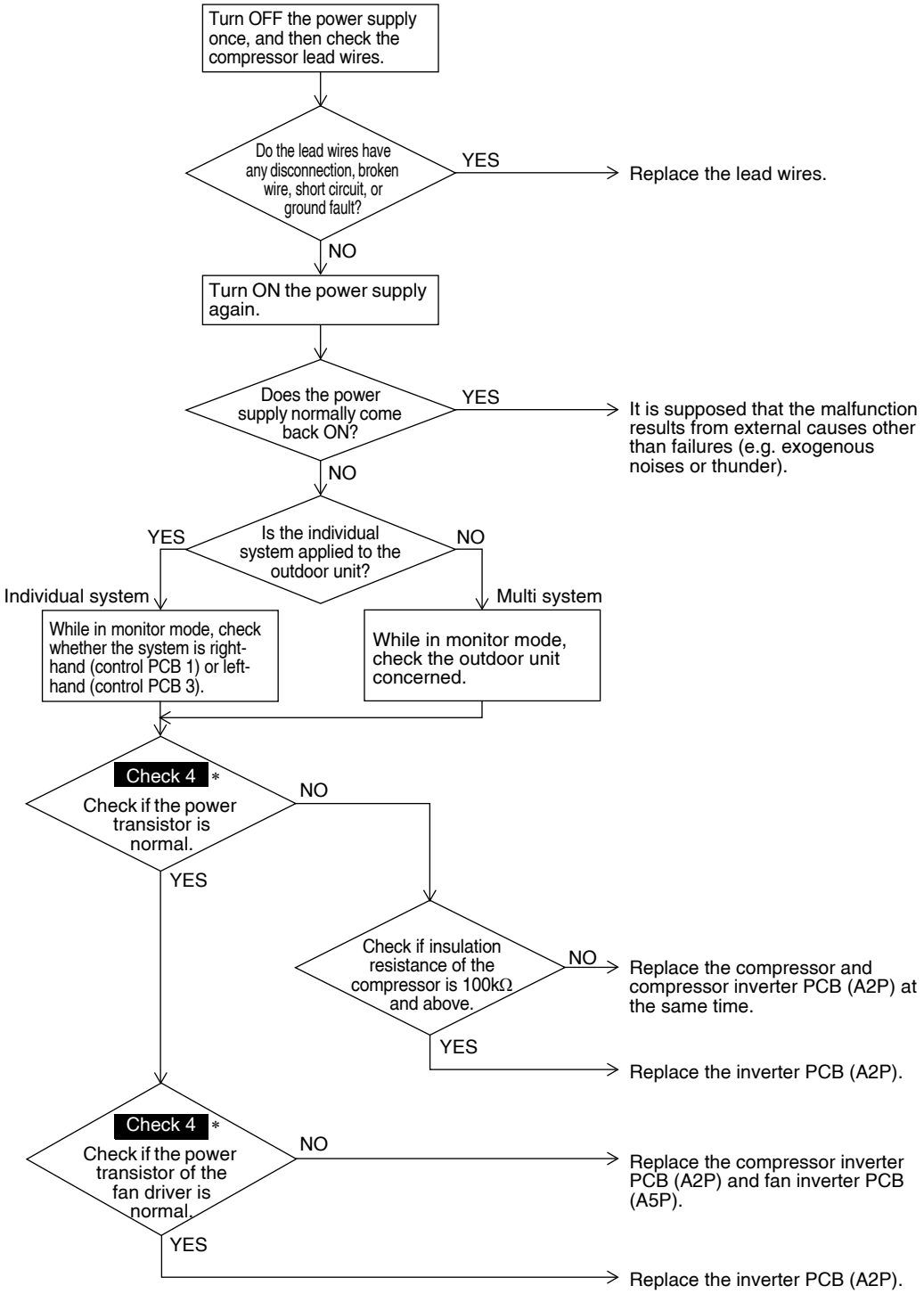
∗2: Refer to “Pressure Sensor”, pressure/voltage characteristics table on P310.

3.48 “L1” Outdoor Unit: Defective Inverter PC Board

Remote Controller Display	L1
Applicable Models	EMRQ*
Method of Malfunction Detection	Malfunction is detected based on the current value during waveform output before starting compressor. Malfunction is detected based on the value from current sensor during synchronous operation when starting the unit.
Malfunction Decision Conditions	Overcurrent (OCP) flows during waveform output. Malfunction of current sensor during synchronous operation. IPM failure.
Supposed Causes	■ Inverter PC board (A2P) ● IPM failure ● Current sensor failure ● Drive circuit failure

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Check 4 : Referring to the information on P287.

*1. List of Inverter PCBs

Model	Name	Electric symbol
EMRQ 8/10/12	Compressor inverter PCB	A5P
	Fan inverter PCB	A6P, A7P
EMRQ 14/16	Compressor inverter PCB	A4P, A7P
	Fan inverter PCB	A6P, A9P

3.49 "L1" Indoor Unit: Malfunction of PC Board

Remote Control Display

L1

Subcode 30

Applicable Models

All indoor units

Method of Malfunction Detection

- Detect malfunctions by current value during waveform output before compressor startup.
- Detect malfunctions by current sensor value during synchronized operation at the time of startup.

Malfunction Decision Conditions

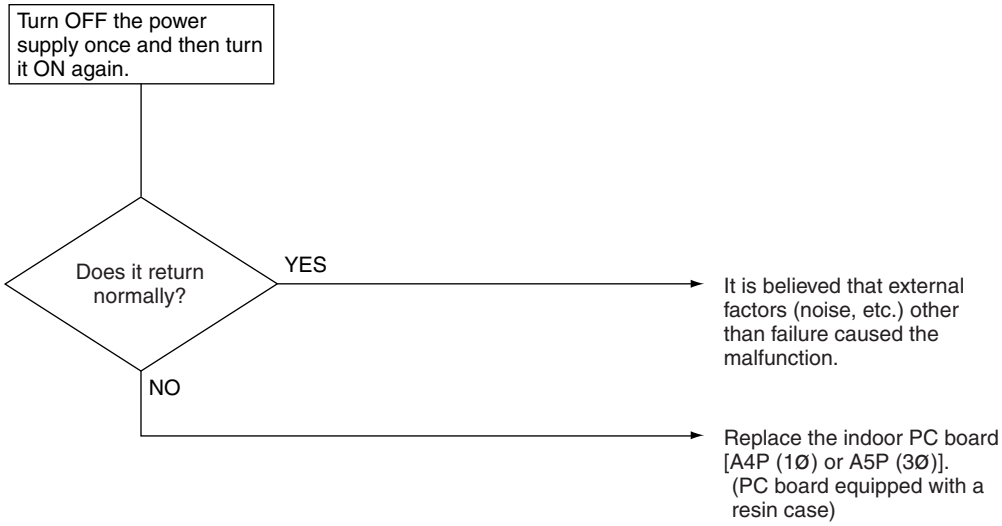
- In case of overcurrent (OCP) during waveform output
- When the current sensor malfunctions during synchronized operation
- In case of IGBT malfunction

Supposed Causes

- Faulty indoor PC board [A4P (1Ø) or A5P (3Ø)]
  - Over current
  - Current sensor failure
  - Failure of IGBT or drive circuit

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

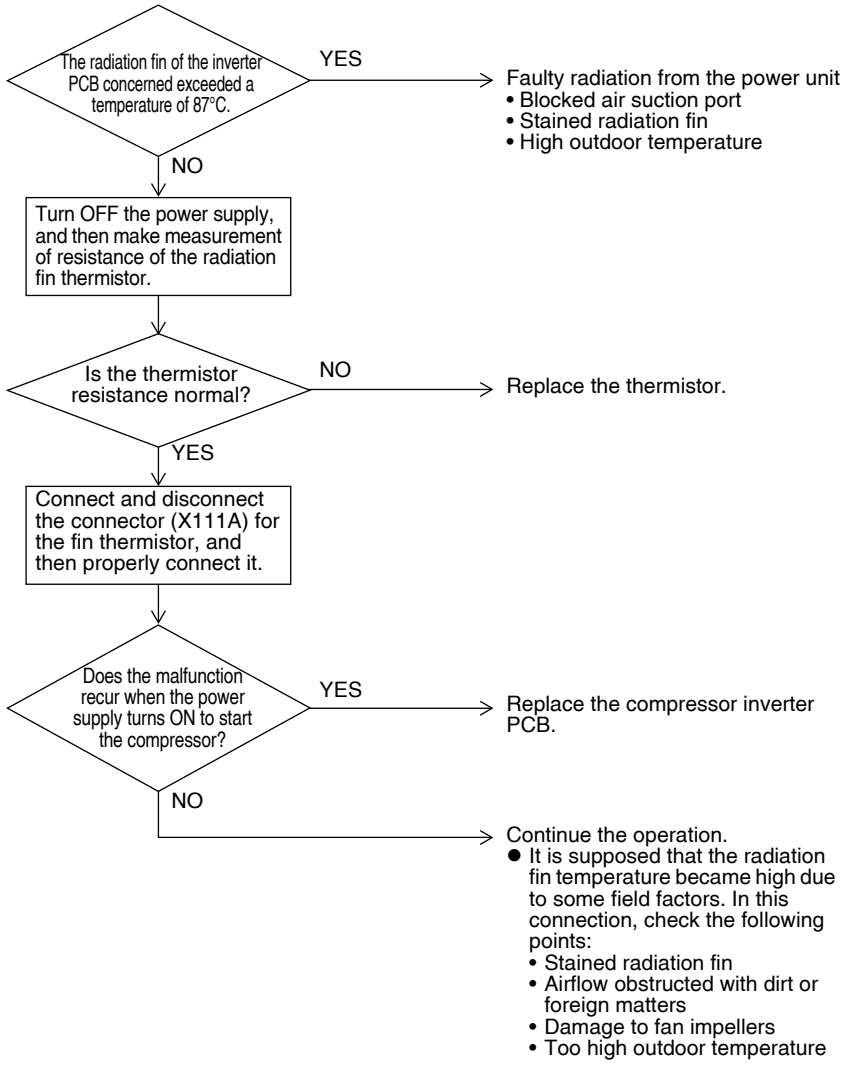


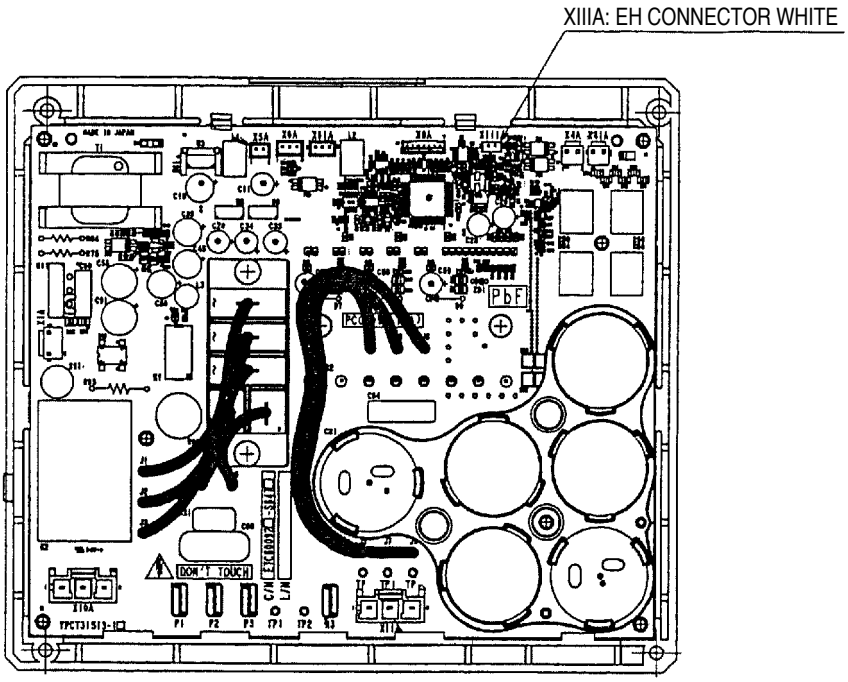
3.50 "L4" Outdoor Unit: Malfunction of Inverter Radiating Fin Temperature Rise

Remote Controller Display	L4
Applicable Models	EMRQ*
Method of Malfunction Detection	Fin temperature is detected by the thermistor of the radiation fin.
Malfunction Decision Conditions	When the temperature of the inverter radiation fin increases above 87°C.
Supposed Causes	■ Actuation of fin thermal (Actuates above 87°C) ■ Defect of inverter PCB ■ Defect of fin thermistor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.





Inverter PCB for compressor

∗ Refer to “Thermistor Resistance / Temperature Characteristics” table on page 307.

3.51 "L4" Indoor Unit: Malfunction of Inverter Radiating Fin Temperature Rise (R8T)

Remote Control Display

L4

Subcode 8

Applicable Models

All indoor units

Method of Malfunction Detection

Fin temperature is detected by the thermistor of the radiation fin.
If fin temperature is too high, the compressor will slow down (capacity shortage)

Malfunction Decision Conditions

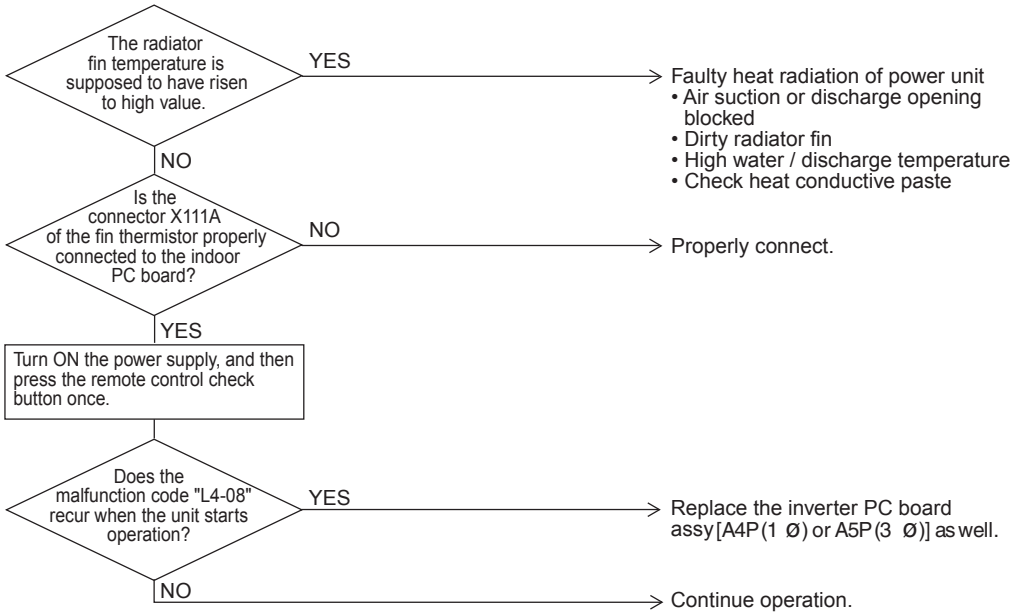
Faulty thermistor.
Broken wire.

Supposed Causes

- Defect of inverter PC board [A4P (1Ø) or A5P (3Ø)]
- Defect of fin thermistor (R8T)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



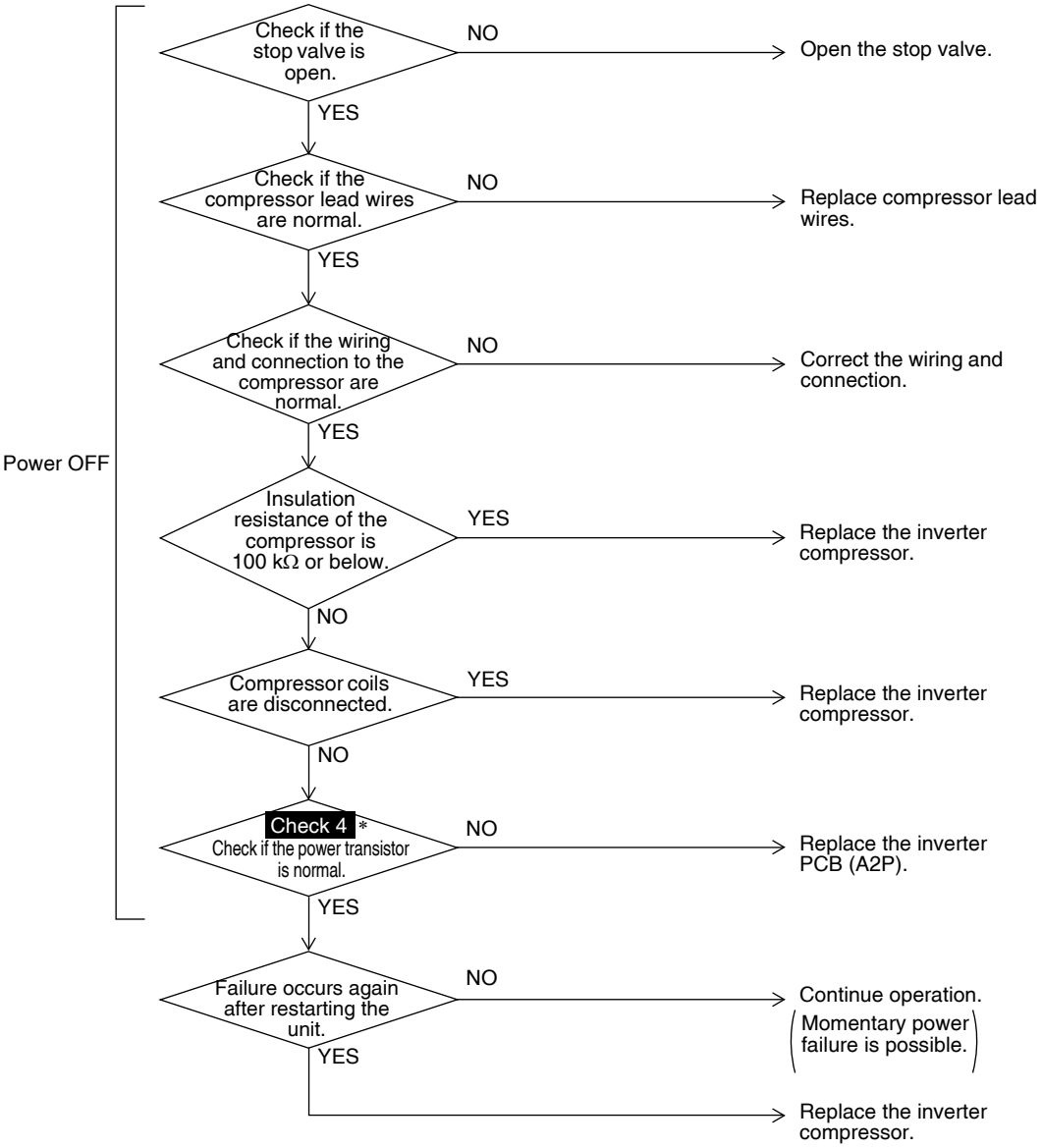
3.52 "L5" Outdoor Unit: Momentary Overcurrent of Inverter Compressor

Remote Controller Display	L5
Applicable Models	EMRQ*
Method of Malfunction Detection	Malfunction is detected from current flowing in the power transistor.
Malfunction Decision Conditions	When an excessive current flows in the power transistor. (Instantaneous overcurrent also causes activation.)
Supposed Causes	■ Defect of compressor coil (disconnected, defective insulation) ■ Compressor start-up malfunction (mechanical lock) ■ Defect of inverter PC board

Troubleshooting

Compressor inspection

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Check 4 : Referring to the information on P287.

3.53 "L5" Indoor Unit: Inverter Compressor Abnormal - R-134a

Remote Control Display

L5

Subcode 13

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected from current flowing in the power transistor.

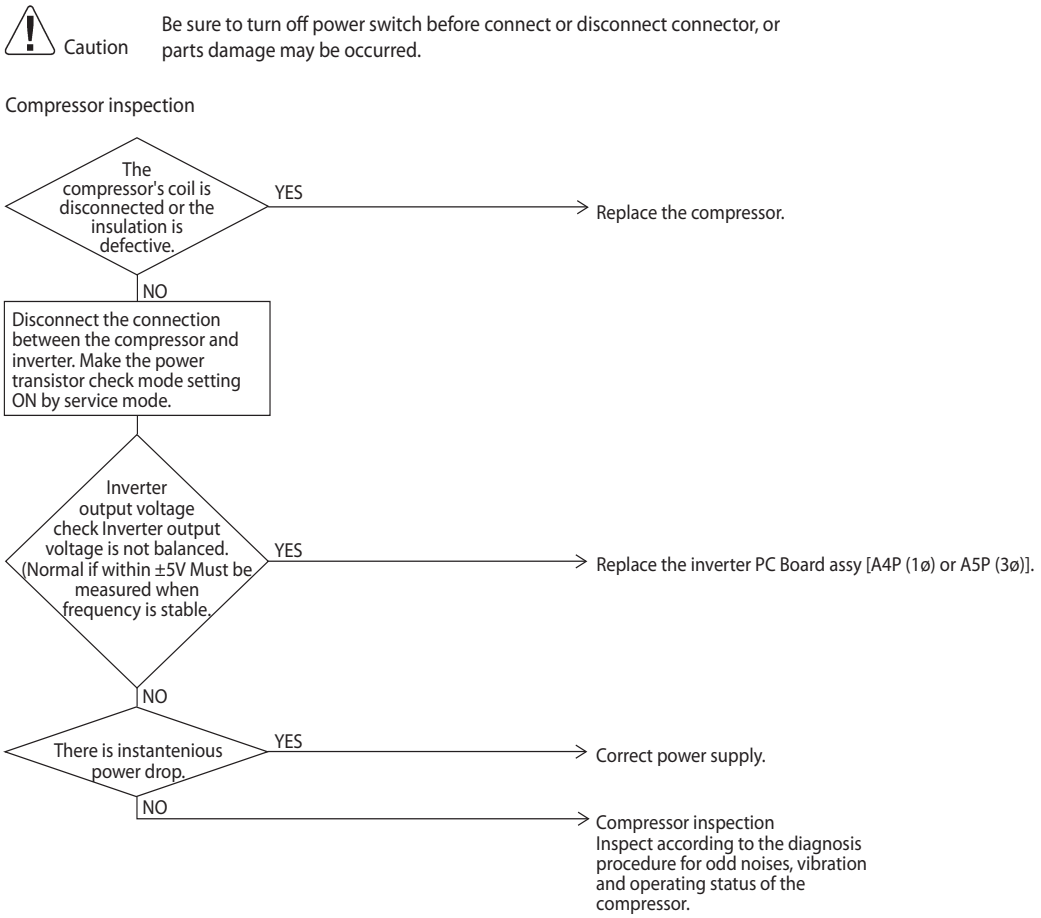
Malfunction Decision Conditions

When an excessive current flows in the power transistor.
(Instantaneous overcurrent also causes activation.)

Supposed Causes

- Overcurrent immediate
- Defect of compressor coil (disconnected, defective insulation)
- Compressor start-up malfunction (mechanical lock)
- Defect of inverter PC board [A4P (1Ø) or A5P (3Ø)]

Troubleshooting



Higher voltage than actual is displayed when the inverter output voltage is checked by tester.

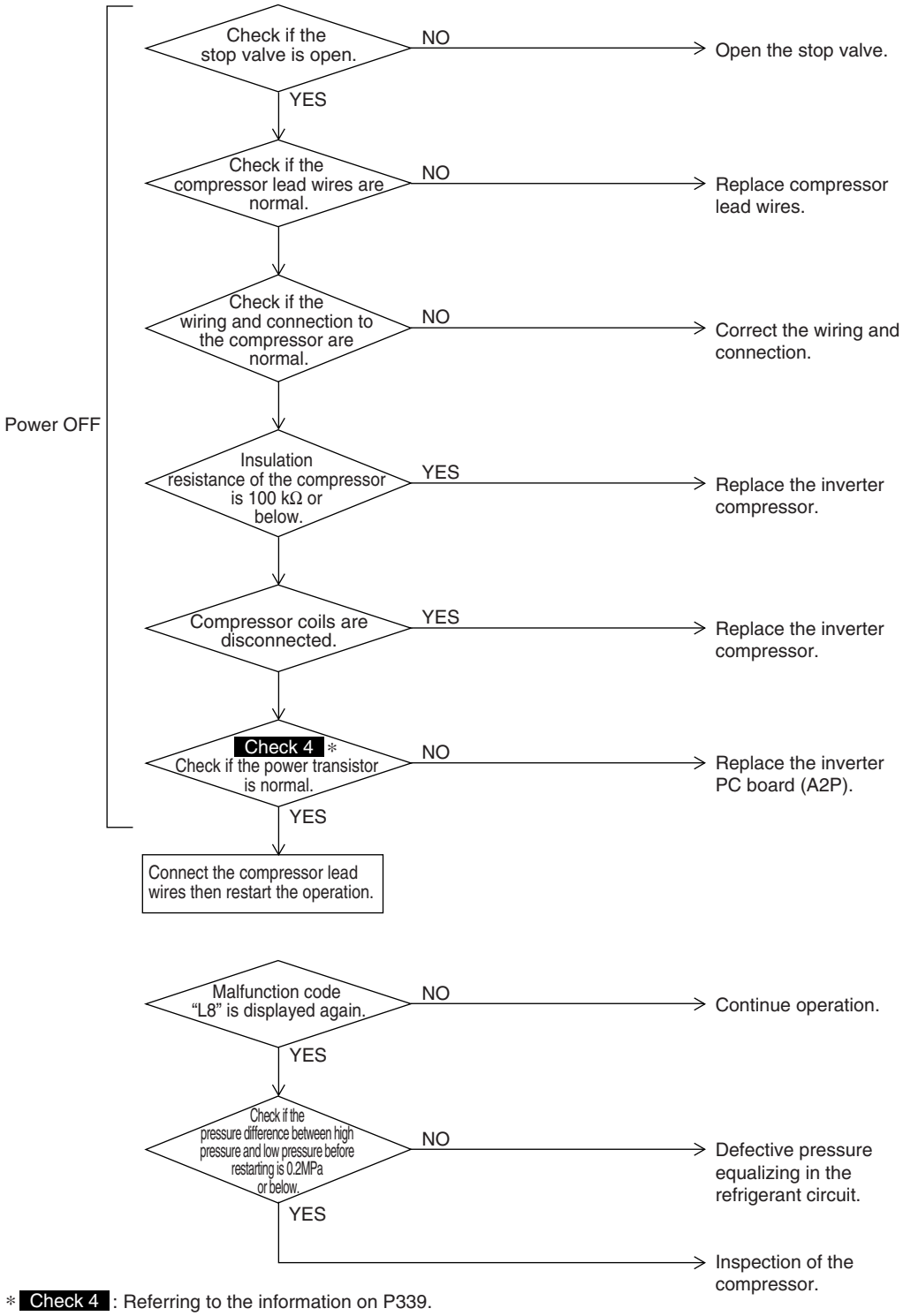
3.54 "L8" Outdoor Unit: Momentary Overcurrent of Inverter Compressor

Remote Controller Display	L8
Applicable Models	EMRQ*
Method of Malfunction Detection	Malfunction is detected by current flowing in the power transistor.
Malfunction Decision Conditions	When overload in the compressor is detected. (Inverter secondary current 16.1A) (1) 19.0A and over continues for 5 seconds. (2) 16.1A and over continues for 260 seconds.
Supposed Causes	■ Compressor overload ■ Compressor coil disconnected ■ Defect of inverter PC board ■ Faulty compressor

Troubleshooting

Output current check

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



* Check 4 : Referring to the information on P339.

3.55 "L8" Indoor Unit: Inverter Current Abnormal

Remote Control Display

L8

Subcode 10

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected by current flowing in the power transistor.

Malfunction Decision Conditions

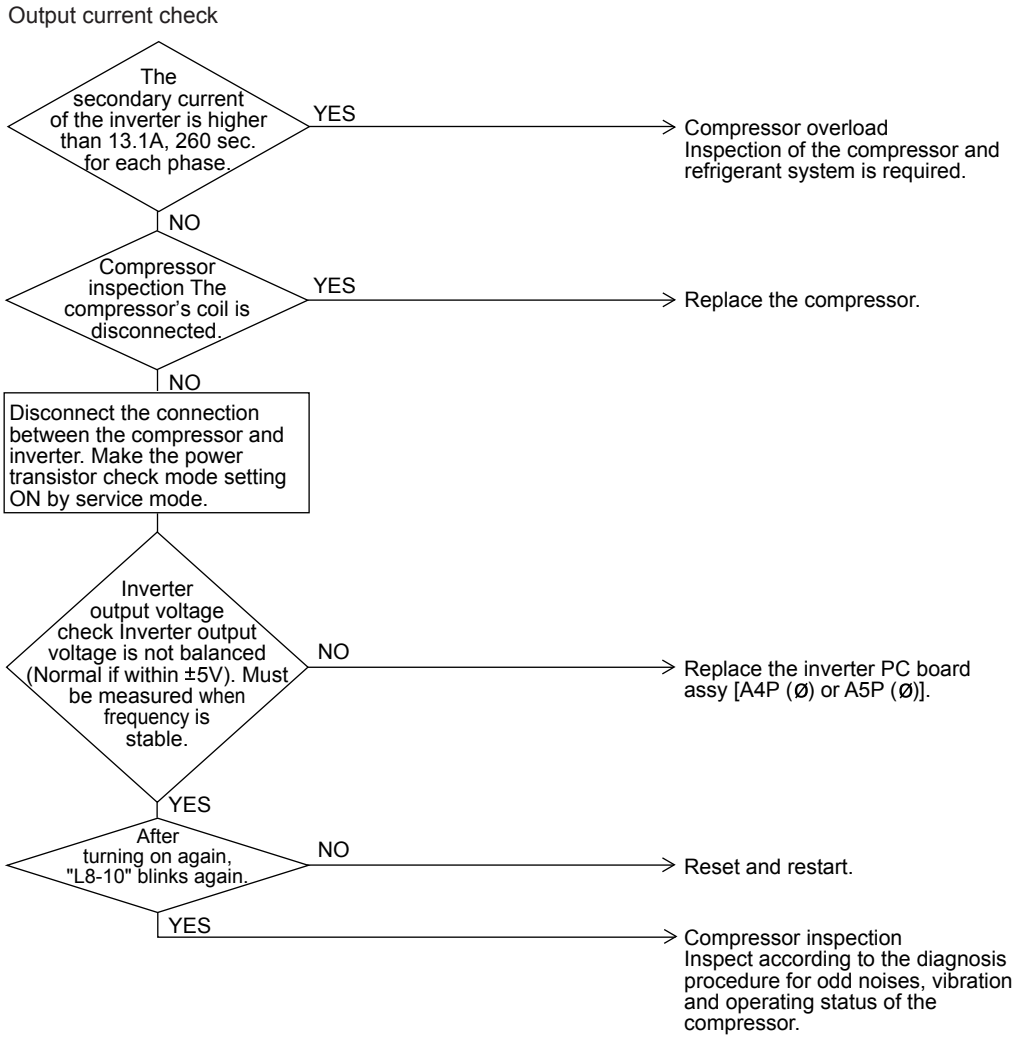
When overload in the compressor is detected.

Supposed Causes

- Compressor overload
- Compressor coil disconnected
- Defect of indoor unit PC board [A4P (1Ø) or A5P (3Ø)]
- Current protection (thermal)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

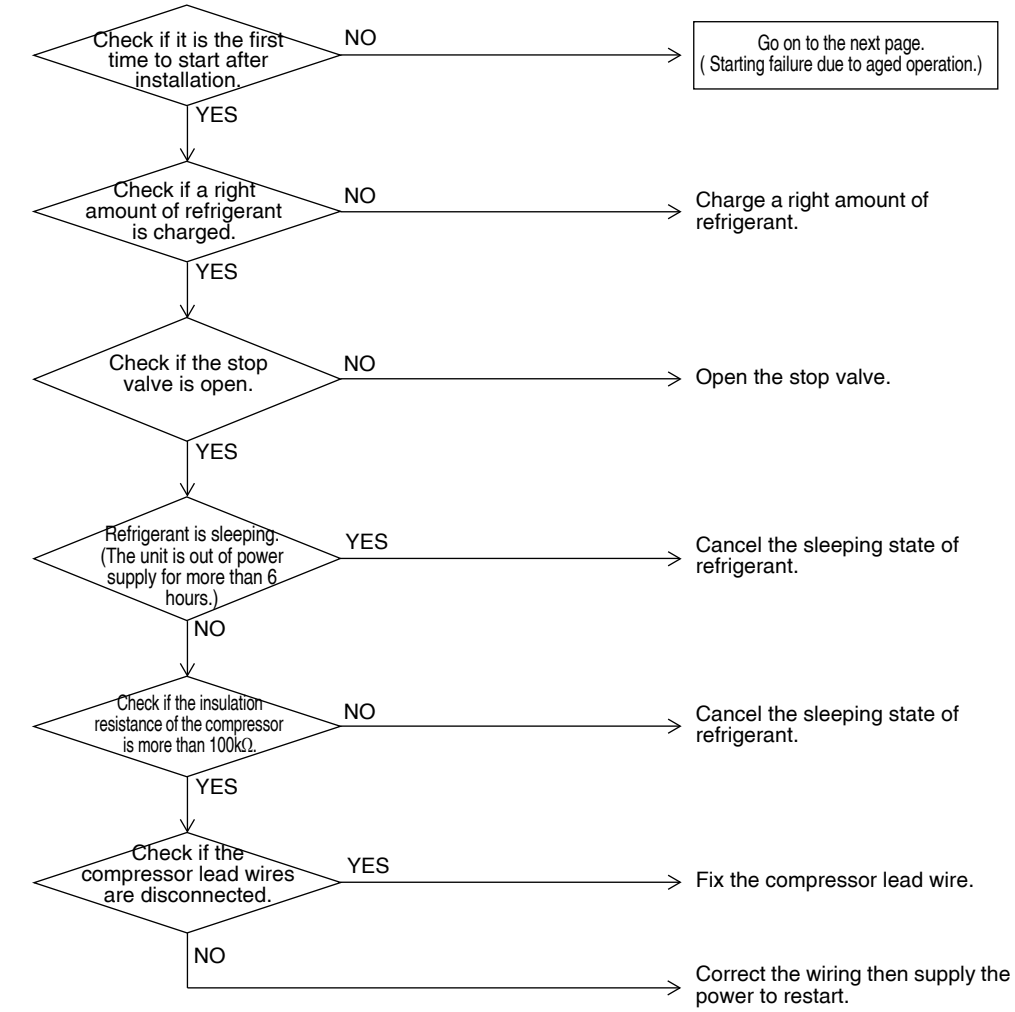


3.56 "L9" Outdoor Unit: Inverter Compressor Starting Failure

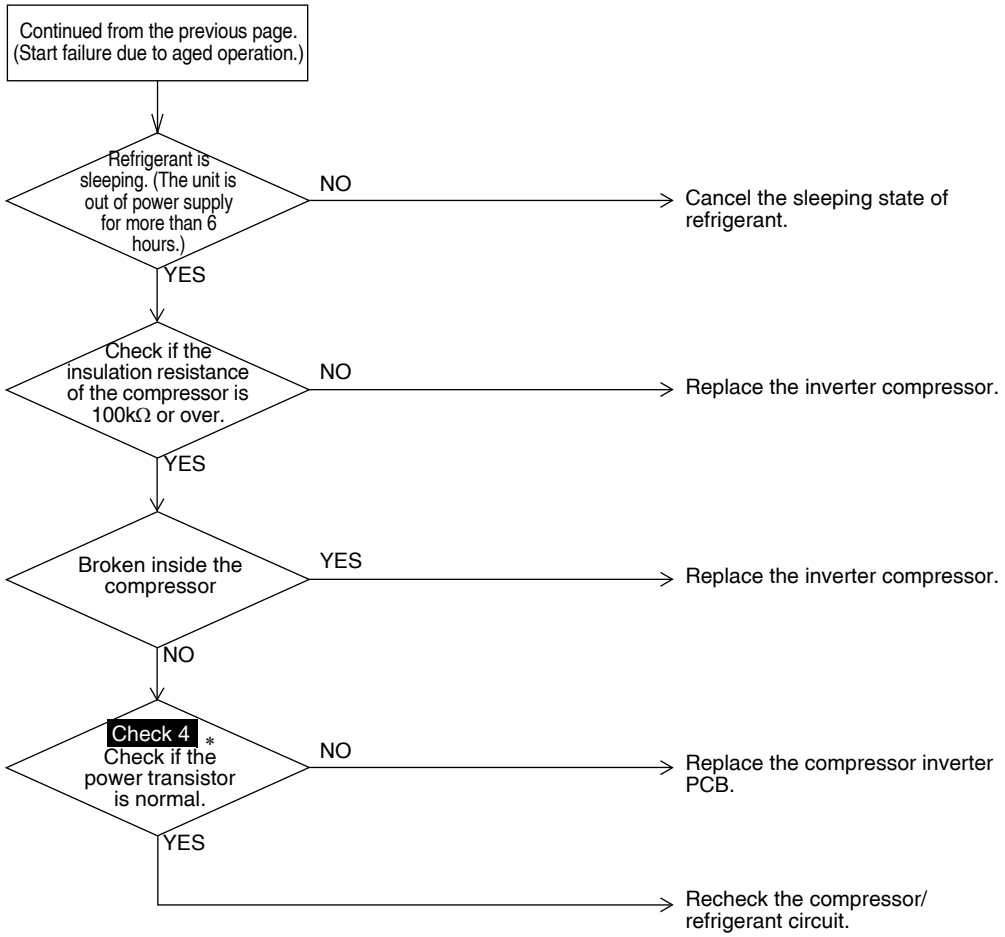
Remote Controller Display	L9
Applicable Models	EMRQ*
Method of Malfunction Detection	Detect the failure based on the signal waveform of the compressor.
Malfunction Decision Conditions	Starting the compressor does not complete.
Supposed Causes	■ Failure to open the stop valve ■ Defective compressor ■ Wiring connection error to the compressor ■ Large pressure difference before starting the compressor ■ Defective inverter PCB

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



Troubleshooting



* Check 4 : Referring to the information on P287.

3.57 "L9" Indoor Unit: Inverter Start up Error

Remote Control Display

L9

Subcode 9

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected from current flowing in the power transistor.

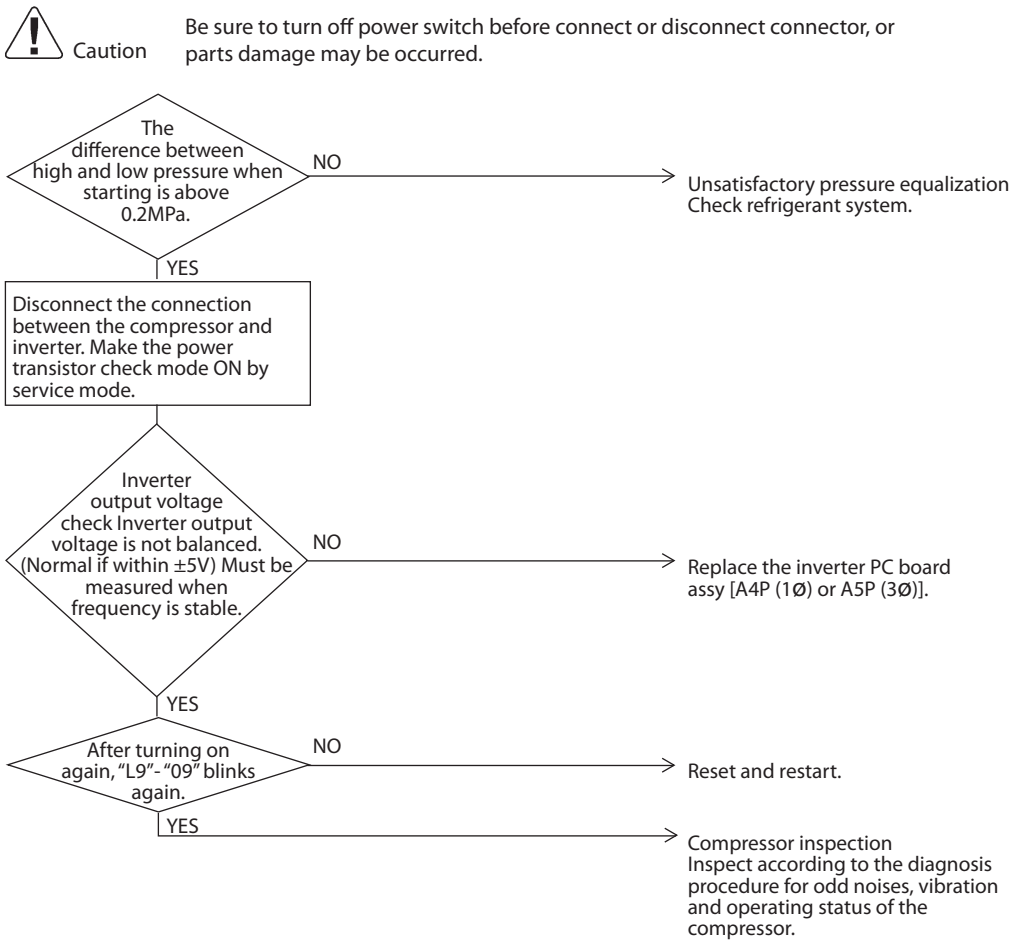
Malfunction Decision Conditions

When overload in the compressor is detected during startup

Supposed Causes

- Defect of compressor
- Pressure differential start
- Defect of outdoor unit PC board [A4P (1Ø) or A5P (3Ø)]

Troubleshooting



3.58 "LC" Outdoor Unit: Malfunction of Transmission between Inverter and Control PC Board

Remote Controller Display

LC

Applicable Models

EMRQ*

Method of Malfunction Detection

Check the communication state between inverter PC board and control PC board by micro-computer.

Malfunction Decision Conditions

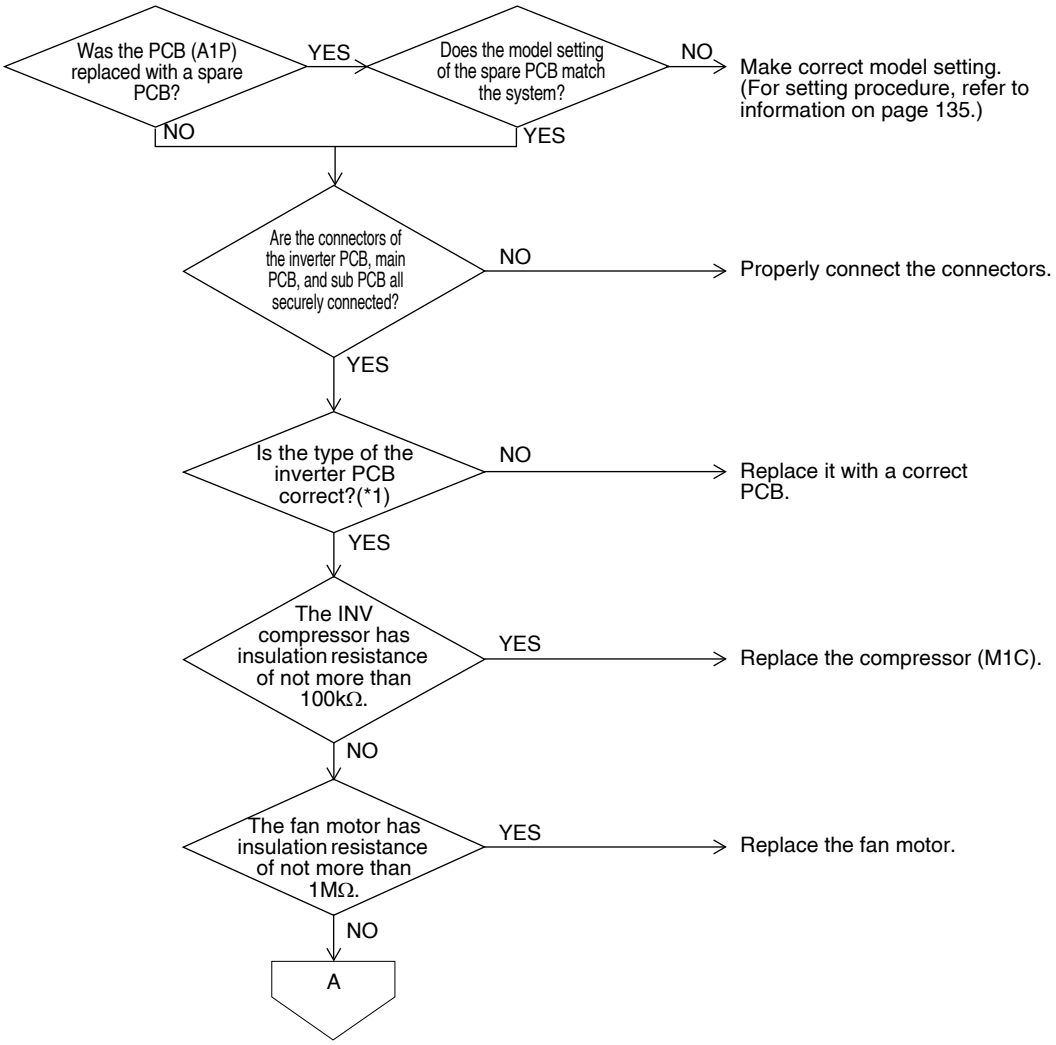
When the correct communication is not conducted in certain period.

Supposed Causes

- Malfunction of connection between the inverter PC board and outdoor control PC board
- Defect of outdoor control PC board (transmission section)
- Defect of inverter PC board
- Defect of noise filter
- Faulty fan inverter
- Incorrect type of fan inverter
- Faulty compressor
- Faulty fan motor
- External factor (noise etc.)

Troubleshooting

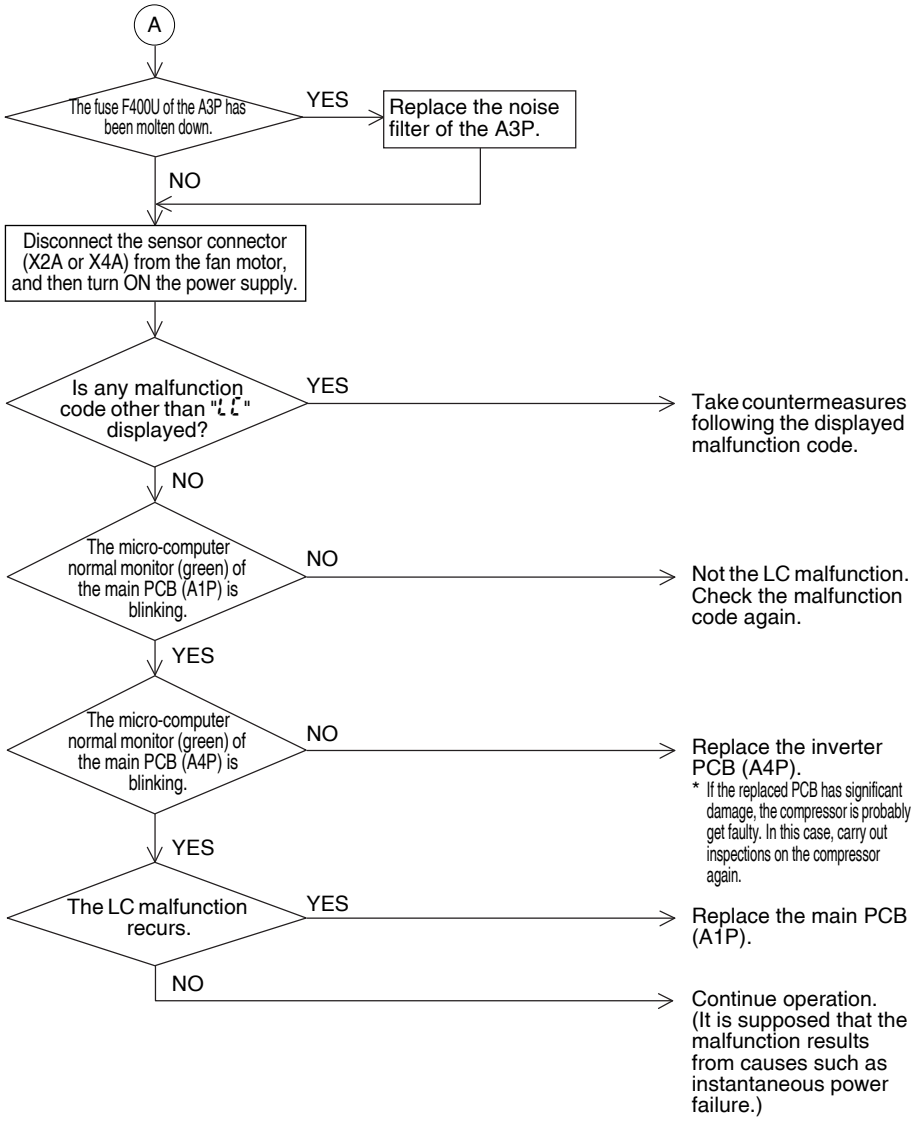
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

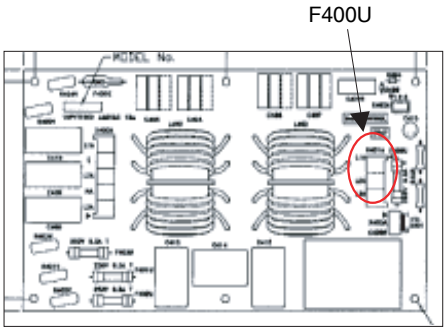


*1. List of Inverter PCBs

	Comp1	Comp2	FAN1	FAN2
EMRQ8AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ10AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ12AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ14AAY1	PC0509-1	PC0509-1	PC0511-1	PC0511-1
EMRQ16AAY1	PC0509-1	PC0509-1	PC0511-1	PC0511-1

Troubleshooting





3.59 "LC" Indoor Unit: Malfunction of Transmission between Inverter and Control PC Board

Remote Control Display

LC

Subcode 29

Applicable Models

All indoor units

Method of Malfunction Detection

Check the communication state between inverter PC board and control PC board by micro-computer.

Malfunction Decision Conditions

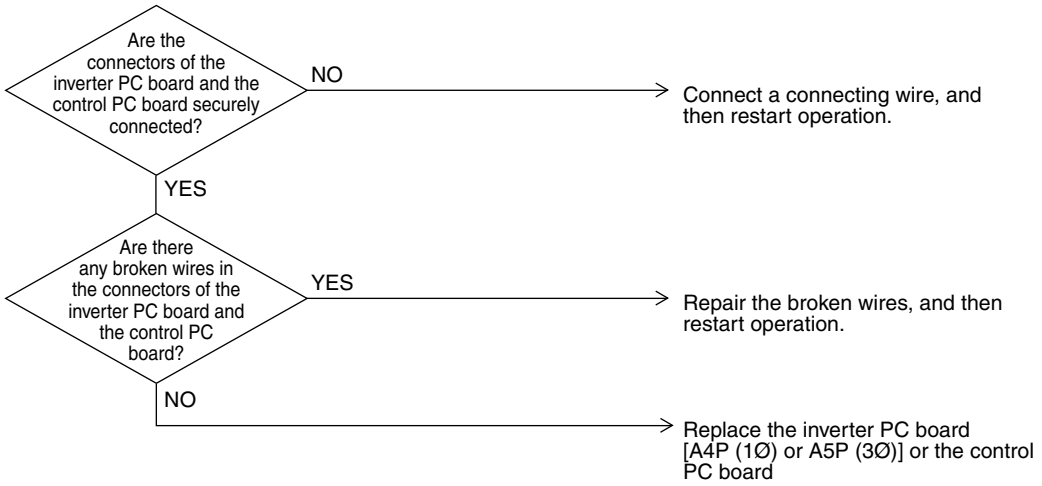
When the correct communication is not conducted in certain period.

Supposed Causes

- Malfunction of connection between the inverter microcomputer and indoor control microcomputer
- Defect of indoor unit PC board [A4P (1Ø) or A5P (3Ø)]
- External factor (Noise etc.)

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



3.60 "LH" Indoor Unit: Converter Error

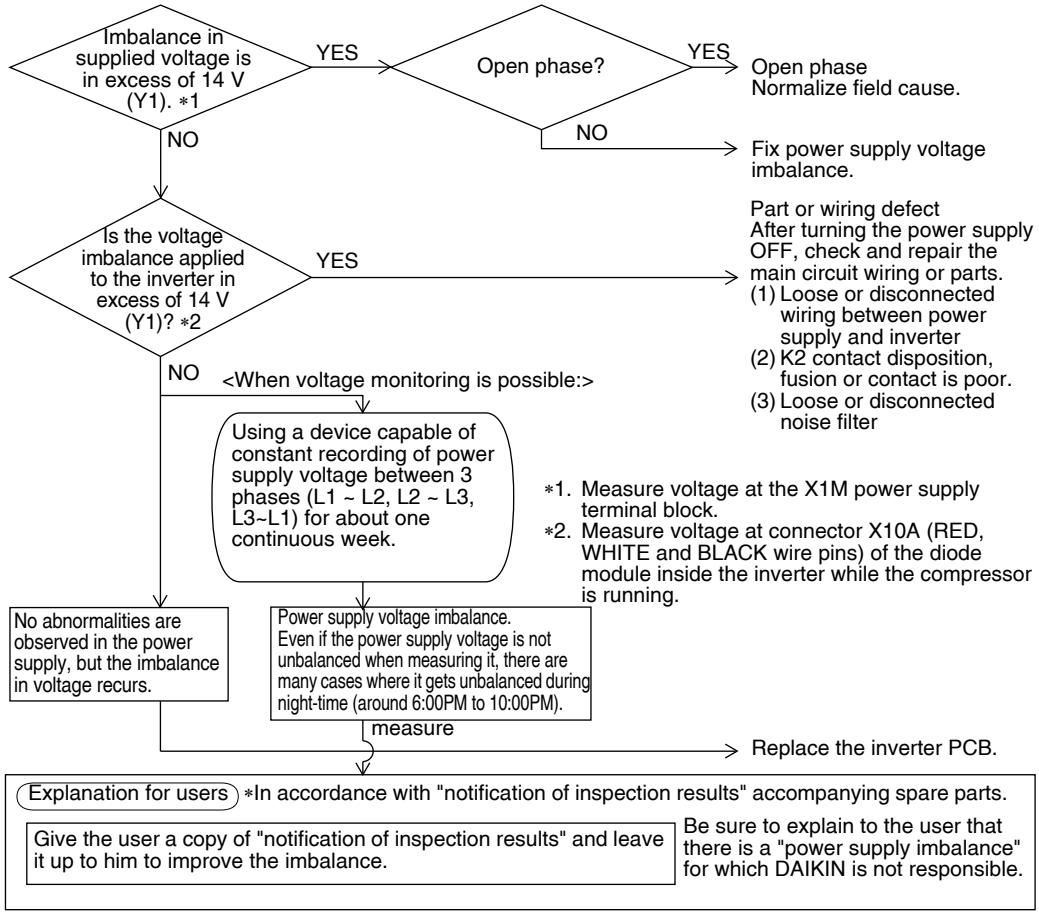
Remote Control Display	LH Subcode 2
Applicable Models	All indoor units
Method of Malfunction Detection	
Malfunction Decision Conditions	
Supposed Causes	■ Inverter PC board problem
Troubleshooting	⚠ **Caution**: Be sure to turn off the power switch before connecting or disconnecting connector, otherwise parts may be damaged. Replace the inverter PC board.

3.61 “P1” Outdoor Unit: Inverter Over-Ripple Protection

Remote Controller Display	P1
Applicable Models	EMRQ*
Method of Malfunction Detection	Imbalance in supply voltage is detected in PCB. Imbalance in the power supply voltage causes increased ripple of voltage of the main circuit capacitor in the inverter. Consequently, the increased ripple is detected.
Malfunction Decision Conditions	When the resistance value of thermistor becomes a value equivalent to open or short circuited status. ★ Malfunction is not decided while the unit operation is continued. "P 1" will be displayed by pressing the inspection button. When the amplitude of the ripple exceeding a certain value is detected for consecutive 4 minutes.
Supposed Causes	■ Open phase ■ Voltage imbalance between phases ■ Defect of main circuit capacitor ■ Defect of inverter PCB ■ Defect of K2 relay in inverter PCB ■ Improper main circuit wiring

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



(V2816)

3.62 "P1" Indoor Unit: High Voltage of Capacitor in Main Inverter Circuit

Remote Control Display

P1

Subcode 6

Applicable Models

All indoor units

Method of Malfunction Detection

Malfunction is detected according to the voltage waveform of main circuit capacitor built in the inverter.

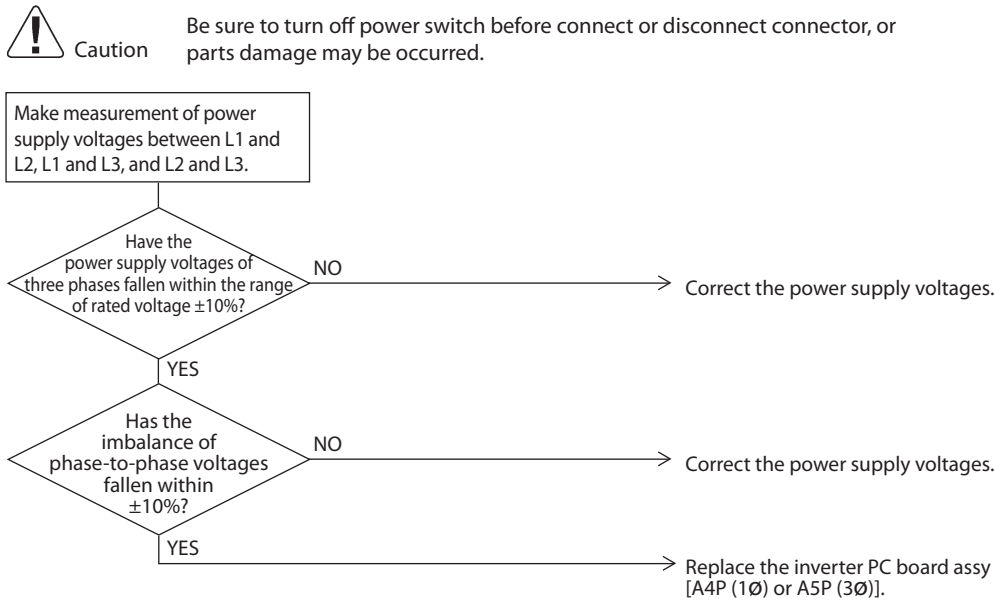
Malfunction Decision Conditions

When the aforementioned voltage waveform becomes identical with the waveform of the power supply open phase.

Supposed Causes

- Defect of main circuit capacitor
- Improper main circuit wiring
- Defect of indoor unit inverter PC board [A4P (1ø) or A5P (3ø)]
- Imbalance of phase-to-phase voltages
- Open phase

Troubleshooting



3.63 "P4" Outdoor Unit: Malfunction of Inverter Radiating Fin Temperature Rise Sensor

Remote Controller Display

P4

Applicable Models

EMRQ*

Method of Malfunction Detection

Resistance of radiation fin thermistor is detected when the compressor is not operating.

Malfunction Decision Conditions

When the resistance value of thermistor becomes a value equivalent to open or short circuited status.

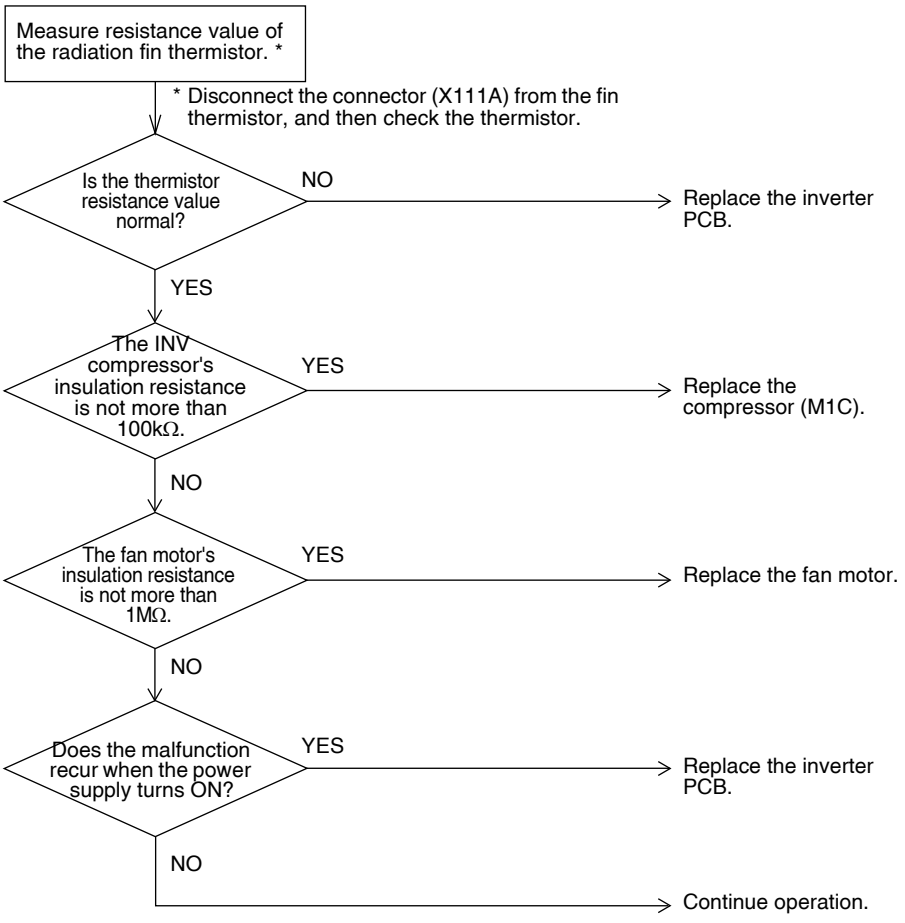
★ Malfunction is not decided while the unit operation is continued.
"P4" will be displayed by pressing the inspection button.

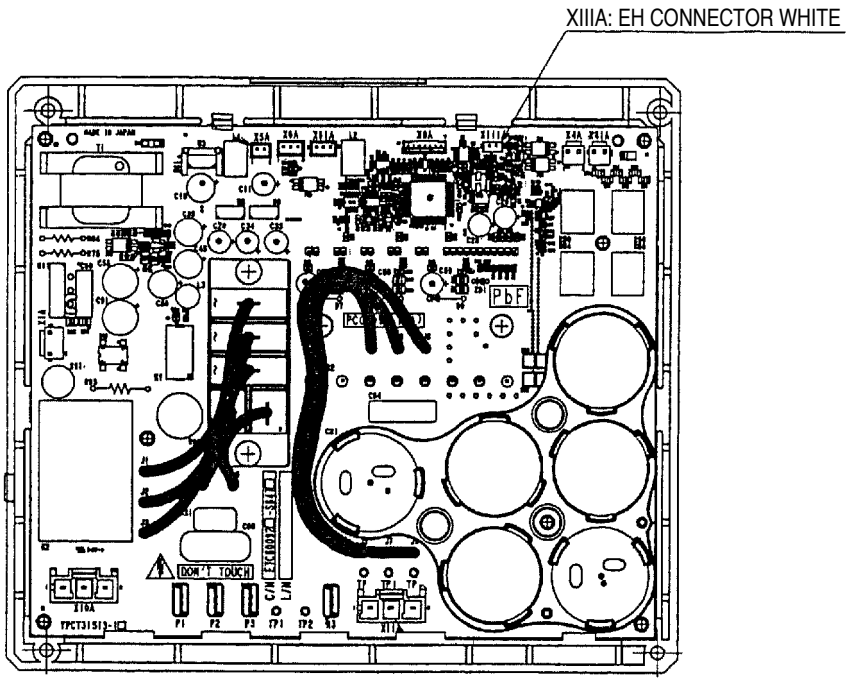
Supposed Causes

- Defect of radiator fin temperature sensor
- Defect of inverter PCB
- Faulty inverter compressor
- Faulty fan motor

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.





Inverter PCB for compressor

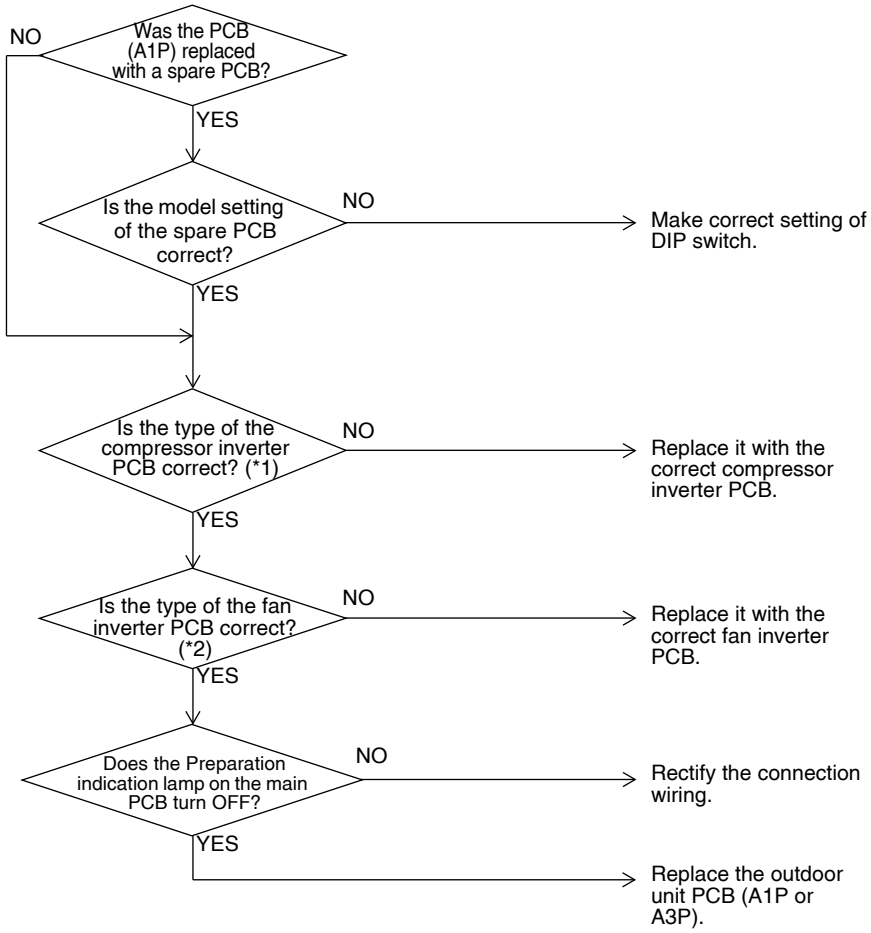
∗ Refer to “Thermistor Resistance / Temperature Characteristics” table on page 307.

3.64 "PJ" Outdoor Unit: Faulty Field Setting after Replacing Main PCB or Faulty Combination of PCB

Remote Controller Display	PJ
Applicable Models	EMRQ*
Method of Malfunction Detection	This malfunction is detected according to communications with the inverter.
Malfunction Decision Conditions	Make judgment according to communication data on whether or not the type of the inverter PCB is correct.
Supposed Causes	■ Faulty (or no) field setting after replacing main PCB ■ Mismatching of type of PCB

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



*1. List of Inverter PCBs

	Comp1	Comp2	FAN1	FAN2
EMRQ8AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ10AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ12AAY1	PC0509-1	—	PC0511-3	PC0511-4
EMRQ14AAY1	PC0509-1	PC0509-1	PC0511-1	PC0511-1
EMRQ16AAY1	PC0509-1	PC0509-1	PC0511-1	PC0511-1

3.65 "PJ" Indoor Unit: Faulty Combination of PCB

Remote Control Display	PJ Subcode 11
Applicable Models	All indoor units
Method of Malfunction Detection	This malfunction is detected according to communications with the inverter.
Malfunction Decision Conditions	Make judgment according to communication data on whether or not the type of the inverter PCB is correct.
Supposed Causes	■ Mismatching of type of PCB.
Troubleshooting	⚠**Caution**: Be sure to turn off the power switch before connecting or disconnecting connector, otherwise parts may be damaged. Replace the inverter PC board assy [A4P (1ø) or A5P (3ø)].

3.66 “U0” Outdoor Unit: Gas Shortage Alert

Remote Controller Display

U0

Applicable Models

EMRQ*

Method of Malfunction Detection

Detect gas shortage based on the temperature difference between low pressure or suction pipe and heat exchanger.

Malfunction Decision Conditions

[In cooling mode]
Low pressure becomes 0.1MPa or below.
[In heating mode]
The degree of superheat of suction gas becomes 20 degrees and over.
SH= Ts1 –Te
Ts1: Suction pipe temperature detected by thermistor
Te : Saturated temperature corresponding to low pressure
★Malfunction is not determined. The unit continues operation.

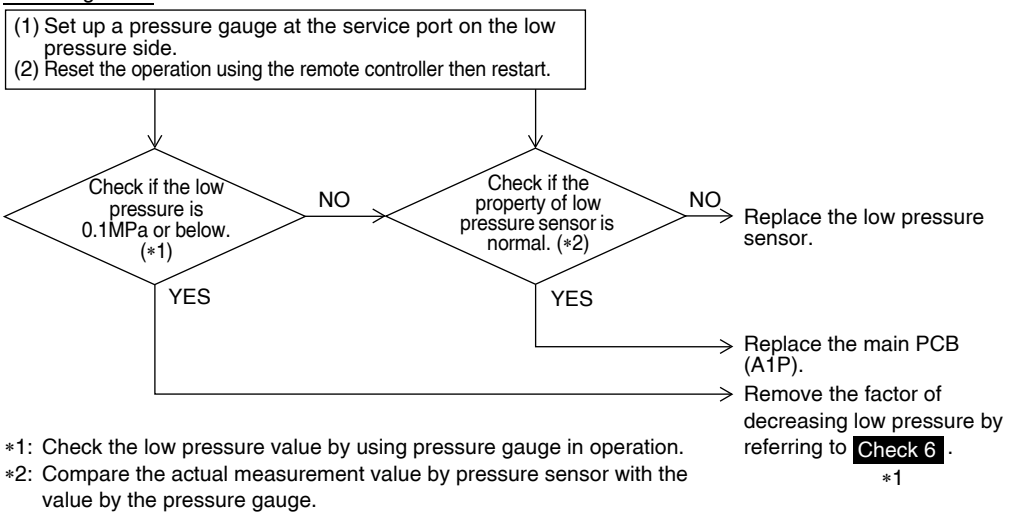
Supposed Causes

- Gas shortage or refrigerant clogging (piping error)
- Defective thermistor (R4T, R7T, R12T, R15T)
- Defective low pressure sensor
- Defective outdoor unit PC board (A1P, A3P)

Troubleshooting

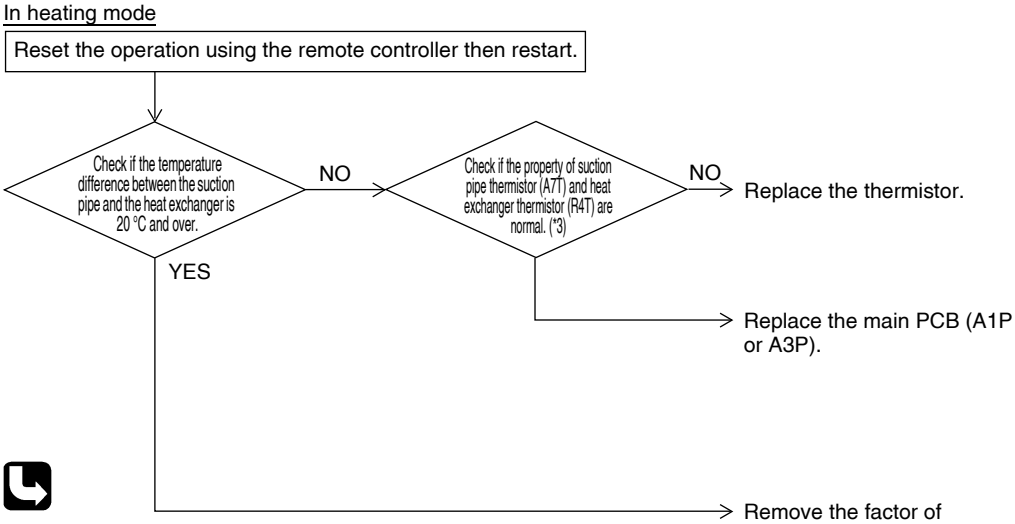
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

In cooling mode



*1: Check the low pressure value by using pressure gauge in operation.
*2: Compare the actual measurement value by pressure sensor with the value by the pressure gauge.
(To gain actual measurement value by pressure sensor, measure the voltage at the connector [between (2)-(3)] and then convert the value into pressure referring to P310.)

In heating mode



*3: Compare the thermistor resistance value with the value on the surface thermometer.

* 1 Check 6 : Referring to the information on P289.

* 2 Check 3 : Referring to the information on P286.

3.67 "U1" Reverse Phase, Open Phase

Remote Controller Display

U1

Applicable Models

EMRQ*

Method of Malfunction Detection

The phase of each phase are detected by reverse phase detection circuit and right phase or reverse phase are judged.

Malfunction Decision Conditions

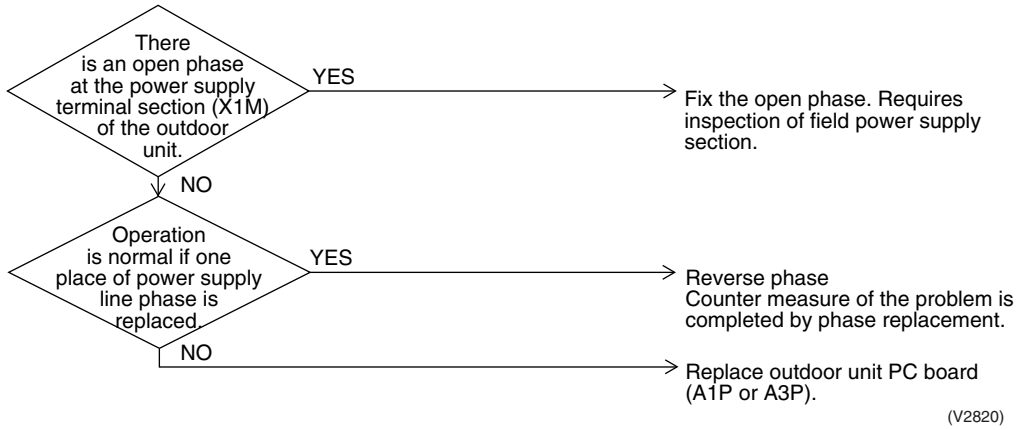
When a significant phase difference is made between phases.

Supposed Causes

- Power supply reverse phase
- Power supply open phase
- Defect of outdoor PC board (A1P, A3P)

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

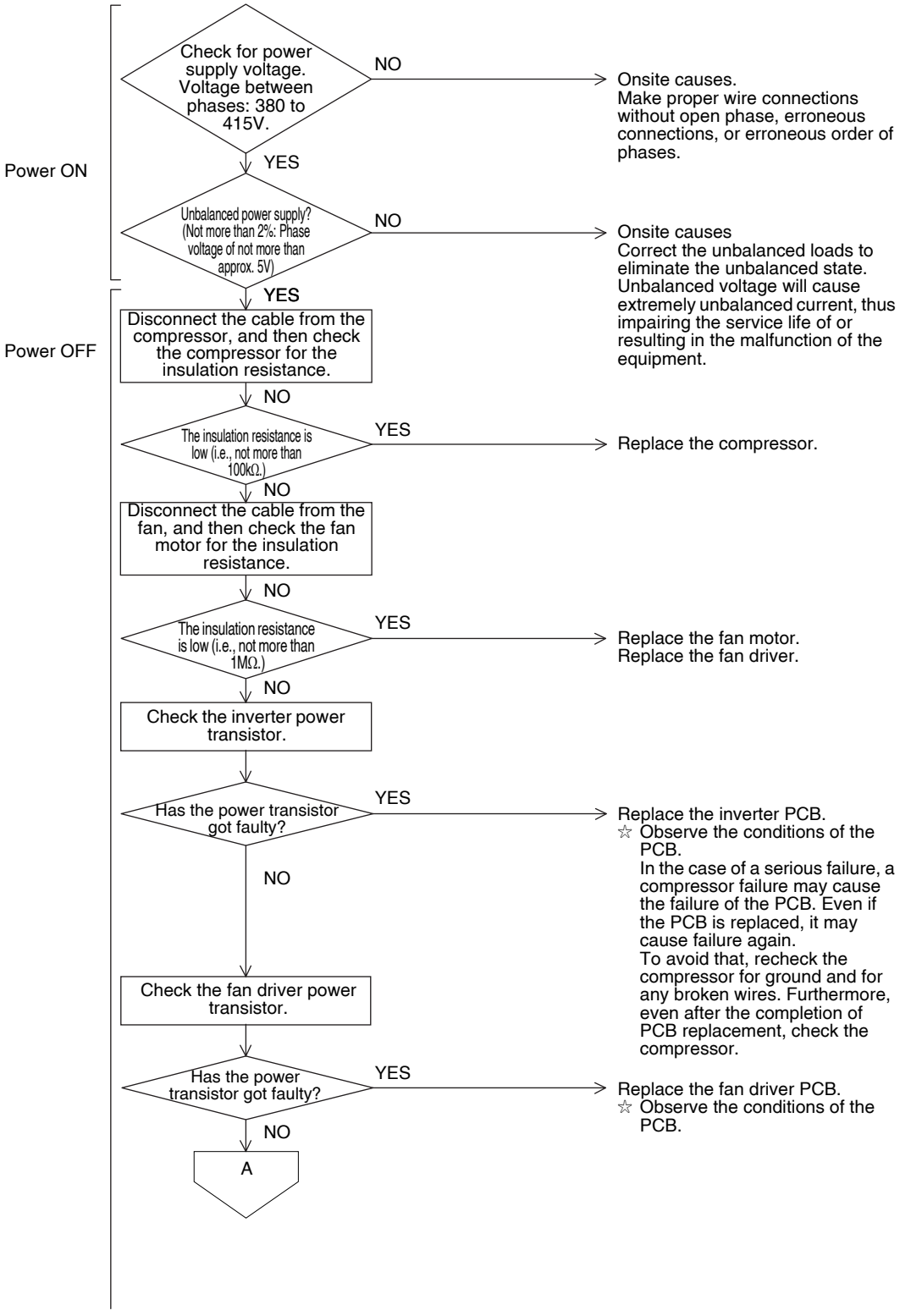


3.68 “U2” Outdoor Unit: Power Supply Insufficient or Instantaneous Failure

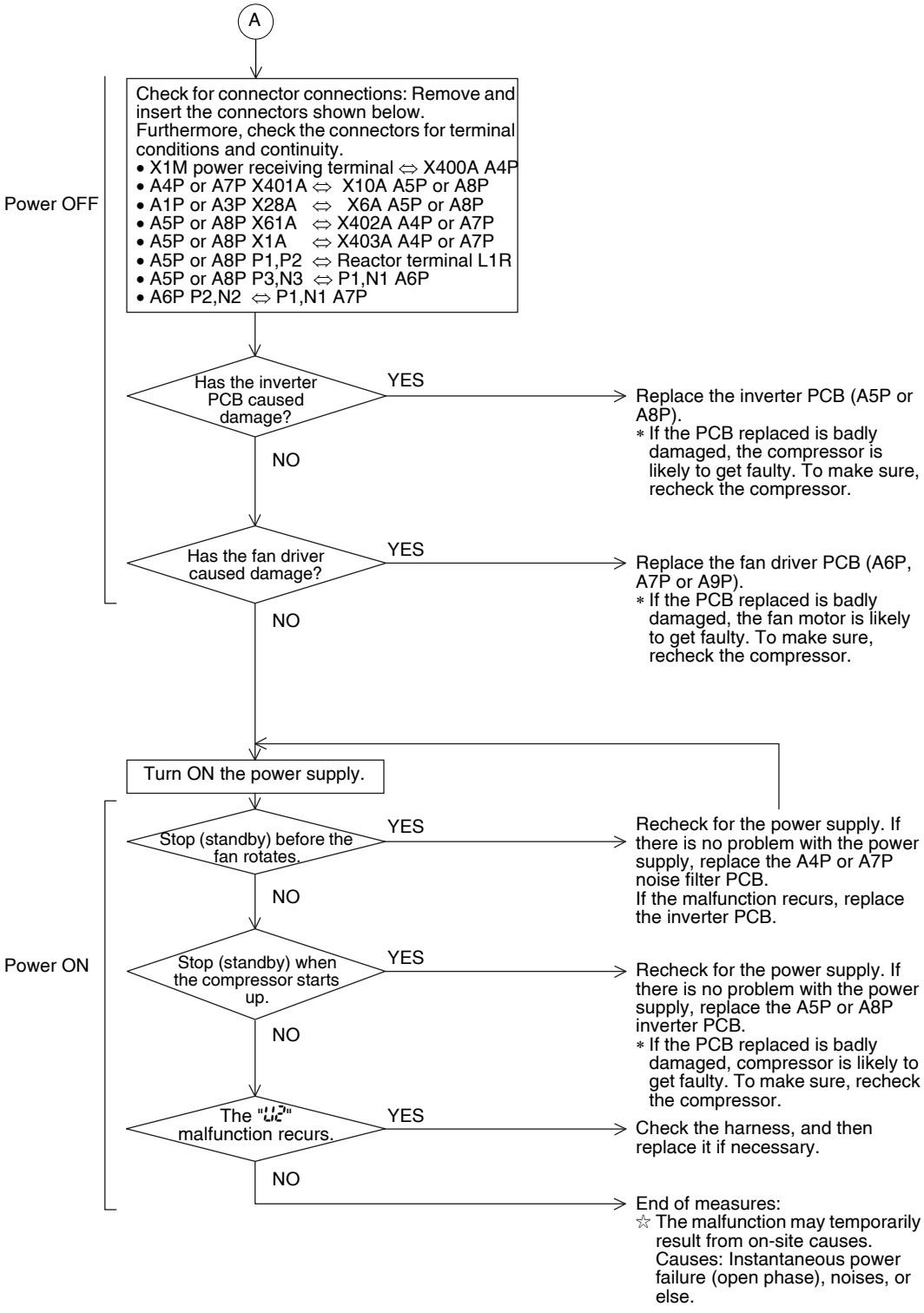
Remote Controller Display	U2
Applicable Models	EMRQ*
Method of Malfunction Detection	Detection of voltage of main circuit capacitor built in the inverter and power supply voltage.
Malfunction Decision Conditions	When the voltage aforementioned is not less than 780V or not more than 320V, or when the current-limiting voltage does not reach 200V or more or exceeds 740V.
Supposed Causes	■ Power supply insufficient ■ Instantaneous power failure ■ Open phase ■ Defect of inverter PC board ■ Defect of outdoor control PC board ■ Main circuit wiring defect ■ Faulty compressor ■ Faulty fan motor ■ Faulty connection of signal cable

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



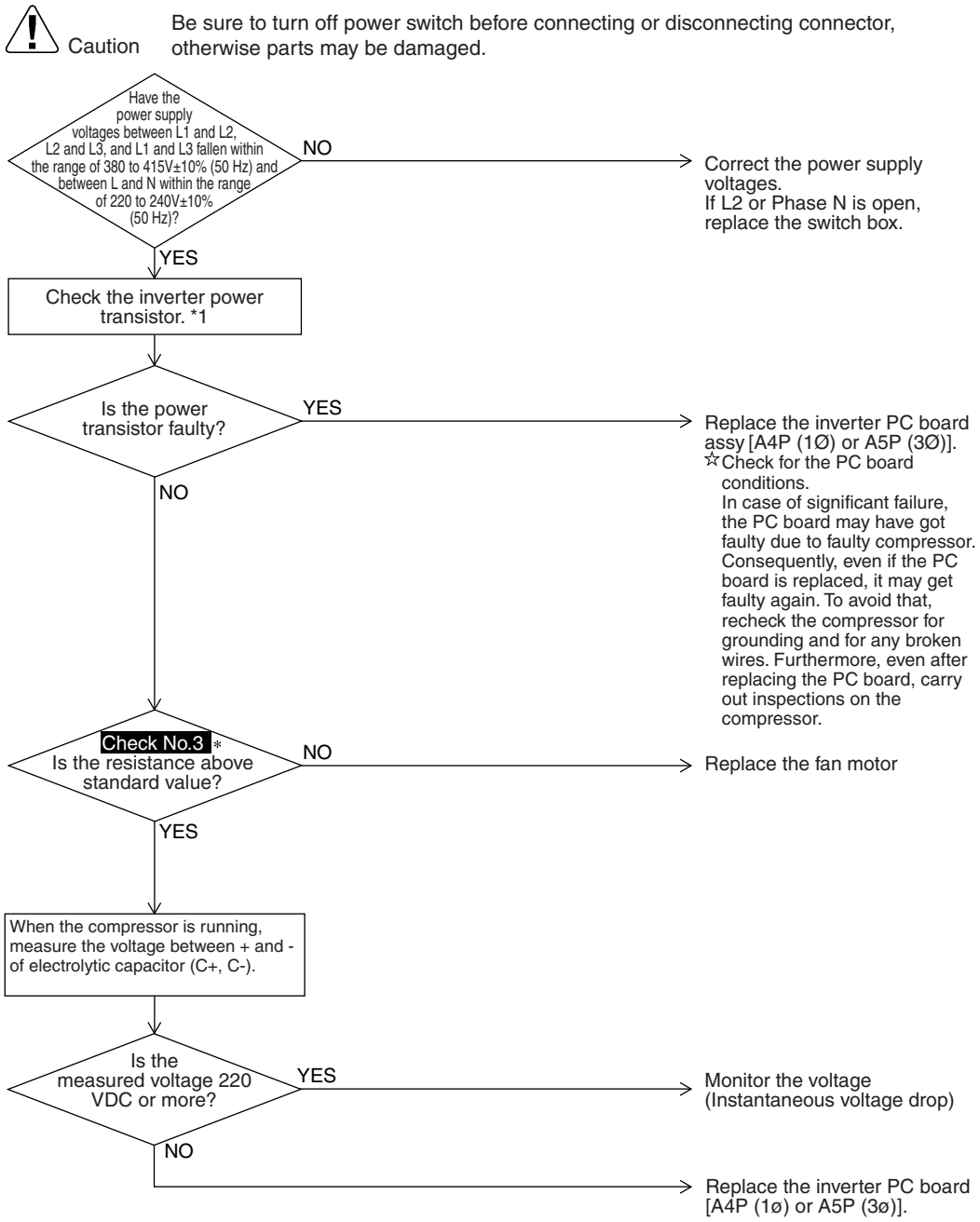
Troubleshooting



3.69 "U2" Power Supply Insufficient or Instantaneous Failure

Remote Control Display	U2 Subcode 20: high/low voltage problem Subcode 21: converter problem
Applicable Models	All indoor units
Method of Malfunction Detection	Detection of voltage of main circuit capacitor built in the inverter and power supply voltage.
Malfunction Decision Conditions	When the abnormal voltage of main circuit capacitor built in the inverter and abnormal power supply voltage are detected.
Supposed Causes	■ Power supply insufficient ■ Instantaneous power failure ■ Defect of indoor inverter PC board [A4P (1Ø) or A5P (3Ø)] ■ Converting problem ⚠ **Warning**: CAPACITOR SHOCK HAZARD. The capacitors (top surfaces) can hold up to 220V. Use correct precautions when servicing.

Troubleshooting



∗1: Inverter's Power Transistors Check : Refer to information on P287.
∗Check No.3 : Refer to information on P286.

3.70 "U3" Outdoor Unit: Check Operation not Executed

Remote Controller Display

U3

Applicable Models

EMRQ*

Method of Malfunction Detection

Check operation is executed or not

Malfunction Decision Conditions

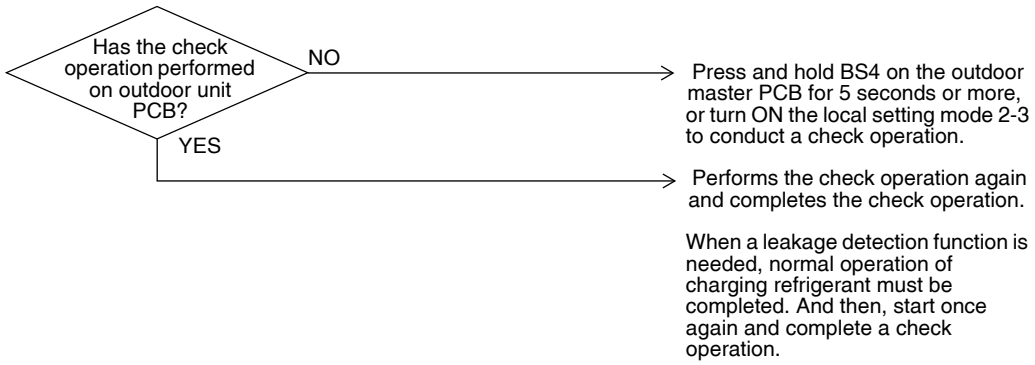
Malfunction is decided when the unit starts operation without check operation.

Supposed Causes

- Check operation is not executed.

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

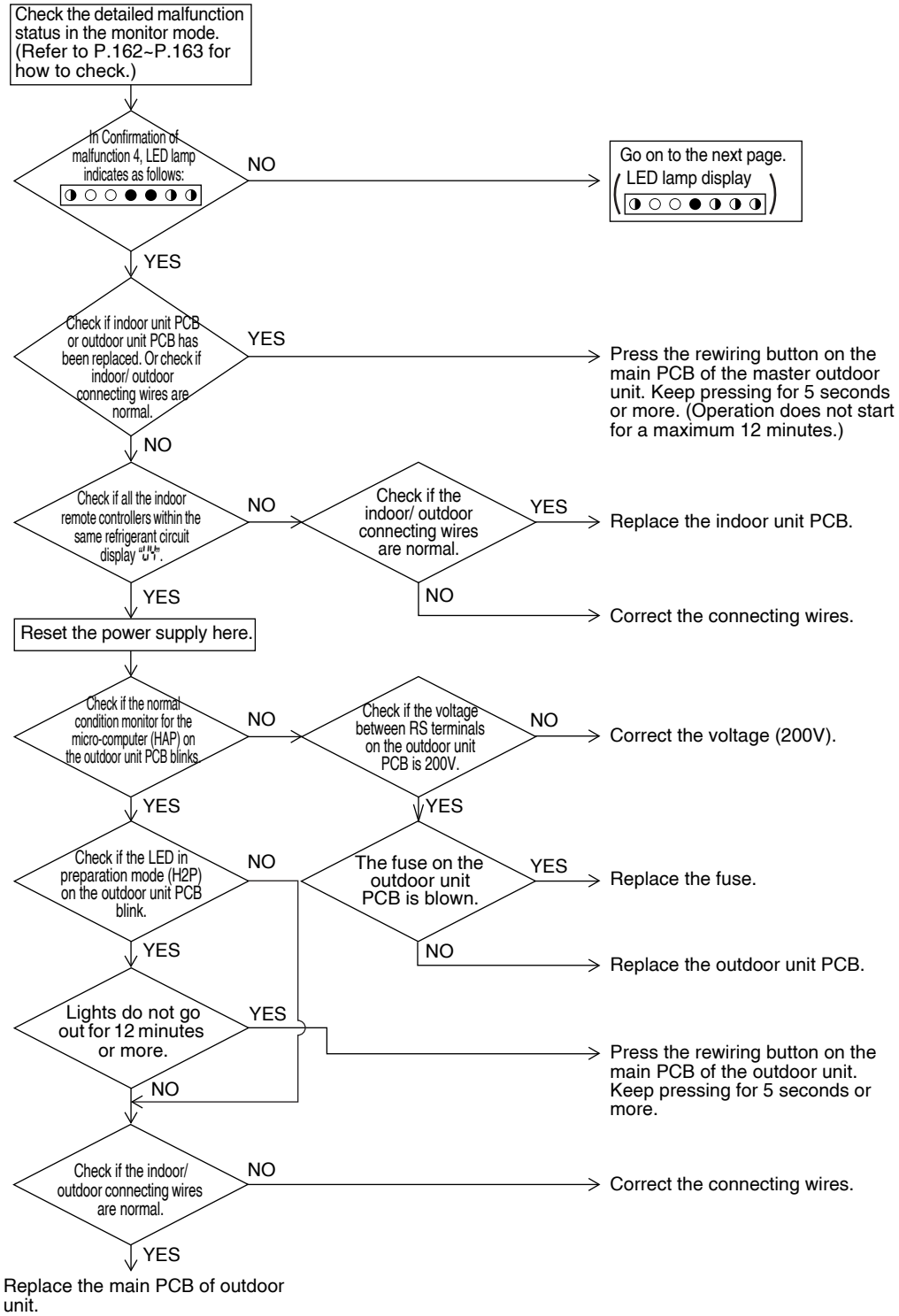


3.71 "U4" Malfunction of Transmission between Indoor Units and Outdoor Units

Remote Controller Display	U4 U4 subcode 0
Applicable Models	All indoor unit models All outdoor unit models
Method of Malfunction Detection	Check if the transmission between indoor unit and outdoor unit is correctly executed using microcomputer.
Malfunction Decision Conditions	When transmission is not carried out normally for a certain amount of time
Supposed Causes	■ Indoor to outdoor, outdoor to outdoor transmission wiring F1, F2 disconnection, short circuit or wrong wiring ■ Outdoor unit power supply is OFF ■ System address doesn't match ■ Defect of indoor unit PC board ■ Defect of outdoor unit PC board

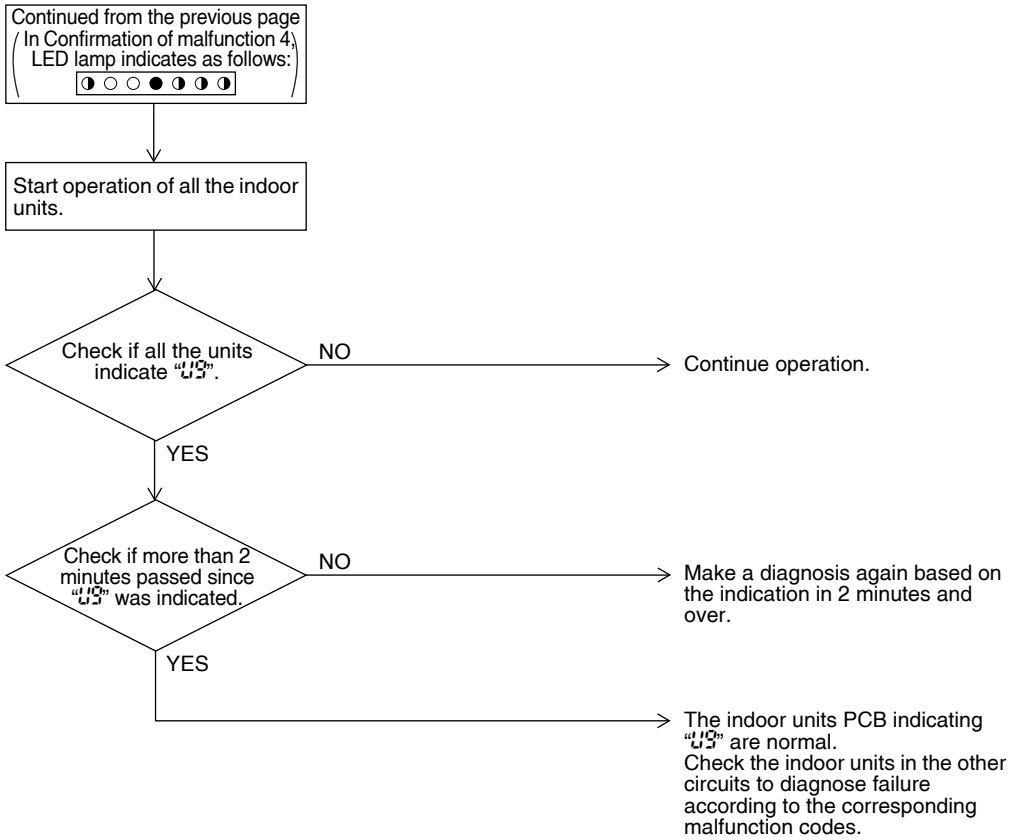
Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

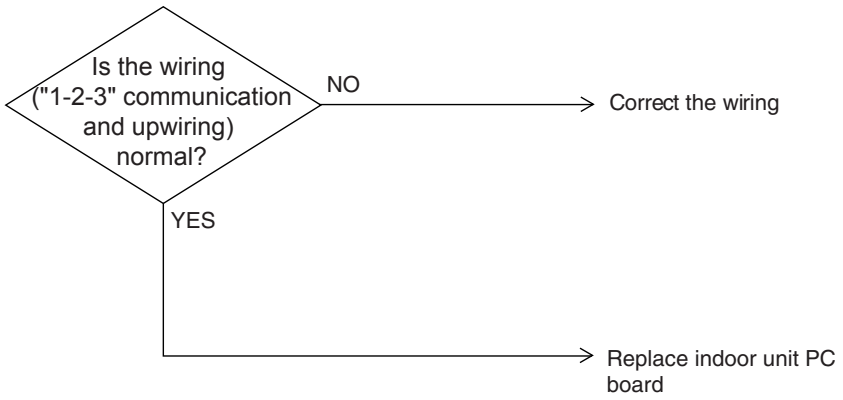


3.72 "U4" Malfunction of Transmission Indoor Unit

Remote Control Display	U4 Subcode 4
Applicable Models	All indoor unit models
Method of Malfunction Detection	Microcomputer checks QA communication of indoor unit.
Malfunction Decision Conditions	When transmission is not carried out normally for a certain amount of time
Supposed Causes	■ Wrong wiring between indoor unit PC boards. [A4P (1Ø) or A5P (3Ø)] and A1P

Troubleshooting

Caution Be sure to turn off power switch before connecting or disconnecting connector, otherwise parts may be damaged.



* Check No.3 : Refer to information on P.286.

3.73 "U5" Indoor Unit: Malfunction of Transmission between Remote Controller and Indoor Unit

Remote Controller Display

U5
U5 subcode 0

Applicable Models

All indoor unit models

Method of Malfunction Detection

In case of controlling with 2-remote controller, check the system using micro-computer is signal transmission between indoor unit and remote controller (main and sub) is normal.

Malfunction Decision Conditions

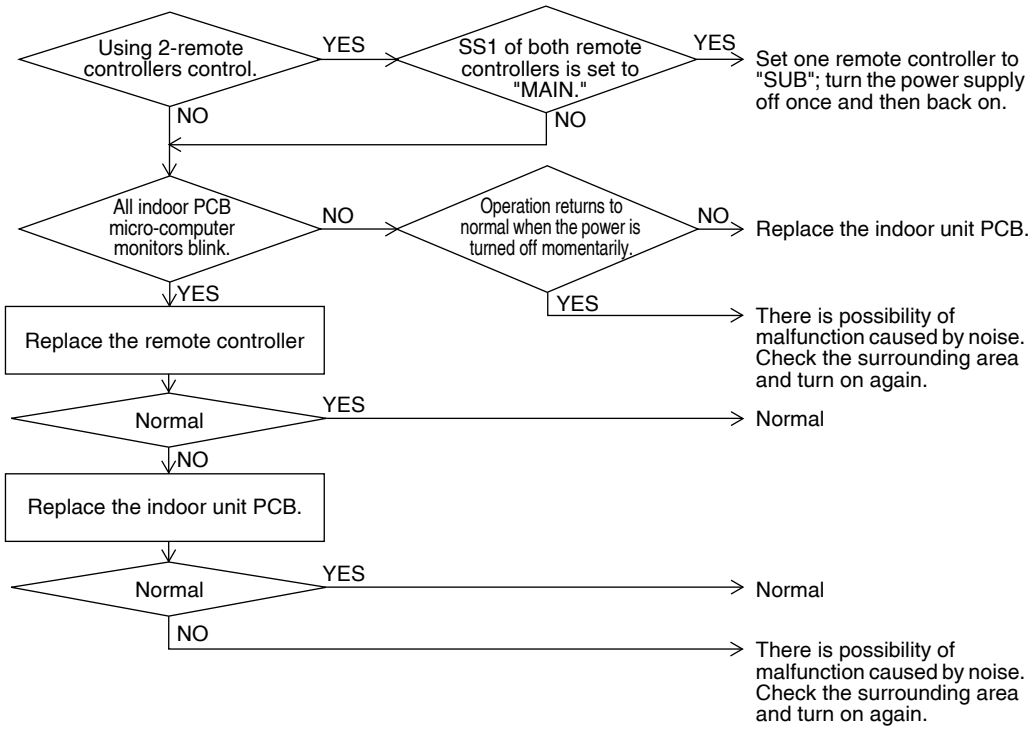
Normal transmission does not continue for specified period.

Supposed Causes

- Malfunction of indoor unit remote controller transmission
- Connection of two main remote controllers (when using 2 remote controllers)
- Defect of indoor unit PCB
- Defect of remote controller PCB
- Malfunction of transmission caused by noise

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



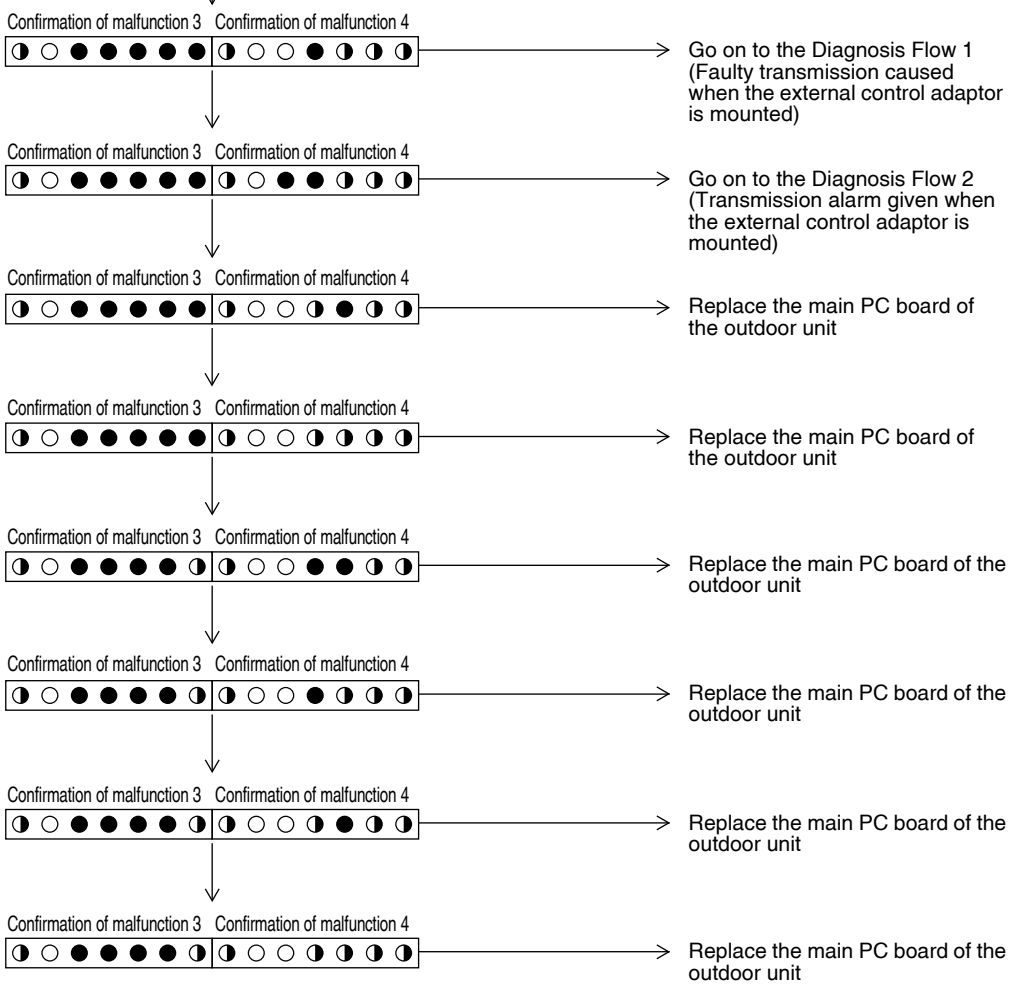
3.74 "U7" Outdoor Unit: Transmission Failure (Across Outdoor Units)

Remote Controller Display	U7
Applicable Models	All outdoor unit models
Method of Malfunction Detection	Micro-computer checks if transmission of outdoor unit.
Malfunction Decision Conditions	When transmission is not carried out normally for a certain amount of time
Supposed Causes	■ Connection error in connecting wires between outdoor unit and outdoor unit external control adaptor ■ Setting error in switching cooling/ heating ■ Integrated address setting error for cooling/ heating (function unit, outdoor unit external control adaptor) ■ Defective outdoor unit PCB (A1P or A3P) ■ Defective outdoor unit external control adaptor

Troubleshooting

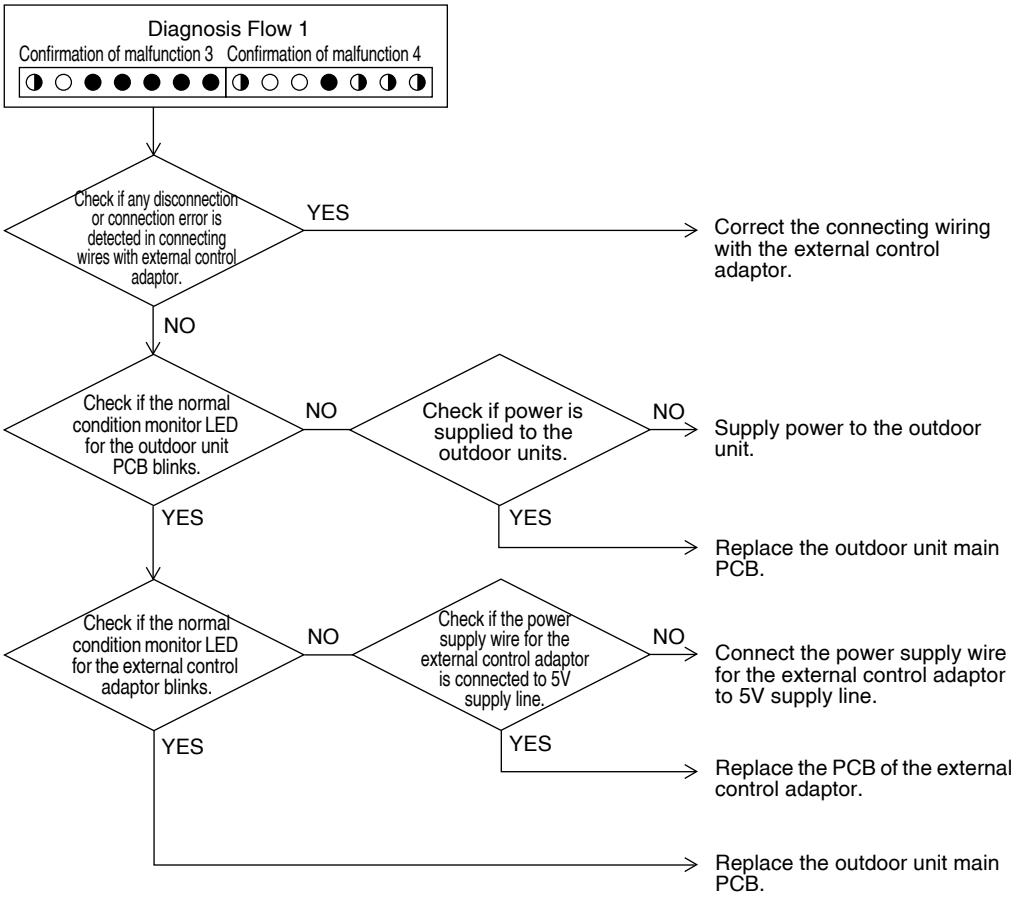
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

Check the LED lamps for "Confirmation of malfunction 3" corresponding to the malfunction code "U1" and for Confirmation of malfunction 4 in the monitor mode. (Refer to P.162~P.163 for how to check)



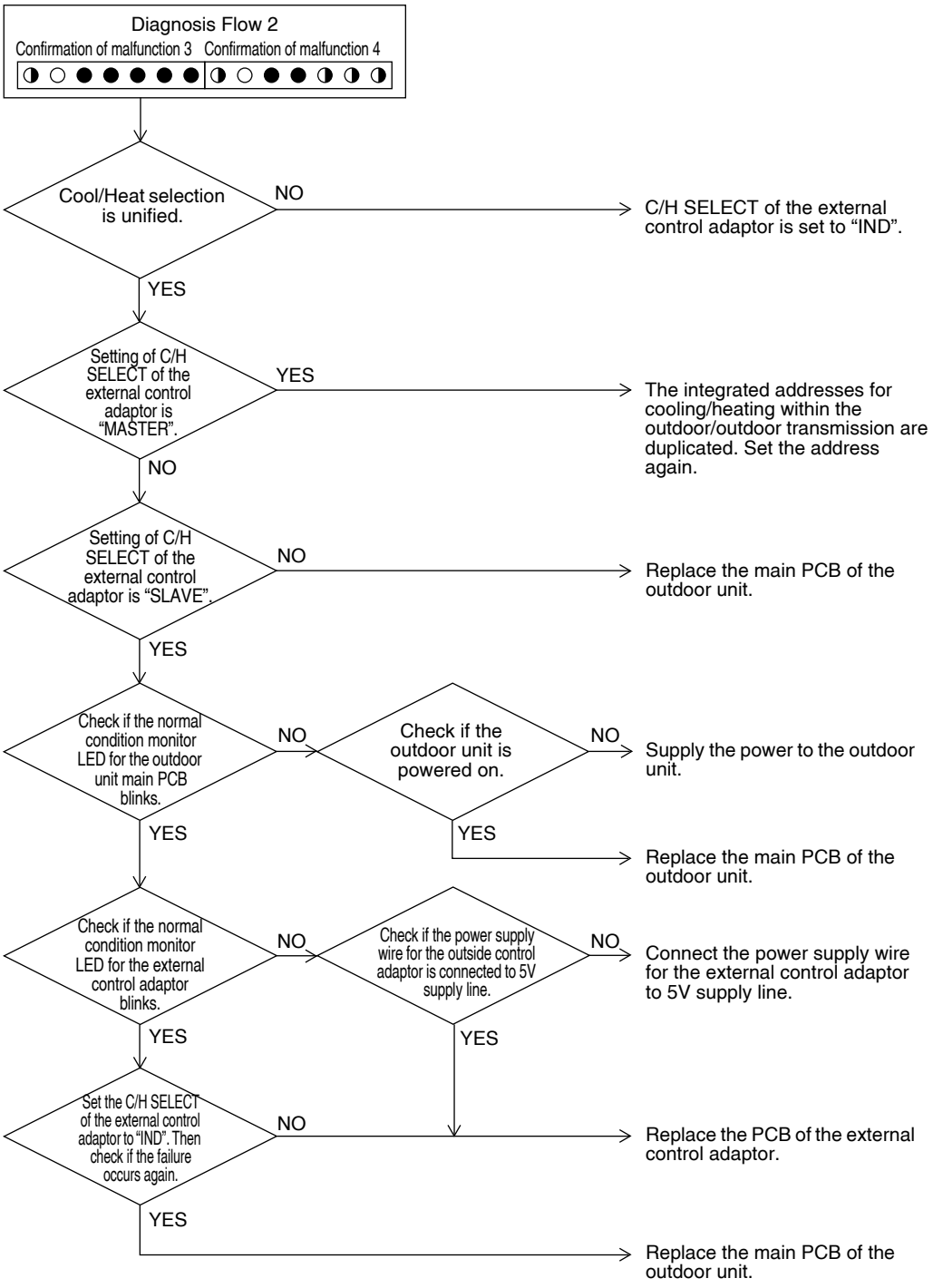
Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



3.75 "U8" Indoor Unit: Malfunction of Transmission between Main and Sub Remote Controllers

Remote Controller Display

U8

Applicable Models

All indoor unit models

Method of Malfunction Detection

In case of controlling with 2-remote controller, check the system using micro-computer if signal transmission between indoor unit and remote controller (main and sub) is normal.

Malfunction Decision Conditions

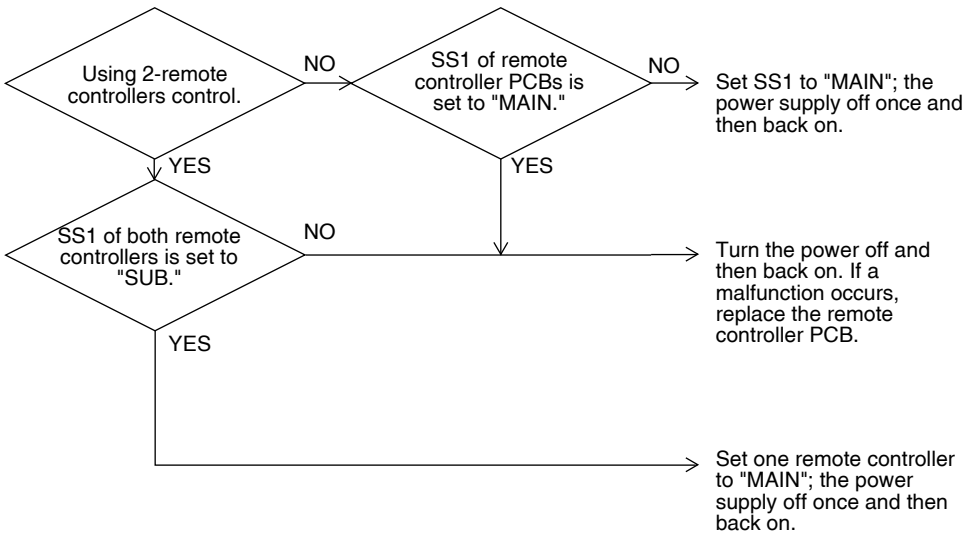
Normal transmission does not continue for specified period.

Supposed Causes

- Malfunction of transmission between main and sub remote controller
- Connection between sub remote controllers
- Defect of remote controller PCB

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



3.76 "U9" Indoor Unit: Malfunction of Transmission between Indoor and Outdoor Units in the Same System

Remote Controller Display

U9

Applicable Models

All indoor unit models
All outdoor unit models

Method of Malfunction Detection

Detect malfunction signal for the other indoor units within the circuit by outdoor unit PCB.

Malfunction Decision Conditions

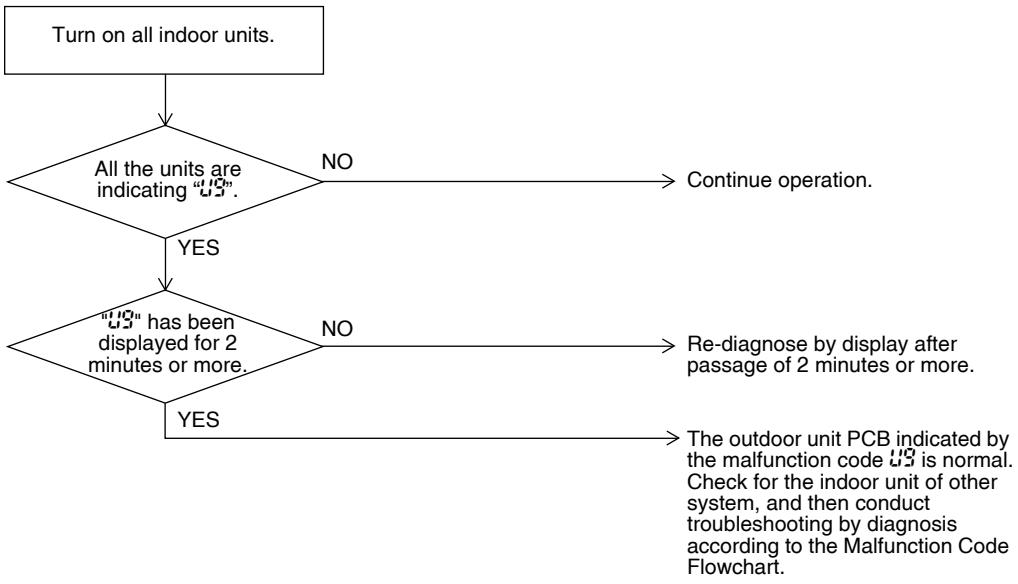
When the malfunction decision is made on any other indoor unit within the system concerned.

Supposed Causes

- Malfunction of transmission within or outside of other system
- Malfunction of electronic expansion valve in indoor unit of other system
- Defect of PCB of indoor unit in other system
- Improper connection of transmission wiring between indoor and outdoor unit

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



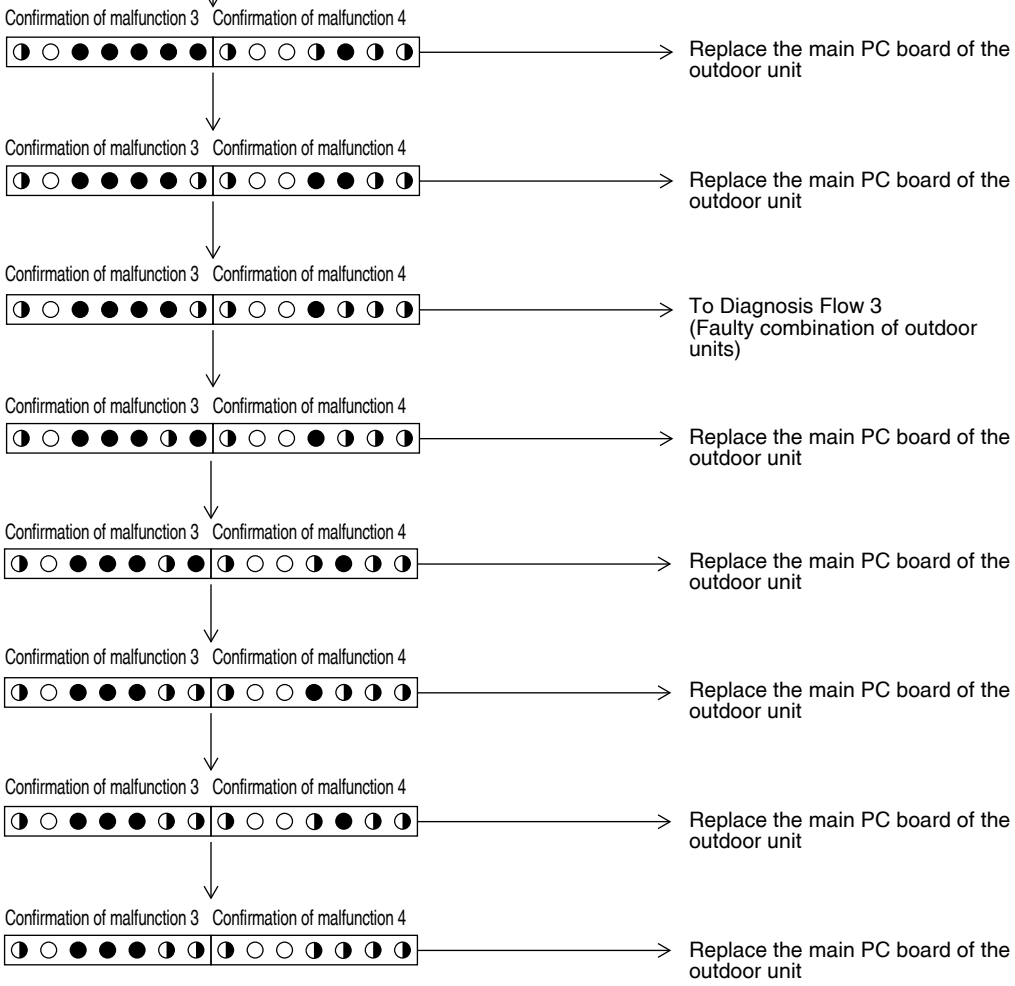
3.77 "UA" Improper Combination of Indoor and Outdoor Unit, Indoor Units and Remote Controller

Remote Controller Display	UA UA subcode 13 UA subcode 39
Applicable Models	All indoor unit models All outdoor unit models
Method of Malfunction Detection	Incorrect signals are transmitted among the indoor unit and outdoor unit.
Malfunction Decision Conditions	The malfunction decision is made as soon as either of the abnormalities aforementioned is detected.
Supposed Causes	■ Defect of outdoor unit PCB (A1P) ■ Setting of outdoor PCB was not conducted after replacing to spare parts PCB.

Troubleshooting

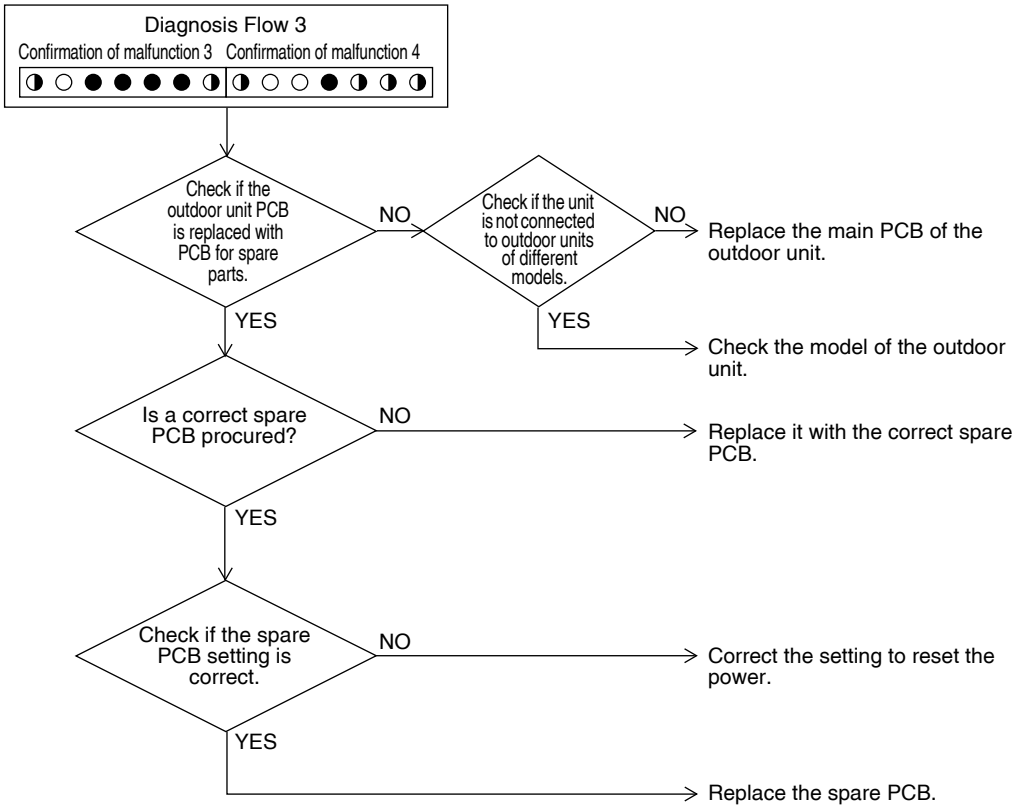
Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.

Check the LED lamps for "Confirmation of malfunction 3" corresponding to the malfunction code "UH" and for Confirmation of malfunction 4 in the monitor mode. (Refer to P.162~P.163 for how to check.)



Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



3.78 "UF" System is not Set yet

Remote Controller Display

UF

UF subcode 6: QA wiring problem

UF subcode 10: Transmission problem with outdoor unit

Applicable Models

All indoor unit models
All outdoor unit models

Method of Malfunction Detection

On check operation, the number of indoor units in terms of transmission is not corresponding to that of indoor units that have made changes in temperature.

Malfunction Decision Conditions

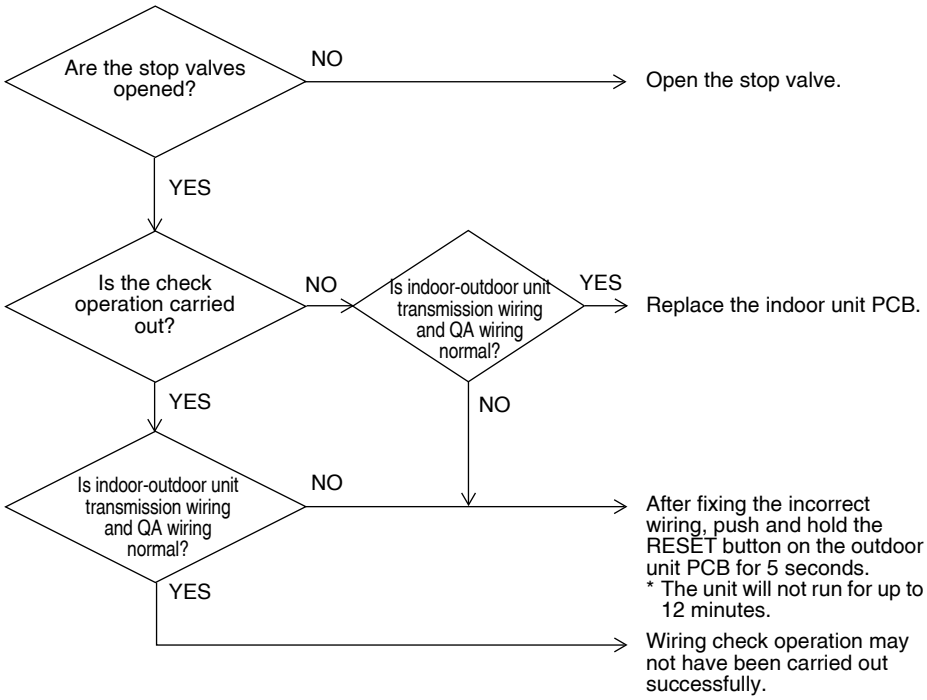
The malfunction is determined as soon as the abnormality aforementioned is detected through checking the system for any erroneous connection of units on the check operation.

Supposed Causes

- Improper connection of transmission wiring between indoor units and outdoor unit
- Failure to execute check operation
- Defect of indoor unit PCB
- Stop valve is closed

Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



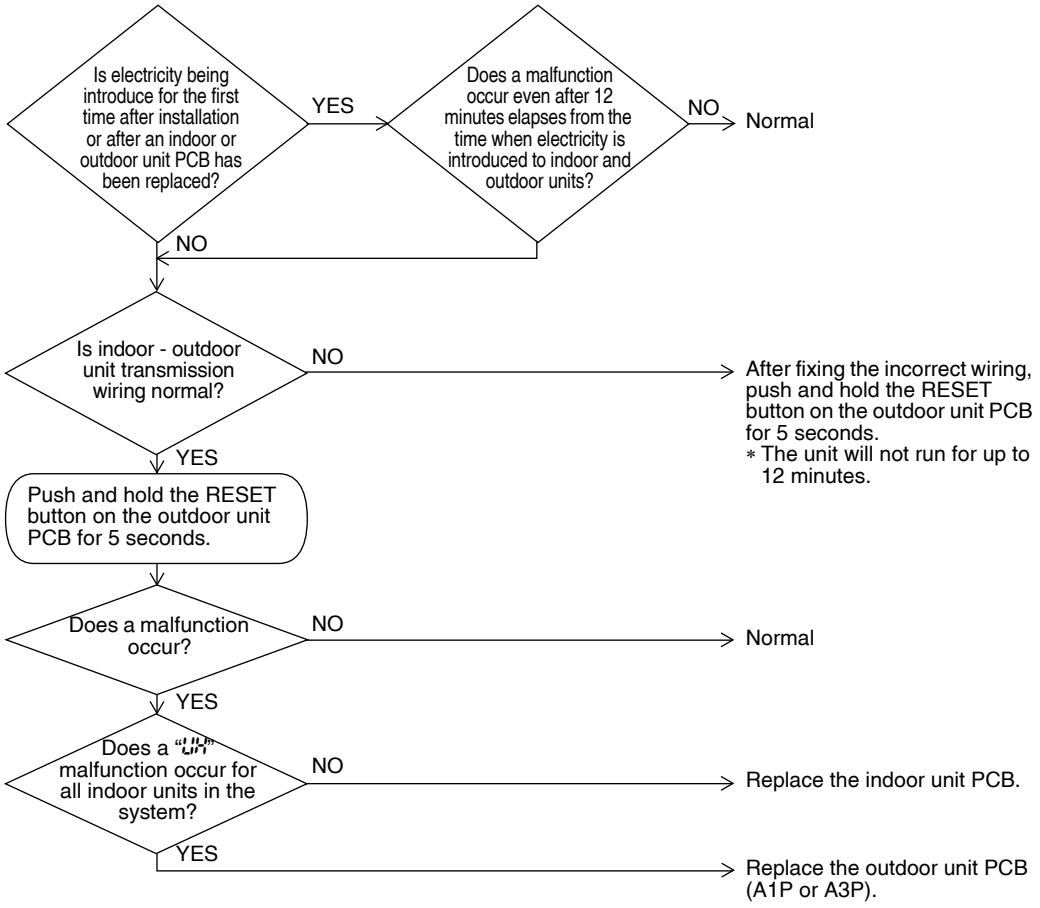
Note: Wiring check operation may not be successful if carried out after the outdoor unit has been off for more than 12 hours.

3.79 "UH" Malfunction of System, Refrigerant System Address Undefined

Remote Controller Display	UH UH subcode 0
Applicable Models	All indoor unit models All outdoor unit models
Method of Malfunction Detection	Detect an indoor unit with no address setting.
Malfunction Decision Conditions	The malfunction decision is made as soon as the abnormality aforementioned is detected.
Supposed Causes	■ Improper connection of transmission wiring between indoor units and outdoor unit ■ Defect of indoor unit PCB ■ Defect of outdoor unit main PCB

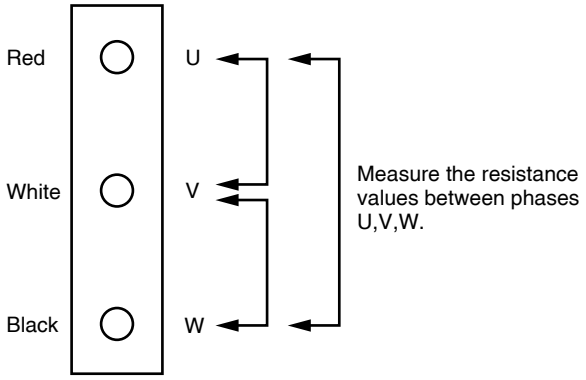
Troubleshooting

Caution Be sure to turn off power switch before connect or disconnect connector, or parts damage may be occurred.



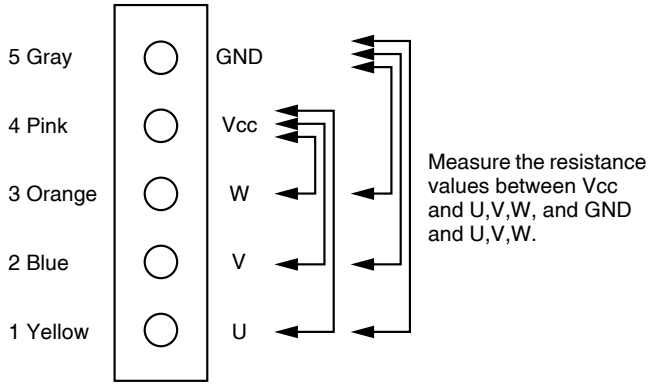
[CHECK 1] **Check on connector of fan motor (Power supply cable)**

(1) Turn off the power supply.
Measure the resistance between phases of U,V,W at the motor side connectors (three-core wire) to check that the values are balanced and there is no short circuiting, while connector or relay connector is disconnected.



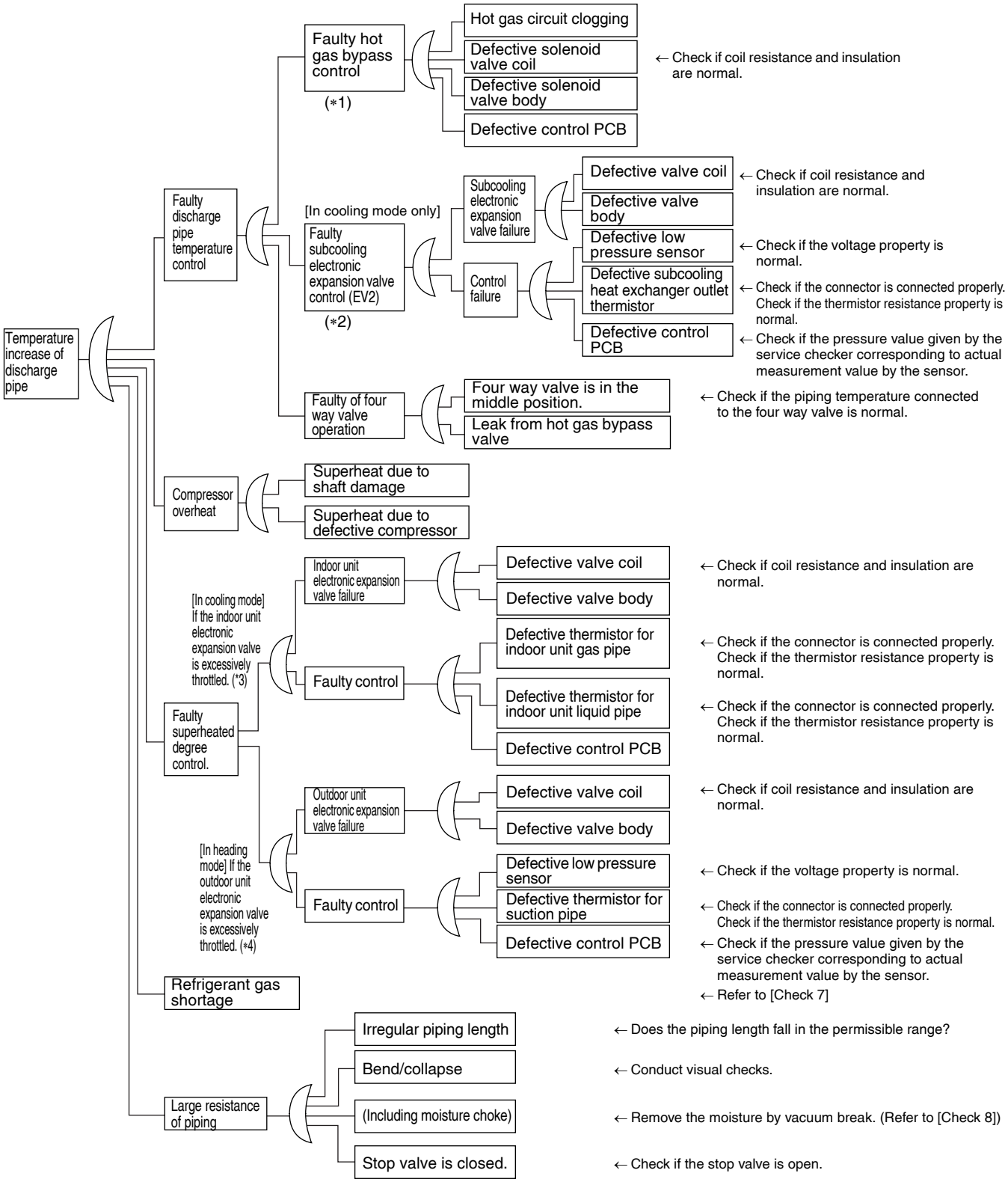
[CHECK 2]

(1) Turn off the power supply.
(2) Measure the resistance between Vcc and each phase of U,V,W, and GND and each phase at the motor side connectors (five-core wire) to check that the values are balanced within the range of ± 20 %, while connector or relay connector is disconnected.
Furthermore, to use a multiple meter for measurement, connect the probe of negative pole to Vcc and that of positive pole to GND.



[CHECK 3] **Check the Factors of Overheat Operation**

Referring to the Fault Tree Analysis (FTA) shown below, probe the faulty points.

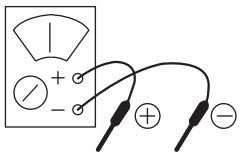


∗1: Refer to “Low pressure protection control” (page 79) for hot gas bypass control.
∗2: Refer to page 62 for subcooling electronic expansion valve control.
∗3: “Superheating temperature control” in cooling mode is conducted by indoor unit electronic expansion valve.
∗4: Superheating temperature control in heating mode is conducted by outdoor unit electronic expansion valve (EVM).
∗5: Judgement criteria of superheat operation:
(1) Suction gas superheating temperature: 10 degrees and over. (2) Discharge gas superheating temperature: 45 degrees and over, except for immediately after starting and drooping control, etc..
(Use the above stated values as a guide. Depending on the other conditions, the unit may be normal despite the values within the above scope.)

[CHECK 4] Power Transistor Check

Perform the following procedures prior to check.
(1) Power Off.
(2) Remove all the wiring connected to the PCB where power transistors are mounted on.

[Preparation]
· Tester



* Preparing a tester in the analog system is recommended. A tester in the digital system with diode check function will be usable.

[Point of Measurement and Judgement Criteria]
· Measure the resistance value using a tester at each point of measurement below, 10 minutes later after power OFF.

To use analog tester:

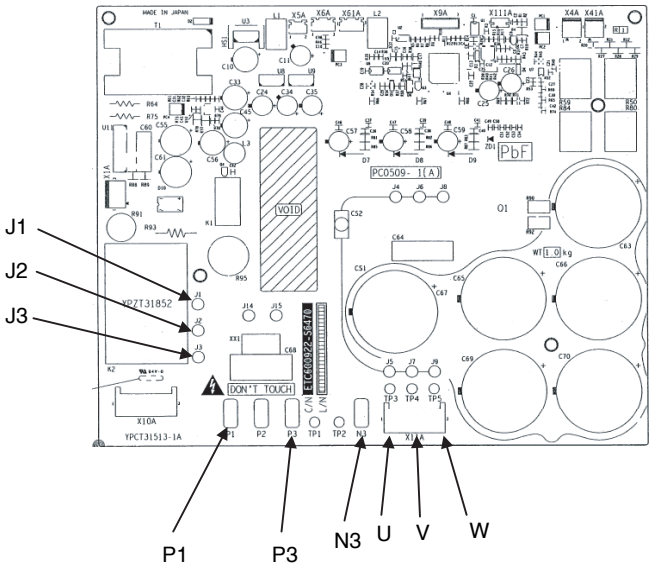
Measurement in the resistance value mode in the range of multiplying 1kΩ.

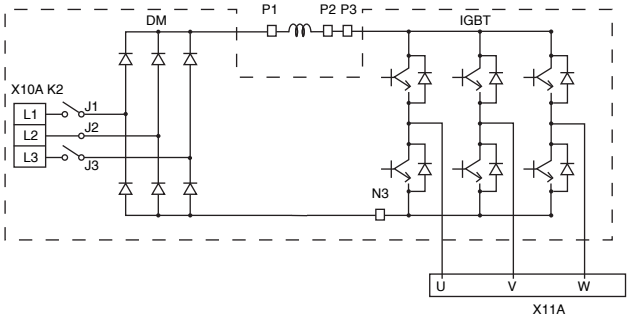
No.	Point of Measurement		Judgement Criteria	Remarks
	+	–		
1	P2	U	2 ~ 15kΩ	
2	P2	V		
3	P2	W		
4	U	P2	15kΩ and above (including ∞)	Due to condenser charge and so on, resistance measurement may require some time.
5	V	P2		
6	W	P2		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	2 ~ 15kΩ	
11	V	N3		
12	W	N3		

To use digital tester:
Measurement is executed in the diode check mode. (→|—)

No.	Point of Measurement		Judgement Criteria	Remarks
	+	–		
1	P2	U	1.2V and over	Due to condenser charge and so on, resistance measurement may require some time.
2	P2	V		
3	P2	W		
4	U	P2	0.3 ~ 0.7V	
5	V	P2		
6	W	P2		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	1.2V and over	Due to condenser charge and so on, resistance measurement may require some time.
11	V	N3		
12	W	N3		

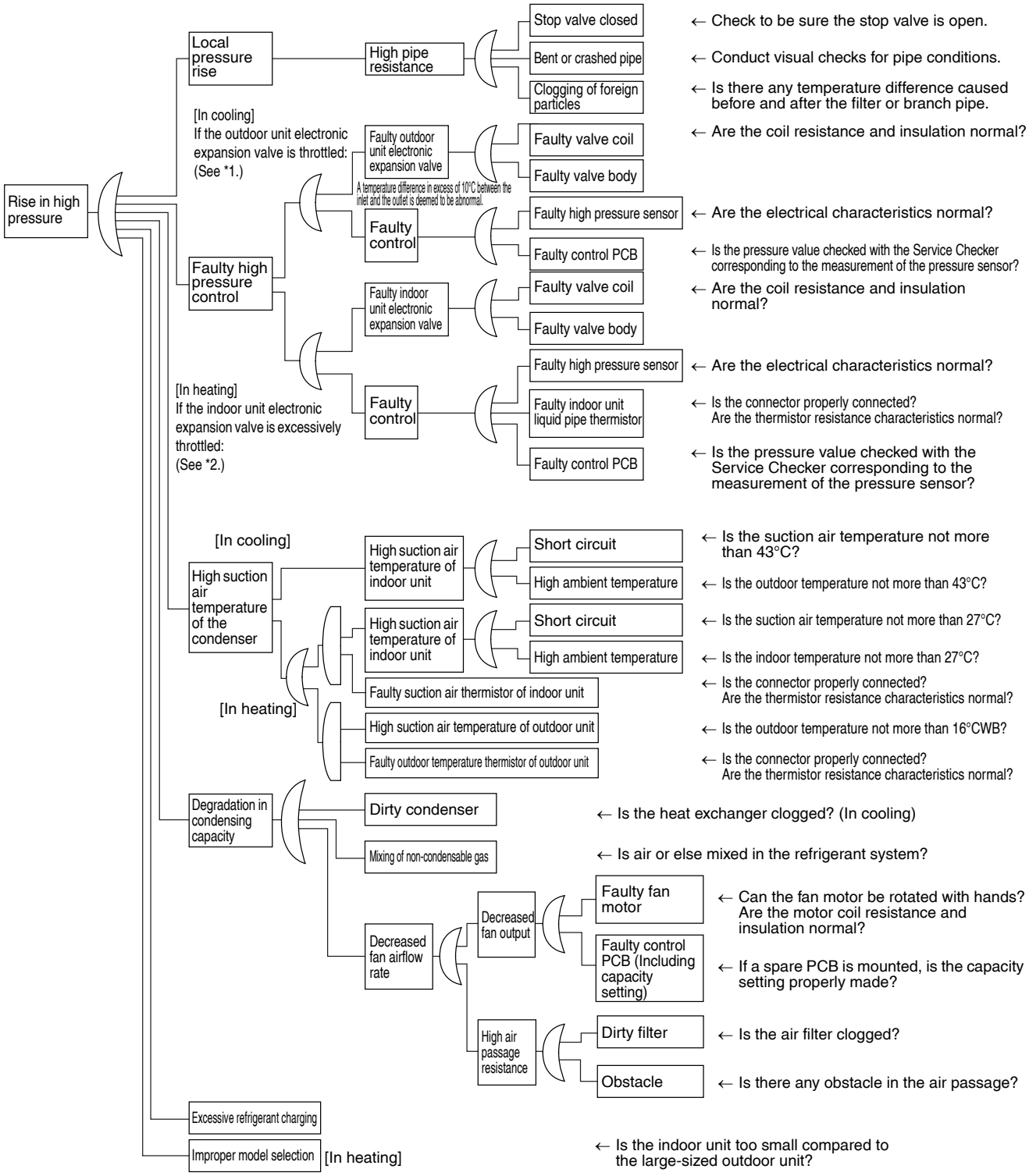
[PCB and Circuit Diagram]





[CHECK 5] **Check for causes of rise in high pressure**

Referring to the Fault Tree Analysis (FTA) shown below, probe the faulty points.

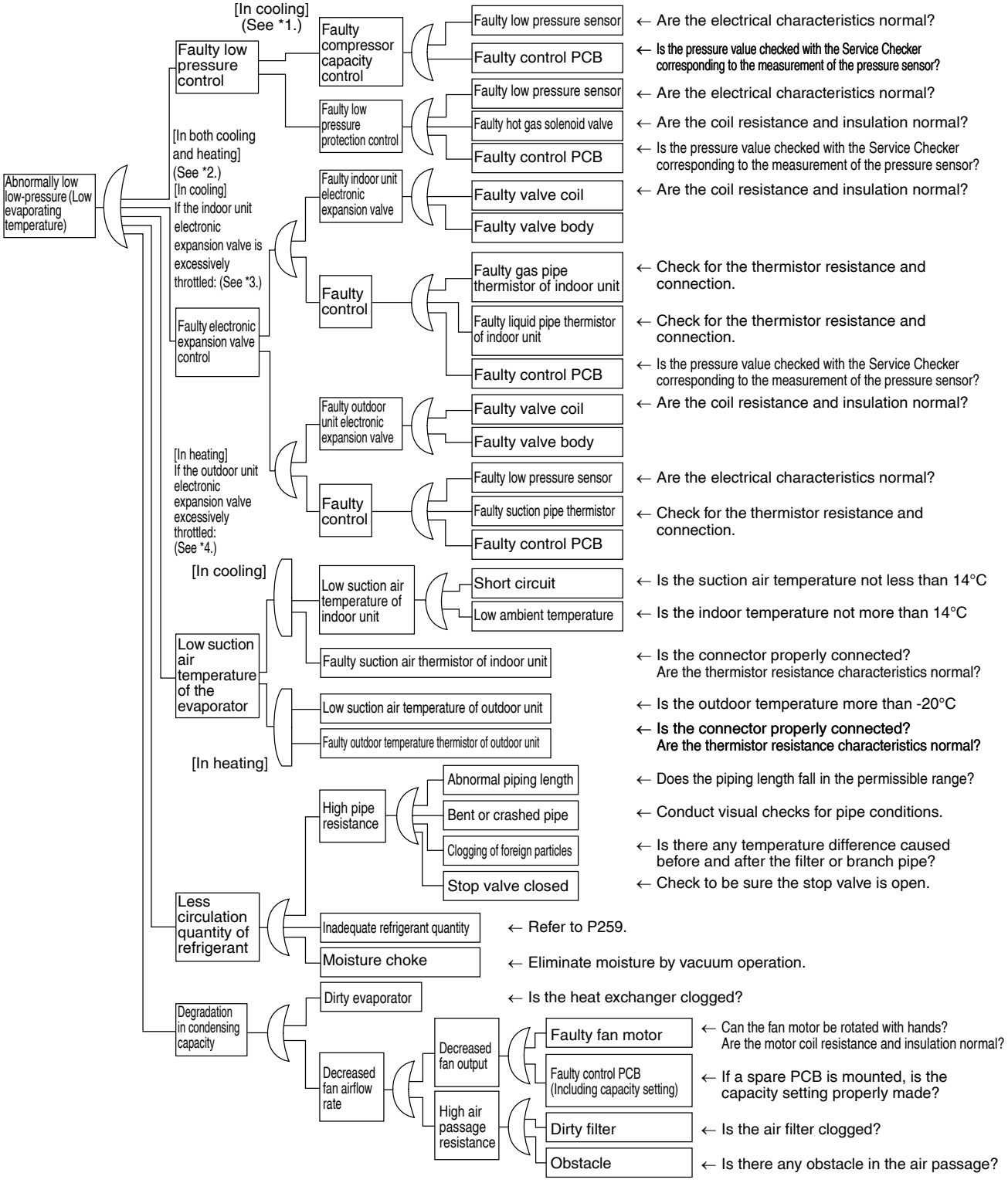


*1: In cooling, it is normal if the outdoor unit electronic expansion valve (EVM) is fully open.
*2: In heating, the indoor unit electronic expansion valve is used for “subcooled degree control”.

SDK04009

[CHECK 6] **Check for causes of drop in low pressure**

Referring to the Fault Tree Analysis (FTA) shown below, probe the faulty points.



*1: For details of the compressor capacity control while in cooling, refer to “Compressor PI Control” on P59.
*2: The “low pressure protection control” includes low pressure protection control and hot gas bypass control. For details, refer to P79.
*3: In cooling, the indoor unit electronic expansion valve is used for “superheated degree control”.
*4: In heating, the outdoor unit electronic expansion valve (EVM) is used for “superheated degree control of outdoor unit heat exchanger”.

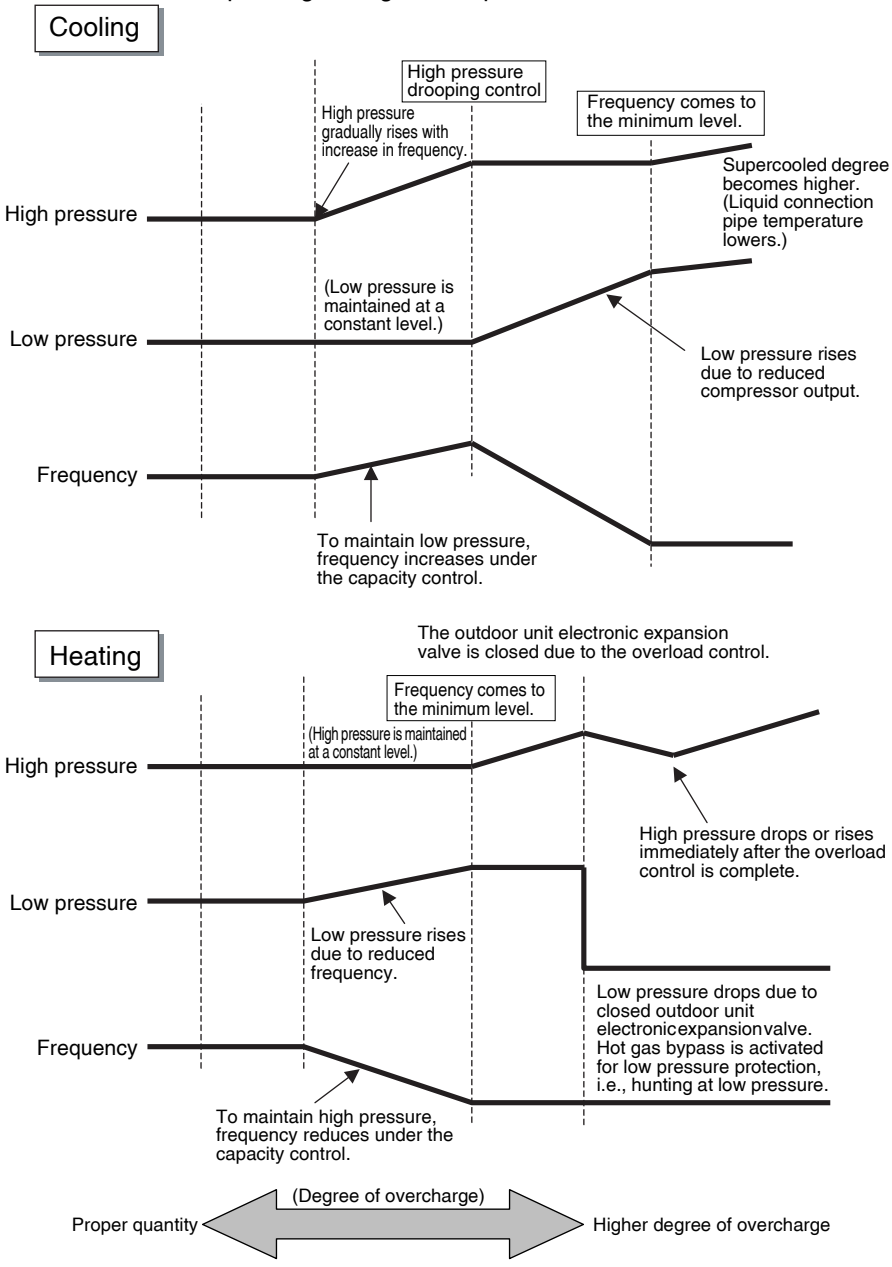
SDK04009

[CHECK 11] **Check for overcharge of refrigerant**

The only way to judge as the overcharge of refrigerant is with operating conditions due to the relationship to pressure control and electronic expansion valve control.
As information for making a judgement, refer to information provided below.

Diagnosis of overcharge of refrigerant

1. High pressure rises. Consequently, overload control is exercised to cause scant cooling capacity.
2. The superheated degree of suction gas lowers (or the wet operation is performed). Consequently, the compressor becomes lower in discharge pipe temperature despite of pressure loads.
3. The supercooled degree of condensate rises. Consequently, in heating operation, the temperature of outlet air passing through the supercooled section becomes lower.

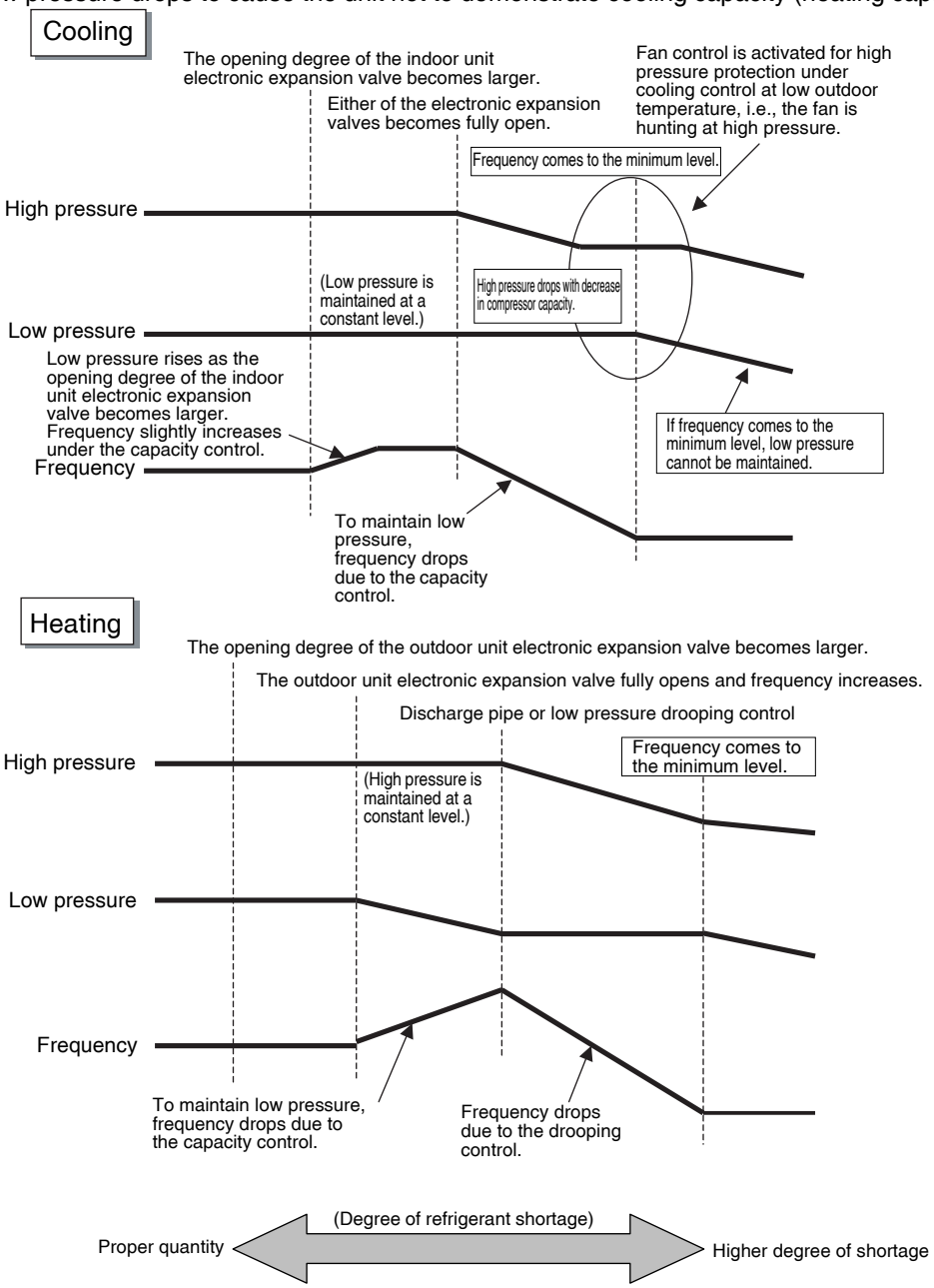


[CHECK 12] **Check for shortage of refrigerant**

The only way to judge as the shortage of refrigerant is with operating conditions due to the relationship to pressure control and electronic expansion valve control.
As information for making a judgement, refer to information provided below.

Diagnosis of shortage of refrigerant

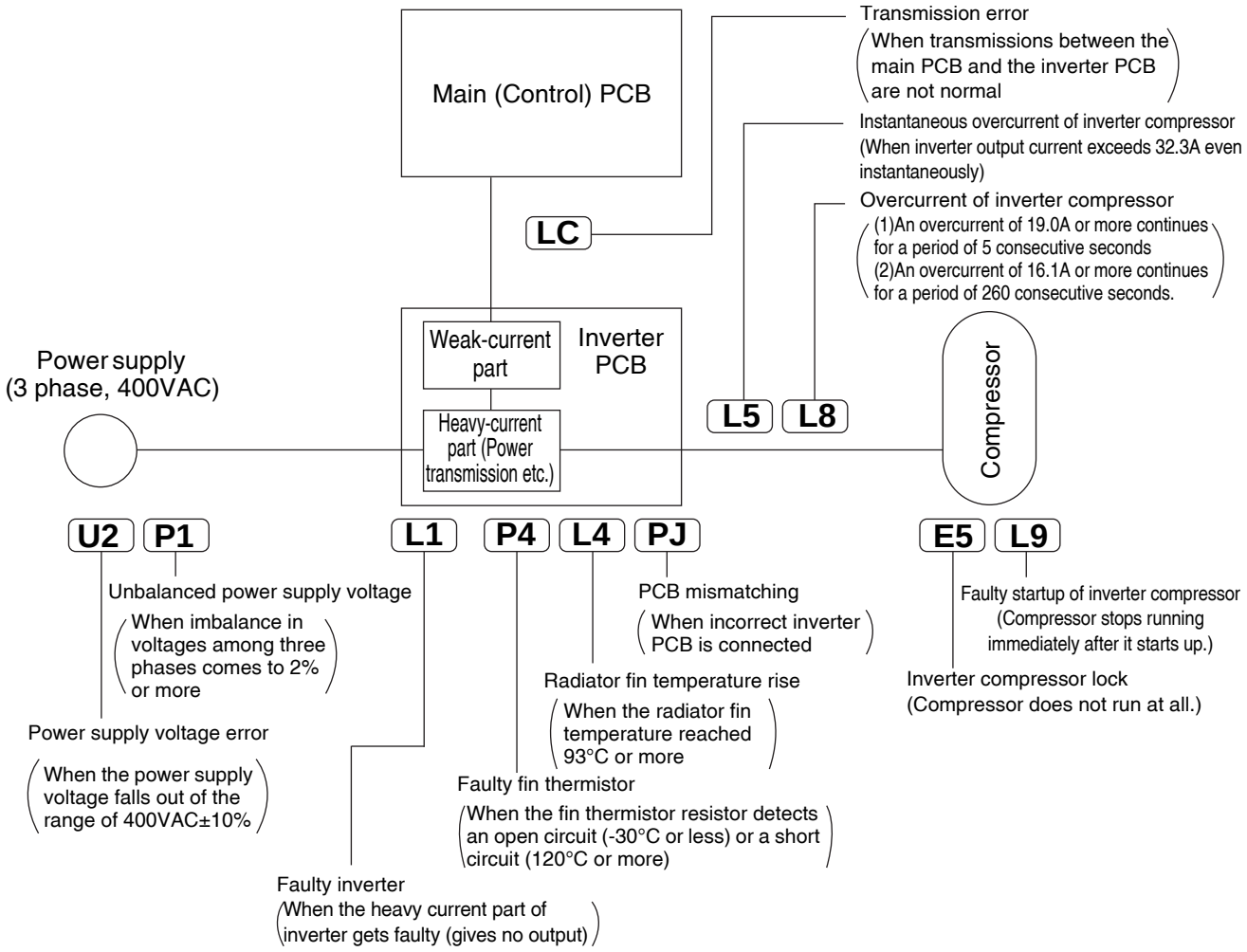
1. The superheated degree of suction gas rises. Consequently, the compressor discharge gas temperature becomes higher.
2. The superheated degree of suction gas rises. Consequently, the electronic expansion valve turns open.
3. Low pressure drops to cause the unit not to demonstrate cooling capacity (heating capacity).



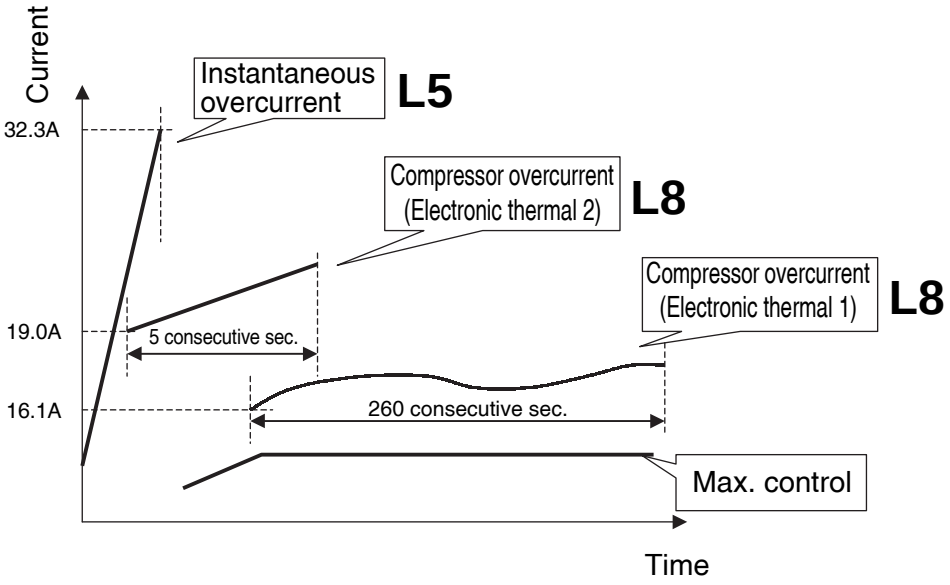
[CHECK 14] List of inverter-related malfunction codes

	Code	Name	Condition for determining malfunction	Major cause
Compressor current	L5	Instantaneous overcurrent of inverter compressor	• Inverter output current exceeds 32.3A even instantaneously.	• Liquid sealing • Faulty compressor • Faulty inverter PCB
	L8	Overcurrent of inverter compressor (Electronic thermal)	• Compressor overload running An overcurrent of 19.0A or more continues for a period of 5 consecutive seconds or that of 16.1A or more continues for a period of 260 consecutive seconds. • The inverter loses synchronization.	• Backflow of compressor liquid • Sudden changes in loads • Disconnected compressor wiring • Faulty inverter PCB
Protection device and others	L1	Faulty inverter PCB	• No output is given.	• Faulty heavy current part of compressor
	L9	Faulty startup of inverter compressor	• The compressor motor fails to start up.	• Liquid sealing or faulty compressor • Excessive oil or refrigerant • Faulty inverter PCB
	E5	Inverter compressor lock	• The compressor is in the locked status (does not rotate).	• Faulty compressor
	L4	Radiator fin temperature rise	• The radiator fin temperature reaches 87°C or more (while in operation).	• Malfunction of fan • Running in overload for an extended period of time • Faulty inverter PCB
	U2	Power supply voltage error	• The inverter power supply voltage is high or low.	• Power supply error • Faulty inverter PCB
	P1	Imbalanced power supply	• Power supply voltages get significantly imbalanced among three phases.	• Power supply error (imbalanced voltages of 2% or more) • Faulty inverter PCB • Dead inverter PCB
	LC	Transmission error (between inverter PCB and control PCB)	• With the outdoor unit PCB, no communications are carried out across control PCB - inverter PCB - fan PCB.	• Broken wire in communication line • Faulty control PCB • Faulty inverter PCB • Faulty fan PCB
	PJ	PCB mismatching	• Any PCB of specification different from that of the product is connected.	• PCB of different specification mounted
	P4	Faulty fin thermistor	• The fin thermistor gets short-circuited or open.	• Faulty fin thermistor

[CHECK 15] **Concept of inverter-related malfunction codes**



Malfunction codes related to compressor current



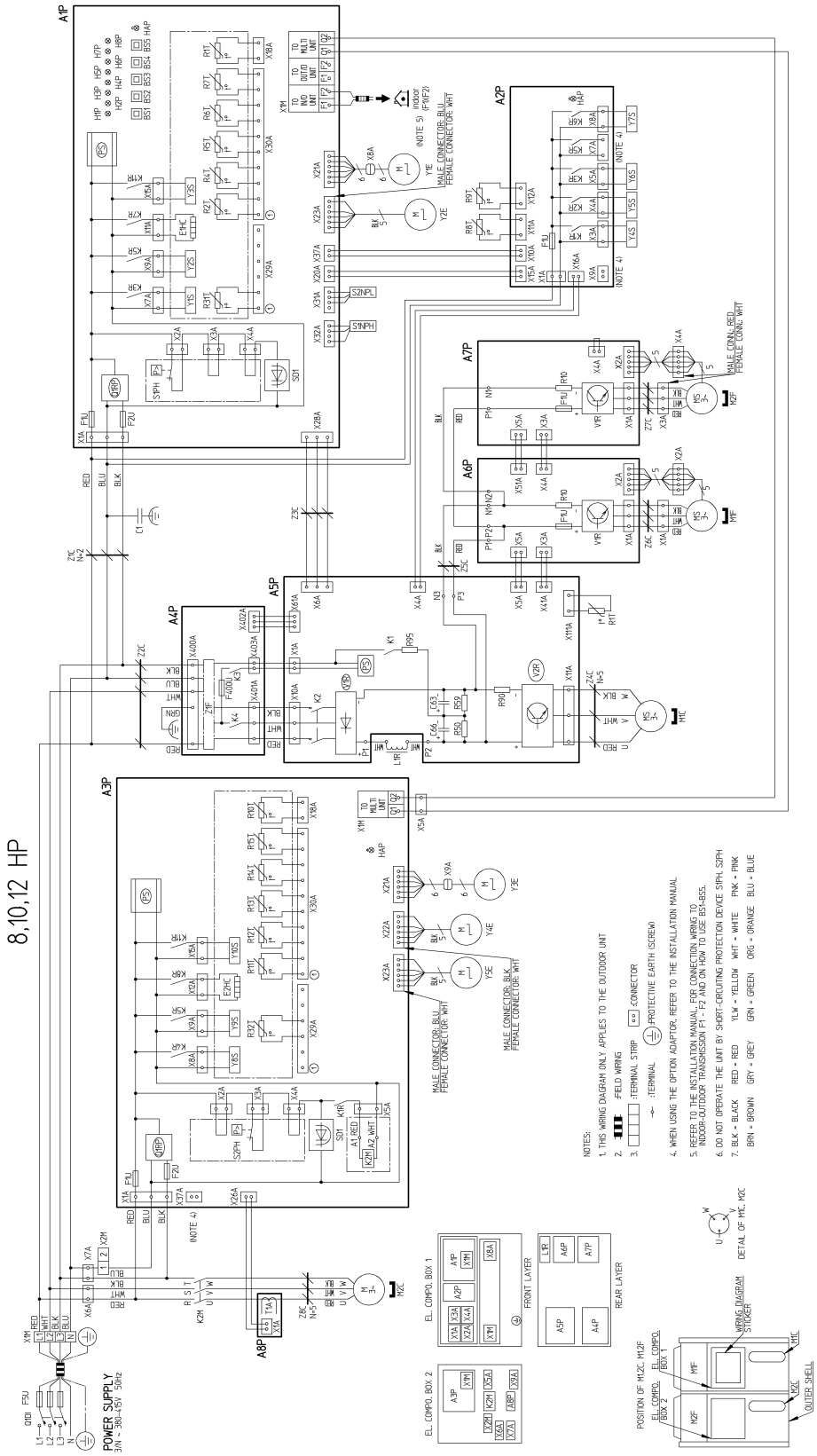
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1. Wiring Diagrams

1.1 Outdoor Unit

1.1.1 EMRQ 8/10/12 AAY1

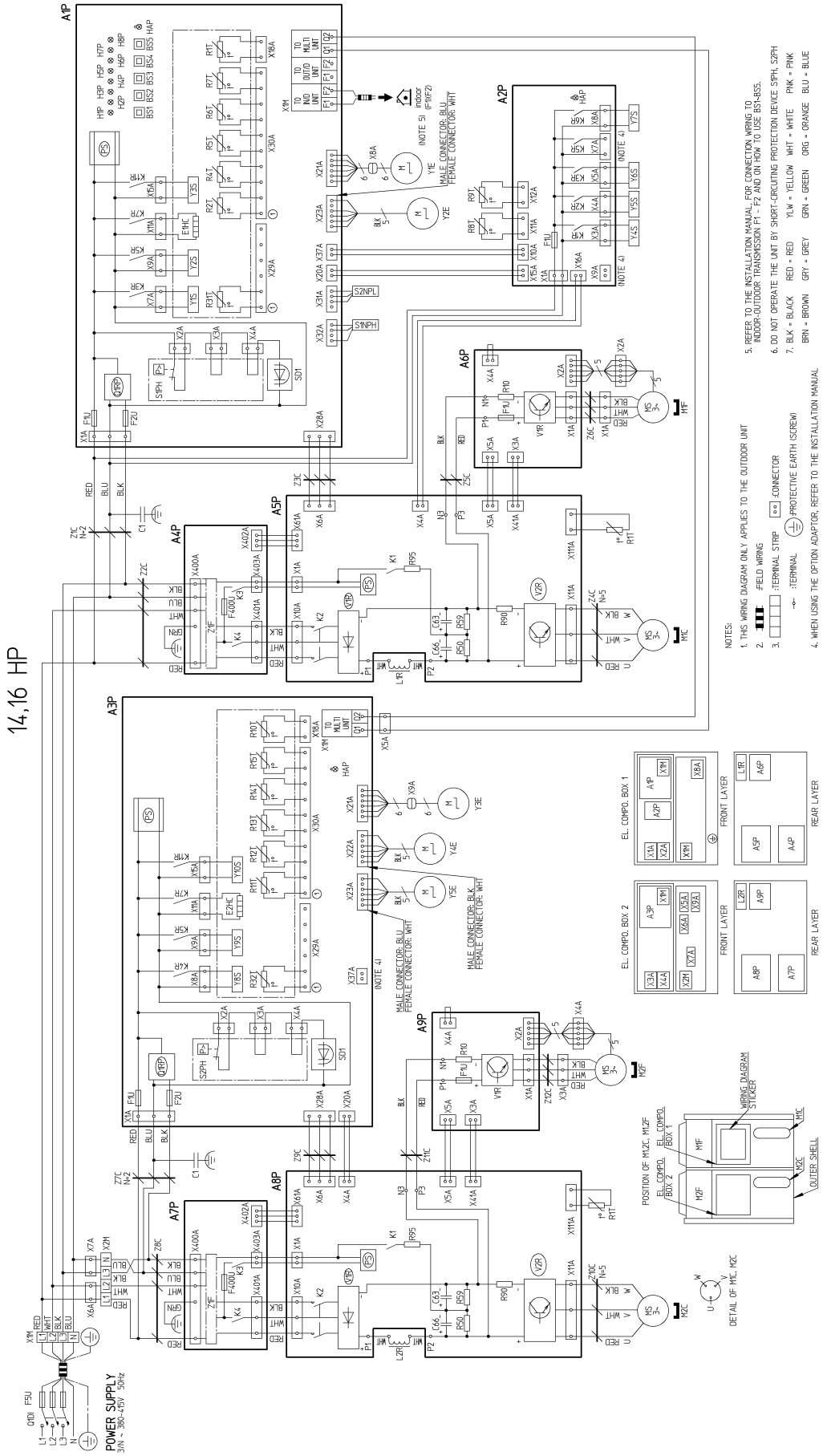


Legend

A1P~A8P	Printed circuit board	
	A1P: Main	A5P: Inverter
	A2P: Sub 1	A6P, A7P: Fan
	A3P: Sub 2	A8P: Current sensor
	A4P: Noise filter	
BS1~BS5	Push Button Switch (Mode, Set, Return, Test, Reset)	
C1, C63, C66	Capacitor	
E1HC, E2HC	Crankcase heater (A1P, A3P)	
F1U, F2U	Fuse (T, 3.15A, 250V) (A1P, A3P)	
F1U	Fuse (T, 3.15A, 250V) (A2P)	
F1U	Fuse (8A, DC650V) (A6P, A7P)	
F5U	Field fuse	
F400U	Fuse (T, 6.3A, 250V)	
H1P~H8P	Pilotlamp (Service monitor - orange) [H2P] Prepare, test ------ Flickering Malfunction detection ━ ━ Light up	
HAP	Pilot lamp (Service monitor - green) (A1P, A2P, A3P)	
K1~K4	K1: Magnetic relay	
	K3: Magnetic relay	
	K2: Magnetic contactor (M1C)	
	K4: Magnetic contactor (M1C)	
K1R~K8R, K11R	Magnetic relay	
	K1R: Y4S (A2P)	K5R: for option (A2P)
	K1R: K2M (A3P)	K5R: Y9S (A3P)
	K2R: Y5S	K6R: Y7S
	K3R: Y1S (A1P)	K7R: E1HC (A1P)
	K3R: Y6S (A2P)	K8R: E2HC (A3P)
	K4R: Y8S	K11R: Y3S (A1P)
	K5R: Y2S (A1P)	K11R: Y10S (A3P)
L1R	Reactor	
M1C, M2C	Motor (compressor)	
M1F, M2F	Motor (fan)	
PS	Switching power supply (A1P, A3P, A5P)	
Q1DI	Earth leakage breaker	
Q1RP	Reverse phase detection circuit (A1P, A3P)	

R10	Resistor (current sensor) (A6P, A7P)	
R50, R59	Resistor	
R90	Resistor (current sensor)	
R95	Resistor (current limiting)	
R1T~R15T R31T, R32T	Thermistor	
	R1T: Air (A1P)	R8T: Suction 1
	R1T: Fin (A5P)	R9T: Liquid 1
	R2T: H/E Gas 1	R10T: Suction 2
	R31T: M1C Discharge	R11T: H/E Gas 2
	R32T: M2C Discharge	R12T: H/E Deicer 2
	R4T: H/E Deicer 1	R13T: Sub cool H/E Gas 2
	R5T: Sub cool H/E Gas 1	R14T: Liquid 2
	R6T: Sub cool H/E Liq	R15T: H/E Liquid 2
	R7T: H/E Liquid 1	
S1NPH	Pressure sensor (high)	
S2NPL	Pressure sensor (low)	
S1PH, S2PH	Pressure switch (high)	
T1A	Current sensor	
SD1	Safety devices input (A1P, A3P)	
V1R	Diode bridge (A5P)	Power module (A6P, A7P)
V2R	Power module	
X1A~X9A	Connector	
X1M	Terminal strip (power supply)	
X1M	Terminal strip (control) (A1P, A3P)	
X2M	Terminal strip (relay)	
Y1E	Electronic expansion valve (main 1)	
Y2E	Electronic expansion valve (subcool 1)	
Y3E	Electronic expansion valve (main 2)	
Y4E	Electronic expansion valve (charge)	
Y5E	Electronic expansion valve (subcool 2)	
Y1S~Y10S	Solenoid valve	
	Y1S: RMTG	Y6S: RMTT
	Y2S: 4-way valve (H/E 1)	Y7S: RMTO
	Y3S: RMTL	Y8S: 4-way valve (pipe)
	Y4S: Hot gas	Y9S: 4-way valve (H/E 2)
	Y5S: EV Bypass 1	Y10S: EV Bypass 2
Z1C~Z8C	Noise filter (ferrite core)	
Z1F	Noise filter (with surge absorber)	
Connector for optional parts		
X7A	Operation output (A2P)	
X9A	Power supply (adapter) (A2P)	
X37A	Power supply (adapter) (A3P)	

1.1.2 EMRQ 14/16 AAY1



Legend

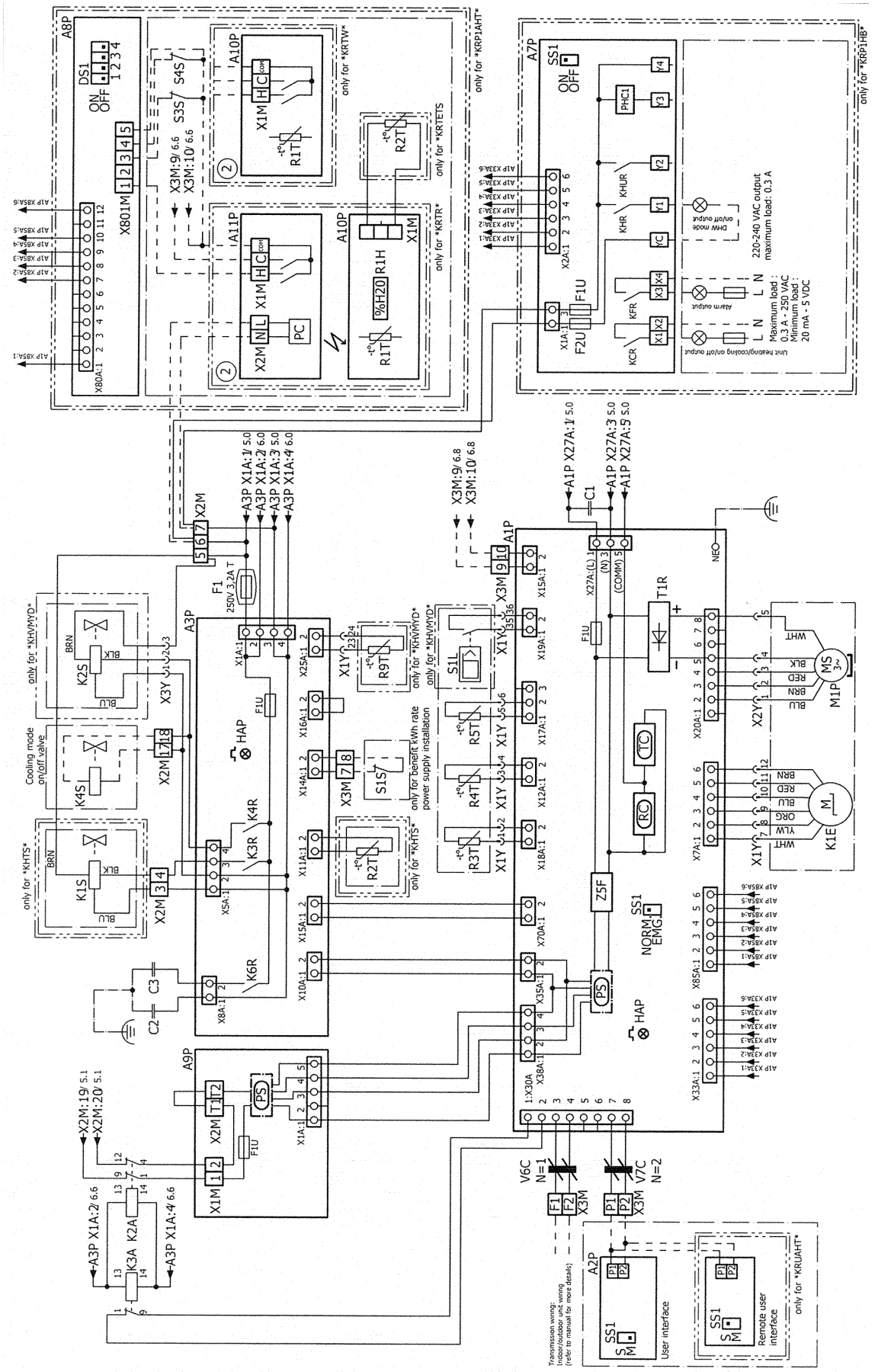
A1P~A8P	Printed circuit board	
	A1P: Main	A5P, A8P: Inverter
	A2P: Sub 1	A6P, A9P: Fan
	A3P: Sub 2	
	A4P, A7P: Noise filter	
BS1~BS5	Push Button Switch (Mode, Set, Return, Test, Reset)	
C1, C63, C66	Capacitor	
E1HC, E2HC	Crankcase heater (A1P, A3P)	
F1U, F2U	Fuse (T, 3.15A, 250V) (A1P, A3P)	
F1U	Fuse (T, 3.15A, 250V) (A2P)	
F1U	Fuse (8A, DC650V) (A6P, A9P)	
F5U	Field fuse	
F400U	Fuse (T, 6.3A, 250V) (A4P)(A7P)	
H1P~H8P	Pilotlamp (Service monitor - orange) [H2P] Prepare, test ------ Flickering Malfunction detection — — Light up	
HAP	Pilot lamp (Service monitor - green) (A1P, A2P, A3P)	
K1~K4	K1: Magnetic relay (A5P, A8P)	
	K3: Magnetic relay (A4P, A7P)	
	K2: Magnetic contactor (M1C-A5P, M2C-A8P)	
	K4: Magnetic contactor (M1C-A4P, M2C-A7P)	
K1R~K7R, K11R	Magnetic relay	
	K1R: Y4S	K5R: for option (A2P)
	K2R: Y5S	K5R: Y9S (A3P)
	K3R: Y1S (A1P)	K6R: Y7S (A2P)
	K3R: Y6S (A2P)	K7R: E1HC (A1P)
	K4R: Y8S	K7R: (E2HC) (A3P)
	K5R: Y2S (A1P)	K11R: Y10S (A3P)
L1R, L2R	Reactor	
M1C, M2C	Motor (compressor)	
M1F, M2F	Motor (fan)	
PS	Switching power supply (A1P, A3P, A5P, A8P)	
Q1DI	Earth leakage breaker	
Q1RP	Reverse phase detection circuit (A1P, A3P)	

R10	Resistor (current sensor) (A6P, A9P)	
R50, R59	Resistor (A5P, A8P)	
R90	Resistor (current sensor) (A5P, A8P)	
R95	Resistor (current limiting) (A5P, A8P)	
R1T~R15T R31T, R32T	Thermistor	
	R1T: Air (A1P)	R8T: Suction 1
	R1T: Fin (A5P, A8P)	R9T: Liquid 1
	R2T: H/E Gas 1	R10T: Suction 2
	R31T: M1C Discharge	R11T: H/E Gas 2
	R32T: M2C Discharge	R12T: H/E Deicer 2
	R4T: H/E Deicer 1	R13T: Sub cool H/E Gas 2
	R5T: Sub cool H/E Gas 1	R14T: Liquid 2
	R6T: Sub cool H/E Liq	R15T: H/E Liquid 2
	R7T: H/E Liquid 1	
S1NPH	Pressure sensor (high)	
S2NPL	Pressure sensor (low)	
S1PH, S2PH	Pressure switch (high)	
SD1	Safety devices input (A1P, A3P)	
V1R	Diode bridge (A5P, A8P)	Power module (A6P, A9P)
V2R	Power module (A5P, A8P)	
X1A~X9A	Connector	
X1M	Terminal strip (power supply)	
X1M	Terminal strip (control) (A1P, A3P)	
X2M	Terminal strip (relay)	
Y1E	Electronic expansion valve (main 1)	
Y2E	Electronic expansion valve (subcool 1)	
Y3E	Electronic expansion valve (main 2)	
Y4E	Electronic expansion valve (charge)	
Y5E	Electronic expansion valve (subcool 2)	
Y1S~Y10S	Solenoid valve	
	Y1S: RMTG	Y6S: RMTT
	Y2S: 4-way valve (H/E 1)	Y7S: RMTO
	Y3S: RMTL	Y8S: 4-way valve (pipe)
	Y4S: Hot gas	Y9S: 4-way valve (H/E 2)
	Y5S: EV Bypass 1	Y10S: EV Bypass 2
Z1C~Z12C	Noise filter (ferrite core)	
Z1F	Noise filter (with surge absorber) (A4P, A7P)	
Connector for optional parts		
X7A	Operation output (A2P)	
X9A	Power supply (adapter) (A2P)	
X37A	Power supply (adapter) (A3P)	

1.2 Indoor Unit

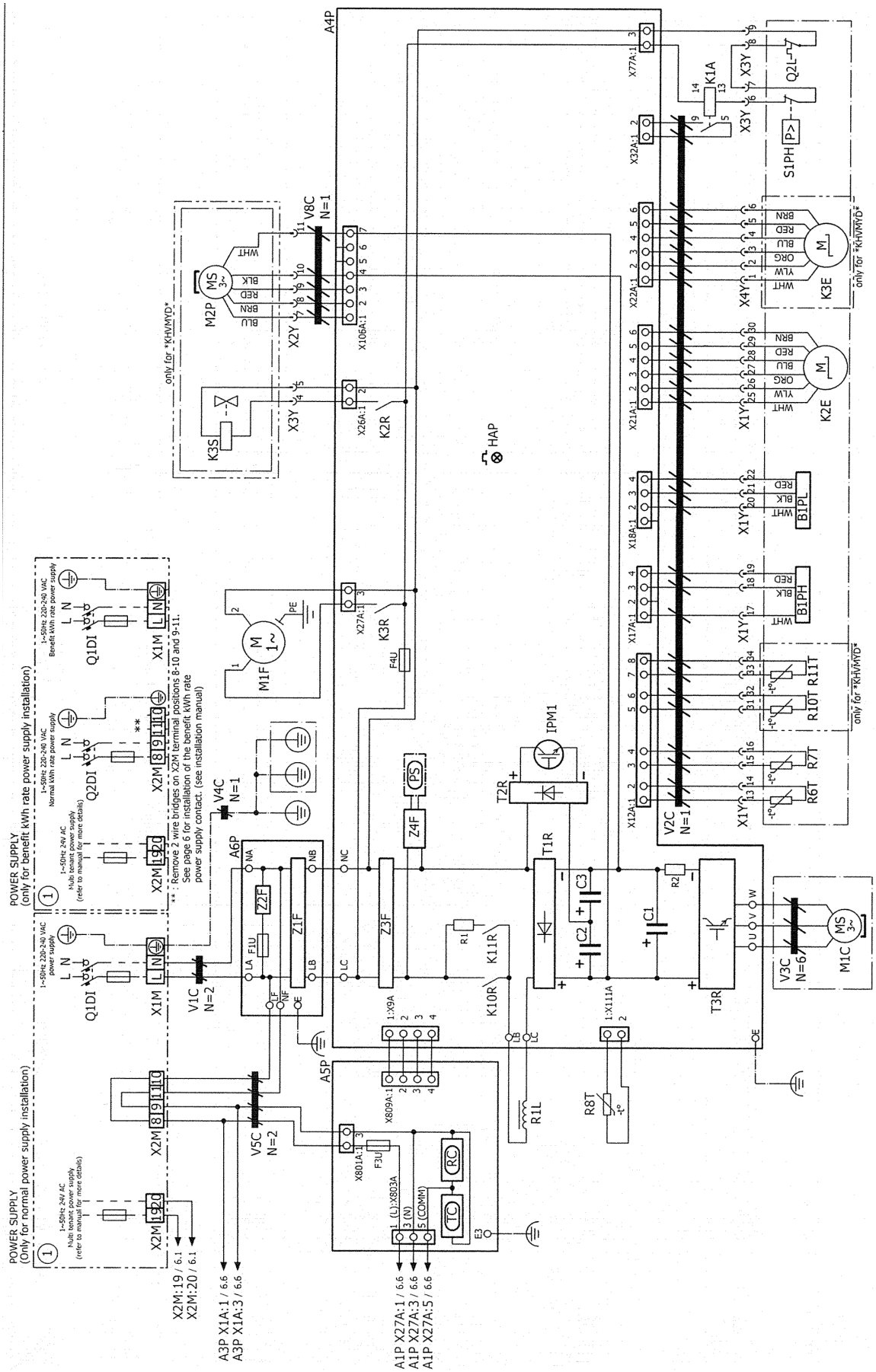
1.2.1 Control Circuit

EKHVM (R/Y) D AA/ABV1



1.2.2 Compressor Circuit

EKHVM (R/Y) D AA/ABV1



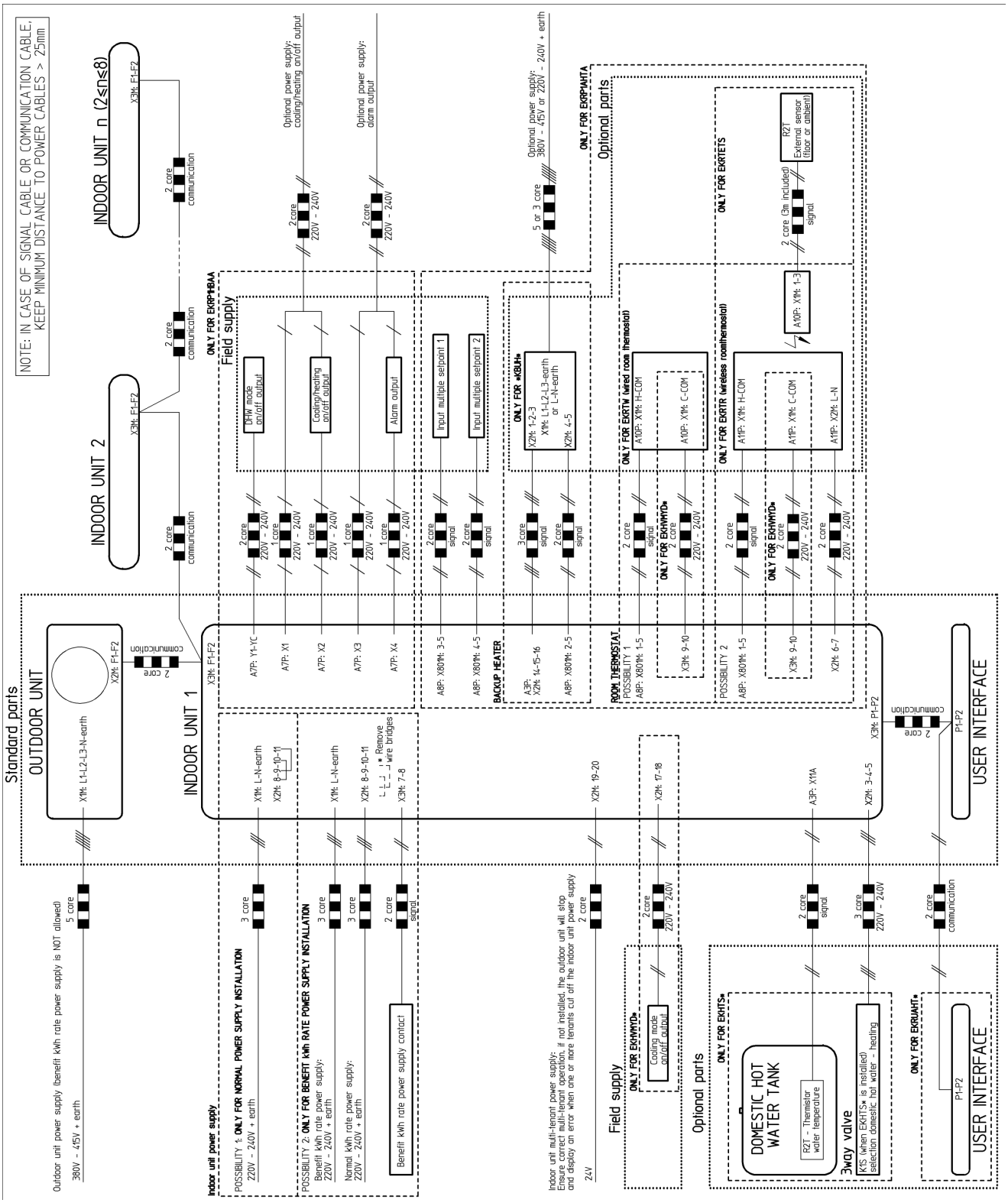
1.2.3 Legend

Part number		Description
A1P		Main PCB
A2P		User interface PCB
A3P		Control PCB
A4P		Inverter PCB
A5P		QA PCB
A6P		Filter PCB
A7P	*	Digital I/O PCB
A8P	*	Demand PCB
A9P		Multi tenant PCB
A10P	*	Thermostat PCB
A11P	*	Receiver PCB
B1PH		High pressure sensor
B1PL		Low pressure sensor
C1 - C3		Filter capacitor
C1 - C3 (A4P)		PCB capacitor
DS1 (A*P)		Dip switch
F1U		Fuse (T, 3.2A, 250V)
F1U (A1P, A3P, A9P)		Fuse (T, 3.15A, 250V)
F1U (A6P)		Fuse (T, 6.3A, 250V)
F1U - F2U (A7P)	*	Fuse (5A, 250V)
F3U - F4U (A*P)		Fuse (T, 6.3A, 250V)
HAP (A*P)		PCB LED
IPM1		Integrated power module
K1A - K3A		Interface relay
K1E - K3E		Electronic expansion valve
K*R (A*P)		PCB relay
K1S	*	3-way valve
K2S		3-way valve
K3S		3-way valve
K4S	#	2-way valve
M1C		Compressor
M1F		Switch box cooling fan
M1P - M2P		DC inverter pump
PC (A11P)	*	Power circuit
PHC1 (A7P)	*	Optocoupler input circuit
PS (A*P)		Switching power supply
Q1DI - Q2DI	#	Earth leakage protector
Q2L		Thermal protector water piping
R1 - R2 (A4P)		Resistance
R1L		Reactor
R1H (A10P)	*	Humidity sensor
R1T (A10P)	*	Ambient sensor
R2T	*	Domestic hot water tank thermistor
R2T	*	External sensor (floor or ambient)
R3T		Liquid thermistor R410A
R4T		Returning water thermistor
R5T		Leaving water thermistor (heating)
R6T		Discharge thermistor
R7T		Liquid thermistor R134a

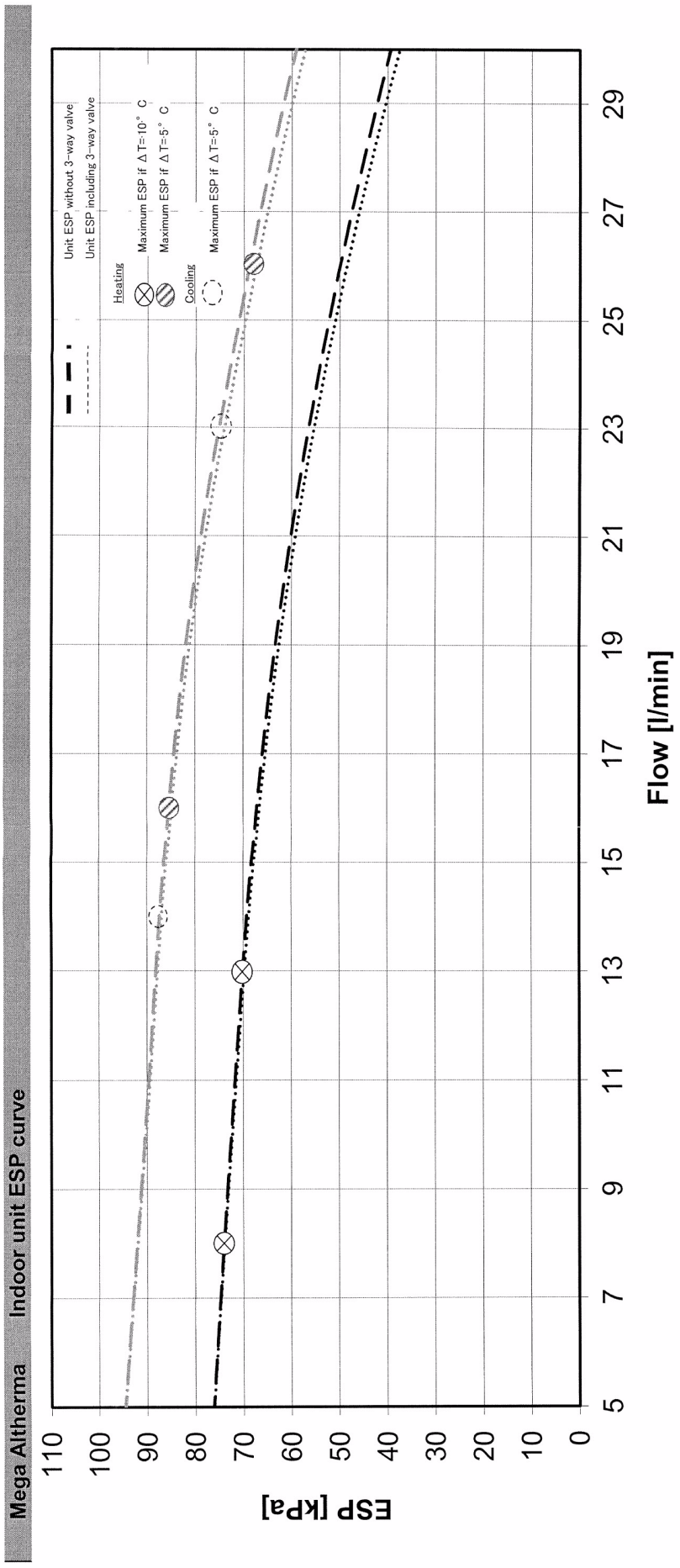
Part number		Description
R8T		Fin thermistor
R9T		Leaving water thermistor (cooling)
R10T		Liquid thermistor (cooling)
R11T		Suction thermistor (cooling)
RC (A*P)		Receiver circuit
S1PH		High pressure switch
S1S	#	Benefit kWh rate power supply contact
S3S	#	Input multiple setpoint 1
S4S	#	Input multiple setpoint 2
SS1 (A1P)		Selector switch (emergency)
SS1 (A2P)		Selector switch (master slave)
SS1 (A7P)	*	Selector switch
TC (A*P)		Transmitter circuit
T1R - T2R (A*P)		Diode bridge
T3R		Power module
V1C - V8C		Ferrite core noise filter
X1M - X3M		Terminal strip
X*M (A*P)	*	PCB terminal strip
X1Y - X4Y		Connector
Z1F - Z5F (A*P)		Noise filter

1.3 Field Wiring Connection Diagram

EMRQ in combination with EKHVMR/YD*



2. ESP Curve


Mega Altherma Indoor unit ESP curve
Unit ESP without 3-way valve
Unit ESP including 3-way valve
Heating
Maximum ESP if ΔT=10° C
Maximum ESP if ΔT=5° C
Cooling
Maximum ESP if ΔT=5° C
ESP [kPa]
110
100
90
80
70
60
50
40
30
20
10
0
5
7
9
11
13
15
17
19
21
23
25
27
29
Flow [l/min]

3. Thermistor Resistance / Temperature Characteristics

Indoor unit	For air suction	R1T
	For liquid pipe	R2T
	For gas pipe	R3T

Outdoor unit for fin thermistor R1T	Outdoor unit	For outdoor air R1T
		For coil R2T
		For suction pipe R4T
		For Receiver gas pipe R5T
		For Receiver outlet liquid pipe R6T

TºC	kΩ
-10	-
-8	-
-6	88.0
-4	79.1
-2	71.1
0	64.1
2	57.8
4	52.3
6	47.3
8	42.9
10	38.9
12	35.3
14	32.1
16	29.2
18	26.6
20	24.3
22	22.2
24	20.3
26	18.5
28	17.0
30	15.6
32	14.2
34	13.1
36	12.0
38	11.1
40	10.3
42	9.5
44	8.8
46	8.2
48	7.6
50	7.0
52	6.7
54	6.0
56	5.5
58	5.2
60	4.79
62	4.46
64	4.15
66	3.87
68	3.61
70	3.37
72	3.15
74	2.94
76	2.75
78	2.51
80	2.41
82	2.26
84	2.12
86	1.99
88	1.87
90	1.76
92	1.65
94	1.55
96	1.46
98	1.38

T°C	kΩ	T°C	kΩ	T°C	kΩ	T°C	kΩ
-20	197.81	-19.5	192.08	30	16.10	30.5	15.76
-19	186.53	-18.5	181.16	31	15.43	31.5	15.10
-18	175.97	-17.5	170.94	32	14.79	32.5	14.48
-17	166.07	-16.5	161.36	33	14.18	33.5	13.88
-16	156.80	-15.5	152.38	34	13.59	34.5	13.31
-15	148.10	-14.5	143.96	35	13.04	35.5	12.77
-14	139.94	-13.5	136.05	36	12.51	36.5	12.25
-13	132.28	-12.5	128.63	37	12.01	37.5	11.76
-12	125.09	-11.5	121.66	38	11.52	38.5	11.29
-11	118.34	-10.5	115.12	39	11.06	39.5	10.84
-10	111.99	-9.5	108.96	40	10.63	40.5	10.41
-9	106.03	-8.5	103.18	41	10.21	41.5	10.00
-8	100.41	-7.5	97.73	42	9.81	42.5	9.61
-7	95.14	-6.5	92.61	43	9.42	43.5	9.24
-6	90.17	-5.5	87.79	44	9.06	44.5	8.88
-5	85.49	-4.5	83.25	45	8.71	45.5	8.54
-4	81.08	-3.5	78.97	46	8.37	46.5	8.21
-3	76.93	-2.5	74.94	47	8.05	47.5	7.90
-2	73.01	-1.5	71.14	48	7.75	48.5	7.60
-1	69.32	-0.5	67.56	49	7.46	49.5	7.31
0	65.84	0.5	64.17	50	7.18	50.5	7.04
1	62.54	1.5	60.96	51	6.91	51.5	6.78
2	59.43	2.5	57.94	52	6.65	52.5	6.53
3	56.49	3.5	55.08	53	6.41	53.5	6.53
4	53.71	4.5	52.38	54	6.65	54.5	6.53
5	51.09	5.5	49.83	55	6.41	55.5	6.53
6	48.61	6.5	47.42	56	6.18	56.5	6.06
7	46.26	7.5	45.14	57	5.95	57.5	5.84
8	44.05	8.5	42.98	58	5.74	58.5	5.43
9	41.95	9.5	40.94	59	5.14	59.5	5.05
10	39.96	10.5	39.01	60	4.96	60.5	4.87
11	38.08	11.5	37.18	61	4.79	61.5	4.70
12	36.30	12.5	35.45	62	4.62	62.5	4.54
13	34.62	13.5	33.81	63	4.46	63.5	4.38
14	33.02	14.5	32.25	64	4.30	64.5	4.23
15	31.50	15.5	30.77	65	4.16	65.5	4.08
16	30.06	16.5	29.37	66	4.01	66.5	3.94
17	28.70	17.5	28.05	67	3.88	67.5	3.81
18	27.41	18.5	26.78	68	3.75	68.5	3.68
19	26.18	19.5	25.59	69	3.62	69.5	3.56
20	25.01	20.5	24.45	70	3.50	70.5	3.44
21	23.91	21.5	23.37	71	3.38	71.5	3.32
22	22.85	22.5	22.35	72	3.27	72.5	3.21
23	21.85	23.5	21.37	73	3.16	73.5	3.11
24	20.90	24.5	20.45	74	3.06	74.5	3.01
25	20.00	25.5	19.56	75	2.96	75.5	2.91
26	19.14	26.5	18.73	76	2.86	76.5	2.82
27	18.32	27.5	17.93	77	2.77	77.5	2.72
28	17.54	28.5	17.17	78	2.68	78.5	2.64
29	16.80	29.5	16.45	79	2.60	79.5	2.55
30	16.10	30.5	15.76	80	2.51	80.5	2.47

Outdoor Unit Thermistors for Discharge Pipe (R3T, R31T, R32T)

T°C	kΩ	T°C	kΩ	T°C	kΩ	T°C	kΩ	T°C	kΩ	T°C	kΩ
0	640.44	0.5	624.65	50	72.32	50.5	70.96	100	13.35	100.5	13.15
1	609.31	1.5	594.43	51	69.64	51.5	68.34	101	12.95	101.5	12.76
2	579.96	2.5	565.78	52	67.06	52.5	65.82	102	12.57	102.5	12.38
3	552.00	3.5	538.63	53	64.60	53.5	63.41	103	12.20	103.5	12.01
4	525.63	4.5	512.97	54	62.24	54.5	61.09	104	11.84	104.5	11.66
5	500.66	5.5	488.67	55	59.97	55.5	58.87	105	11.49	105.5	11.32
6	477.01	6.5	465.65	56	57.80	56.5	56.75	106	11.15	106.5	10.99
7	454.60	7.5	443.84	57	55.72	57.5	54.70	107	10.83	107.5	10.67
8	433.37	8.5	423.17	58	53.72	58.5	52.84	108	10.52	108.5	10.36
9	413.24	9.5	403.57	59	51.98	59.5	50.96	109	10.21	109.5	10.06
10	394.16	10.5	384.98	60	49.96	60.5	49.06	110	9.92	110.5	9.78
11	376.05	11.5	367.35	61	48.19	61.5	47.33	111	9.64	111.5	9.50
12	358.88	12.5	350.62	62	46.49	62.5	45.67	112	9.36	112.5	9.23
13	342.58	13.5	334.74	63	44.86	63.5	44.07	113	9.10	113.5	8.97
14	327.10	14.5	319.66	64	43.30	64.5	42.54	114	8.84	114.5	8.71
15	312.41	15.5	305.33	65	41.79	65.5	41.06	115	8.59	115.5	8.47
16	298.45	16.5	291.73	66	40.35	66.5	39.65	116	8.35	116.5	8.23
17	285.18	17.5	278.80	67	38.96	67.5	38.29	117	8.12	117.5	8.01
18	272.58	18.5	266.51	68	37.63	68.5	36.98	118	7.89	118.5	7.78
19	260.60	19.5	254.72	69	36.34	69.5	35.72	119	7.68	119.5	7.57
20	249.00	20.5	243.61	70	35.11	70.5	34.51	120	7.47	120.5	7.36
21	238.36	21.5	233.14	71	33.92	71.5	33.35	121	7.26	121.5	7.16
22	228.05	22.5	223.08	72	32.78	72.5	32.23	122	7.06	122.5	6.97
23	218.24	23.5	213.51	73	31.69	73.5	31.15	123	6.87	123.5	6.78
24	208.90	24.5	204.39	74	30.63	74.5	30.12	124	6.69	124.5	6.59
25	200.00	25.5	195.71	75	29.61	75.5	29.12	125	6.51	125.5	6.42
26	191.53	26.5	187.44	76	28.64	76.5	28.16	126	6.33	126.5	6.25
27	183.46	27.5	179.57	77	27.69	77.5	27.24	127	6.16	127.5	6.08
28	175.77	28.5	172.06	78	26.79	78.5	26.35	128	6.00	128.5	5.92
29	168.44	29.5	164.90	79	25.91	79.5	25.49	129	5.84	129.5	5.76
30	161.45	30.5	158.08	80	25.07	80.5	24.66	130	5.69	130.5	5.61
31	154.79	31.5	151.57	81	24.26	81.5	23.87	131	5.54	131.5	5.46
32	148.43	32.5	145.37	82	23.48	82.5	23.10	132	5.39	132.5	5.32
33	142.37	33.5	139.44	83	22.73	83.5	22.36	133	5.25	133.5	5.18
34	136.59	34.5	133.79	84	22.01	84.5	21.65	134	5.12	134.5	5.05
35	131.06	35.5	128.39	85	21.31	85.5	20.97	135	4.98	135.5	4.92
36	125.79	36.5	123.24	86	20.63	86.5	20.31	136	4.86	136.5	4.79
37	120.76	37.5	118.32	87	19.98	87.5	19.67	137	4.73	137.5	4.67
38	115.95	38.5	113.62	88	19.36	88.5	19.05	138	4.61	138.5	4.55
39	111.35	39.5	109.13	89	18.75	89.5	18.46	139	4.49	139.5	4.44
40	106.96	40.5	104.84	90	18.17	90.5	17.89	140	4.38	140.5	4.32
41	102.76	41.5	100.73	91	17.61	91.5	17.34	141	4.27	141.5	4.22
42	98.75	42.5	96.81	92	17.07	92.5	16.80	142	4.16	142.5	4.11
43	94.92	43.5	93.06	93	16.54	93.5	16.29	143	4.06	143.5	4.01
44	91.25	44.5	89.47	94	16.04	94.5	15.79	144	3.96	144.5	3.91
45	87.74	45.5	86.04	95	15.55	95.5	15.31	145	3.86	145.5	3.81
46	84.38	46.5	82.75	96	15.08	96.5	14.85	146	3.76	146.5	3.72
47	81.16	47.5	79.61	97	14.62	97.5	14.40	147	3.67	147.5	3.62
48	78.09	48.5	76.60	98	14.18	98.5	13.97	148	3.58	148.5	3.54
49	75.14	49.5	73.71	99	13.76	99.5	13.55	149	3.49	149.5	3.45
50	72.32	50.5	70.96	100	13.35	100.5	13.15	150	3.41	150.5	3.37

Tank Thermistor (R2T)

NTC-curve

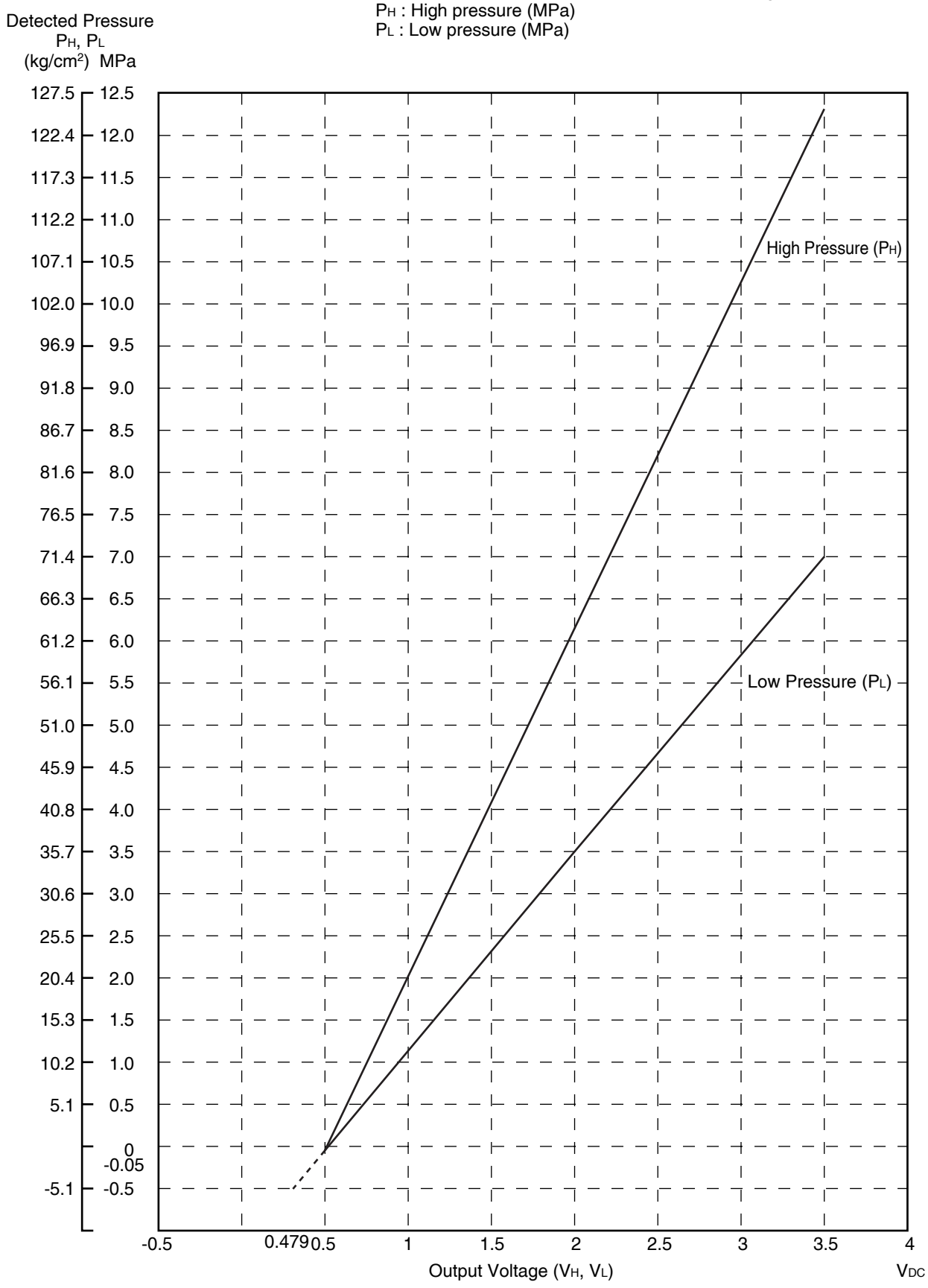
T°C	Resistance value
-20	197.81 kΩ
0	65.84 kΩ
25	20 kΩ

4. Pressure Sensor Characteristics

4.1 Outdoor Unit EMRQ

$P_H = 4.1V_H-2.05$
$P_L = 7/3 \times V_L-7/6$
P_H : High pressure (MPa)
P_L : Low pressure (MPa)

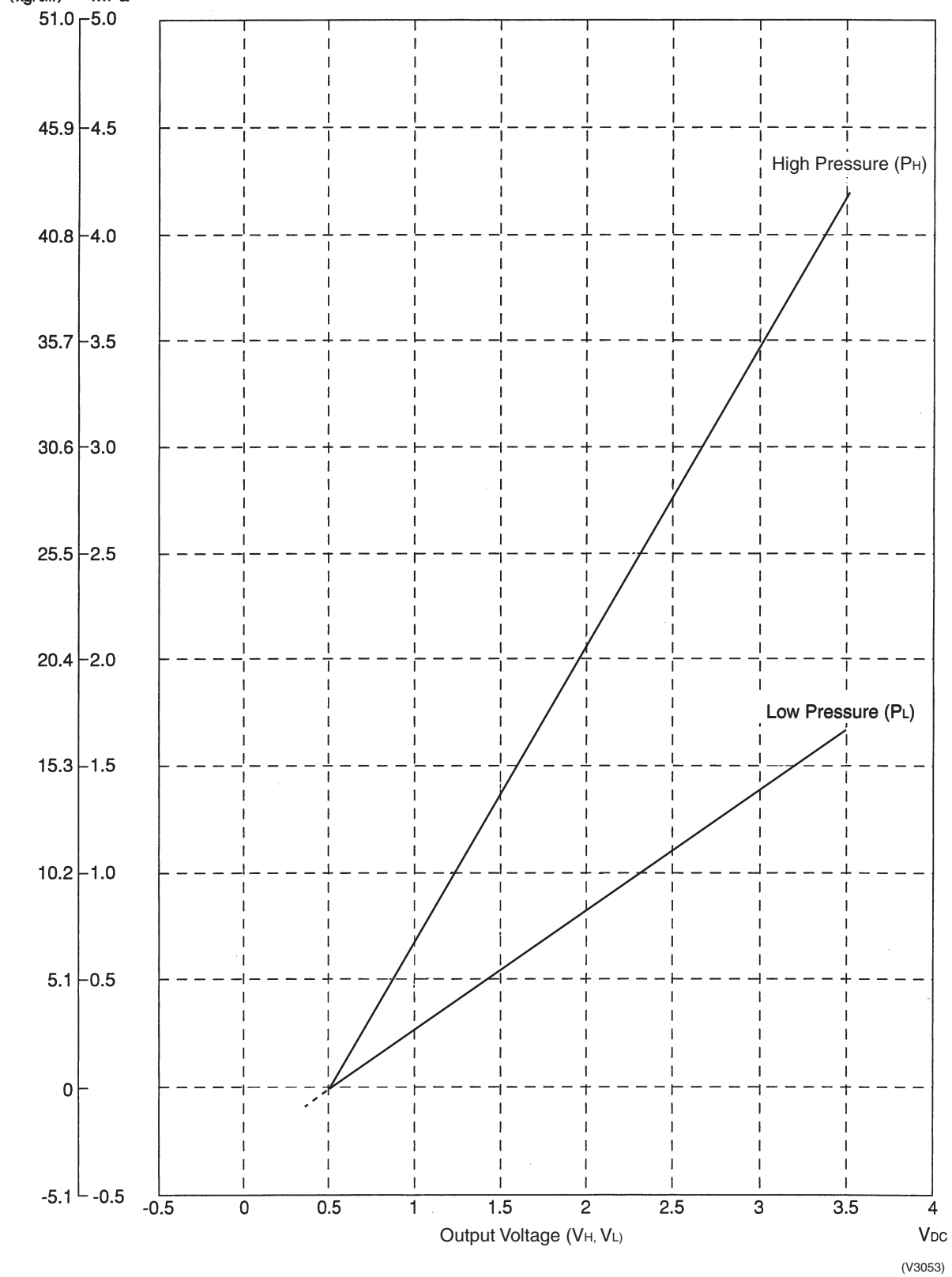
V_H : Output Voltage [High Side] V_{DC}
V_L : Output Voltage [Low Side] V_{DC}



4.2 Indoor Unit EKHVM(R/Y)D

P_H = 1.38V-0.69
P_L = 0.57V-0.28
P_H : High pressure (MPa)
V_L : Low pressure (MPa)
V : Voltage (V)

P_H : Detected Pressure [High Side] MPa
P_L : Detected Pressure [Low Side] MPa
V_H : Output Voltage [High Side] V_{DC}
V_L : Output Voltage [Low Side] V_{DC}



5. Method of Checking the Inverter's Power Transistors and Diode Modules

5.1 Outdoor Unit EMRQ

Checking failures in power semiconductors mounted on inverter PCB

Check the power semiconductors mounted on the inverter PCB by the use of a multiple tester.

<Items to be prepared>

- Multiple tester : Prepare the analog type of multiple tester.
  For the digital type of multiple tester, those with diode check function are available for the checking.

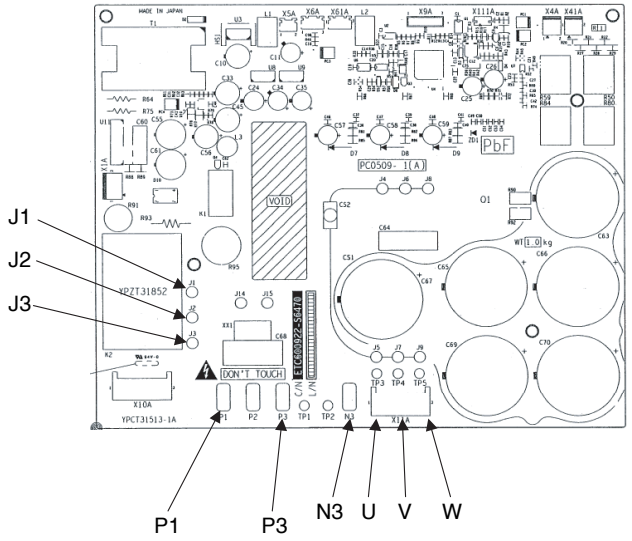
<Test points>

- Turn OFF the power supply. Then, after a lapse of 10 minutes or more, make measurement of resistance.

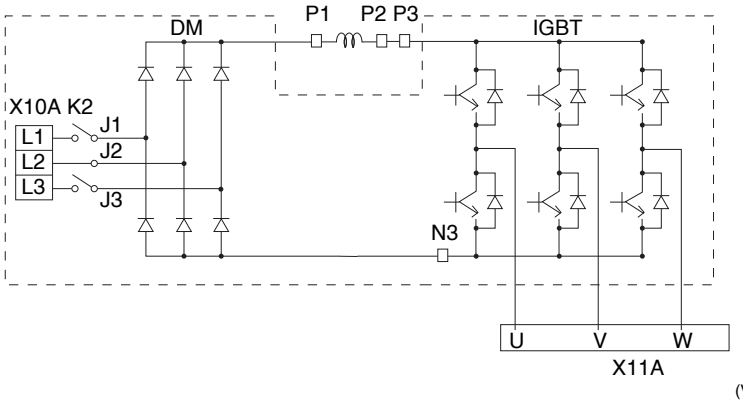
<Preparation>

- To make measurement, disconnect all connectors and terminals.

Inverter PCB



Electronic circuit



(V2895)

- According to the checking aforementioned, it is probed that the malfunction results from the faulty inverter. The following section describes supposed causes of the faulty inverter.
- Faulty compressor (ground leakage)
- Faulty fan motor (ground leakage)
- Entry of conductive foreign particles
- Abnormal voltage (e.g. overvoltage, surge (thunder), or unbalanced voltage)

In order to replace the faulty inverter, be sure to check for the points aforementioned.

1. Power module checking

When using the analog type of multiple tester, make measurement in resistance measurement mode in the x1kΩ range.

No.	Measuring point		Criterion	Remark
	+	-		
1	P3	U	2 to 15kΩ	
2	P3	V		
3	P3	W		
4	U	P3	Not less than 15kΩ (including)	It may take time to determine the resistance due to capacitor charge or else.
5	V	P3		
6	W	P3		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	2 to 15kΩ	
11	V	N3		
12	W	N3		

When using the digital type of multiple tester, make measurement in diode check mode (→⊢).

No.	Measuring point		Criterion	Remark
	+	-		
1	P3	U	Not less than 1.2V (including)	It may take time to determine the voltage due to capacitor charge or else.
2	P3	V		
3	P3	W		
4	U	P3	0.3 to 0.7V	
5	V	P3		
6	W	P3		
7	N3	U		
8	N3	V		
9	N3	W		
10	U	N3	Not less than 1.2V (including)	It may take time to determine the voltage due to capacitor charge or else.
11	V	N3		
12	W	N3		

2. Diode module checking

When using the analog type of multiple tester, make measurement in resistance measurement mode in the x1kΩ range.

No.	Measuring point		Criterion	Remark
	+	-		
1	P1	J1	2 to 15kΩ	
2	P1	J2		
3	P1	J3		
4	J1	P1	Not less than 15kΩ (including)	It may take time to determine the resistance due to capacitor charge or else.
5	J2	P1		
6	J3	P1		
7	N3	J1		
8	N3	J2		
9	N3	J3		
10	J1	N3	2 to 15kΩ	
11	J2	N3		
12	J3	N3		

When using the digital type of multiple tester, make measurement in diode check mode (→⊢).

No.	Measuring point		Criterion	Remark
	+	-		
1	P1	J1	Not less than 1.2V (including)	It may take time to determine the voltage due to capacitor charge or else.
2	P1	J2		
3	P1	J3		
4	J1	P1	0.3 to 0.7V	
5	J2	P1		
6	J3	P1		
7	N3	J1		
8	N3	J2		
9	N3	J3		
10	J1	N3	Not less than 1.2V (including)	It may take time to determine the voltage due to capacitor charge or else.
11	J2	N3		
12	J3	N3		

5.2 Indoor Unit EKHVM(R/Y)D

⚠**Warning**: CAPACITOR SHOCK HAZARD. The capacitors (top surfaces) can hold up to 220V. Use correct precautions when servicing.

Checking failures in power semiconductors mounted on inverter PC board

Check the power semiconductors mounted on the inverter PC board by the use of a multiple tester.

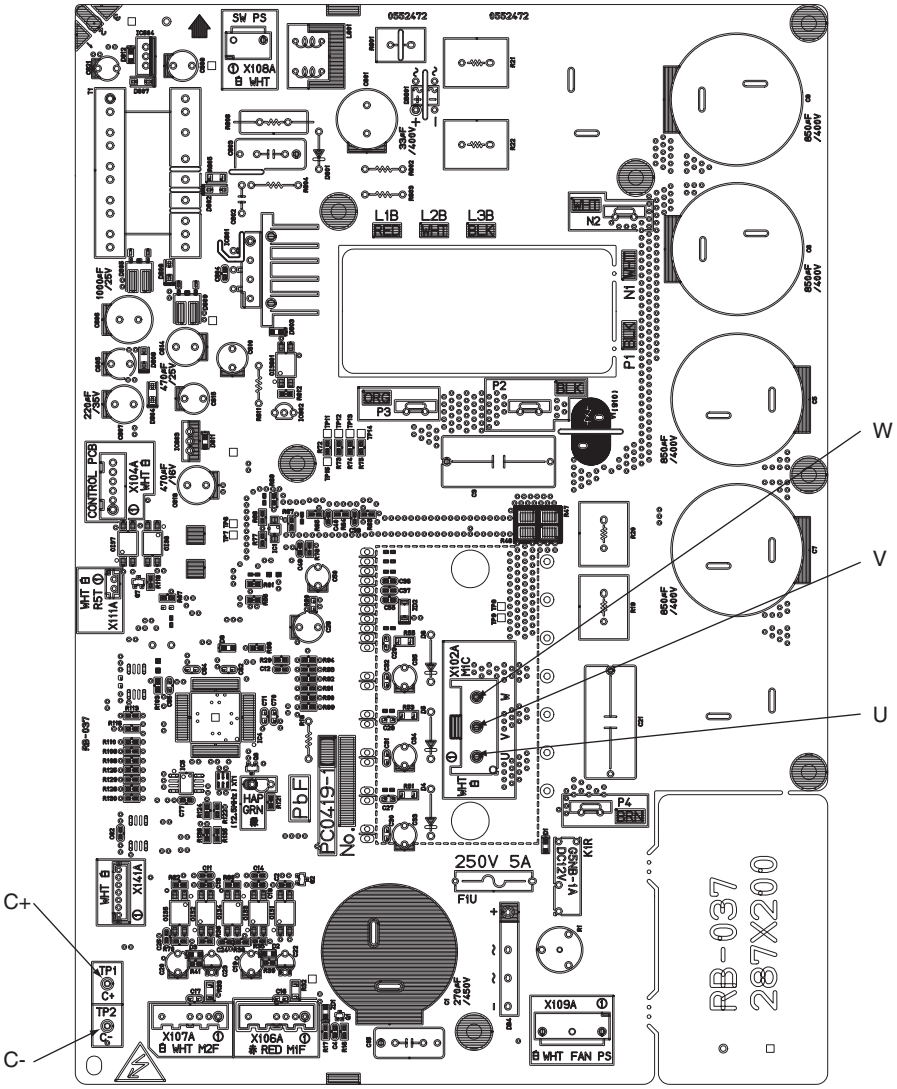
<Items to be prepared>

- Multiple tester : Prepare the digital type of multiple tester with diode check function.

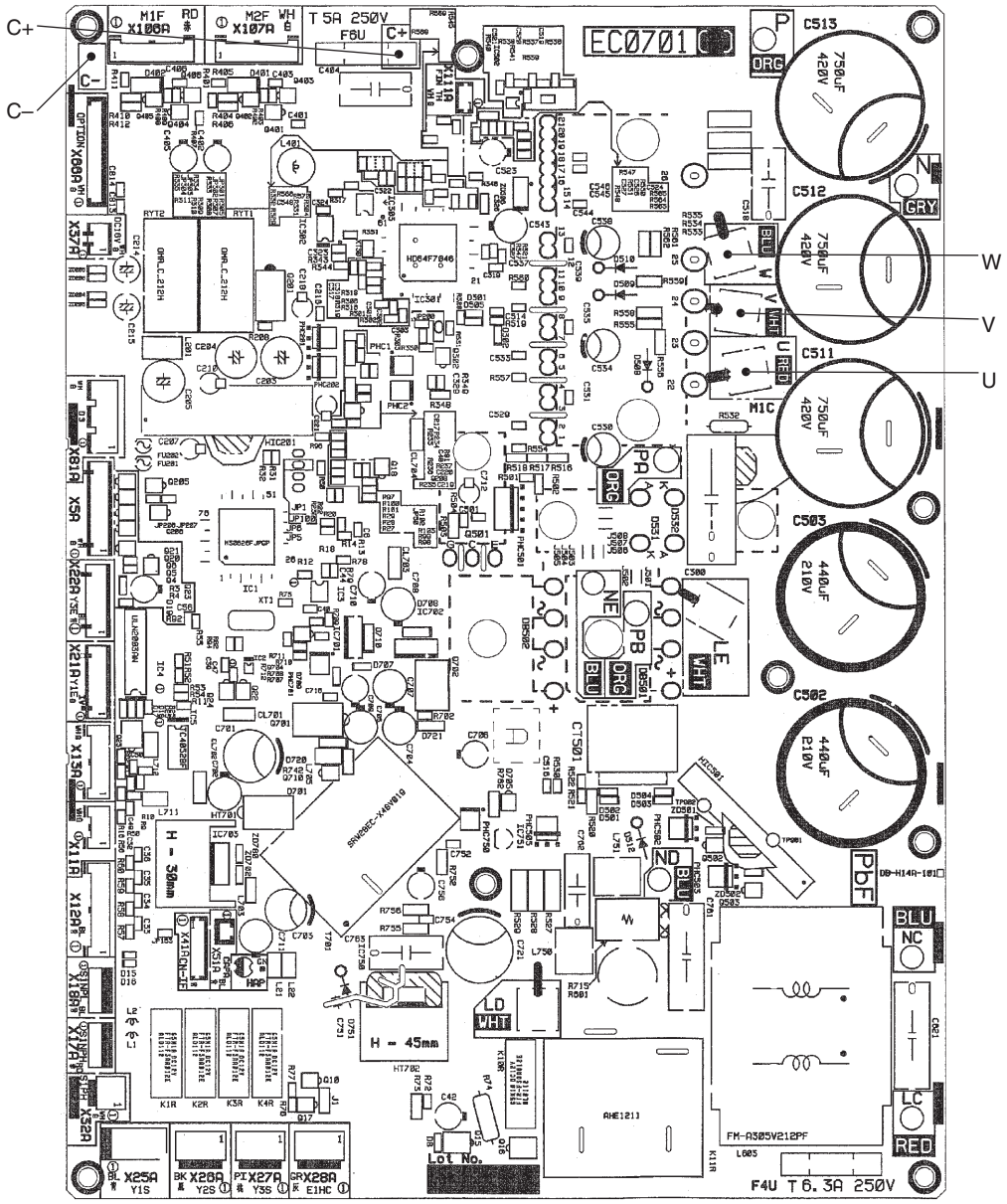
<Preparation>

- Turn OFF the power supply. Then, after a lapse of 10 minutes or more, make measurement of resistance.
- To make measurement, disconnect all connectors and terminals.

Inverter PC board



Inverter PC board



Power module checking

When using the digital type of multiple tester, make measurement in diode check mode.

Tester terminal		Criterion	Remark
+	-		
C+	U	Not less than 0.3V (including ∞)*	It may take time to determine the voltage due to capacitor charge or else.
	V		
	W		
U	C-	Not less than 0.3V (including ∞)*	
V			
W			
U	C+	0.3 to 0.7V (including ∞)*	
V			
W			
C-	U	0.3 to 0.7V (including ∞)*	
	V		
	W		

*There needs to be none of each value variation.

The following abnormalities are also doubted besides the PC board abnormality.

- Faulty compressor (ground fault, ground leakage)
- Faulty fan motor (ground leakage)

Part 8 - Precautions for Refrigerant (R-410A)

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1. Precautions for Refrigerant (R-410A)

1.1 Outline

1.1.1 About Refrigerant R-410A

■ Characteristics of new refrigerant, R-410A

1. Performance
   Almost the same performance as R-22 and R-407C
2. Pressure
   Working pressure is approx. 1.4 times more than R-22 and R-407C.
3. Refrigerant composition
   Few problems in composition control, since it is a Quasi-azeotropic mixture refrigerant.

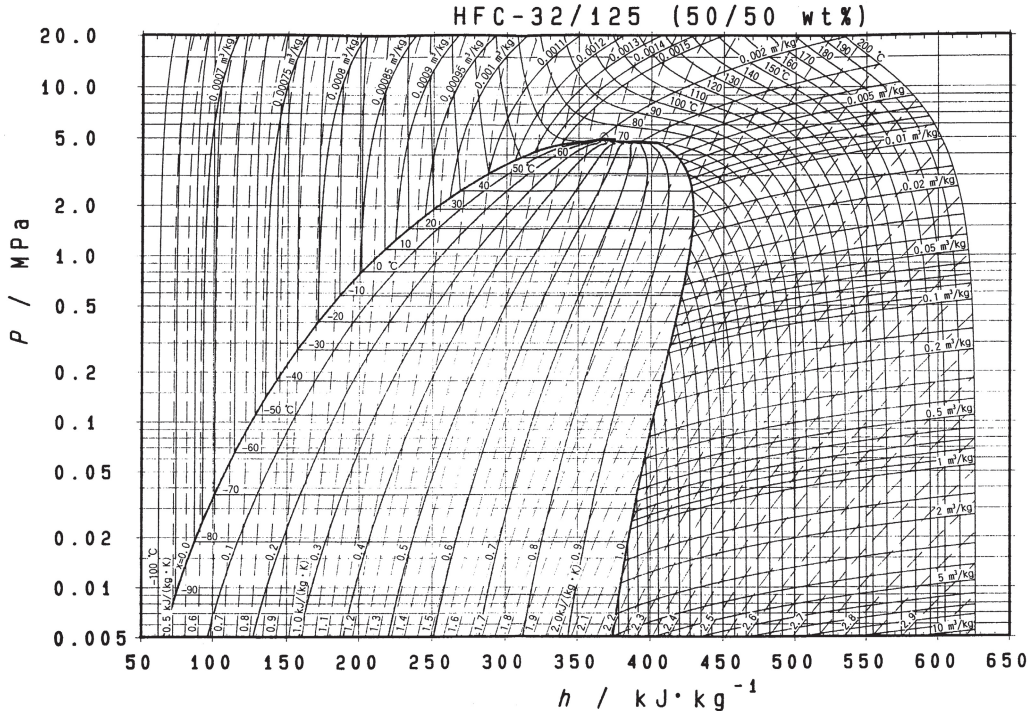
	HFC units (Units using new refrigerants)		HCFC units
Refrigerant name	R-407C	R-410A	R-22
Composing substances	Non-azeotropic mixture of HFC32, HFC125 and HFC134a (*1)	Quasi-azeotropic mixture of HFC32 and JFC125 (*1)	Single-component refrigerant
Design pressure	3.2 MPa (gauge pressure) = 32.6 kgf/cm^2	4.0 MPa (gauge pressure) = 40.8 kgf/cm^2	2.75MPa (gauge pressure) = 28.0 kgf/cm^2
Refrigerant oil	Synthetic oil (Ether)		Mineral oil (Suniso)
Ozone destruction factor (ODP)	0	0	0.05
Combustibility	None	None	None
Toxicity	None	None	None

★1. Non-azeotropic mixture refrigerant: mixture of two or more refrigerants having different boiling points.

★2. Quasi-azeotropic mixture refrigerant: mixture of two or more refrigerants having similar boiling points.

★3. The design pressure is different at each product. Please refer to the installation manual for each product.

(Reference) 1 MPa ≒ 10.19716 kgf / cm^2



Pressure-Enthalpy curves of HFC-32/125 (50/50wt%)

■ Thermodynamic characteristic of R-410A

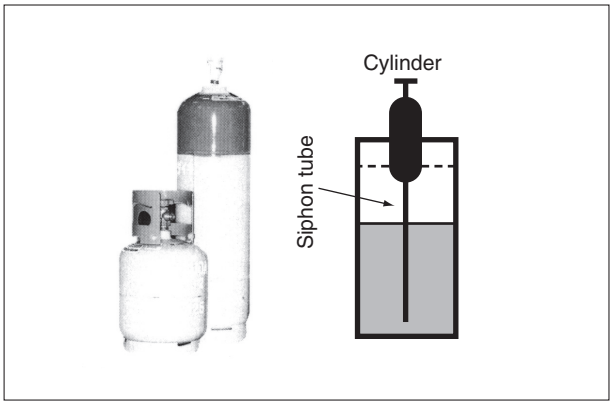
DAIREP ver2.0

Temperature (°C)	Steam pressure (kPa)		Density (kg/m³)		Specific heat at constant pressure (kJ/kgK)		Specific enthalpy (kJ/kg)		Specific entropy (kJ/KgK)	
	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor
-70	36.13	36.11	1410.7	1.582	1.372	0.695	100.8	390.6	0.649	2.074
-68	40.83	40.80	1404.7	1.774	1.374	0.700	103.6	391.8	0.663	2.066
-66	46.02	45.98	1398.6	1.984	1.375	0.705	106.3	393.0	0.676	2.058
-64	51.73	51.68	1392.5	2.213	1.377	0.710	109.1	394.1	0.689	2.051
-62	58.00	57.94	1386.4	2.463	1.378	0.715	111.9	395.3	0.702	2.044
-60	64.87	64.80	1380.2	2.734	1.379	0.720	114.6	396.4	0.715	2.037
-58	72.38	72.29	1374.0	3.030	1.380	0.726	117.4	397.6	0.728	2.030
-56	80.57	80.46	1367.8	3.350	1.382	0.732	120.1	398.7	0.741	2.023
-54	89.49	89.36	1361.6	3.696	1.384	0.737	122.9	399.8	0.754	2.017
-52	99.18	99.03	1355.3	4.071	1.386	0.744	125.7	400.9	0.766	2.010
-51.58	101.32	101.17	1354.0	4.153	1.386	0.745	126.3	401.1	0.769	2.009
-50	109.69	109.51	1349.0	4.474	1.388	0.750	128.5	402.0	0.779	2.004
-48	121.07	120.85	1342.7	4.909	1.391	0.756	131.2	403.1	0.791	1.998
-46	133.36	133.11	1336.3	5.377	1.394	0.763	134.0	404.1	0.803	1.992
-44	146.61	146.32	1330.0	5.880	1.397	0.770	136.8	405.2	0.816	1.987
-42	160.89	160.55	1323.5	6.419	1.401	0.777	139.6	406.2	0.828	1.981
-40	176.24	175.85	1317.0	6.996	1.405	0.785	142.4	407.3	0.840	1.976
-38	192.71	192.27	1310.5	7.614	1.409	0.792	145.3	408.3	0.852	1.970
-36	210.37	209.86	1304.0	8.275	1.414	0.800	148.1	409.3	0.864	1.965
-34	229.26	228.69	1297.3	8.980	1.419	0.809	150.9	410.2	0.875	1.960
-32	249.46	248.81	1290.6	9.732	1.424	0.817	153.8	411.2	0.887	1.955
-30	271.01	270.28	1283.9	10.53	1.430	0.826	156.6	412.1	0.899	1.950
-28	293.99	293.16	1277.1	11.39	1.436	0.835	159.5	413.1	0.911	1.946
-26	318.44	317.52	1270.2	12.29	1.442	0.844	162.4	414.0	0.922	1.941
-24	344.44	343.41	1263.3	13.26	1.448	0.854	165.3	414.9	0.934	1.936
-22	372.05	370.90	1256.3	14.28	1.455	0.864	168.2	415.7	0.945	1.932
-20	401.34	400.06	1249.2	15.37	1.461	0.875	171.1	416.6	0.957	1.927
-18	432.36	430.95	1242.0	16.52	1.468	0.886	174.1	417.4	0.968	1.923
-16	465.20	463.64	1234.8	17.74	1.476	0.897	177.0	418.2	0.980	1.919
-14	499.91	498.20	1227.5	19.04	1.483	0.909	180.0	419.0	0.991	1.914
-12	536.58	534.69	1220.0	20.41	1.491	0.921	182.9	419.8	1.003	1.910
-10	575.26	573.20	1212.5	21.86	1.499	0.933	185.9	420.5	1.014	1.906
-8	616.03	613.78	1204.9	23.39	1.507	0.947	189.0	421.2	1.025	1.902
-6	658.97	656.52	1197.2	25.01	1.516	0.960	192.0	421.9	1.036	1.898
-4	704.15	701.49	1189.4	26.72	1.524	0.975	195.0	422.6	1.048	1.894
-2	751.64	748.76	1181.4	28.53	1.533	0.990	198.1	423.2	1.059	1.890
0	801.52	798.41	1173.4	30.44	1.543	1.005	201.2	423.8	1.070	1.886
2	853.87	850.52	1165.3	32.46	1.552	1.022	204.3	424.4	1.081	1.882
4	908.77	905.16	1157.0	34.59	1.563	1.039	207.4	424.9	1.092	1.878
6	966.29	962.42	1148.6	36.83	1.573	1.057	210.5	425.5	1.103	1.874
8	1026.5	1022.4	1140.0	39.21	1.584	1.076	213.7	425.9	1.114	1.870
10	1089.5	1085.1	1131.3	41.71	1.596	1.096	216.8	426.4	1.125	1.866
12	1155.4	1150.7	1122.5	44.35	1.608	1.117	220.0	426.8	1.136	1.862
14	1224.3	1219.2	1113.5	47.14	1.621	1.139	223.2	427.2	1.147	1.859
16	1296.2	1290.8	1104.4	50.09	1.635	1.163	226.5	427.5	1.158	1.855
18	1371.2	1365.5	1095.1	53.20	1.650	1.188	229.7	427.8	1.169	1.851
20	1449.4	1443.4	1085.6	56.48	1.666	1.215	233.0	428.1	1.180	1.847
22	1530.9	1524.6	1075.9	59.96	1.683	1.243	236.4	428.3	1.191	1.843
24	1615.8	1609.2	1066.0	63.63	1.701	1.273	239.7	428.4	1.202	1.839
26	1704.2	1697.2	1055.9	67.51	1.721	1.306	243.1	428.6	1.214	1.834
28	1796.2	1788.9	1045.5	71.62	1.743	1.341	246.5	428.6	1.225	1.830
30	1891.9	1884.2	1034.9	75.97	1.767	1.379	249.9	428.6	1.236	1.826
32	1991.3	1983.2	1024.1	80.58	1.793	1.420	253.4	428.6	1.247	1.822
34	2094.5	2086.2	1012.9	85.48	1.822	1.465	256.9	428.4	1.258	1.817
36	2201.7	2193.1	1001.4	90.68	1.855	1.514	260.5	428.3	1.269	1.813
38	2313.0	2304.0	989.5	96.22	1.891	1.569	264.1	428.0	1.281	1.808
40	2428.4	2419.2	977.3	102.1	1.932	1.629	267.8	427.7	1.292	1.803
42	2548.1	2538.6	964.6	108.4	1.979	1.696	271.5	427.2	1.303	1.798
44	2672.2	2662.4	951.4	115.2	2.033	1.771	275.3	426.7	1.315	1.793
46	2800.7	2790.7	937.7	122.4	2.095	1.857	279.2	426.1	1.327	1.788
48	2933.7	2923.6	923.3	130.2	2.168	1.955	283.2	425.4	1.339	1.782
50	3071.5	3061.2	908.2	138.6	2.256	2.069	287.3	424.5	1.351	1.776
52	3214.0	3203.6	892.2	147.7	2.362	2.203	291.5	423.5	1.363	1.770
54	3361.4	3351.0	875.1	157.6	2.493	2.363	295.8	422.4	1.376	1.764
56	3513.8	3503.5	856.8	168.4	2.661	2.557	300.3	421.0	1.389	1.757
58	3671.3	3661.2	836.9	180.4	2.883	2.799	305.0	419.4	1.403	1.749
60	3834.1	3824.2	814.9	193.7	3.191	3.106	310.0	417.6	1.417	1.741
62	4002.1	3992.7	790.1	208.6	3.650	3.511	315.3	415.5	1.433	1.732
64	4175.7	4166.8	761.0	225.6	4.415	4.064	321.2	413.0	1.450	1.722

1.2 Refrigerant Cylinders

■ Cylinder specifications

- The cylinder is painted refrigerant color (pink).
- The cylinder valve is equipped with a siphon tube.



Refrigerant can be charged in liquid state with cylinder in upright position.

Caution: Do not lay cylinder on its side during charging, since it cause refrigerant in gas state to enter the system.

■ Handling of cylinders

(1) Laws and regulations

R-410A is liquefied gas, and the High-Pressure Gas Safety Law must be observed in handling them. Before using, refer to the High-Pressure Gas Safety Law.

The Law stipulates standards and regulations that must be followed to prevent accidents with high-pressure gases. Be sure to follow the regulations.

(2) Handing of vessels

Since R-410A is high-pressure gas, it is contained in high-pressure vessels.

Although those vessels are durable and strong, careless handling can cause damage that can lead to unexpected accidents. Do not drop vessels, let them fall, apply impact or roll them on the ground.

(3) Storage

Although R-410A is not flammable, it must be stored in a well-ventilated, cool, and dark place in the same way as any other high-pressure gases.

It should also be noted that high-pressure vessels are equipped with safety devices that releases gas when the ambient temperature reaches more than a certain level (fusible plug melts) and when the pressure exceeds a certain level (spring-type safety valve operates).

1.3 Service Tools

R-410A is used under higher working pressure, compared to previous refrigerants (R-22,R-407C). Furthermore, the refrigerating machine oil has been changed from Suniso oil to Ether oil, and if oil mixing is occurred, sludge results in the refrigerants and causes other problems. Therefore, gauge manifolds and charge hoses that are used with a previous refrigerant (R-22,R-407C) can not be used for products that use new refrigerants.
Be sure to use dedicated tools and devices.

■ Tool compatibility

Tool	Compatibility			Reasons for change
	HFC		HCFC	
	R-410A	R-407C	R-22	
Gauge manifold Charge hose	×			• Do not use the same tools for R-22 and R-410A. • Thread specification differs for R-410A and R-407C.
Charging cylinder	×		○	• Weighting instrument used for HFCs.
Gas detector	○		×	• The same tool can be used for HFCs.
Vacuum pump (pump with reverse flow preventive function)	○			• To use existing pump for HFCs, vacuum pump adapter must be installed.
Weighting instrument	○			
Charge mouthpiece	×			• Seal material is different between R-22 and HFCs. • Thread specification is different between R-410A and others.
Flaring tool (Clutch type)	○			• For R-410A, flare gauge is necessary.
Torque wrench	○			• Torque-up for 1/2 and 5/8
Pipe cutter	○			
Pipe expander	○			
Pipe bender	○			
Pipe assembling oil	×			• Due to refrigerating machine oil change. (No Suniso oil can be used.)
Refrigerant recovery device	Check your recovery device.			
Refrigerant piping	See the chart below.			• Only ϕ19.1 is changed to 1/2H material while the previous material is "O".

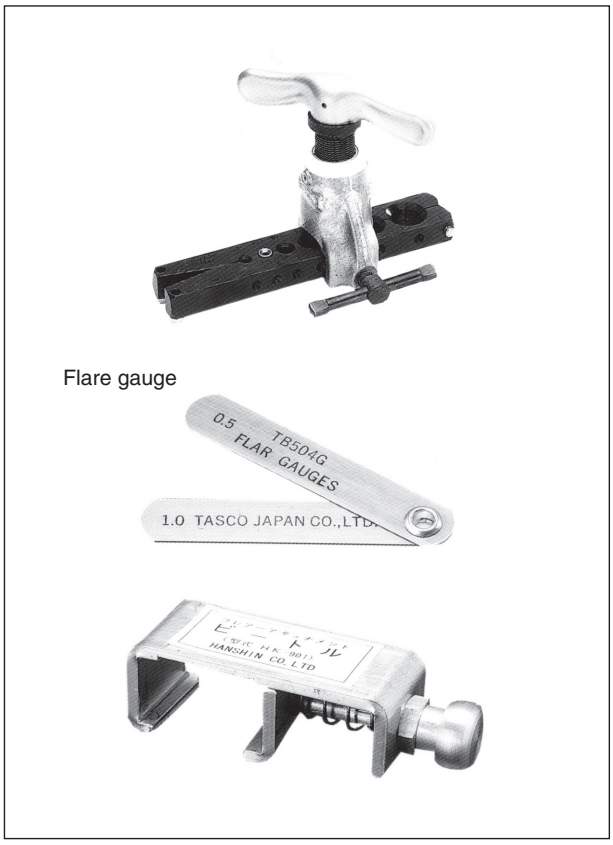
As for the charge mouthpiece and packing, 1/2UNF20 is necessary for mouthpiece size of charge hose.

■ Copper tube material and thickness

Pipe size	R-407C		R-410A	
	Material	Thickness t (mm)	Material	Thickness t (mm)
ϕ6.4	O	0.8	O	0.8
ϕ9.5	O	0.8	O	0.8
ϕ12.7	O	0.8	O	0.8
ϕ15.9	O	1.0	O	1.0
ϕ19.1	O	1.0	1/2H	1.0
ϕ22.2	1/2H	1.0	1/2H	1.0
ϕ25.4	1/2H	1.0	1/2H	1.0
ϕ28.6	1/2H	1.0	1/2H	1.0
ϕ31.8	1/2H	1.2	1/2H	1.1
ϕ38.1	1/2H	1.4	1/2H	1.4
ϕ44.5	1/2H	1.6	1/2H	1.6

* O: Soft (Annealed)
H: Hard (Drawn)

1. Flaring tool



■ Specifications

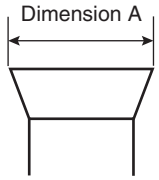
• Dimension A

Unit:mm

Nominal size	Tube O.D.	$A^{+0}_{-0.4}$	
	Do	Class-2 (R-410A)	Class-1 (Conventional)
1/4	6.35	9.1	9.0
3/8	9.52	13.2	13.0
1/2	12.70	16.6	16.2
5/8	15.88	19.7	19.4
3/4	19.05	24.0	23.3

■ Differences

• Change of dimension A



For class-1: R-407C
For class-2: R-410A

Conventional flaring tools can be used when the work process is changed.
(change of work process)
Previously, a pipe extension margin of 0 to 0.5mm was provided for flaring. For R-410A air conditioners, perform pipe flaring with a pipe extension margin of 1.0 to 1.5mm.
(For clutch type only)
Conventional tool with pipe extension margin adjustment can be used.

2. Torque wrench



■ Specifications

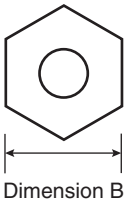
• Dimension B Unit:mm

Nominal size	Class-1	Class-2	Previous
1/2	24	26	24
5/8	27	29	27

No change in tightening torque
No change in pipes of other sizes

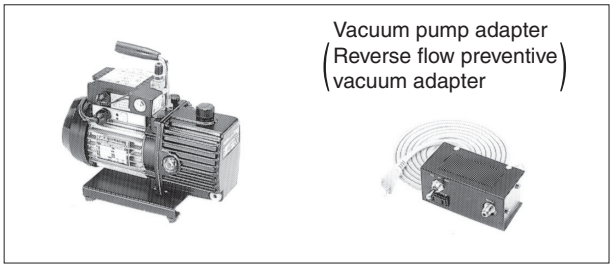
■ Differences

• Change of dimension B
Only 1/2", 5/8" are extended



For class-1: R-407C
For class-2: R-410A

3. Vacuum pump with check valve



■ Specifications

• Discharge speed
50 l/min (50Hz)
60 l/min (60Hz)
• Suction port UNF7/16-20(1/4 Flare)
UNF1/2-20(5/16 Flare) with adapter

● Maximum degree of vacuum
Select a vacuum pump which is able to keep the vacuum degree of the system in excess of –100.7 kPa (5 torr – 755 mmHg).

■ Differences

• Equipped with function to prevent reverse oil flow
• Previous vacuum pump can be used by installing adapter.

4. Leak tester



■ Specifications
- Hydrogen detecting type, etc.
- Applicable refrigerants
  R-410A, R-407C, R-404A, R-507A, R-134a, etc.

■ Differences
- Previous testers detected chlorine. Since HFCs do not contain chlorine, new tester detects hydrogen.

5. Refrigerant oil (Air compal)



■ Specifications
- Contains synthetic oil, therefore it can be used for piping work of every refrigerant cycle.
- Offers high rust resistance and stability over long period of time.

■ Differences
- Can be used for R-410A and R-22 units.

6. Gauge manifold for R-410A



■ Specifications
- High pressure gauge
  - 0.1 to 5.3 MPa (-76 cmHg to 53 kg/cm^2)
- Low pressure gauge
  - 0.1 to 3.8 MPa (-76 cmHg to 38 kg/cm^2)
- 1/4" → 5/16" (2min → 2.5min)
- No oil is used in pressure test of gauges.
  → For prevention of contamination

- Temperature scale indicates the relationship between pressure and temperature in gas saturated state.

■ Differences
- Change in pressure
- Change in service port diameter

7. Charge hose for R-410A

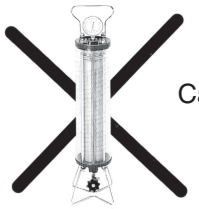


(Hose with ball valve)

■ Specifications
- Working pressure 5.08 MPa (51.8 kg/cm^2)
- Rupture pressure 25.4 MPa (259 kg/cm^2)
- Available with and without hand-operate valve that prevents refrigerant from outflow.

■ Differences
- Pressure proof hose
- Change in service port diameter
- Use of nylon coated material for HFC resistance

8. Charging cylinder



Can not be used

■ Specifications
- Use weigher for refrigerant charge listed below to charge directly from refrigerant cylinder.

■ Differences
- The cylinder can not be used for mixed refrigerant since mixing ratio is changed during charging.

  When R-410A is charged in liquid state using charging cylinder, foaming phenomenon is generated inside charging cylinder.

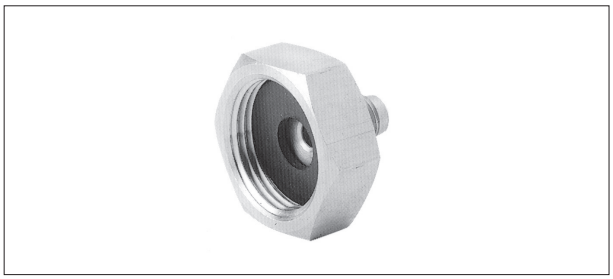
9. Weigher for refrigerant charge



■ Specifications
- High accuracy
  TA101A (for 10-kg cylinder) = ± 2g
  TA101B (for 20-kg cylinder) = ± 5g
- Equipped with pressure-resistant sight glass to check liquid refrigerant charging.
- A manifold with separate ports for HFCs and previous refrigerants is equipped as standard accessories.

■ Differences
- Measurement is based on weight to prevent change of mixing ratio during charging.

10. Charge mouthpiece



■ Specifications
- For R-410A, 1/4"→ 5/16" (2min → 2.5min)
- Material is changed from CR to H-NBR.

■ Differences
- Change of thread specification on hose connection side (For the R-410A use)
- Change of sealer material for the HFCs use.

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