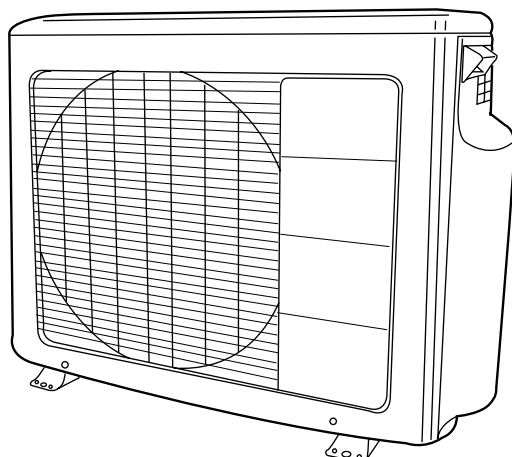


SERVICE MANUAL

TECHNICAL INFORMATION

FOR SERVICE PERSONNEL ONLY



RAM-35QH5

CONTENTS

SPECIFICATIONS	5
INSTALLATION	10
CONSTRUCTION AND DIMENSIONAL DIAGRAM	14
MAIN PARTS COMPONENT	15
CAPACITY DIAGRAM	17
WIRING DIAGRAM	22
CIRCUIT DIAGRAM	23
BLOCK DIAGRAM	25
BASIC MODE	27
REFRIGERATING CYCLE DIAGRAM	46
DESCRIPTION OF MAIN CIRCUIT OPERATION	48
TROUBLE SHOOTING	72
PARTS LIST AND DIAGRAM	88

SPECIFICATIONS

TYPE		DC INVERTER DUAL SYSTEM MULTI	
		OUTDOOR UNIT	
MODEL		RAM-35QH5	
POWER SOURCE		1ø, 220 - 240V, 50Hz	
TOTAL INPUT	(W)	REFER TO THE SPECIFICATIONS PAGE	
TOTAL AMPERES	(A)		
COOLING CAPACITY	(kW)		
HEATING CAPACITY	(B.T.U.)		
DIMENSIONS	(mm)	W	750
		H	570
		D	280
NET WEIGHT	(kg)	40	

※ After installation

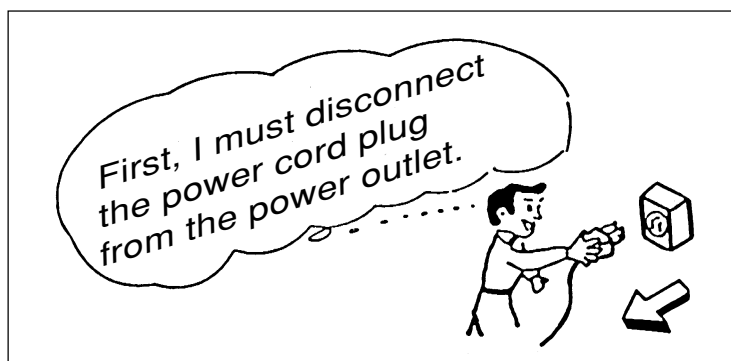
SPECIFICATIONS AND PARTS ARE SUBJECT TO CHANGE FOR IMPROVEMENT

ROOM AIR CONDITIONER

OUTDOOR UNIT

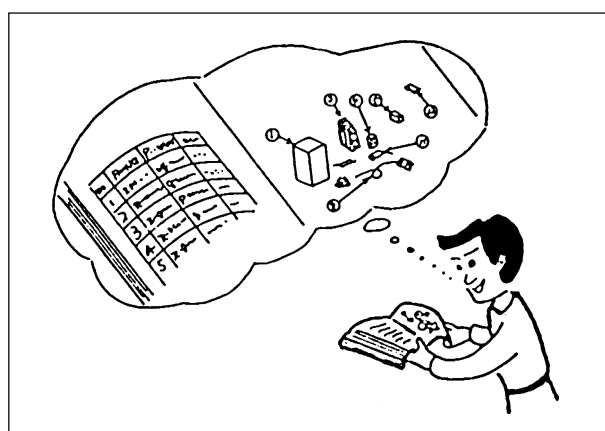
SAFETY DURING REPAIR WORK

1. In order to disassemble and repair the unit in question, be sure to disconnect the power cord plug from the power outlet before starting the work.



2. If it is necessary to replace any parts, they should be replaced with respective genuine parts for the unit, and the replacement must be effected in correct manner according to the instructions in the Service Manual of the unit.

If the contacts of electrical parts are defective, replace the electrical parts without trying to repair them.



3. After completion of repairs, the initial state should be restored.
4. Lead wires should be connected and laid as in the initial state.
5. Modification of the unit by user himself should absolutely be prohibited.
6. Tools and measuring instruments for use in repairs or inspection should be accurately calibrated in advance.
7. In installing the unit having been repaired, be careful to prevent the occurrence of any accident such as electrical shock, leak of current, or bodily injury due to the drop of any part.
8. To check the insulation of the unit, measure the insulation resistance between the power cord plug and grounding terminal of the unit. The insulation resistance should be $1\text{M}\Omega$ or more as measured by a 500V DC megger.
9. The initial location of installation such as window, floor or the other should be checked for being and safe enough to support the repaired unit again. If it is found not so strong and safe, the unit should be installed at the initial location reinforced or at a new location.
10. Any inflammable thing should never be placed about the location of installation.
11. Check the grounding to see whether it is proper or not, and if it is found improper, connect the grounding terminal to the earth.



WORKING STANDARDS FOR PREVENTING BREAKAGE OF SEMICONDUCTORS

1. Scope

The standards provide for items to be generally observed in carrying and handling semiconductors in relative manufacturers during maintenance and handling thereof. (They apply the same to handling of abnormal goods such as rejected goods being returned).

2. Object parts

- (1) Micro computer
- (2) Integrated circuits (IC)
- (3) Field-effect transistors (FET)
- (4) P.C. boards or the like on which the parts mentioned in (1) and (2) of this paragraph are equipped.

3. Items to be observed in handling

- (1) Use a conductive container for carrying and storing of parts. (Even rejected goods should be handled in the same way).

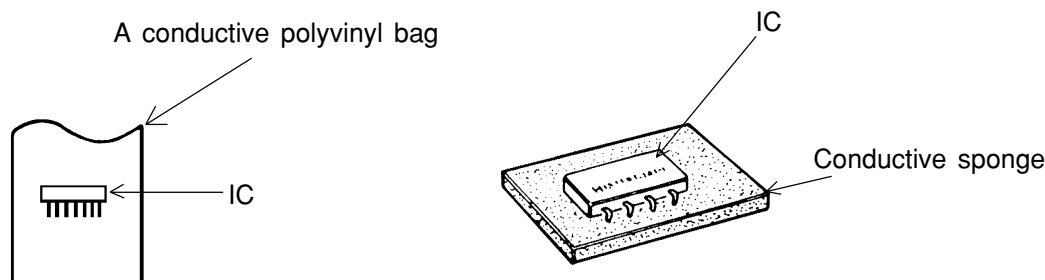


Fig. 1. Conductive Container

- (2) When any part is handled uncovered (in counting, packing and the like), the handling person must always use himself as a body earth. (Make yourself a body earth by passing one M ohm earth resistance through a ring or bracelet).
- (3) Be careful not to touch the parts with your clothing when you hold a part even if a body earth is being taken.
- (4) Be sure to place a part on a metal plate with grounding.
- (5) Be careful not to fail to turn off power when you repair the printed circuit board. At the same time, try to repair the printed circuit board on a grounded metal plate.

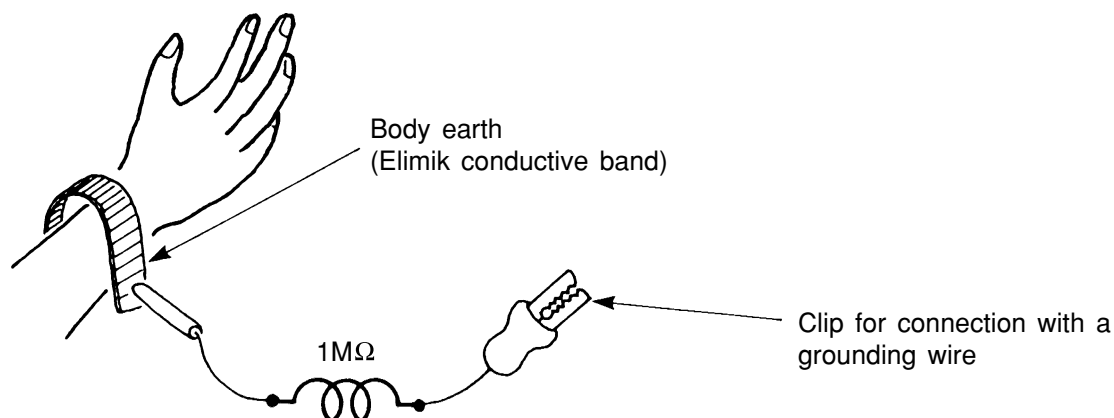


Fig. 2. Body Earth

- (6) Use a three wire type soldering iron including a grounding wire.

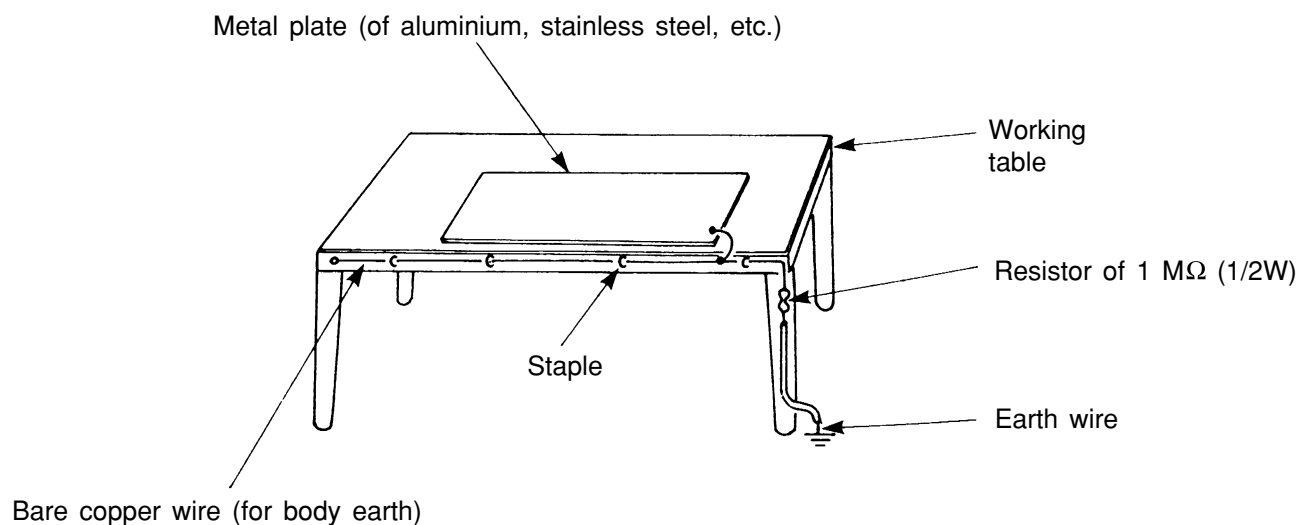


Fig. 3. Grounding of the working table

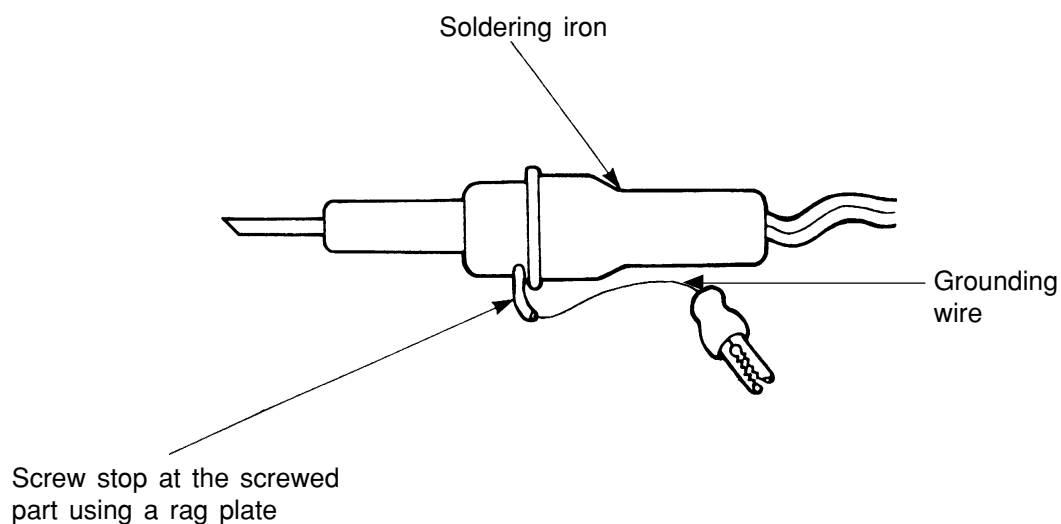


Fig. 4. Grounding a soldering iron

Use a high insulation mode (100V, 10MΩ or higher) when ordinary iron is to be used.

- (7) In checking circuits for maintenance, inspection or some others, be careful not to have the test probes of the measuring instrument shortcircuit a load circuit or the like.

⚠ CAUTION

1. In quiet or stop operation, slight flowing noise of refrigerant in the refrigerating cycle is heard occasionally, but this noise is not abnormal for the operation.
2. When it thunders near by, it is recommend to stop the operation and to disconnect the power cord plug from the power outlet for safety.
3. The room air conditioner does not start automatically after recovery of the electric power failure for preventing fuse blowing. Re-press START/STOP button after 3 minutes from when unit stopped.
4. If the room air conditioner is stopped by adjusting thermostat, or missoperation, and re-start in a moment, there is occasion that the cooling and heating operation does not start for 3 minutes, it is not abnormal and this is the result of the operation of IC delay circuit. This IC delay circuit ensures that there is no danger of blowing fuse or damaging parts even if operation is restarted accidentally.
5. This room air conditioner should not be used at the cooling operation when the outside temperature is below -10°C (14°F).
6. This room air conditioner (the reverse cycle) should not be used when the outside temperature is below -15°C (5°F).
If the reverse cycle is used under this condition, the outside heat exchanger is frosted and efficiency falls.
7. When the outside heat exchanger is frosted, the frost is melted by operating the hot gas system, it is not trouble that at this time fan stops and the vapour may rise from the outside heat exchanger.

SPECIFICATIONS

MODEL	RAM-35QH5	
FAN MOTOR	40 W	
FAN MOTOR CAPACITOR	NO	
FAN MOTOR PROTECTOR	NO	
COMPRESSOR	JU1013DB	
COMPRESSOR MOTOR CAPACITOR	NO	
OVERLOAD PROTECTOR	YES	
OVERHEAT PROTECTOR	YES	
FUSE (for MICROPROCESSOR)	5.0A	
POWER RELAY	G4A	
POWER SWITCH	NO	
TEMPORARY SWITCH	NO	
SERVICE SWITCH	YES	
TRANSFORMER	NO	
VARISTOR	450NR	
NOISE SUPPRESSOR	YES	
THERMOSTAT	YES(IC)	
REMOTE CONTROL SWITCH (LIQUID CRYSTAL)	NO	
REFRIGERANT CHARGING VOLUME (Refrigerant 410A)	UNIT	1450g
	WITHOUT REFRIGERANT BECAUSE COUPLING IS FLARE TYPE.	
	PIPES	MAX. 35m

RAM-35QH5

※ Additional charge of refrigerant is not required.

SPECIFICATIONS FOR INDOOR UNITS COMBINATION

TYPE		DC INVERTER DUAL SYSTEM MULTI COOLING AND HEATING
MODEL	OUTDOOR UNIT	RAM-35QH5
PHASE/VOLTAGE/FREQUENCY		1ø, 220 - 240V, 50Hz
CIRCUIT AMPERES TO CONNECT (A)		16
COOLING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	3.5 (1.50 - 4.00)
		11,940 (5,120 - 13,650)
	TOTAL INPUT (W)	940 (200 - 1,050)
	EER (B.T.U./hW)	12.70
	TOTAL AMPERES (A)	4.32 - 3.96
POWER FACTOR (%)		99
HEATING (TWO UNITS)	CAPACITY (kW) (B.T.U./h)	4.2 (1.50 - 5.00)
		14,330 (5,120 - 17,060)
	TOTAL INPUT (W)	850 (200 - 1,130)
	EER (B.T.U./hW)	16.85
	TOTAL AMPERES (A)	3.90 - 3.58
POWER FACTOR (%)		99
MAXIMUM LENGTH OF PIPING		MAX. 35m (TWO UNIT TOTAL)
STANDARD		CE (EMC&LVD)

MODEL		RAM-35QH5
PACKING (mm)	W	905
	H	633
	D	394
	cu.ft.	8.27
GROSS WEIGHT (kg)		43
FLARE NUT SIZE (SMALL/LARGE)		6.35D/9.52DX2

OPERATION SCOPE

	INDOOR SUCTION TEMPERATURE (°C)	OUTDOOR SUCTION TEMPERATURE (°C)	INDOOR SUCTION HUMIDITY (%)
COOLING OPERATION SCOPE	16 - 32	22 - 41	BELOW 80
DEHUMIDIFYING OPERATION	16 - 32	22 - 42	BELOW 80
HEATING OPERATION SCOPE	BELOW 27	-15 - 23	—

DUAL SYSTEM MULTI R.A.C. *RAM-35QH5* COOL / HEAT CAPACITY SPEC. FOR INDOOR UNITS COMBINATIONS TO BE ABLE TO OPERATE SIMULTANEOUSLY

Whichever indoor units are installed, cooling and heating capacity depends on how many and which indoor units are operating at that time.

2 ROOM MULTI-SPLIT INVERTER TYPE RAC: RAM-35QH5

POSSIBLE COMBINATION TO OPERATE (SAME TIME OPERATION)

(Reference value)

POSSIBLE COMBINATIONS TO OPERATE		COOLING					HEATING				
		CAPACITY RATING (kW) (RANGE)		OUTDOOR UNIT		COP	CAPACITY RATING (kW) (RANGE)		OUTDOOR UNIT		COP
				POWER CONSUMPTION (W)	AMPERE (A)				POWER CONSUMPTION (W)	AMPERE (A)	
					220 - 240 V					220 - 240 V	
		TOTAL					TOTAL				
ONE UNIT	1.8	1.80 (1.00-2.50)	1.80	560 (200-750)	2.6 - 2.4	3.21	2.50 (1.10-3.20)	2.50	690 (200-970)	3.2 - 2.9	3.62
	2.5	2.50 (1.00-3.10)	2.50	780 (200-880)	3.6 - 3.3	3.21	3.40 (1.10-4.40)	3.40	870 (200-1120)	4.0 - 3.7	3.91
	3.5	3.50 (1.00-4.00)	3.50	1090 (200-1300)	5.0 - 4.6	3.21	4.20 (1.10-5.00)	4.20	1080 (200-1300)	5.0 - 4.5	3.89
TWO UNITS	1.8 + 1.8	1.75 + 1.75 (1.50-4.00)	3.50	940 (200-1050)	4.3 - 4.0	3.72	2.10 + 2.10 (1.50-5.00)	4.20	920 (200-1130)	4.2 - 3.9	4.57
	1.8 + 2.5	1.47 + 2.03 (1.50-4.00)	3.50	940 (200-1050)	4.3 - 4.0	3.72	1.64 + 2.56 (1.50-5.00)	4.20	890 (200-1130)	4.1 - 3.7	4.72
	1.8 + 3.5	1.19 + 2.31 (1.50-4.00)	3.50	940 (200-1050)	4.3 - 4.0	3.72	1.44 + 2.76 (1.50-5.00)	4.20	870 (200-1130)	4.0 - 3.7	4.83
	2.5 + 2.5	1.75 + 1.75 (1.50-4.00)	3.50	940 (200-1050)	4.3 - 4.0	3.72	2.10 + 2.10 (1.50-5.00)	4.20	870 (200-1130)	4.0 - 3.7	4.83
	2.5 + 3.5	1.46 + 2.04 (1.50-4.00)	3.50	940 (200-1050)	4.3 - 4.0	3.72	1.88 + 2.32 (1.50-5.00)	4.20	850 (200-1130)	3.9 - 3.6	4.94

** REMARKS:

* ONE UNIT INDICATED ARE ONLY FOR ONE UNIT OPERATION WHEN TWO INDOOR UNITS ARE CONNECTED.

* TOTAL NOMINAL COOLING CAPACITY SHOULD NOT MORE THAN 6.0kW.

RATING CONDITON (DRY BLUB / WET BULB)

	INDOOR	OUTDOOR
COOLING	27 / 19 °C	24 / - °C
HEATING	20 / - °C	7 / 6 °C

DUAL AND TRIPLE SYSTEM MULTI R.A.C. *RAM-35QH5* INDOOR UNITS COMBINATIONS TO BE ABLE TO INSTALL

Two units can be installed with one outdoor unit.

And total nominal cooling capacity should not be more than 6.0kW

NOMINAL COOLING CAPACITY (kW)	INDOOR UNIT MODEL	CAPACITY (kW) at one unit operation		SUITABLE ROOM SIZE (m ²) at one unit operation	
		COOLING	HEATING	COOLING	HEATING
1.8kW	RAK-18NH5	1.00 – 2.50	1.10 – 3.20	8 – 12	9 – 11
	RAK-18NH6	1.00 – 2.50	1.10 – 3.20	8 – 12	9 – 11
	RAK-18NH6A	1.00 – 2.50	1.10 – 3.20	8 – 12	9 – 11
	RAK-18QH8	1.00 – 2.50	1.10 – 3.20	8 – 12	9 – 11
2.5kW	RAK-25NH5	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAK-25NH6	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAK-25NH6A	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAK-25QH8	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAI-25NH5	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAI-25NH5A	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAF-25NH5	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAF-25QH8	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAD-25NH5	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAD-25NH7	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
	RAD-25NH7A	1.00 – 3.10	1.10 – 4.40	11 – 17	14 – 18
3.5kW	RAK-35NH5	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAK-35NH6	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAK-35NH6A	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAK-35QH8	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAI-35NH5	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAI-35NH5A	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAF-35NH5	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAF-35QH8	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAD-35NH5	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAD-35NH7	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22
	RAD-35NH7A	1.00 – 4.00	1.50 – 5.00	16 – 24	17 – 22

Be sure to connect two indoor units to this outdoor unit. If not, condensed water may drop, resulting in trouble.

DUAL SYSTEM MULTI R.A.C. *RAM-35QH5*

CONNECTING POSISION TO BE ABLE TO INSTALL

POSSIBLE COMBINATIONS TO INSTALL (kW)		SUITABLE ROOM SIZE TO INSTALL (m ²)	CONNECTING POSITION ON OUTDOOR UNIT (VALVE DIAMETER) (mm)	
			No.1	No.2
			6.35/9.52D	6.35/9.52D
TWO UNITS	1.8+1.8	(8-12) + (8-12)	1.8	1.8
	1.8+2.5	(8-12) + (10-16)	1.8	2.5
	1.8+3.5	(7-9) + (15-22)	1.8	3.5
	2.5+2.5	(12-15) + (12-15)	2.5	2.5
	2.5+3.5	(11-14) + (14-18)	2.5	3.5

1.8, 2.5, 3.5 means indoor units cooling capacity class.

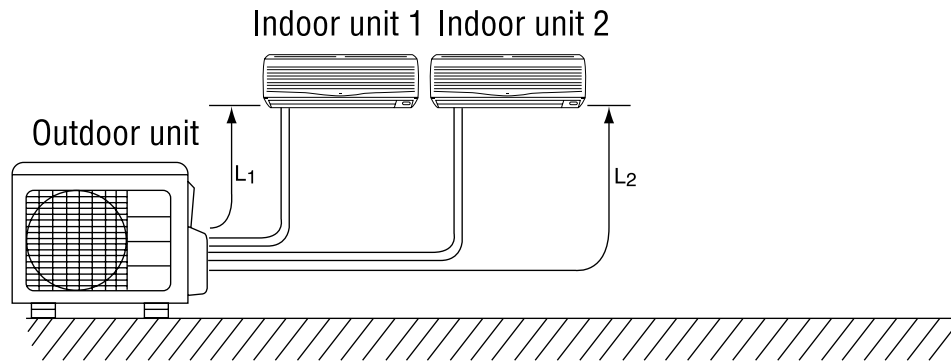
(1) Suitable room size is determined based on the conditions below:

- For usual residential use.
- Smaller figure is for light construction which means light thermally sealed.
- Larger figure is for heavy constructions, which means well thermally sealed.

INSTALLATION

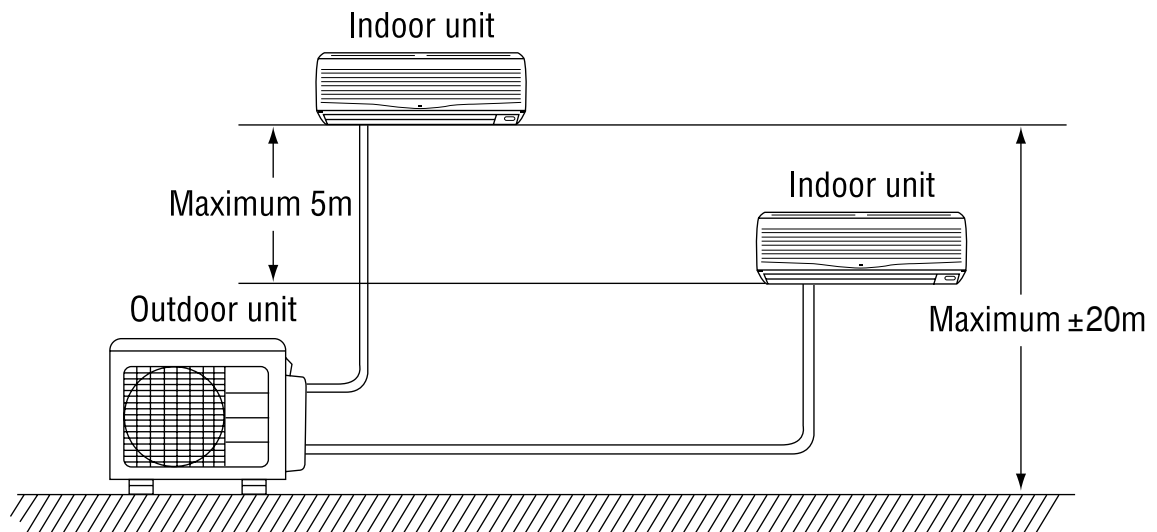
PIPE LENGTH

- (1) Total 35m maximum pipe length.
- (2) Pipe length for one indoor unit : maximum 25m.



HIGHT DIFFERENCE

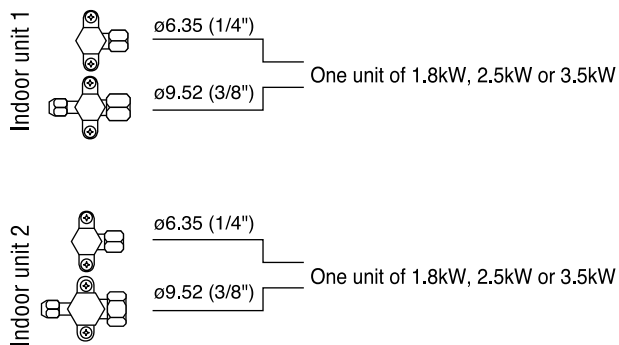
- (1) Height : maximum $\pm 20\text{m}$
- (2) Height difference between each indoor unit $\leq 5\text{m}$.



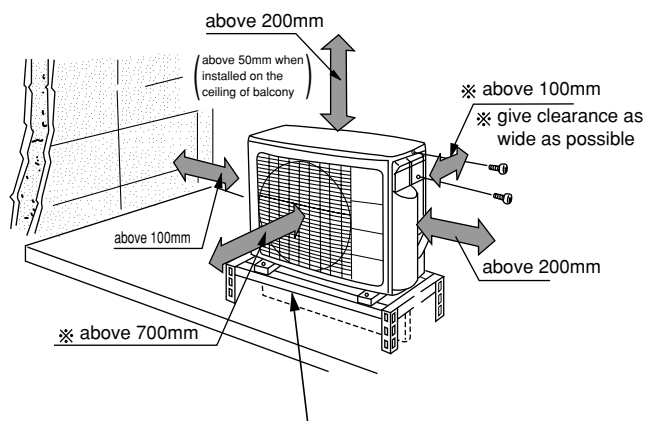
- To the outdoor unit, two indoor units can be connected until the total nominal cooling capacity not more than 6.0 kW
- Make sure to connect to two indoor units.

MODEL: RAM-35QH5

Outdoor unit pipe connection port

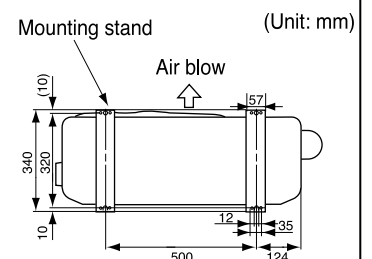


- Remove the side cover.
- For installation, refer as shown below.
- The space indicated with a ⇔ mark is required to guarantee the air conditioner's performance. Install the air conditioner in a place big enough to provide ample space for servicing and repairs later on.



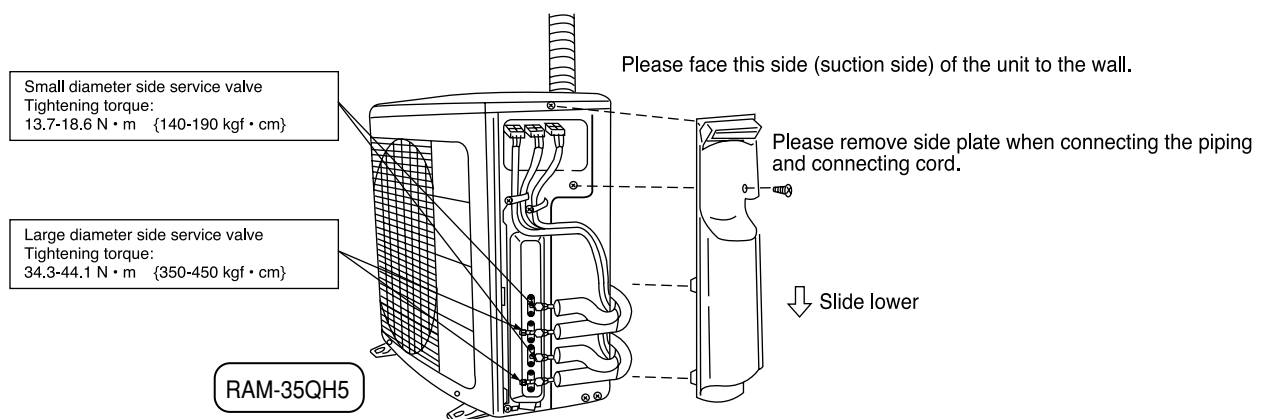
Heating efficiency will be increased if the ventilation below the outdoor unit is minimized.

Dimension of Mounting Stand of the Outdoor Unit



Connecting the pipe

- Install the unit in a stable place to minimize vibration or noise.
- After arranging the cord and pipes, secure them in place.



- Hold the handle of the side cover. Slide down and takeoff the corner hook, then pull. Reverse these steps when installing.

1. Remove flare nut from service valve.
2. Apply refrigerant oil to flare nut sections of service valve and pipings.
3. Match center of piping to large diameter side service valve, and tighten flarenut first by hand, then securely tighten using torque wrench.
4. Perform air purge and gas leak inspection.
5. Wrap the provided insulating material around piping using vinyl tape.

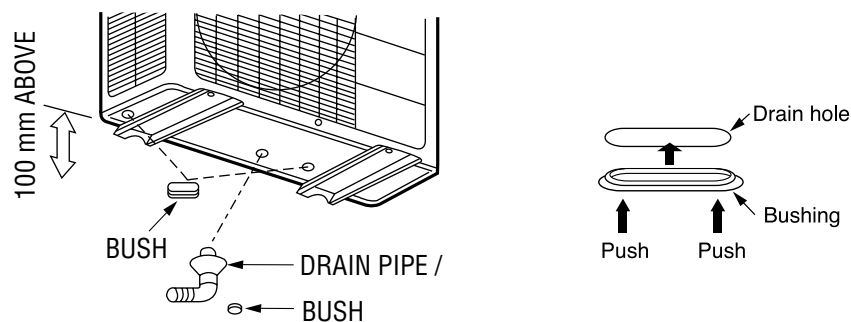
Condensed water disposal of outdoor unit

- There are holes on the base of outdoor unit for condensed water to drain.
- To lead condensed water to the drain hole, place the outdoor unit on the mounting stand (optional) or on blocks to raise its level more than 100mm from the ground surface. Connect the drain pipe as shown in the figure. Cover two other water drain holes with the bushings included. (To install a bushing, push in both ends of the bushing so that it aligns with the drain hole.)
- When connecting the drain pipe, make sure that the bushing does not lift off or deviate from the base.
- Install the outdoor unit on a stable, flat surface and check to see that the condensed water drains.

When Using and Installing in Cold Areas

When the air conditioner is used in low temperature and in snowy conditions, water from the heat exchanger may freeze on the base surface and cause poor drainage. When using the air conditioner in such areas, do not install the bushings. Keep a minimum of 250mm between the drain hole and the ground. When using the drain pipe, consult your sales agent.

※ For more details, refer to the Installation Manual for Cold Areas.

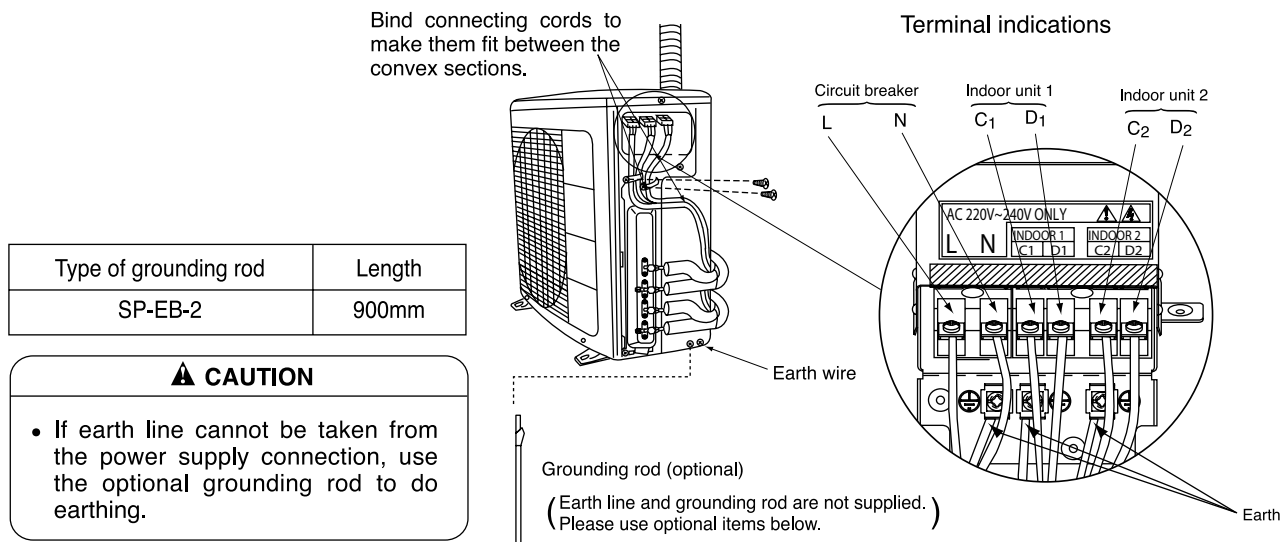


Connection of the connecting cords and power cord. (Outdoor unit)

MODEL RAM-35QH5

⚠ WARNING

- Connecting cord should be connected according to Fig.1, that the Indoor unit No. shall match with terminal board No. of Outdoor unit.
- Be sure to fix the connecting cord with the band as shown below. Otherwise water leakage causes short circuit or faults.



Wiring pattern
Indoor Unit

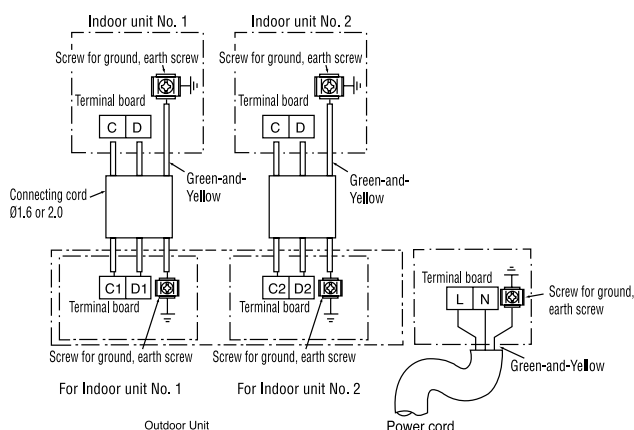


Fig. 1

⚠ WARNING

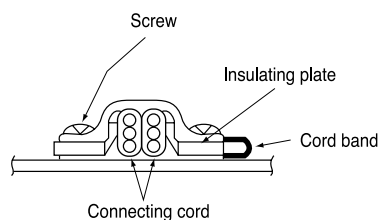
Connection of the power cord and connecting cord

- Securely screw in the power cord and connecting cord so that it will not get loose or disconnect.
- Tightening torque reference value:
1.2 to 1.6 N·m (12 to 16 kgf·cm)
- Excessive tightening may damage the interior of the cord requiring replacement.
- Power cord and Connecting cord
-

⚠ CAUTION

- To prevent a connection error, connecting cords should be bundled and taped to each respective pipe. If connecting cords are mixed with other indoor units, a refrigeration cycle abnormality may occur, causing dripping.

- When putting two connecting cords through the band.



⚠ WARNING

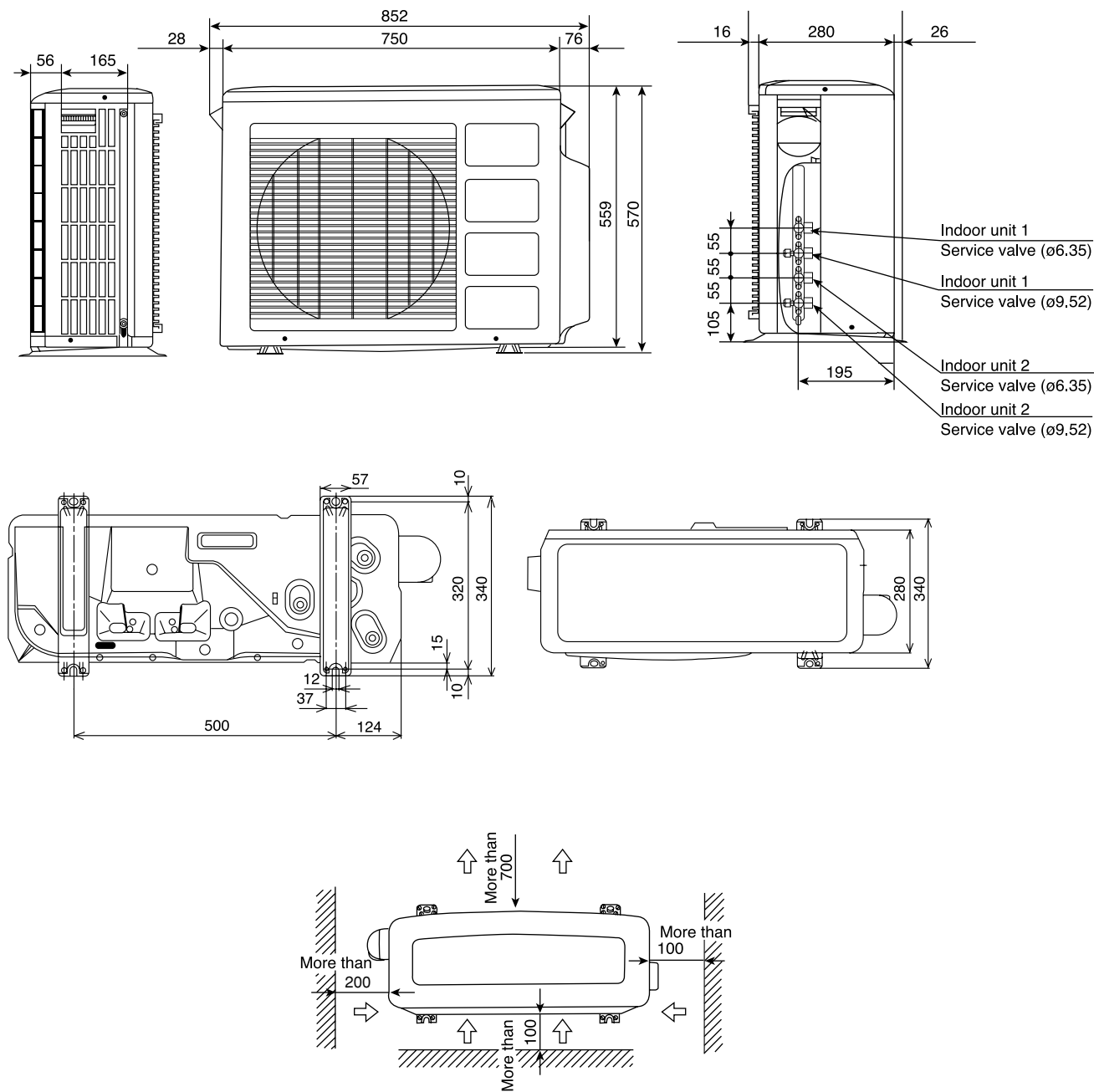
- Leave some space in the connecting cord for maintenance purpose and be sure to secure it with the cord band.
 - Secure the connecting cord along the coated part of the wire using the cord band. Do not exert pressure on the wire as this may cause overheating or fire.
-

- Hold the handle of the side cover, slide down and take off the corner hook, then pull. Reverse these steps when installing.

CONSTRUCTION AND DIMENSIONAL DIAGRAM

MODEL RAM-35QH5

Unit: mm



Service space

Note:

1. Insulated pipes should be used for both small and large diameter pipes.
2. Piping length should be within 35m in total.
3. Height difference of piping between indoor unit and outdoor unit should be within 20m.
4. Overhead clearance of outdoor unit should be 200mm to allow servicing.
5. For electrical connection, please refer to the installation manual.

ATTENTION

During service, before opening the side cover, please switch off power supply.

MAIN PARTS COMPONENT

FAN MOTOR

Fan Motor Specifications

MODEL		RAM-35QH5
POWER SOURCE		DC : 360V
OUTPUT		40W
CONNECTION		<p>(Control circuit built in)</p>
RESISTANCE VALUE (Ω)	20°C (68°F)	—
	75°C (167°F)	—

BLU : BLUE

YEL : YELLOW

BRN : BROWN

WHT : WHITE

GRY : GRAY

ORN : ORANGE

GRN : GREEN

RED : RED

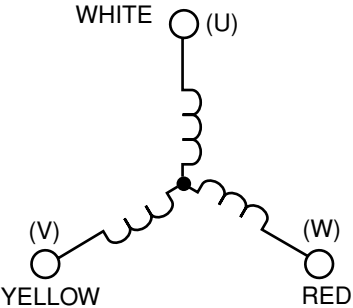
BLK : BLACK

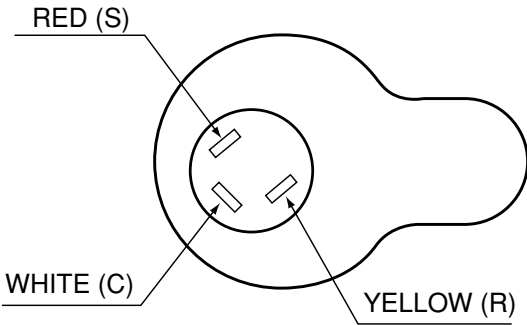
PNK : PINK

VIO : VIOLET

COMPRESSOR

Compressor Motor Specifications

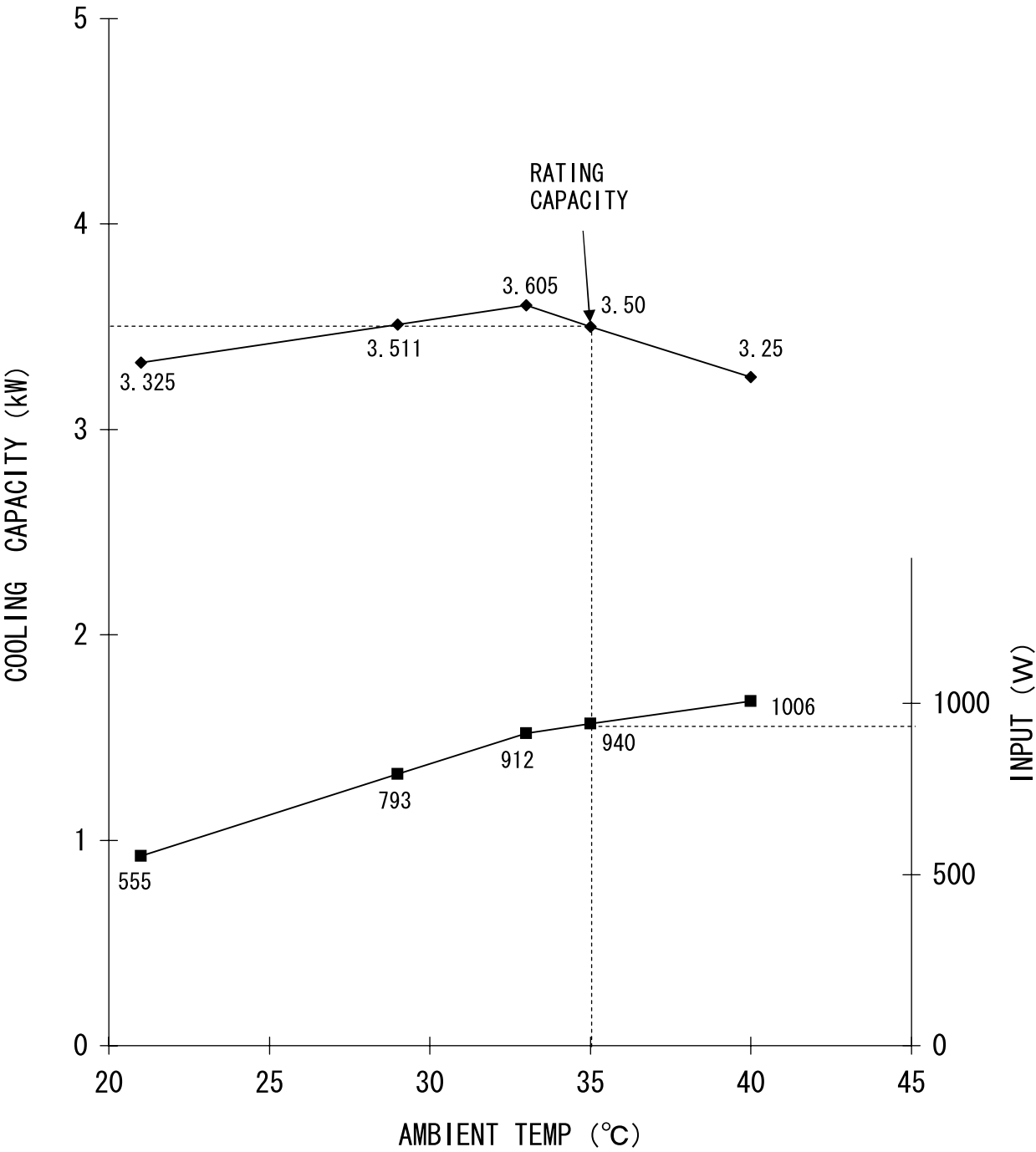
MODEL		RAM-35QH5
COMPRESSOR MODEL		JU1013DB
PHASE		SINGLE
RATED VOLTAGE		DC: 280-330V
RATED FREQUENCY		50Hz
POLE NUMBER		4
CONNECTION		
RESISTANCE VALUE (Ω)	25°C (68°F)	1.268
	75°C (167°F)	1.512



CAPACITY DIAGRAM (RELATED TO THE AMBIENT TEMPERATURE)

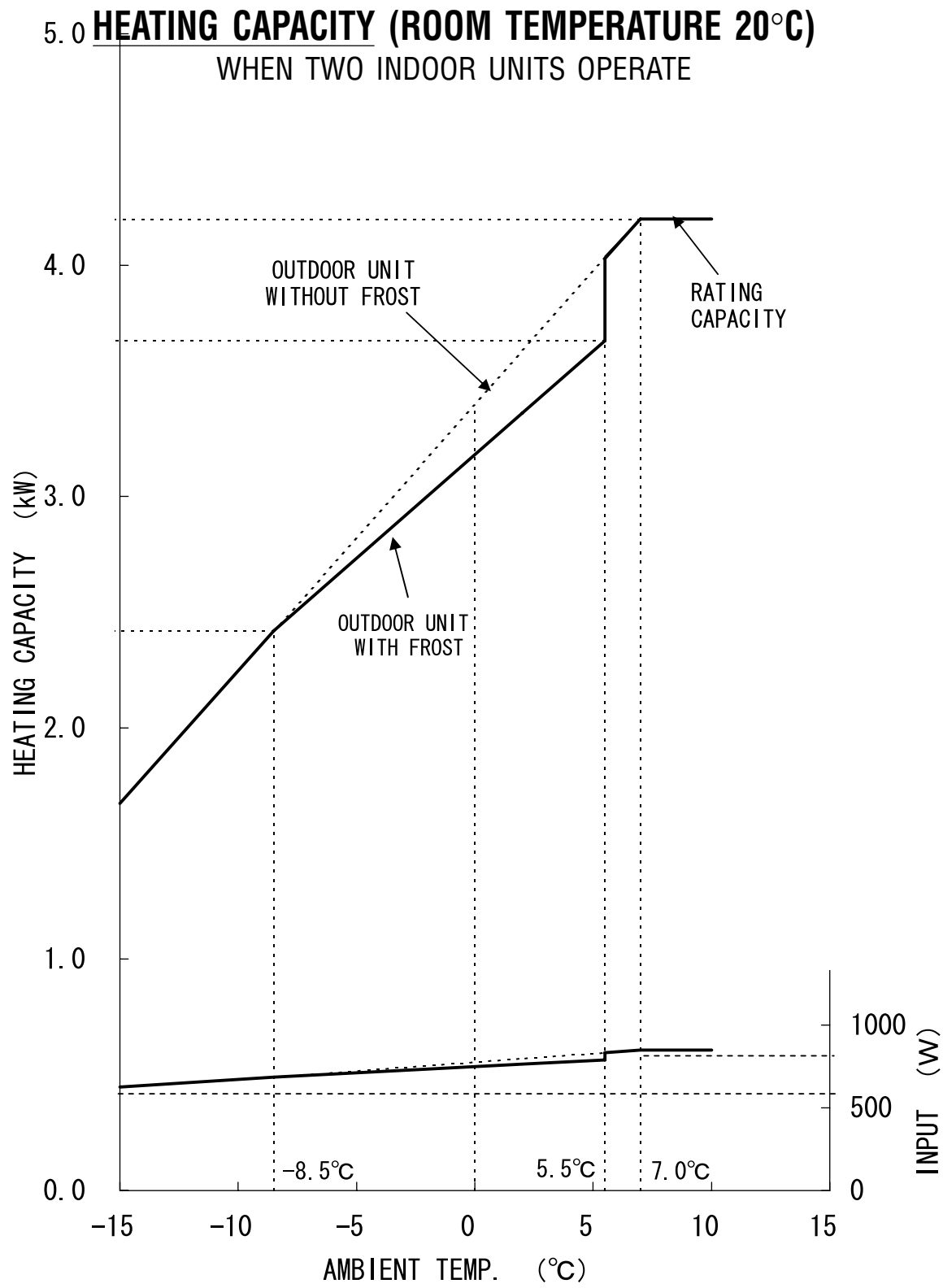
MODEL : RAM-35QH5

COOLING CAPACITY (ROOM TEMPERATURE 27°C)
WHEN TWO INDOOR UNITS OPERATE



CAPACITY DIAGRAM (RELATED TO THE AMBIENT TEMPERATURE)

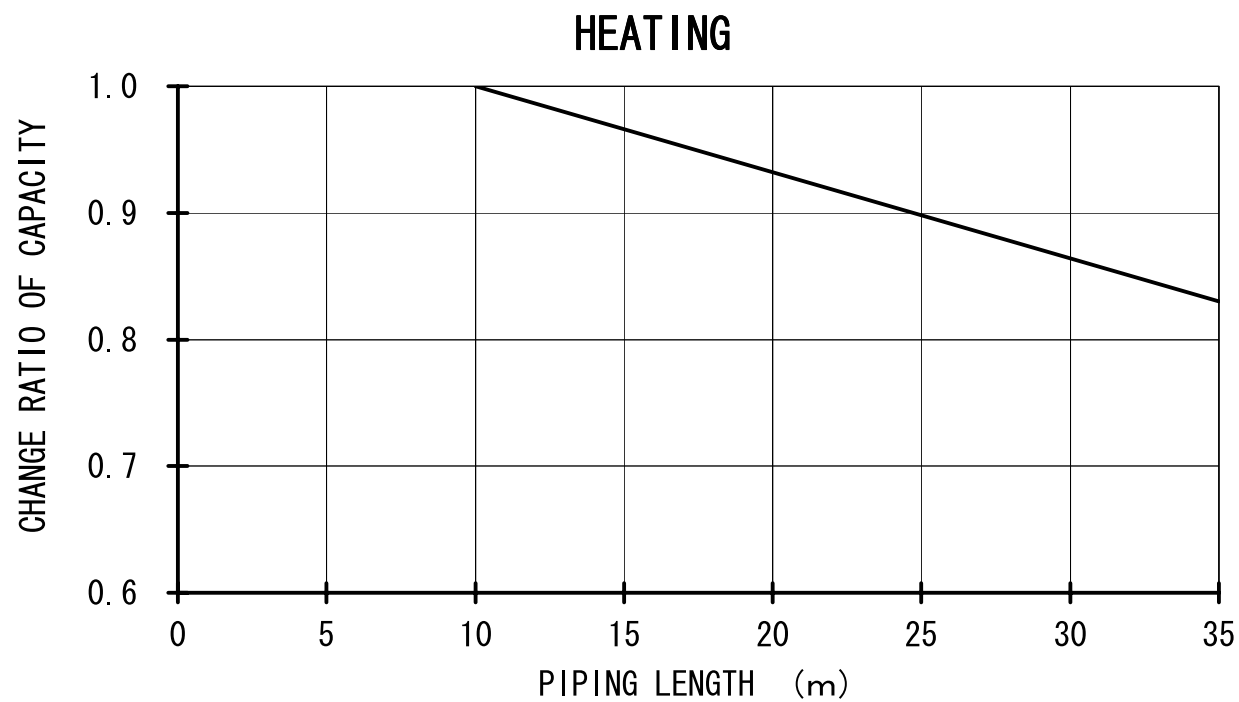
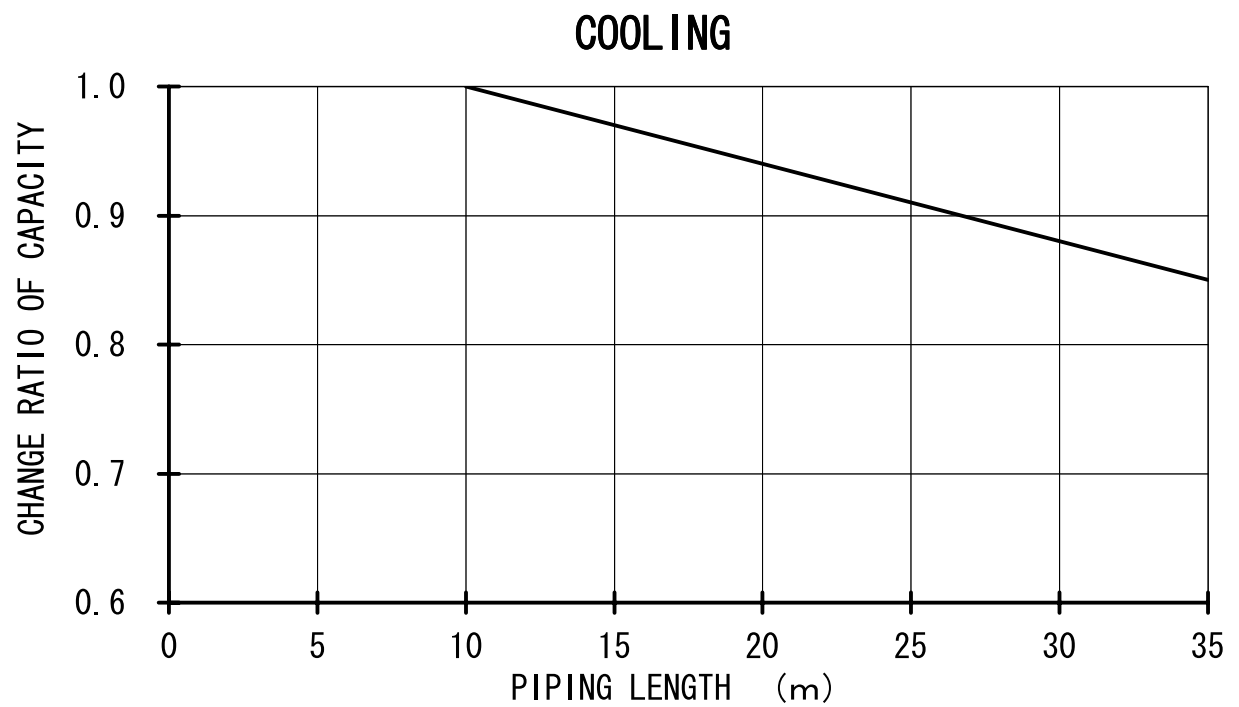
MODEL : RAM-35QH5



CAPACITY DIAGRAM (RELATED TO THE PIPING LENGTH)

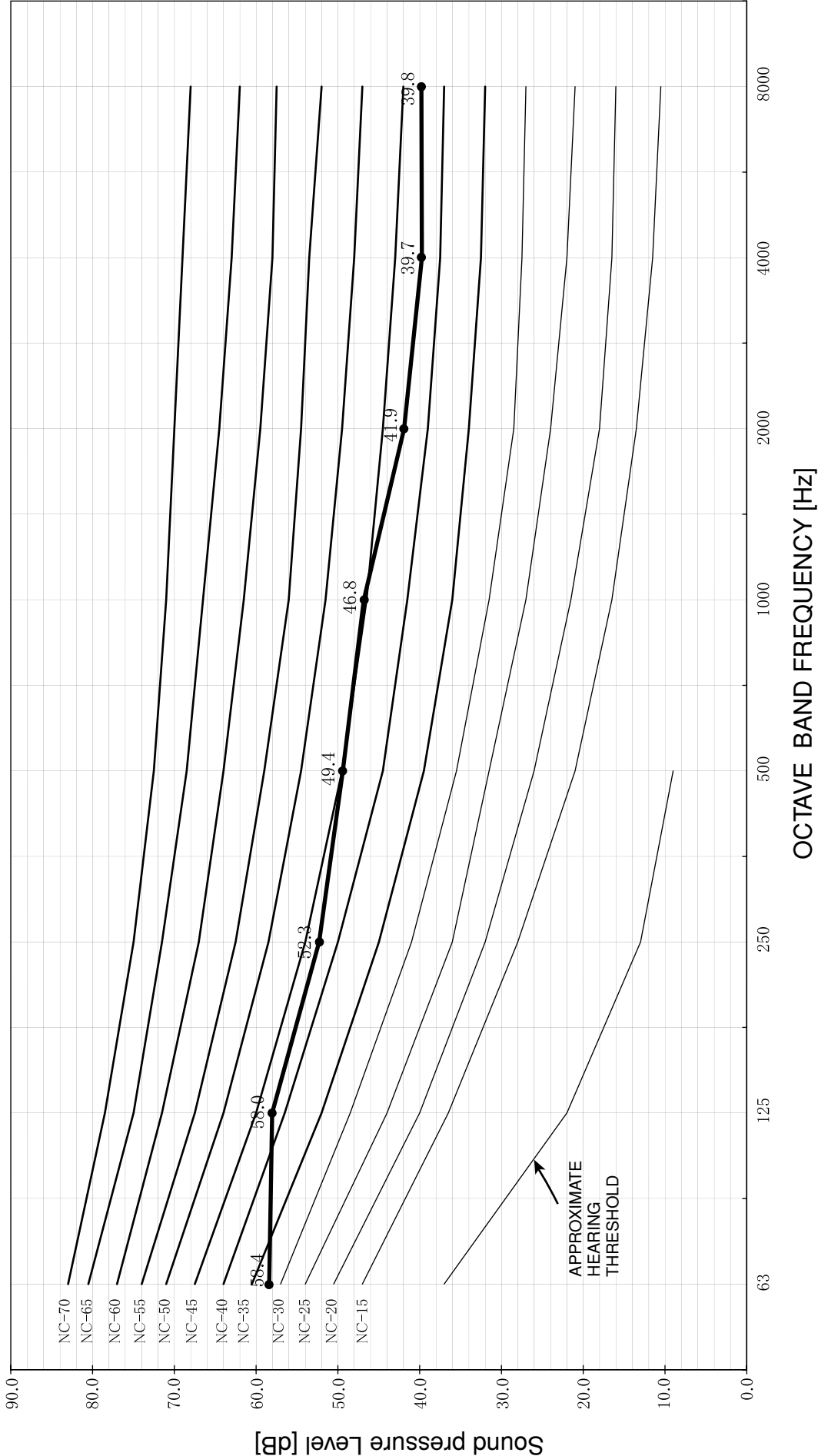
MODEL : RAM-35QH5

CAPACITY DIAGRAM (RELATED TO THE PIPING LENGTH)



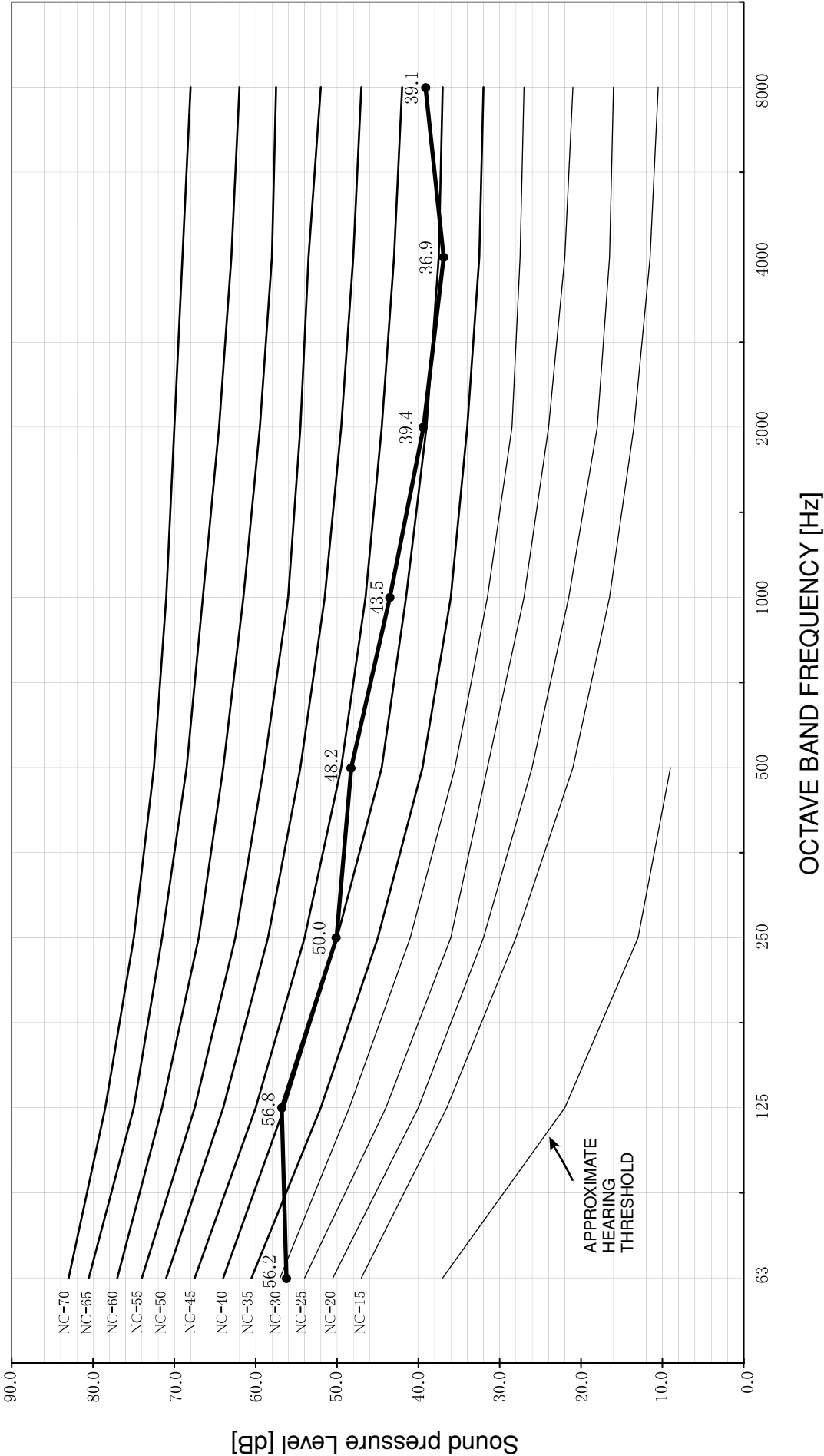
NC CURVE FOR HEATING (TWO UNITS RUN)

MODEL : RAM-35QH5 (Heating)



NC CURVE FOR COOLING (TWO UNITS RUN)

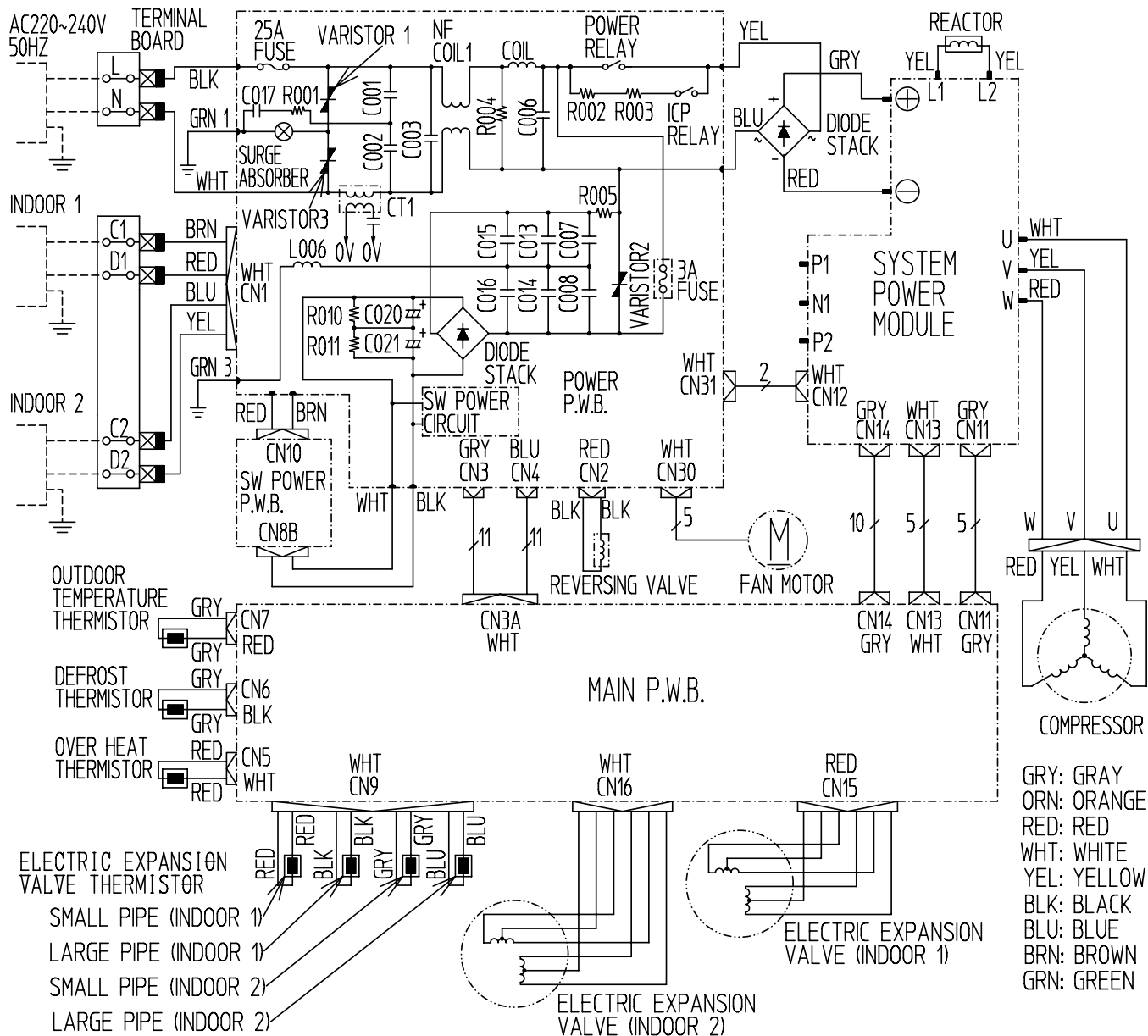
MODEL : RAM-35QH5 (Cooling)



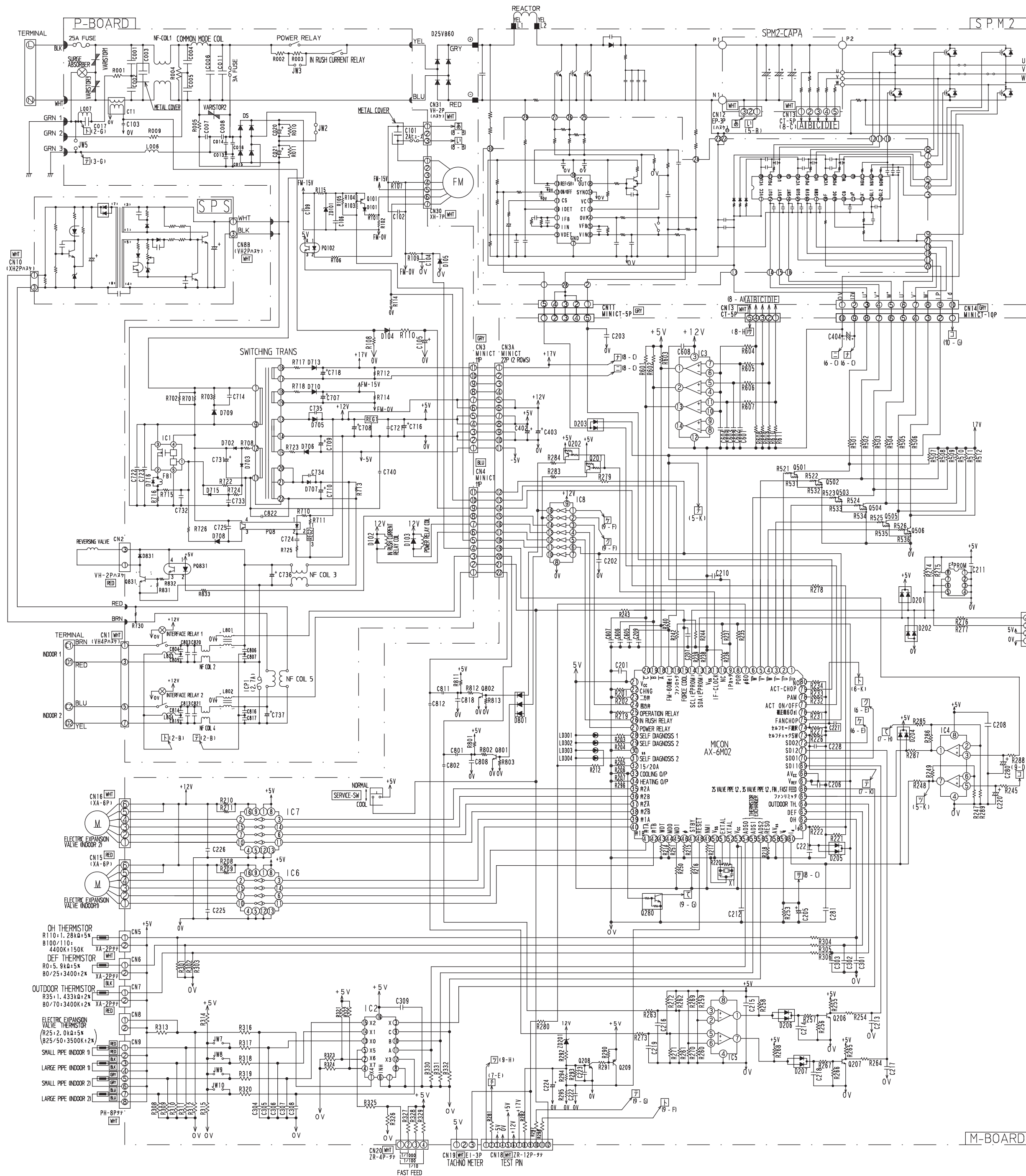
WIRING DIAGRAM

OUTDOOR UNIT

MODEL RAM-35QH5



PRINTED WIRING BOARD LOCATION DIAGRAM
MODEL RAM-35QH5



MOUNTING
R : RADIAL
C : SMD
A : AXIAL
H : HAND INSERT

PCB SET
NO MARKING : M-BORD-AS
P : M-BORD-AS

TYPE
F : FILM
C : CERAMIC
D : ELECTROLYTIC

RESISTOR

MARK	RATING			W	VOLTAGE	PCB SET	REMARK
	Ω	%	W				
R280	10	5%	1/16	C	17	1608	
R281	100	5%	1/16	C	17	1608	
R282	100	5%	1/16	C	17	1608	
R283	360	5%	1/10	C	27	2125	
R284	360	5%	1/10	C	27	2125	
R285			1/16	C		1608	
R286	2K	1%	1/16	C	48	1608	
R287	2K	5%	1/16	C	48	1608	
R288	1K	5%	1/16	C	48	1608	
R289	1K	1%	1/16	C	48	1608	
R290	10K	5%	1/16	C	10	1608	
R291	4.7K	5%	1/16	C	28	1608	
R292	3K	5%	1/16	C	28	1608	
R293	1.6K	5%	1/16	C	30	1608	
R294	27K	5%	1/16	C	31	1608	
R295	5.1K	5%	1/16	C	18	1608	
R296	10K	5%	1/16	C	10	1608	
R297	1K	5%	1/16	C	28	1608	
R298	1K	5%	1/16	C	28	1608	
R301	3.74K	1%	1/16	C	32	1608	
R302	3.01K	1%	1/16	C	33	1608	
R303	3.01K	1%	1/16	C	33	1608	
R304	100	5%	1/16	C	10	1608	
R305	10K	5%	1/16	C	10	1608	
R306	100	5%	1/16	C	10	1608	
R307	2K	5%	1/16	C	34	1608	
R308	2K	2%	1/16	C	34	1608	
R309	2K	2%	1/16	C	34	1608	
R310	2K	2%	1/16	C	34	1608	
R311	2K	2%	1/16	C	34	1608	
R312	10K	1%	1/16	C	10	1608	
R313	5.1K	5%	1/16	C	18	1608	
R314			1/16	C		1608	
R315			1/16	C		1608	
R316	1K	5%	1/16	C	28	1608	
R317	1K	5%	1/16	C	28	1608	
R318	1K	5%	1/16	C	28	1608	
R319	1K	5%	1/16	C	28	1608	
R320	1K	5%	1/16	C	28	1608	
R321			1/16	C		1608	
R322			1/16	C		1608	
R323	10K	5%	1/16	C	10	1608	
R324	10K	5%	1/16	C	10	1608	
R325	1K	5%	1/16	C	28	1608	
R326	2.7K	5%	1/16	C	38	1608	
R327	470	5%	1/16	C	37	1608	
R328	1.6K	5%	1/16	C	39	1608	
R329	4.3K	5%	1/16	C	38	1608	
R330	10K	5%	1/16	C	10	1608	
R331	10K	5%	1/16	C	10	1608	
R332	10K	5%	1/16	C	10	1608	
R501	1K	5%	1/16	C	28	1608	
R502	1K	5%	1/16	C	28	1608	
R503	1K	5%	1/16	C	28	1608	
R504	1K	5%	1/16	C	28	1608	
R505	1K	5%	1/16	C	28	1608	
R506	1K	5%	1/16	C	28	1608	
R507	5.1K	5%	1/16	C	48	2116	
R508	5.1K	5%	1/16	C	48	2116	
R509	5.1K	5%	1/16	C	48	2116	
R510	5.1K	5%	1/16	C	48	2116	
R511	5.1K	5%	1/16	C	48	2116	
R512	5.1K	5%	1/16	C	48	2116	
R521	10K	5%	1/16	C	10	1608	
R522	10K	5%	1/16	C	10	1608	
R523	10K	5%	1/16	C	10	1608	
R524	10K	5%	1/16	C	10	1608	
R525	10K	5%	1/16	C	10	1608	
R526	10K	5%	1/16	C	10	1608	
R531	5.1K	5%	1/16	C	18	1608	
R532	5.1K	5%	1/16	C	18	1608	
R533	5.1K	5%	1/16	C	18	1608	
R534	5.1K	5%	1/16	C	18	1608	
R535	5.1K	5%	1/16	C	18	1608	
R536	5.1K	5%	1/16	C	18	1608	
R601	2K	5%	1/16	C	18	1608	
R602	2K	5%	1/16	C	18	1608	
R603	2K	5%	1/16	C	18	1608	
R604	100	5%	1/16	C	10	1608	
R605	100	5%	1/16	C	10	1608	
R606	100	5%	1/16	C	10	1608	
R607	100	5%	1/16	C	10	1608	
R608	4.02K	1%	1/16	C	44	1608	
R609	4.02K	1%	1/16	C	44	1608	
R610	4.02K	1%	1/16	C	44	1608	
R611	4.02K	1%	1/16	C	44	1608	

MARK	RATING			W	VOLTAGE	PCB SET	REMARK
	μ	%	V				
R701	560K	5%	1/2	A	17	1608	
R702	560K	5%	1/2	A	17	1608	
R703	100K	5%	2	A	29	1608	
R704				A		1608	
R708	10	5%	1/4	A	17	1608	
R710	1.8K	5%	1/4	A	18	1608	
R711	75	5%	1/6	A	28	1608	
R712	3.3K	5%	1/4	A	27	1608	
R713	8.2K	5%	1	A	28	1608	
R714	3.3K	5%	1/4	A	28	1608	
R715	680	5%	1/4	A	28	1608	
R716	0.39	5%	1/4	A	28	1608	
R717	JUMPER WIRE	1/4	A	A		1608	
R718	8.2	5%	1/4	A	29	1608	
R722	2.7K	5%	1/4	A	27	1608	
R723	33	5%	1/6	A	28	1608	
R724	2.7K	5%	1/4	A	27	1608	
R725	JUMPER WIRE	1/4	A	A		1608	
R726	3.3K	5%	1/4	A	17	1608	
R730	1.6K	5%	2	A	28	1608	
R801	39	5%	1/4	C		1608	
R802	39	5%	1/4	C		1608	
R803	3K	5%	1/16	C		1608	
R811	39	5%	1/4	C		1608	
R812	39	5%	1/4	C		1608	
R813	3K	5%	1/16	C		1608	
R831	10K	5%	1/6	A	39	1608	
R832	7.5K	5%	1/2	A	37	1608	
R833	620	5%	1/6	A	32	1608	

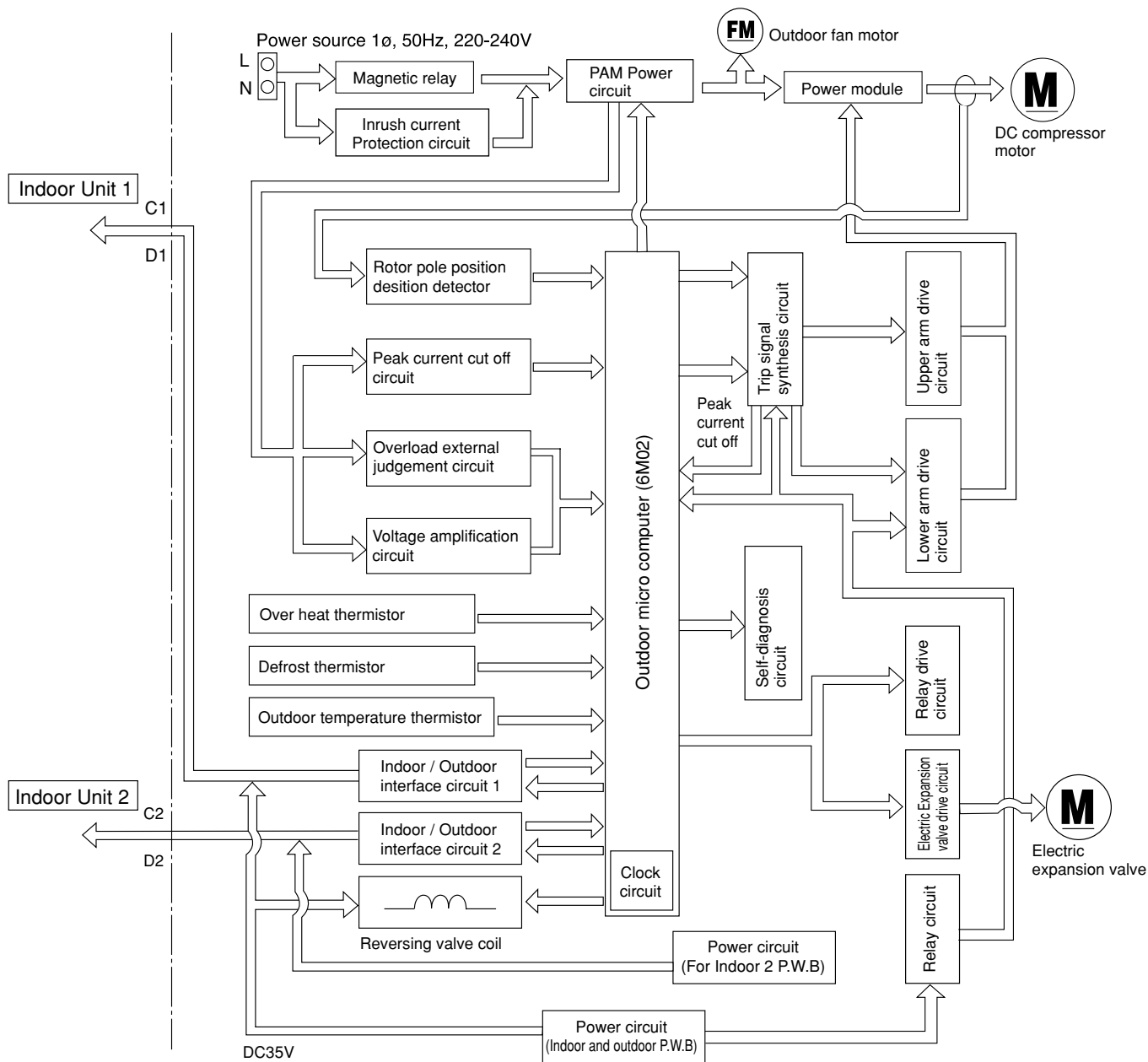
CAPACITOR

MARK	RATING		TYPE	W	VOLTAGE	PCB SET	REMARK
	μ	V					
C001	0.01	AC250	C	R	P	72	無極性
C002	0.01	AC250	C	R	P	72	無極性
C003	0.56	630	C	R	P	93	無極性
C004			C	R	P		
C005			C	R	P		
C006	4.0	AC400	F	H	P	68	無極性
C007	0.01	AC250	C	R	P	72	無極性
C008	0.01	AC250	C	R	P	72	無極性
C010			D	H	P		
C011			F	H	P		
C013	0.01	AC250	C	R	P	72	無極性
C014	0.01	AC250	C	R	P	72	無極性
C015	0.01	AC250	C	R	P	72	無極性
C016	0.01	AC250	C	R	P	72	無極性
C017	0.01	AC250	C	R	P	72	無極性
C020	220	200	D	H	P	67	MM
C021	220	200	D	H	P	67	MM

BLOCK DIAGRAM

OUTDOOR

MODEL RAM-35QH5



BASIC MODE

Operation mode		Fan	Cooling	Dehumidifying	Heating	Auto
Basic operation of start / stop switch		<div>Start / stop switch</div> <div>Operation lamp</div> <div>Start Stop Start Stop</div>				
Timer functions	Off-timer	<div>Start / stop switch</div> <div>Reserve switch</div> <div>Cancel switch</div> <div>Operation lamp</div> <div>Timer lamp</div> <div>Remote controller timer mark "O"</div> <div>Timer memory</div> <div>(Off-timer during stop) (Change in reserved time)</div>				
	On-timer	<div>Start / stop switch</div> <div>Reserve switch</div> <div>Cancel switch</div> <div>Operation lamp</div> <div>Timer lamp</div> <div>Remote controller timer mark "I"</div> <div>Timer memory</div> <div>(Change in reserved time) (Off-timer during operation)</div>				
Fan speed mode (indoor fan)	Auto		<div>Changes from "Hi" to "Med" or "Lo" depending on room temperature.</div> <div><div>Room temperature</div><div>Temperature set for cooling</div><div>Thermo judgment</div><div>Compressor</div><div>Hi</div><div>Med</div><div>Lo</div><div>3'</div></div> <div>1. Runs at "Hi" until first thermo off after operation is started. 2. Runs at "Lo" when thermo is off.</div>		<div>Set to "Ultra-Lo", "Lo", "Med", "Hi", "Ultra-Hi" or "stop" depending on the room temperature, time and heat exchange temperature. Set to "stop" if the room temperature is 18°C in the "Ultra-Lo" mode other than during preheating (cooling is recovered at 18.33°C).</div> <div>When the compressor is running at maximum speed during hot dash or when recovered from defrosting.</div> <div><div>°C</div><div>42.32</div><div>37.66</div><div>34.66</div><div>32.66</div><div>29.66</div><div>24.66</div><div>Hi or ultra-Hi (fan speed set to "auto")</div><div>Med</div><div>Lo</div><div>In modes other than left</div><div>Heat exchanger temperature</div></div>	<div>(Operation mode)</div> <div>● Judgment based on the room temperature and external temperature: Cooling: external temperature $\geq 25^{\circ}\text{C}$, or $21^{\circ}\text{C} \leq$ external temperature $< 25^{\circ}\text{C}$ and room temperature $> 27^{\circ}\text{C}$ Heating: external temperature $< 18^{\circ}\text{C}$, or $18^{\circ}\text{C} \leq$ external temperature $< 21^{\circ}\text{C}$ and room temperature $\leq 23^{\circ}\text{C}$ Dehumidifying: $21^{\circ}\text{C} \leq$ external temperature $< 25^{\circ}\text{C}$ and room temperature $\leq 27^{\circ}\text{C}$, or $18^{\circ}\text{C} \leq$ external temperature $< 21^{\circ}\text{C}$ and room temperature $> 23^{\circ}\text{C}$</div> <div>● Set to the mode of the indoor unit that has previously been operating. If, when one indoor unit is heating, the other unit is set to auto, the other unit will also enter the heating operation. If, when one indoor unit is cooling or dehumidifying, the other unit is set to auto, the other unit will enter the cooling or dehumidifying operation.</div>
	Hi	Operates at "Hi" regardless of the room temperature.	Set to "Ultra-Hi" when the compressor runs at maximum speed, and to "Hi" in other modes.		<div>Set to "Ultra-Lo", "Lo", "Med", "Hi", "Ultra-Hi" or "Stop" depending on the room temperature and time. Set to "Stop" if the room temperature is 18°C in the "Ultra-Lo" mode other than during preheating (cooling is recovered at 18.33°C). Set to "Ultra-Hi" when the compressor is running at maximum speed during hot dash or when recovered from defrosting.</div>	<div><div>Temperature (°C)</div><div>32</div><div>31</div><div>30</div><div>29</div><div>28</div><div>27</div><div>26</div><div>25</div><div>24</div><div>23</div><div>22</div><div>21</div><div>20</div><div>19</div><div>18</div><div>17</div><div>16</div><div>14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30</div><div>External temperature (°C)</div><div>Cooling</div><div>Dehumidifying</div><div>Heating</div></div> <div>※ Operation mode stays uncharged even if the room or ambient temperature changes during operation.</div>
	Med	Operates at "Med" regardless of the room temperature.	Same as at left.		<div>Set to "Ultra-Lo", "Lo", "Med" or "Stop" depending on the room temperature and time. Set to "Stop" if the room temperature is 18°C in the "Ultra-Lo" mode other than during preheating (cooling is recovered at 18.33°C).</div>	
	Lo	Operates at "Lo" regardless of the room temperature.	Same as at left.	<div>Set to "Lo" in modes other than when the compressor stops.</div>	<div>Set to "Ultra-Lo", "Lo", or "Stop" depending on the room temperature and time. Set to "Stop" if the room temperature is 18°C in the "Ultra-Lo" mode other than during preheating (cooling is recovered at 18.33°C). The fan speed is controlled by the heat exchanger temperature; the overload control is executed as in the following diagram:</div> <div><div>KAFON</div><div>KAFOF</div><div>Heat exchanger temperature</div><div>On</div><div>Off</div><div>On</div><div>"Med" with overload</div><div>"Lo"</div></div>	
Basic operation of temperature controller	<div>Performs only fan operation at the set speed regardless of the room temperature.</div> <div><div>Start / stop switch</div><div>Operation lamp</div><div>Hi</div><div>Med</div><div>Lo</div></div>	See page 53.	See page 57.	See page 59.	<div>(Set room temperature)</div> <div>● All the following temperatures can be compensated for $\pm 3^{\circ}\text{C}$ using the remote control: Cooling: 27°C Heating: 23°C Dehumidifying: Current room temperature (upper limit: 27°C, lower limit: 23°C) ※ Operates at a target of set temperature minus 2°C.</div>	
Sleep operation (with sleep button ON)	<div>Enters sleep operation after set as on the left.</div> <div>Action during sleep operation silent (sleep) operation</div>	<div>·Same as at left.</div> <div>·See page 55.</div>	<div>·Same as at left.</div> <div>·See page 57.</div>	<div>·Same as at left.</div> <div>·See page 61.</div>	<div>·Same as at left.</div> <div>·Performs the sleep operation of each operation mode.</div>	

Combination of operations:

When operation mode is selected:

- You cannot operate the indoor units in the following combinations.
- The indoor unit which is switched on first continues to operate, but other indoor units which is switched on later, does not operate while the lamp lights.

One unit	Other unit
Heating	Cooling
	Dehumidifying
	Circulating (fan)

During automatic operation:

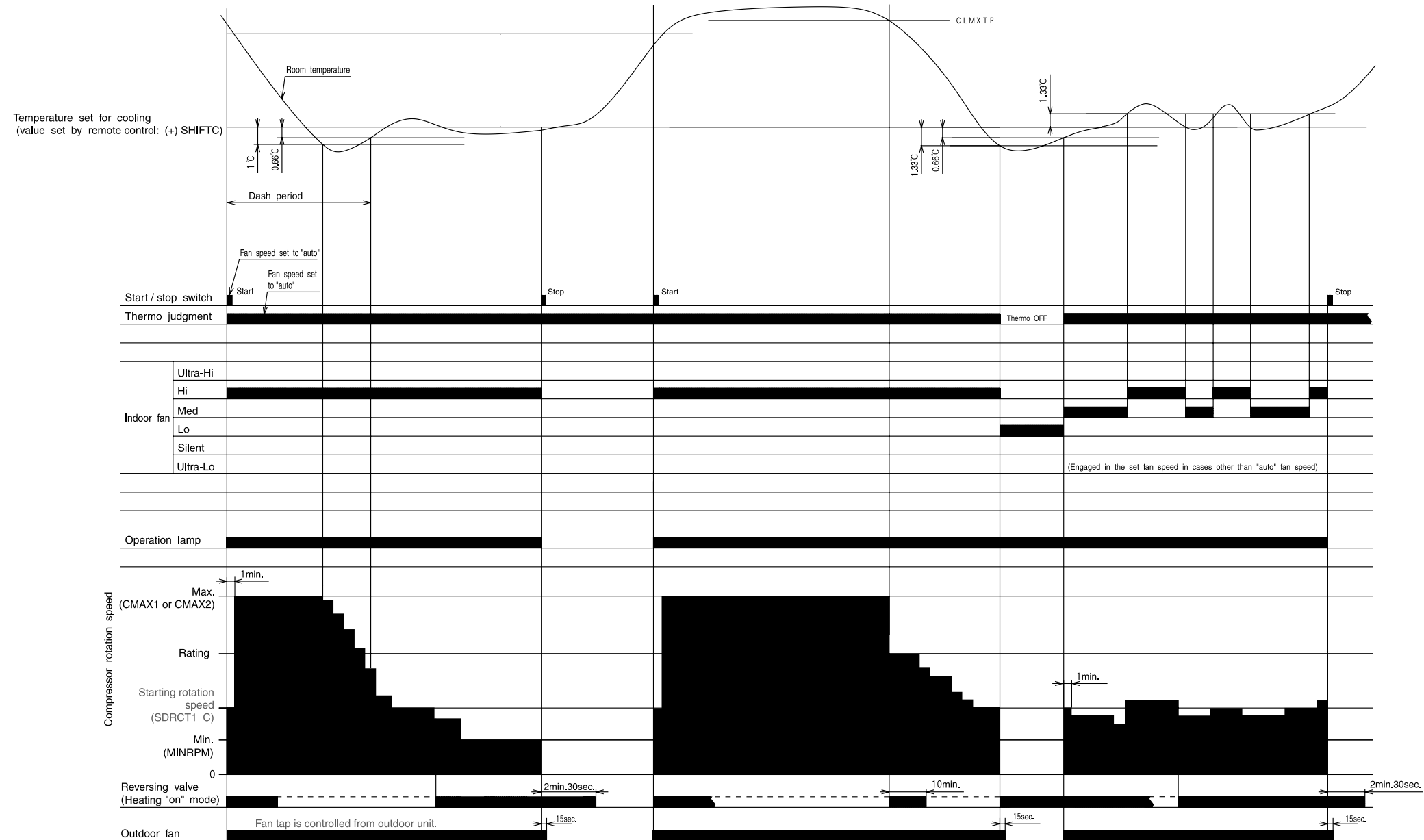
- When heating operation is automatically selected for the first indoor unit, the next indoor unit will then start to heat. Also, if cooling or dehumidifying is automatically selected for the first indoor unit, the next indoor unit will also start to cool or dehumidify.

Notes:

1. Refer to the PWRITE-ZU data for the constants expressed by capital alphabet letters in the drawing.
2. The speed set of rotation for the fan motor in each operation mode are as shown in Table 1.
3. The set room temperatures in the diagram include the shift values in Table 2.

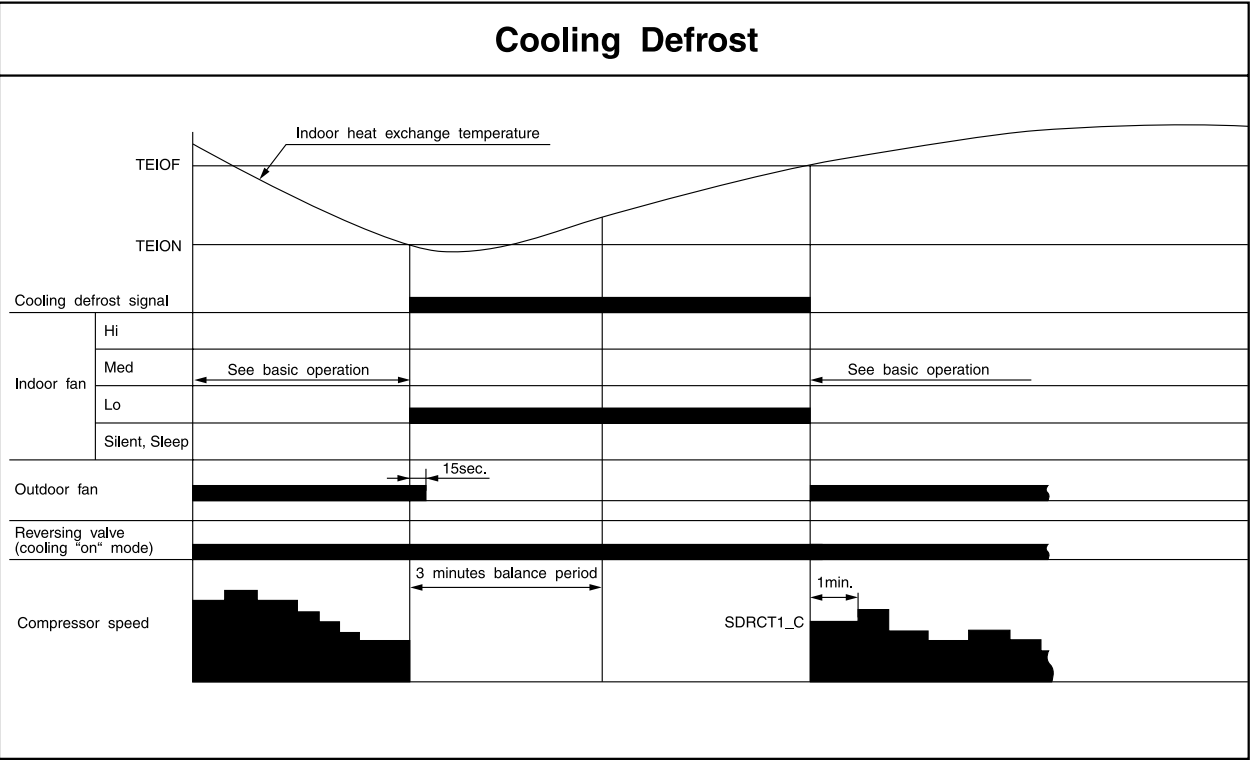
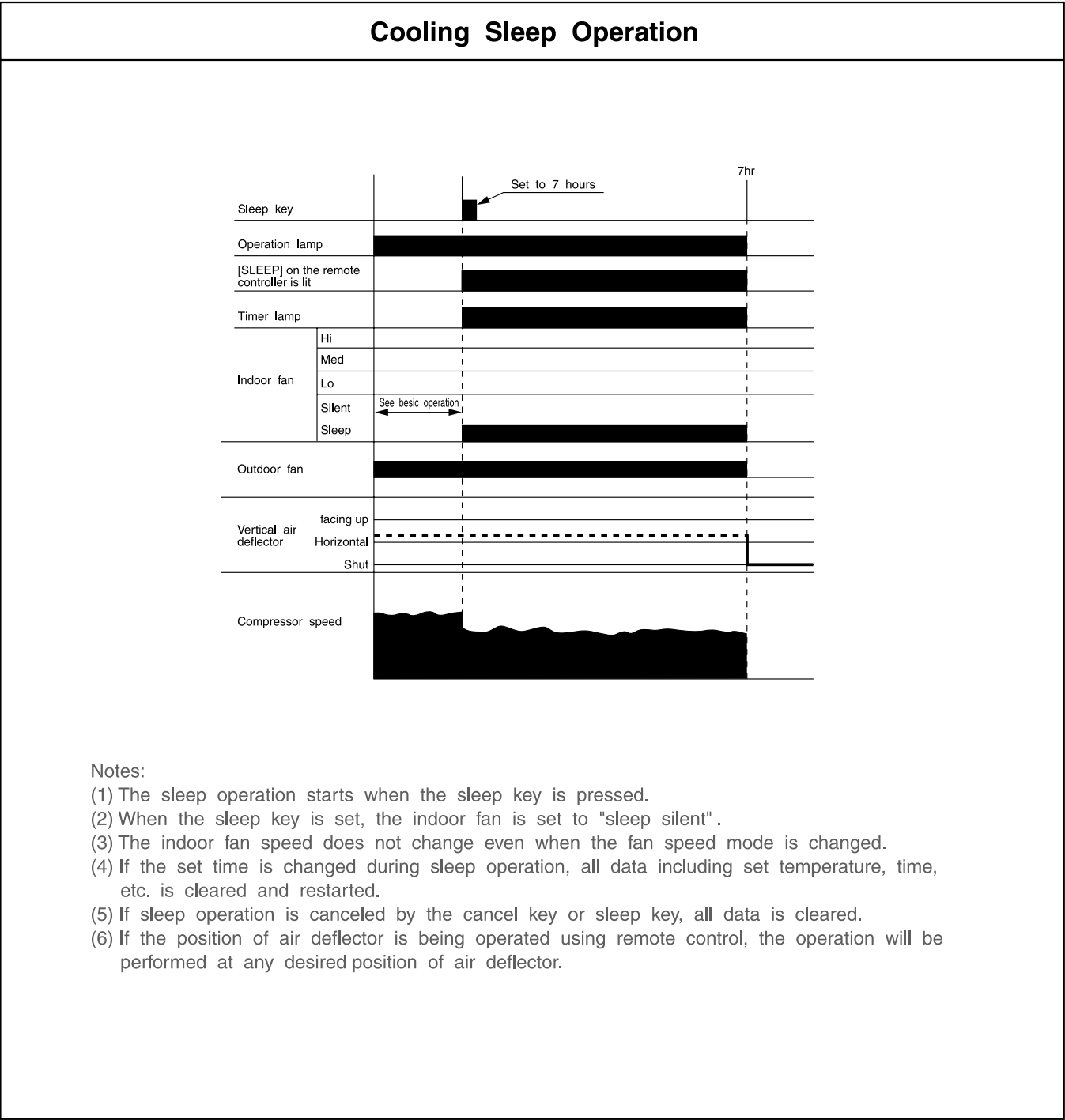
MODEL		RAM-35QH5
NO.	LABEL NAME	REQUIRED VALUE OF UNIT SIDE
46	OH_ON	118 °C
47	OH_OFF	105 °C
4A	PSTARTC2\$	150
4B	PSTARTC2K\$	300
4C	PSTARTH\$	100
4D	PSTARTH2\$	150
4E	PMIN\$	30
4F	DFCTPS\$	250
50	DFCTPN\$	240
51	DFSPPS\$	12
52	DFPSMX\$	480
53	PCLOSH\$	80
8C	WMAX1	4200 min ⁻¹
8D	WMAX2	4400 min ⁻¹
8E	CMAX1	4900 min ⁻¹
8F	CMAX2	4900 min ⁻¹
90	MINRPM	1600 min ⁻¹
91	STAROTP	5 °C
92	SDRCT1_W1	2000 min ⁻¹
93	TSKTM1_W1	60 sec.
94	SDRCT1_W2	3000 min ⁻¹
95	TSKTM1_W2	60 sec.
96	SDRCT1_C	2000 min ⁻¹
97	TSKTM1_C	60 sec.
98	SDSTEP	1000 min ⁻¹
99	TSKSPT	8 sec.
9D	TDF414	180 sec.
9E	DFMXTM	15 min.
9F	SDRCT2	2000 min ⁻¹
A0	TSKTM2	60 sec.
A1	DFSTEP	300 min ⁻¹
A2	TDFSPT	60 sec.
A3	DEFMAX	6000 min ⁻¹
A4	TDF415	120 sec.
A5	KYO_RPM	3000 min ⁻¹
D9	BONRPM_S	1900 min ⁻¹
DA	BONRPM_N	1300 min ⁻¹
DB	BOFRPM	2000 min ⁻¹
DE	DFSTMB	50 min.
DF	DFSTMB2	50 min.
E6	SBNTIM	10 min.
E7	SIREISA	300 min ⁻¹
E8	NDWN_ON	118 °C
E9	NDWN_OFF	105 °C
EA	PSTARTC1\$	250
EB	PSTARTC1K\$	300

Basic Cooling Operation

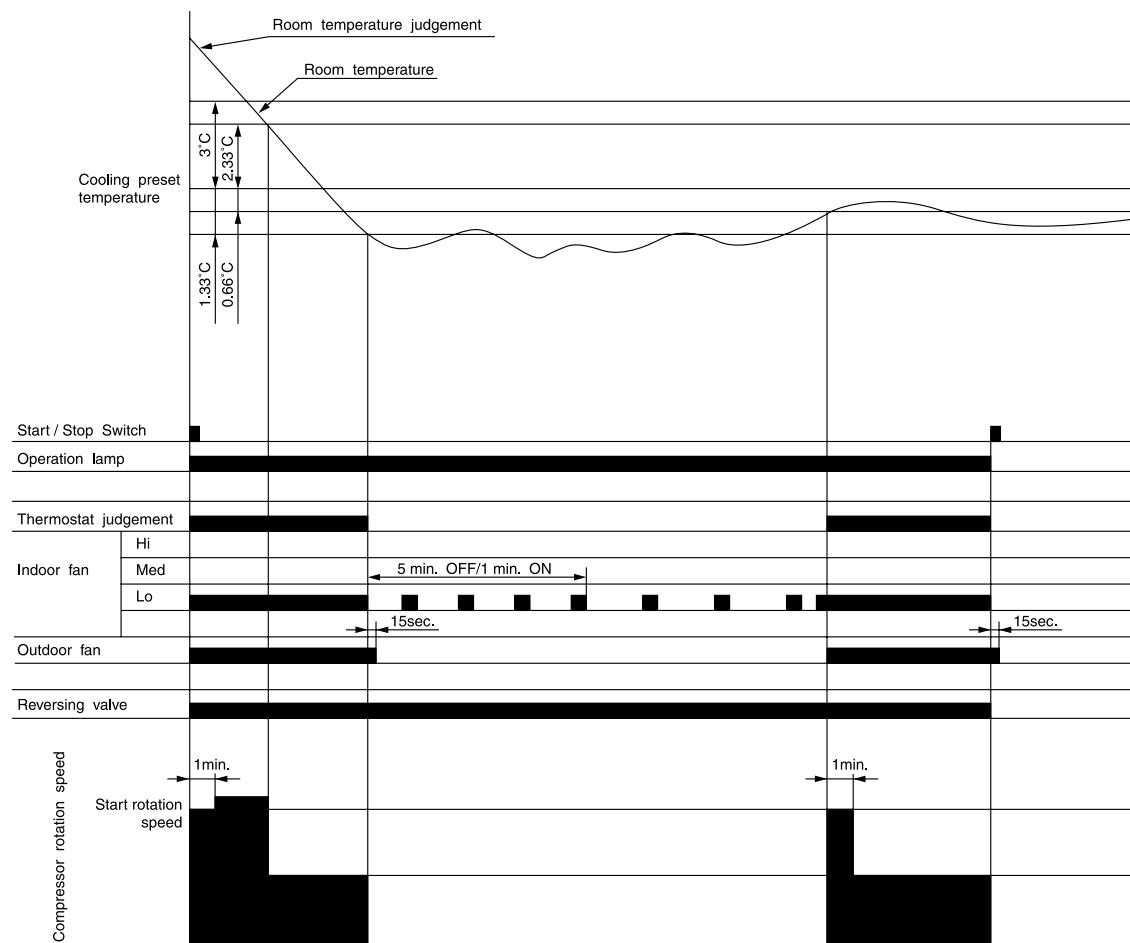


Notes:

- (1) Cool dash is started when the operation is started at fan speed "AUTO" or "HI" or when the fan speed is changed to "AUTO" or "HI" during cooling operation, and when the compressor speed (P item) reaches (CMAX1 or CMAX2) or higher.
- (2) The maximum compressor speed period during cool dash is finished ① when 25 minutes have elapsed after cool dash was started ② when the room temperature reaches the cooling set temperature -1°C (including cooling shift) and then becomes lower than the preset temperature by 0.66°C after the steady speed period, ③ when thermo is OFF.
(If cool dash finished in the above ①, the compressor does not go through the steady speed period but it starts fuzzy control.)
- (3) The thermo OFF temperature during cool dash is cooling set temperature (including cooling shift) -3°C. After thermo OFF, cool dash is finished and fuzzy control starts.
- (4) The compressor minimum ON time and minimum OFF time is 3 minutes.
- (5) The time limit for which the maximum compressor speed (CMAX1 or CMAX2) during normal cooling can be maintained is less than 60 minutes when the room temperature is less than CLMXTP: it is not provided when the room temperature is CLMXTP or more.
- (6) Compressor speed is determined by instruction sent from indoor unit and corrected by outdoor unit according to such factors as capacity, fan speed, number of units being operated, outdoor temperature, etc.
- (7) If another indoor unit is doing heating operation, cooling operation cannot be done.



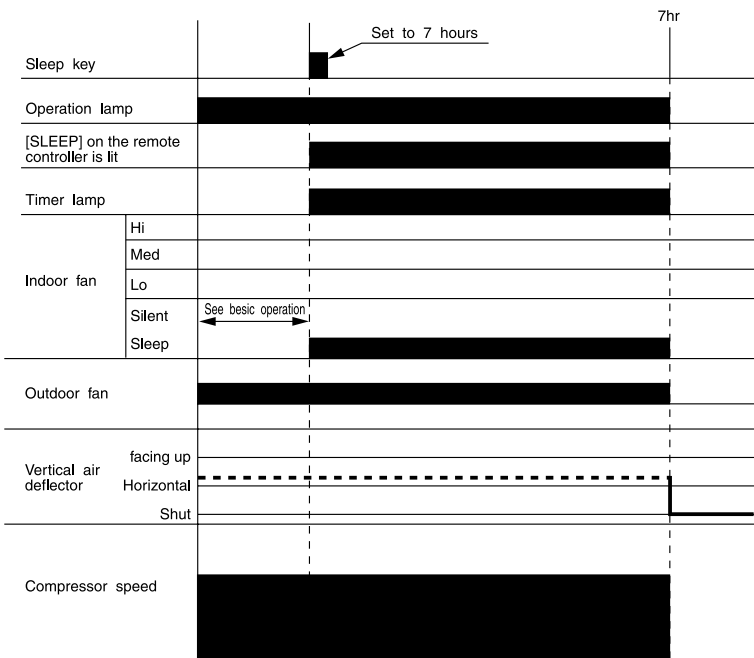
Dehumidifying



Notes:

- (1) The indoor fan is operated in the "Lo" mode, OFF for 5 minutes and ON for 1 minute, repeatedly according to the humidity judgement when the thermostat is turned OFF.
- (2) The compressor is operated forcedly for 3 minutes after operation is started.
- (3) The minimum ON time and OFF time of the compressor are 3 minutes.
- (4) At the start of operation, the thermostat will be off when room temperature \leq setting temperature -1.33°C ; the thermostat will be on when room temperature \geq setting temperature -0.66°C .
- (5) The following procedure is performed to prevent excessive cooling during operation other than start. However, this procedure applies only when the thermostat is intermittent:
 - Whether THERMO ON is to continue or not depends on the thermal condition when the 3-minute forced operation ceases.
 - ① "THERMO ON continues" when room temperature \geq setting temperature $+1^{\circ}\text{C}$: (The THERMO operation value is usually the same as that at "start of operation")
 - ② "Forced THERMO OFF" when room temperature $<$ setting temperature $+1^{\circ}\text{C}$: (The same THERMO operation value as that at "start of operation" is usually used for recovery)Therefore, if the air-conditioner is stabilized under this thermal condition, it will enter intermittent operation, which is "3-minute operation/3-minute stop".
- (6) Compressor speed is determined by instruction sent from indoor unit and corrected by outdoor unit according to such factors as capacity, fan speed, number of units being operated, outdoor temperature, etc.

Dehumidifying Sleep Operation



Notes:

- (1) The sleep operation starts when the sleep key is pressed.
- (2) When the sleep key is set, the indoor fan is set to "sleep silent".
- (3) The indoor fan speed does not change even when the fan speed mode is changed.
- (4) If the set time is changed during sleep operation, all data including set temperature, time, etc. is cleared and restarted.
- (5) If sleep operation is canceled by the cancel key or sleep key, all data is cleared.
- (6) If the position of air deflector is being operated using remote control, the operation will be performed at any desired position of air deflector.

Heating Basic Operation

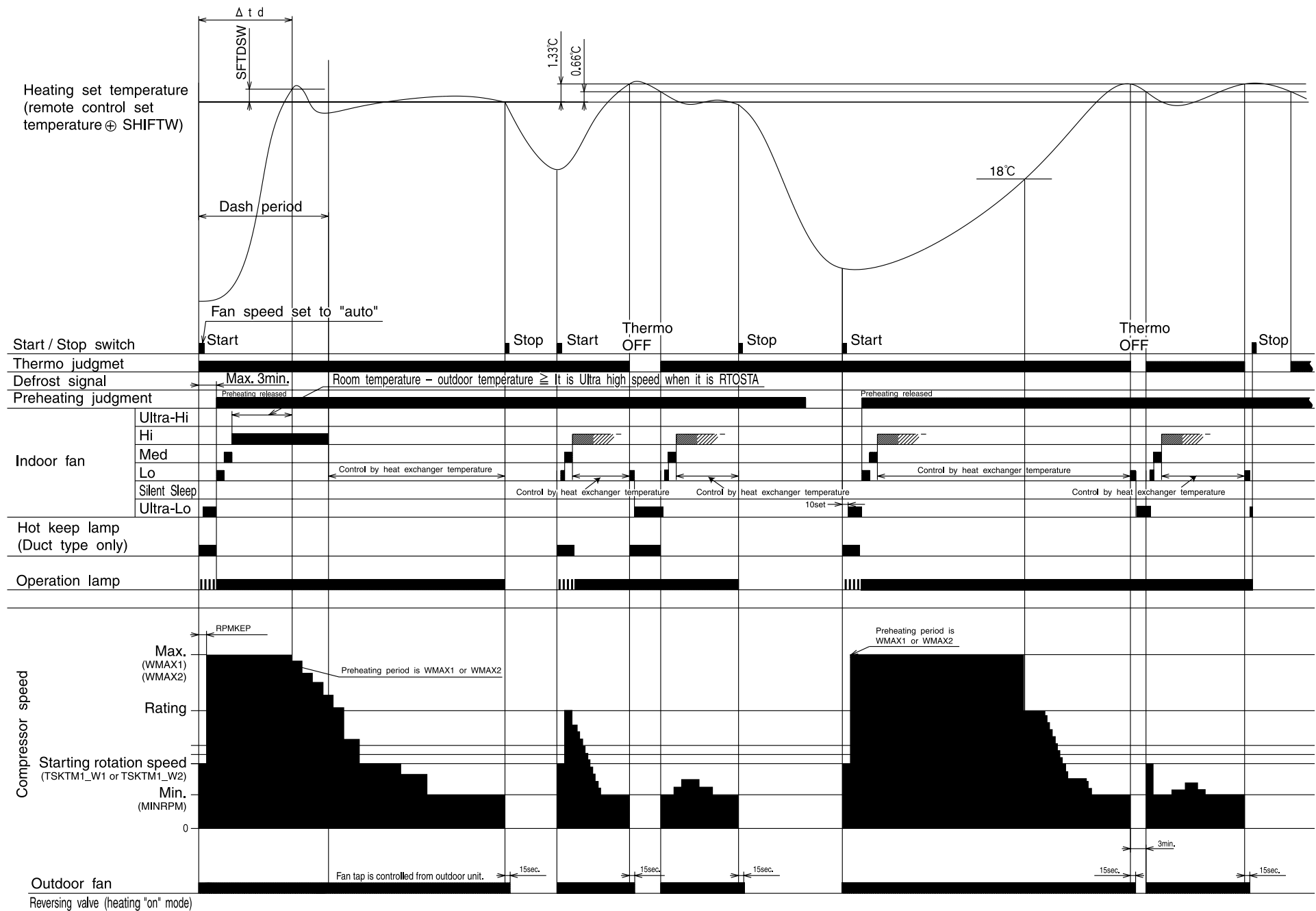


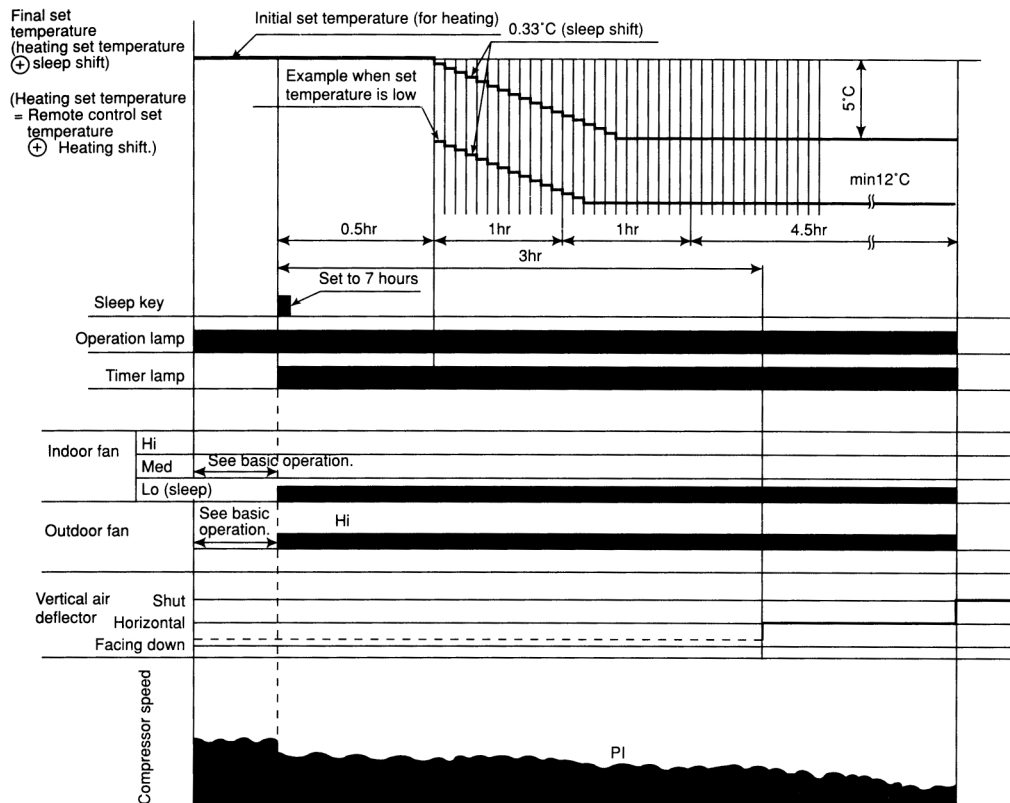
Table 6 Speed Specifications during Steady Speed Period

Δt_d (Hot dash time)	Wtd_1	Wtd_2
Less than 10 minutes	2000min ⁻¹	1600min ⁻¹
10-20 minutes	3000min ⁻¹	2400min ⁻¹
20 minutes or more	4000min ⁻¹	3200min ⁻¹

Notes:

- (1) Hot Dash is started when the operation is started at fan speed "AUTO" or "HI" or when the fan speed is changed to "AUTO" or "HI" during heating operation, and when the compressor speed (P item) reaches (WMAX1 or WMAX2) or higher with the room temperature at 8°C or less and outdoor temperature at 10°C or less.
- (2) The maximum compressor speed period during hot dash is finished (1) when the room temperature reaches the heating set temperature (including heating shift) plus SFTDSW or (2) when the thermo is off.
- (3) The thermo OFF temperature during hot dash is heating set temperature (including heating shift) plus 3°C. After thermo OFF, hot dash finishes, and PI control starts.
- (4) The compressor minimum ON time and minimum OFF time is 3 minutes.
- (5) The time limit for which the maximum compressor speed (WMAX1 or WMAX2) during normal heating (except for hot dash) can be maintained is less than 120 minutes when the room temperature is 18°C or more; it is not provided when the room temperature is less than 18°C and outdoor temperature is less than 4°C.
- (6) The operation indicator will blink every second during initial cycle operation, preheating, defrosting (including balance time after defrost is finished), or auto fresh defrosting. However, with duct type models, operation indicator does not blink, but Hot Keep indicator will light. And Hot Keep indicator will also light in "Thermo OFF" mode.
- (7) For preheating judgment, preheating starts if the heat exchange temperature is lower than YNEOFC and is cancelled if the heat exchange temperature is YNEOF plus 0.33°C or higher at the start of operation using the START/STOP button.
- (8) If the room temperature falls to less than 18°C in the "Ultra-Lo" mode, the indoor fan stops. When the room temperature is 18°C+0.33°C or more, the ultra-Lo operation restarts. However, the ultra-Lo operation during preheating or preheating after defrosting does not stop if the room temperature is less than 18°C.
- (9) Compressor speed is determined by instruction sent from indoor unit and corrected by outdoor unit according to such factors as capacity, fan speed, number of units being operated, outdoor temperature, etc.
- (10) If another indoor unit is doing cooling operation, dehumidifying operation or fan operation, heating operation cannot be done.

Heating Sleep Operation



Notes:

- (1) The sleep operation starts when the sleep key is pressed.
- (2) 30 minutes after the sleep key is set, the sleep shift of set temperature starts.
- (3) The maximum sleep shift of set temperature is 5°C, and the minimum is 12°C.
- (4) If the operation mode is changed during sleep operation, the changed operation mode is set and sleep control starts.
- (5) The indoor fan speed does not change even when the fan speed mode is changed. (Lo)
- (6) When defrosting is to be set during sleep operation, defrosting is engaged and sleep operation is restored after defrosting.
- (7) When operation is stopped during sleep operation, the set temperature when stopped, as well as the time, continue to be counted.
- (8) If the set time is changed during sleep operation, all data including set temperature, time, etc. is cleared and restarted.
- (9) If sleep operation is cancelled by the cancel key or sleep key, all data is cleared.

DEFROST

- Reversing valve defrost system is employed: it consists of balancing period → reversing cycle period → balancing period.

(1) Defrost start condition

- When all the following conditions are established, defrost is executed:
 - ① Normal operation
 - ② Heat exchange temperature is within defrost range specified by outdoor temperature and heat exchange temperature.
 - ③ Defrost inhibit period linked to outdoor temperature has passed.

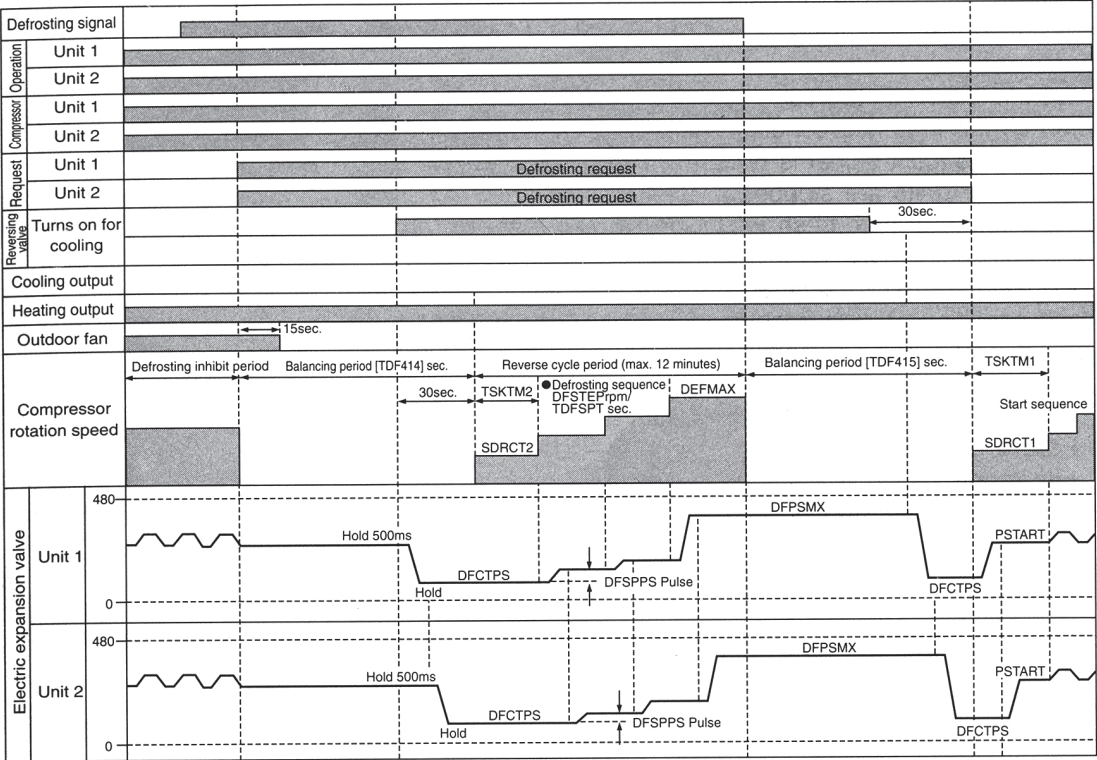
(2) Defrost release condition

- If any one of the following conditions is established, defrost is released:
 - ① Heat exchange temperature returns (heat exchange temperature \geq DEFOFF).
 - ② Defrost max time of 12 minutes has elapsed.
- Released by condition ① during balancing period: When remaining balancing period has elapsed, returned to initial condition (ASTUS = 0).
- Released by condition ① or ② during reversing cycle period: Shifted to balancing period.

(3) Outputs during defrost

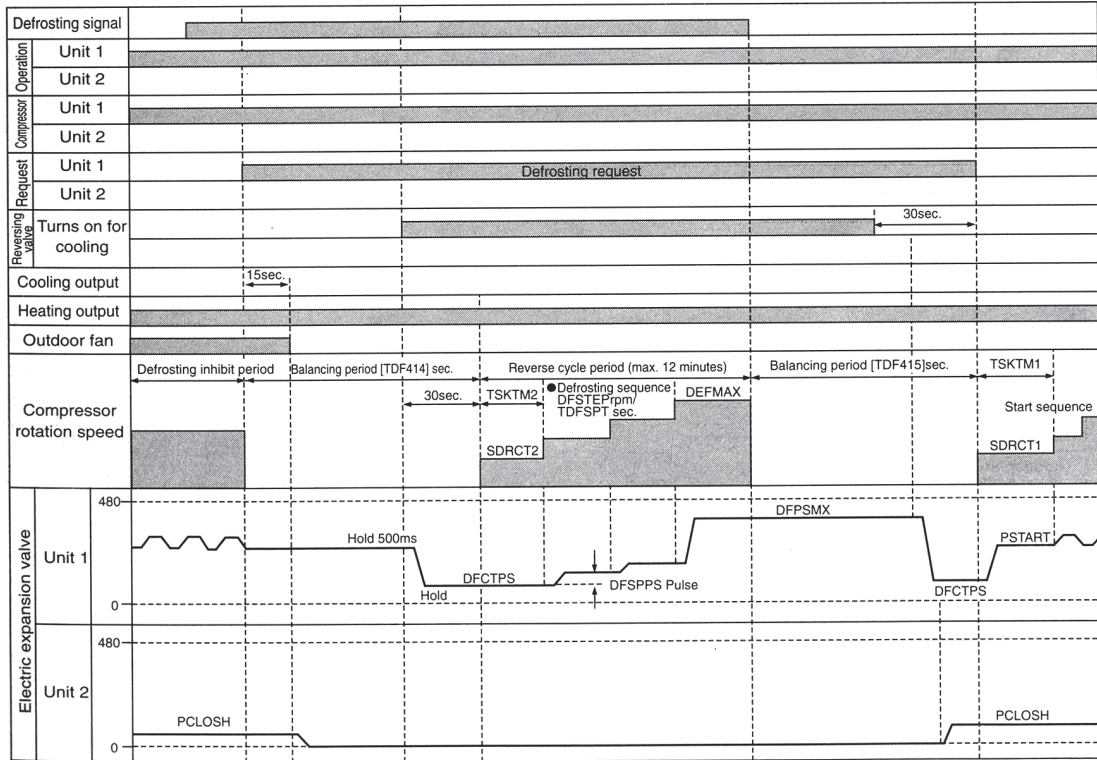
- Indoor defrost request: Transmitted to all units being operated in heating mode.
- Compressor: Balancing period for [TDF414] seconds → Starting of reversing cycle period by [SDRCT2] min^{-1} for [TSKTM2] seconds → Accelerating by [DFCTEP] min^{-1} / [TDFSPT] seconds in remaining reversing cycle period until defrost MAX speed [DEFMAX] is reached → Balancing period for [TDF415] seconds
- Electric expansion valve
 - Unit being stopped : [FULL CLOSE] 30 seconds after balancing period has passed → [FULL CLOSE] during reversing cycle period → [PCLOSH] 15 seconds before balancing period is finished.
 - Unit being operated : [DFCTPS] 30 seconds before balancing period is finished → Synchronized with step-up of rotation speed of compressor, opened by [DFSPPS] pulses and reaches MAX opening degree [DEFSMX] when rotation speed of compressor reaches [DEFMAX].

● Time chart when executing defrost (both unit 1 and unit 2 operated)



* Maximum defrost time is 15 minutes.

● Time chart when executing defrost (Only unit 1 operated, unit 2 stopped)



* Maximum defrost time is 15 minutes.

AUTO-FRESH DEFROST

- During heating operation is stopped, and when auto-fresh condition is established, defrost operation will be performed while operation is stopped.

Auto-fresh consists of balancing period at start of defrost for [TDF414] seconds Æ Reverse cycle period for MAX 12 minutes.

(1) Start conditions for auto-fresh

- When all the following conditions are established, auto-fresh is executed:
 - Defrost request signal is present.
 - All indoor units are stopped.
 - 15 minutes of auto-fresh inhibit period has elapsed.
 - Compressor is ON when operation is stopped.
 - Compressor delay command is sent from indoor unit when operation is stopped.

(2) Release condition of auto-fresh

- If any one of following conditions is established, auto-fresh is released:
 - Heat exchange temperature returns (heat exchange temperature \geq DEFOFF)
 - 12 minutes of defrost MAX time has elapsed.
 - Failure occurred.
 - Either unit 1 or unit 2 started operation.
- * Released during start of balancing period : Stopped or started after remaining balancing period has elapsed.
- * Released during reverse cycle period : Stopped or started after balancing for 3 minutes.

(3) Outputs during auto-fresh

[Indoor unit defrost request] : Transmitted only to unit to which auto-fresh is applied indoor unit stopped last).

[Compressor]: Accelerated by DFSTEP rpm/TDFSPT seconds and reaches defrost MAX speed [DEFMAX].

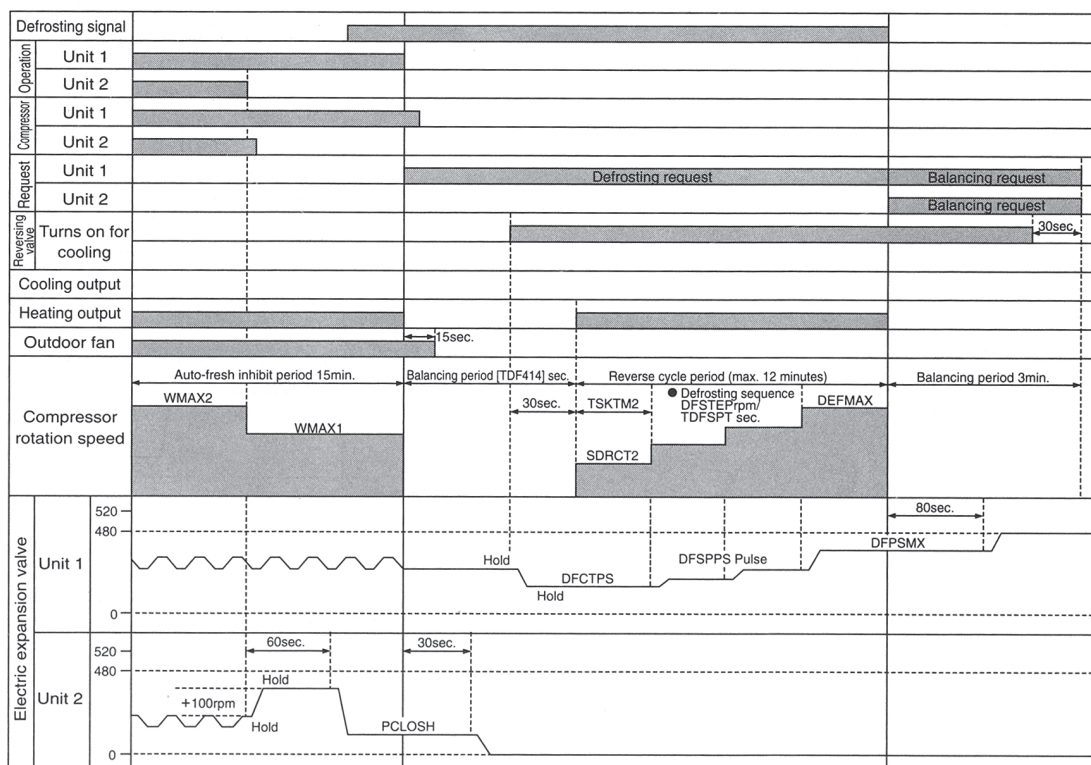
[Electric expansion valve]:

Unit auto-fresh not applied: FULL CLOSE when balancing for 30 seconds has elapsed at start of defrost.

Unit auto-fresh applied: Synchronized with step-up of rotation speed of compressor, opened by [pulses and reaches MAX opening degree [DEFMAX] when rotation speed of compressor reaches [DEFMAX].

(4) Note

- Shifted to auto-fresh in defrost mode when operation is stopped.
 - All indoor units must be stopped to fulfill condition for auto-fresh.
- If signal is delayed, auto-fresh condition will not be established.

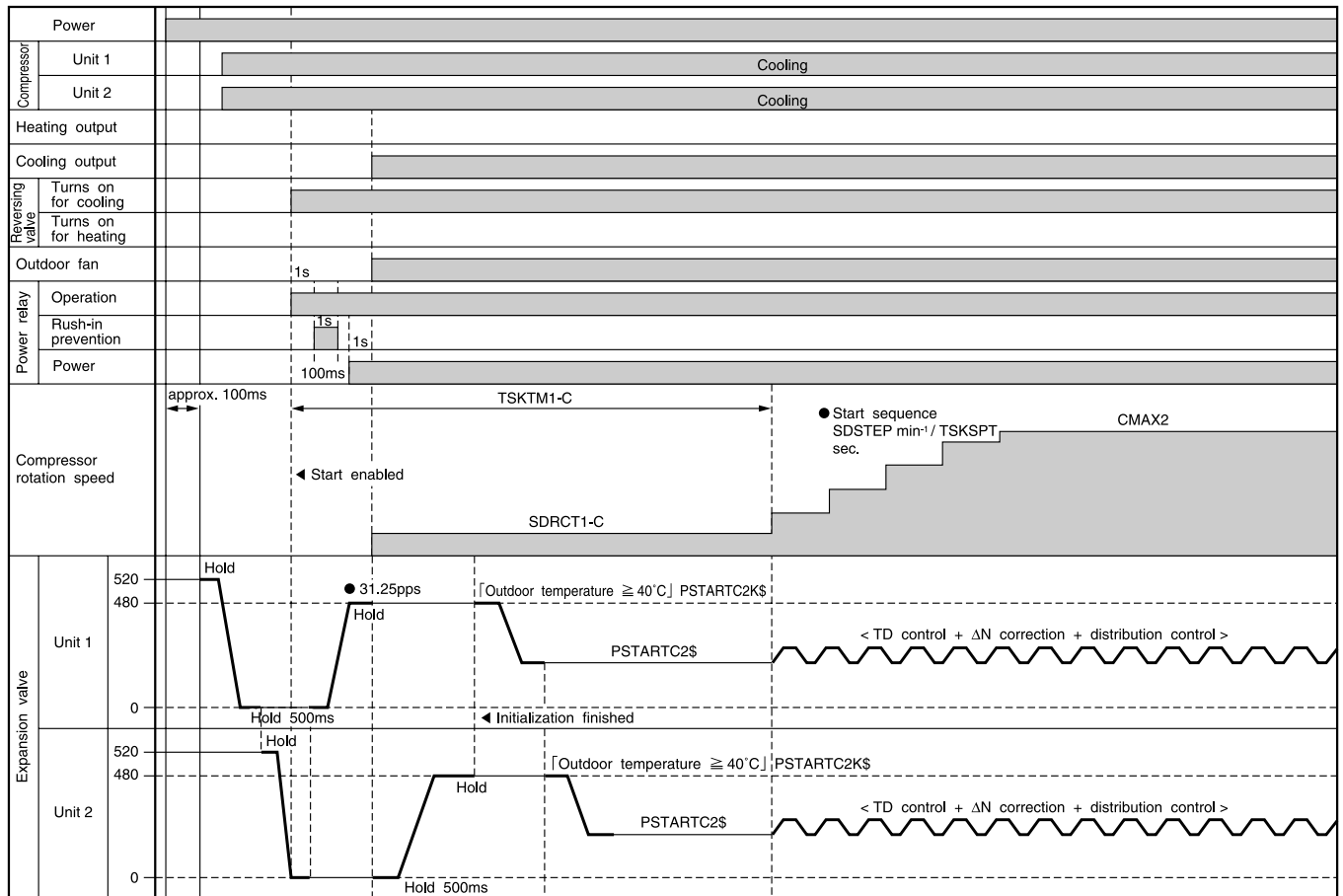


◇ Expansion valves

- The expansion valves are initialized when power is supplied. The valve for unit 1 is fully closed (520 pulses), and then that for unit 2 is fully opened (480 pulses). When the valve for unit 1 is fully closed (0 pulse), start-up is possible.
- The start openings are held during the steady speed period when the compressor is started. After the steady speed period is finished, the TD control is entered. The start openings are set to PSTARTH when the outdoor temperature at start 40°C or more, and to PSTART when it is less than 40°C.

◇ Compressor rotation speed

- When the compressor is started, the SDRCT1 speed / TSKTM1 second is held.
- After the steady speed period is finished, the speed increases at the rate of SDSTEP speed / TSKSPT second until the target speed is reached.



* Refer to the PWRITE-ZU data for the constants expressed by the capital alphabet letter in the diagram.

FORCED COOLING

- In order to accumulate refrigerant, units operate in cooling cycle.

Execution condition and operation status are shown below.

[Execution condition]

- With neither indoor unit 1 and 2 not operated, when forced cooling switch is turned ON, forced cooling will be performed.
- Always operation status of indoor unit are monitored and forced cooling is inhibited when operation of any unit is detected.

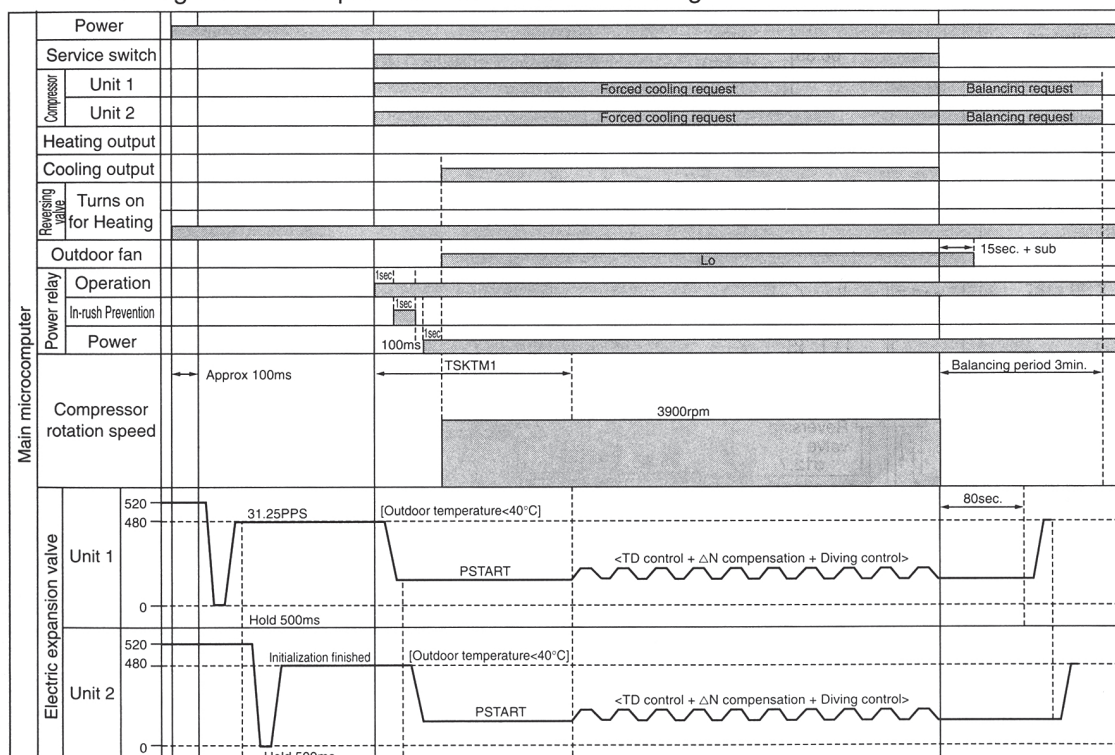
[Operation status]

- Outdoor unit fan: Fixed in LO.
- Compressor rotation speed: Fixed in 3900min⁻¹.

[Note]

- During forced cooling, if failure occurs in outdoor unit, thermostat is turned off. However, it is not counted.
- Since rotation speed of compressor is fixed in 3900min⁻¹ during forced cooling, compressor fixed speed control at start is not performed.

- The following shows the operation state of forced cooling.

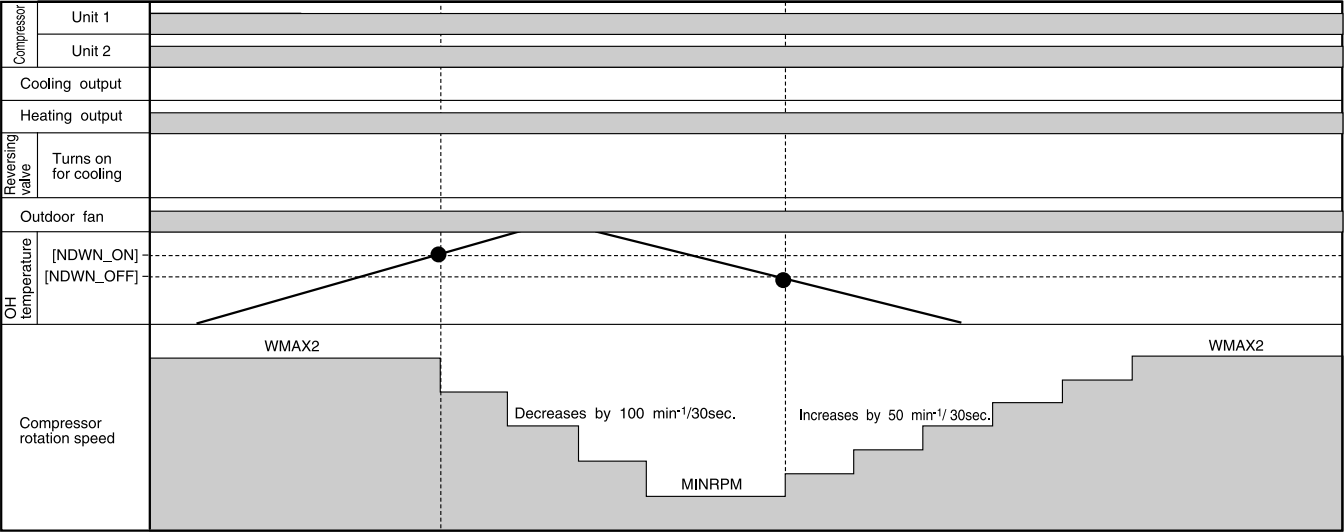


※ • TSKTM1 and PSTART are EEPROM data.

PROCESSING AT OVERHEAT THERMISTOR (OH) HIGH TEMPERATURE

- ◇ Restriction Start Conditions
 - If any expansion valve is operated at 480 pulses and the OH temperature > [NDOWN_ON], the compressor speed will be reduced at a rate of 100 min⁻¹/30 seconds.
 - This reduced rotation speed is based on the speed when the reduction started, and will be maintained until the reduction is finished. However, the reference speed will be exchanged only if the target speed is lower than the speed when the reduction started.
 - If [NDOWN_OFF] ≤ OH temperature ≤ [NDOWN_ON] and the OH temperature does not rise from that 20 seconds before, the reduction of compressor speed will not occur.
- ◇ Restriction Release Condition (in common for all)
 - The restriction will be released when OH temperature < [NDOWN_OFF], and the compressor speed will be increased at a rate of 50 min⁻¹/30 seconds to restore the target speed.

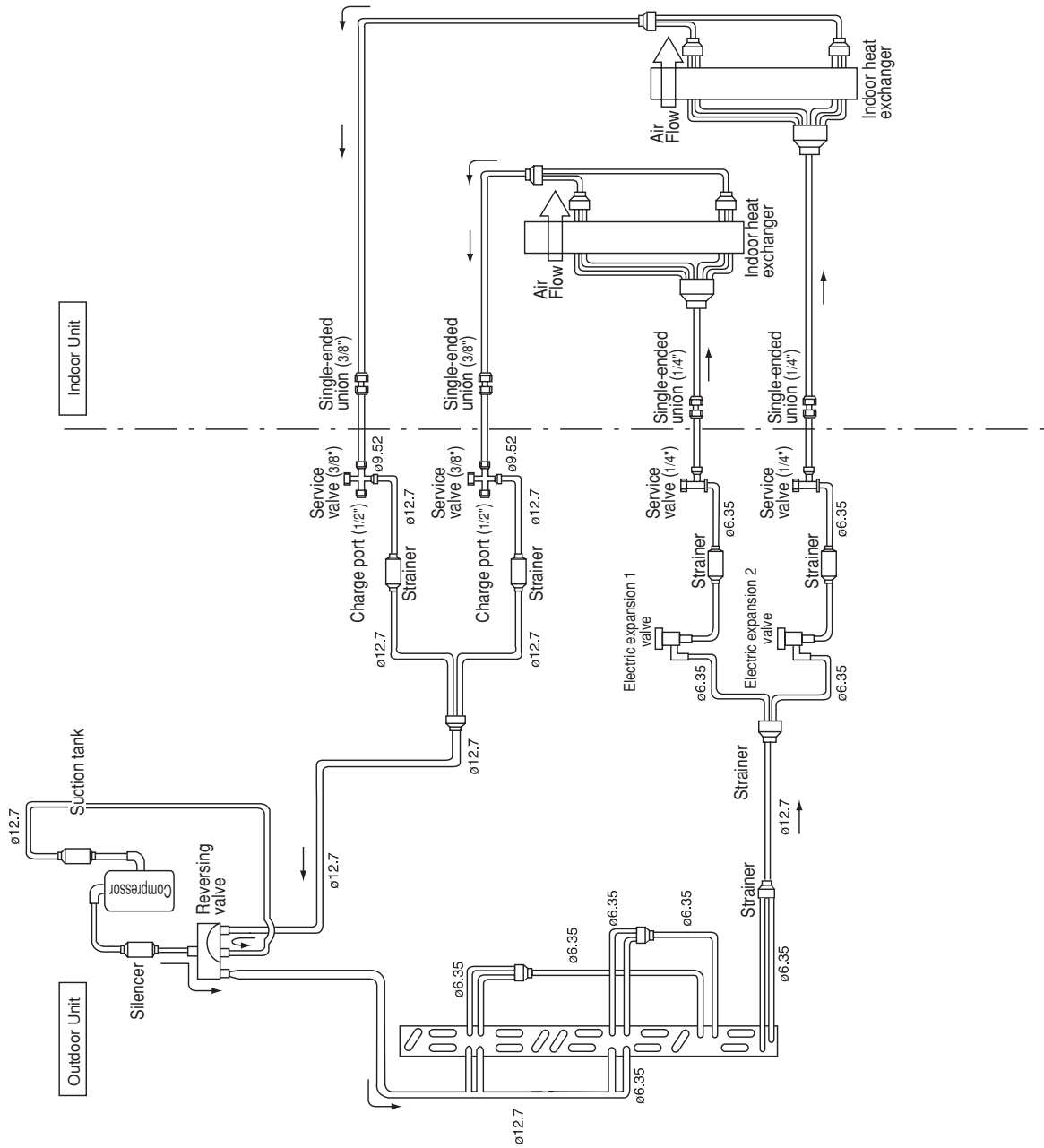
When two units are operated for heating:



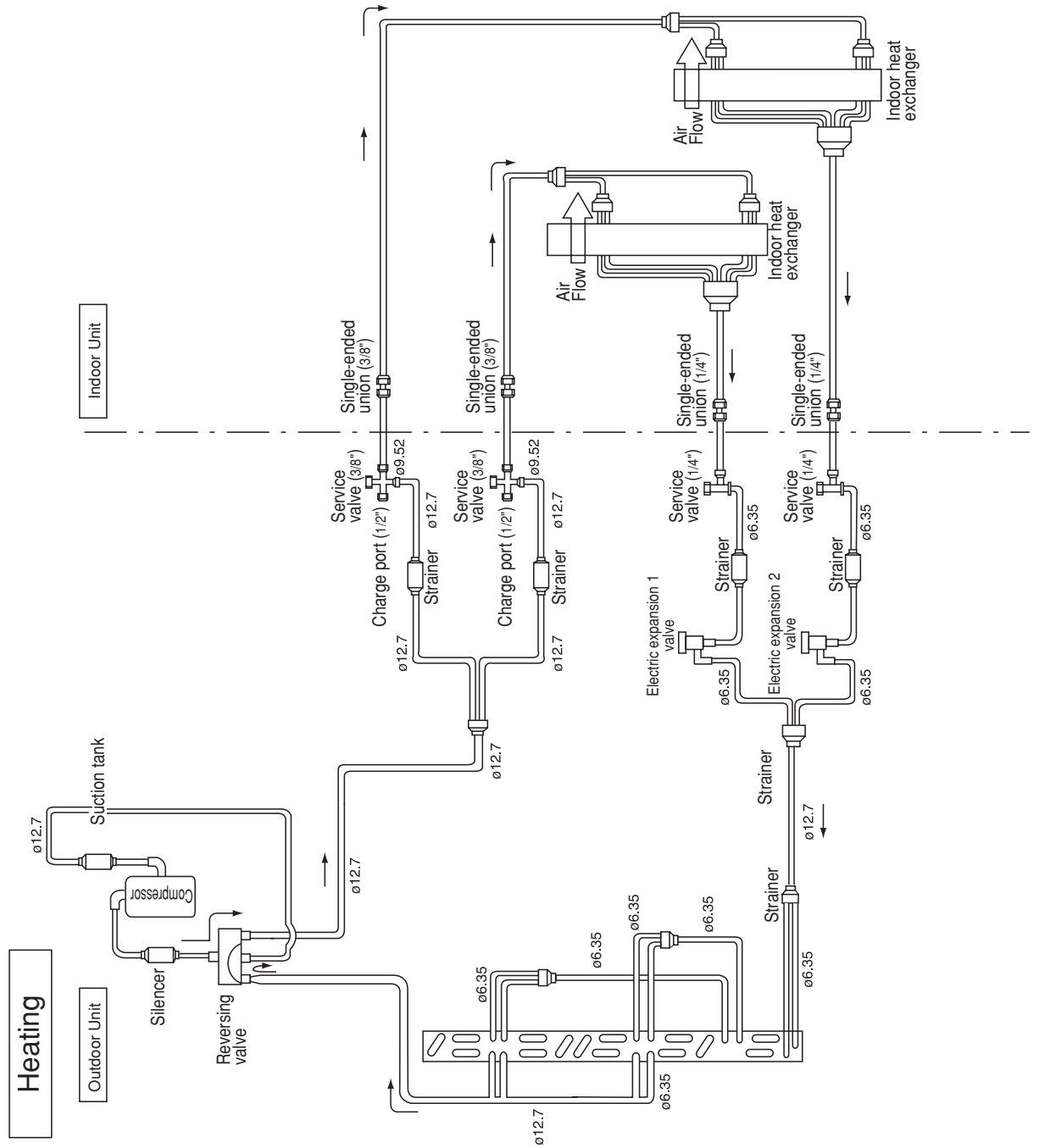
- ※ • Operation with one unit in heating or cooling mode and with two units in cooling mode is the same as in the above diagram.
- WMAX2 and MINRPM are EEPROM data.

REFRIGERATING CYCLE DIAGRAM
RAM-35QH5

Cooling, dehumidifying, defrosting



REFRIGERATING CYCLE DIAGRAM RAM-35QH5



DESCRIPTION OF MAIN CIRCUIT OPERATION (OUTDOOR)

Model RAM-35QH5

1. Power Circuit

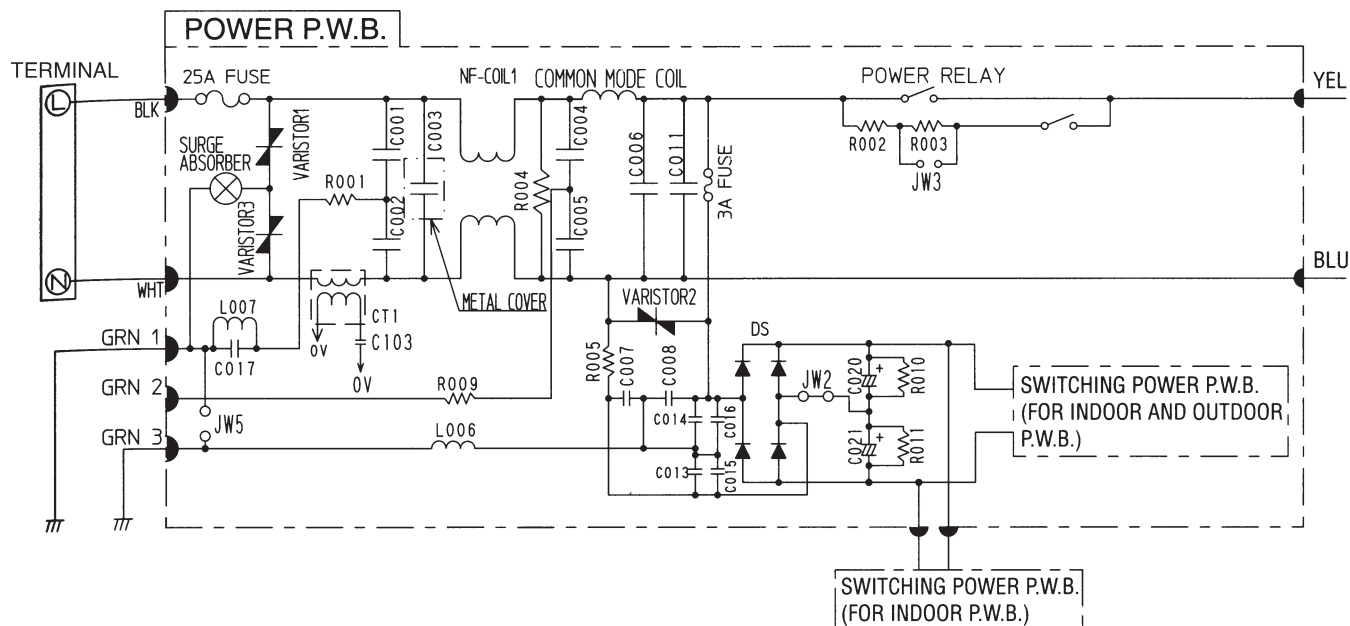


Fig. 1-1

- This circuit full-wave rectifies 220-240V AC applied between terminals L and N, and boosts it to a required voltage with the active module, to create a DC voltage.

The voltage becomes 260-380V when the compressor is operated

(1) System power module (SPM2)

(Current ACT module, smoothing capacitors and power module are combined into one unit)

① Active module

The active filter, consisting of a reactor and switching element, eliminates higher harmonic components contained in the current generated when the compressor is operated, and improves the power-factor.

② Smoothing capacitor smoothes voltage, which has been rectified by diode stack and boosted at ACT section.

③ Power module section

Refer to item 3 System Power Module Circuit.

(2) Diode stacks

These rectify the 220-240V AC from terminals L and N to a DC power supply.

< Reference >

- In case of malfunction or defective connection: Immediately after the compressor starts, it may stop due to "abnormally low speed" active error, etc. The compressor may continue to operate normally, but the power-factor will decrease, the operation current will increase, and the overcurrent breaker of the household power board will probably activate.
- In case of active module faulty or defective contact: Although the compressor continues to operate normally, the power-factor will decrease, the operation current will increase, and the overcurrent breaker of the household power board will probably activate.

< Reference >

- If diode bridge 1 is faulty, the compressor may stop due to "lp", "abnormally low speed", etc. immediately after it starts, or it may not operate at all because no DC voltage is generated between the positive ⊕ and negative ⊖ terminals. If diode bridge (D25VB60) is faulty, be aware that the 25A fuse might also have blown.
- If diode bridge (DS) is faulty, DC voltage may be not generated and the compressor may not operate at all. Also, be aware that the 3A fuse might have blown.

(3) Smoothing capacitor (C501, C502, C503)

This smoothes (averages) the voltage rectified by the diode stacks.

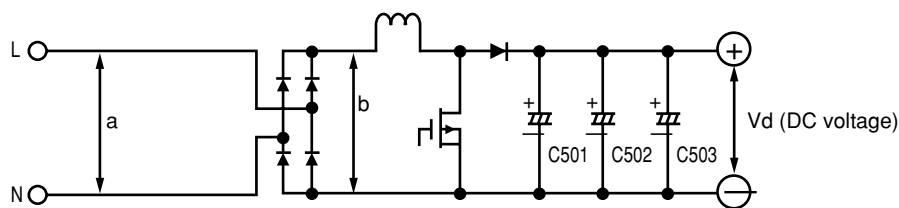


Fig. 1-2

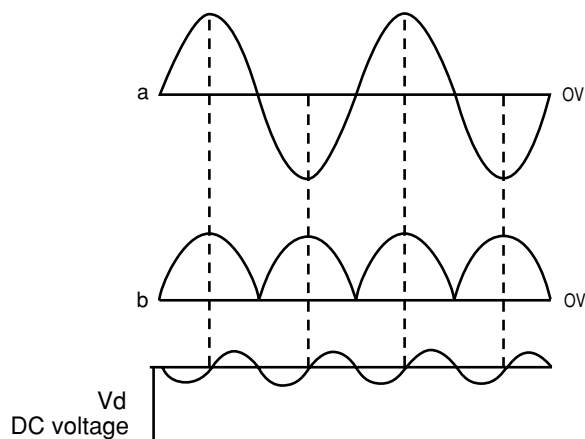
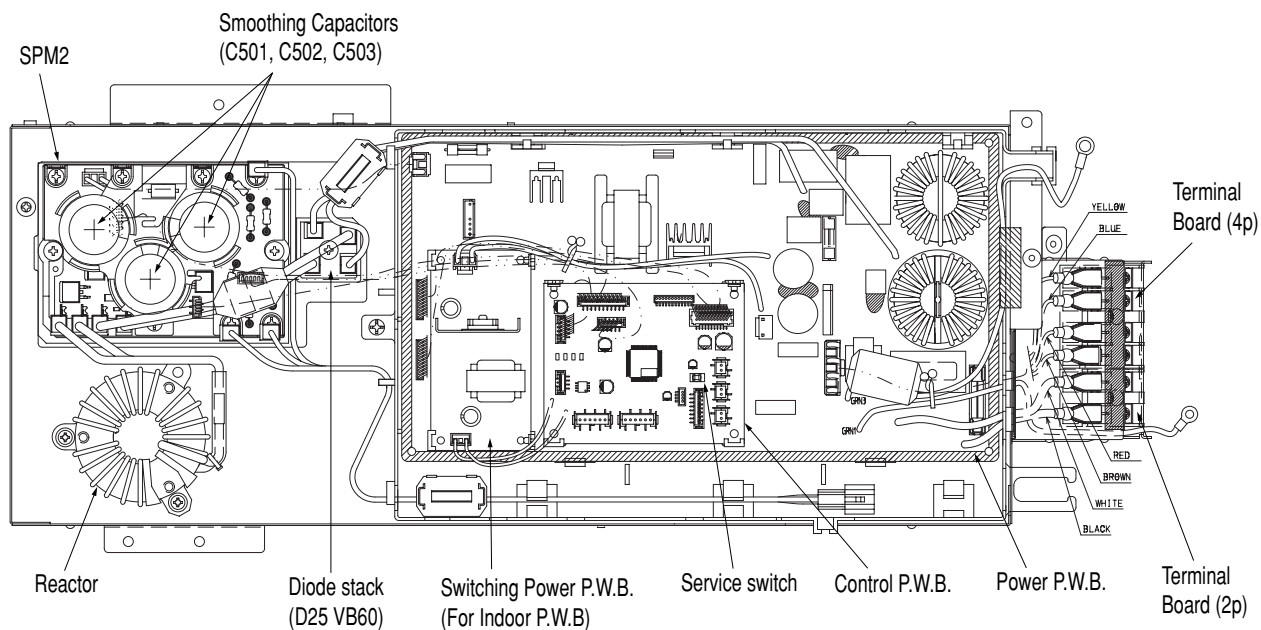


Fig. 1-3

(Approx. 330 or 360V during operation)



- Be careful to avoid an electric shock as a high voltage is generated. Also take care not to cause a short-circuit through incorrect connection of test equipment terminals. The circuit board could be damaged.

(4) Smoothing capacitor (C020, C021)

This smoothes (averages) the voltage rectified by the diode stacks.

A DC voltage is generated in the same way as in Fig. 1-3. Voltage between \oplus side of C020 and \ominus side of C021 is about 330V.

- (5) C001 to C005, NF COIL 1
These absorb electrical noise generated during operation of compressor, and also absorb external noise entering from power line to protect electronic parts.
 - (6) Surge absorber, varistor 1, 2, 3
These absorb external power surge.
 - (7) Inrush protective resistor (R002, R003)
This works to protect from overcurrent when power is turned on.
- * Be sure to ground outdoor unit.
If not grounded, noise filter circuit does not operate correctly.
 - * If outdoor unit is not grounded, "surge absorber", "varistors 1 and 3" do not operate.
Be sure to perform grounding.

< Reference >

- When inrush protective resistor is defective, diode stack may malfunction. As a result, DC voltage is not generated and no operation can be done. In this case, 3A fuse may have been blown.

2. Indoor/Outdoor Interface Circuit

- The interface circuit superimposes an interface signal on the 35V DC line supplied from the outdoor unit to perform communications between indoor and outdoor units. This circuit consists of a transmitting circuit which superimposes an interface signal transmit from the micro computer on the 35V DC line and a transmitting circuit which detects the interface signal on the 35V DC line and outputs it to the micro computer.
- Communications are performed by mutually transmitting and receiving the 4-frame outdoor request signal one frame of which consists of a leader of approx. 100 ms., start bit, 8-bit data and stop bit and the command signal with the same format transmit from the indoor unit.
- From outdoor microcomputer to indoor microcomputer

The request signal output from microcomputer pins ⑦ is input to the transmitting circuit. The transmitting circuit outputs an approx. 38kHz high-frequency signal via pin ⑩ and continues the output intermittently according to the request signal. This high-frequency signal is amplified by a transistor, superimposed on the DC 35V line via C801, C811 and L801, L802 and supplied to the indoor unit.

To prevent erroneous reception, the outdoor microcomputer is designed so that it cannot receive a signal while it is outputting a request signal,

The receiving circuit in the indoor unit consists of a comparator and transistor. The interface signal from the outdoor unit on the DC 35V line is supplied to C821, where DC components are eliminated, and is then shaped by the comparator. The shaped signal is detected by diode, amplified by amp, and supplied to receiving ④ input of the indoor microcomputer.

Fig. 2-2 shows the voltages at each component when data is transferred from the outdoor microcomputer to the indoor microcomputer.

- Indoor micro computer to outdoor micro computer
The communications from the indoor micro computer to the outdoor micro computer are the same. Fig. 2-3 shows the voltages and waveforms at each circuit.

- Fig. 2-1 shows the interface circuit used for the indoor and outdoor micro computers to communicate with each other.

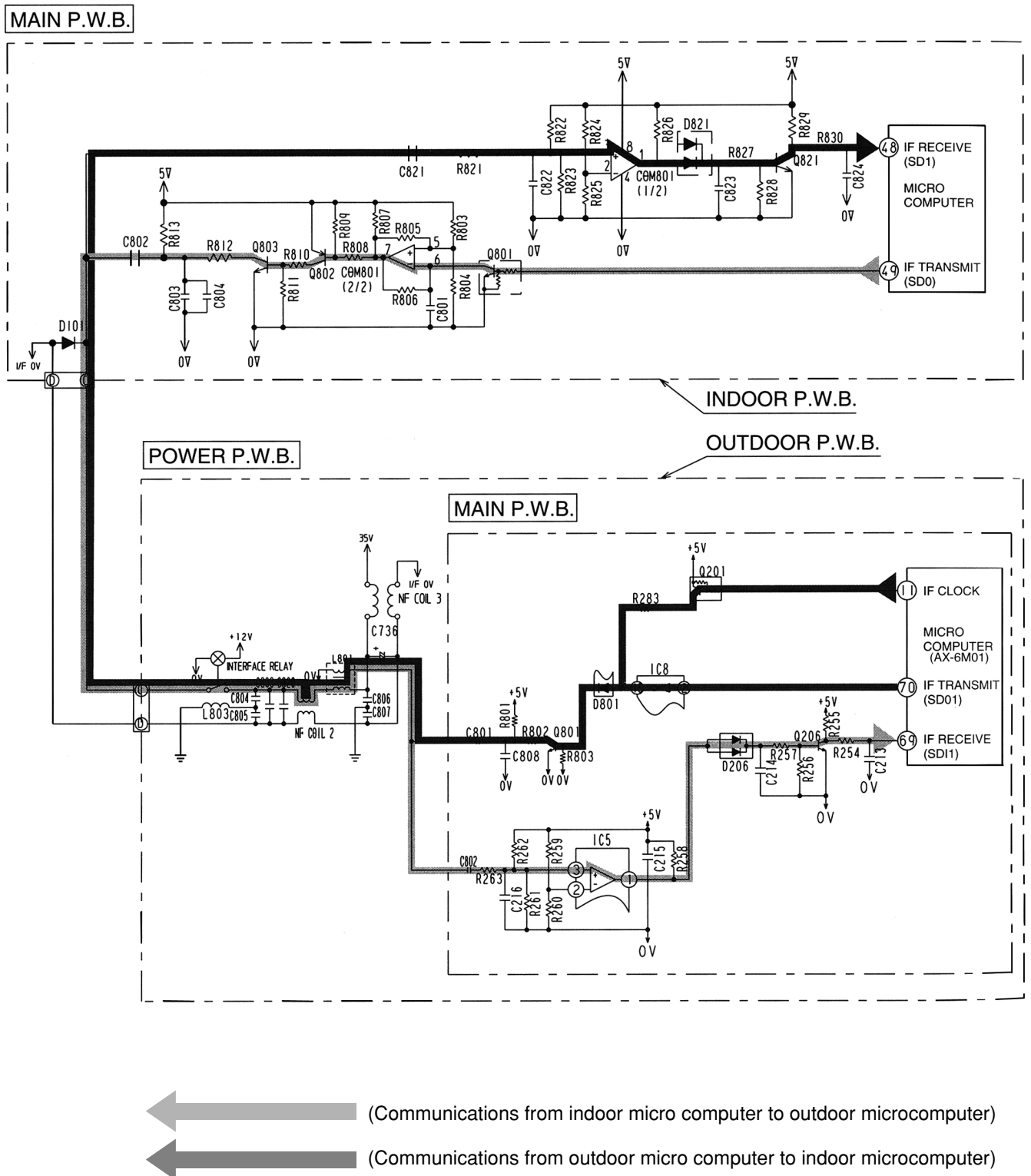


Fig. 2-1 Indoor / outdoor interface Circuit

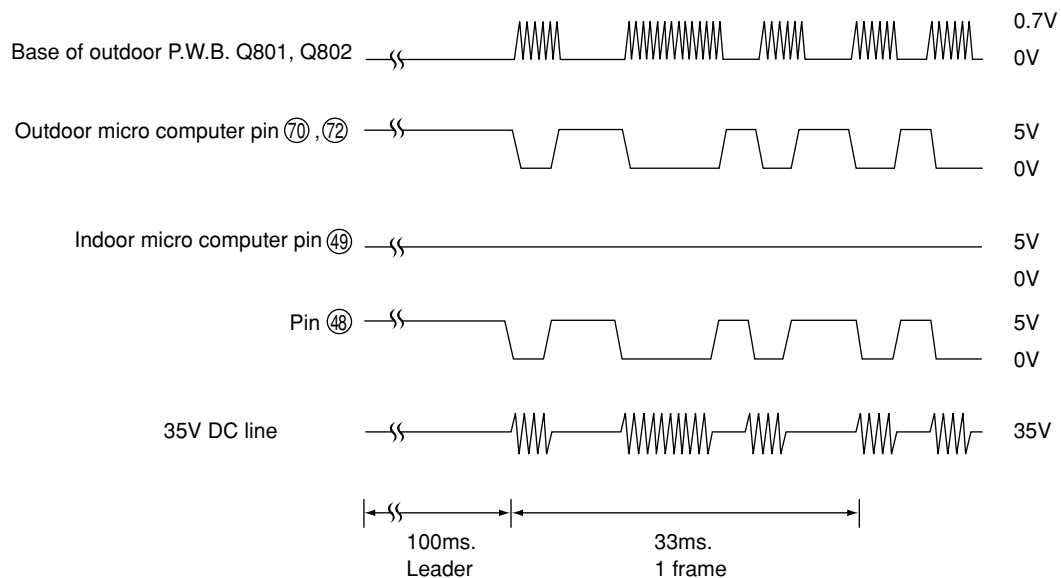


Fig. 2-2 Voltages Waveforms of indoor / Outdoor Micro computers (Outdoor to Indoor Communications)

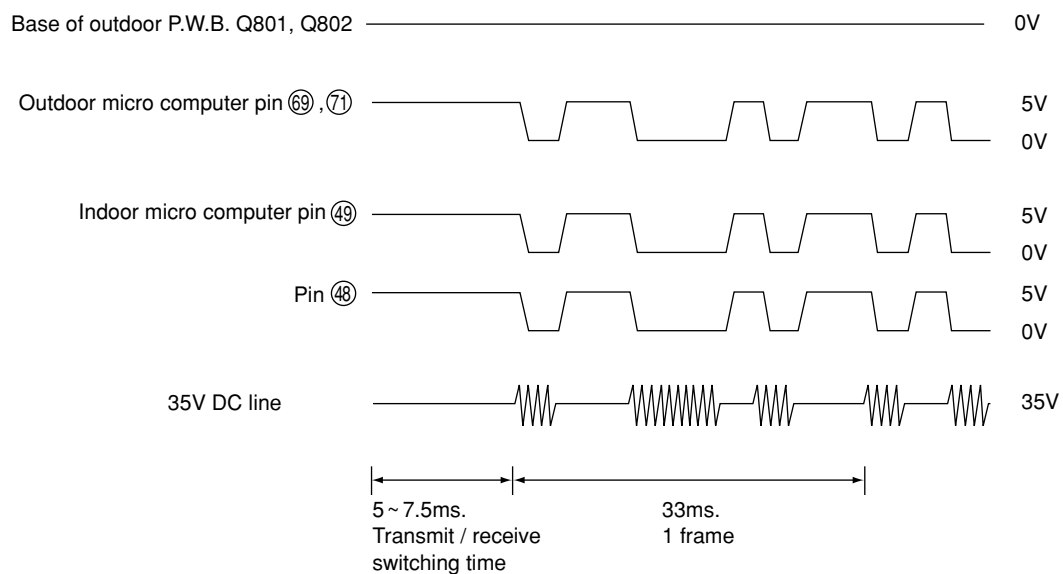


Fig. 2-3 Voltages Waveforms of indoor / Outdoor Micro computers (Indoor to Outdoor Communications)

3. System Power Module Circuit

- Fig. 3-1 shows the system power module and its peripheral circuit. (Current ACT module and power module are combined into one unit.) The three transistors on the positive \oplus side are called the upper arm, and the three transistors on the negative \ominus side, the lower arm.

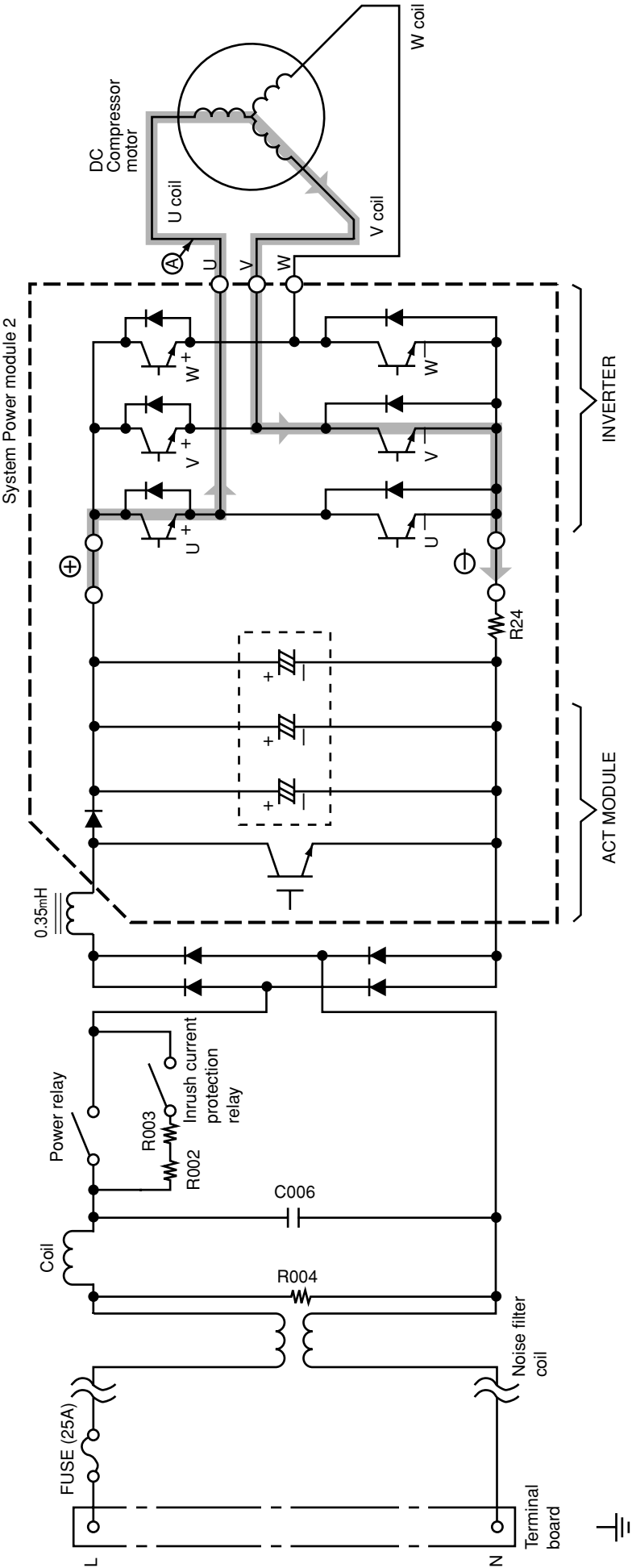


Fig. 3-1 System power module circuit (U⁺ is ON, V⁻ is ON)

- DC 260-360V is input to power module and power module switches power supply current according to rotation position of magnet rotor. The switching order is as shown in Fig. 3-2.

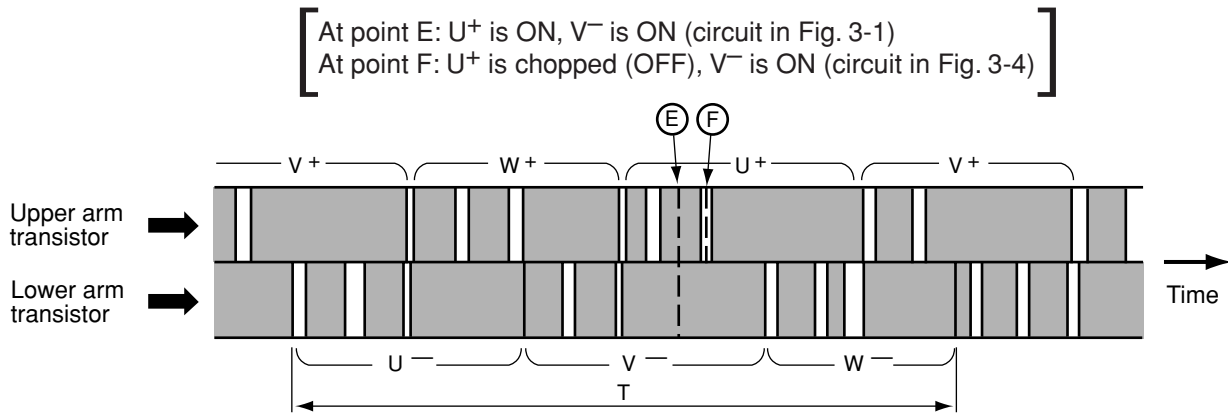


Fig. 3-2 Switching order of power module

- Upper arm transistor is controlled to ON/OFF by 3.2kHz chopper signal. Rotation speed of the compress is proportional to duty ratio (ON time/ ON time + OFF time) of this chopper signal.
- Time T in Fig. 3-2 shows the switching period, and relation with rotation speed (N) of the compressor is shown by formula below;

$$N = 60/2 \times 1/T$$

- Fig. 3-3 shows voltage/current waveform at each point shown in Figs. 3-1 and 3-4. First half of upper arm is chopper, second half is ON, and first half of lower arm is chopper, second half is ON.

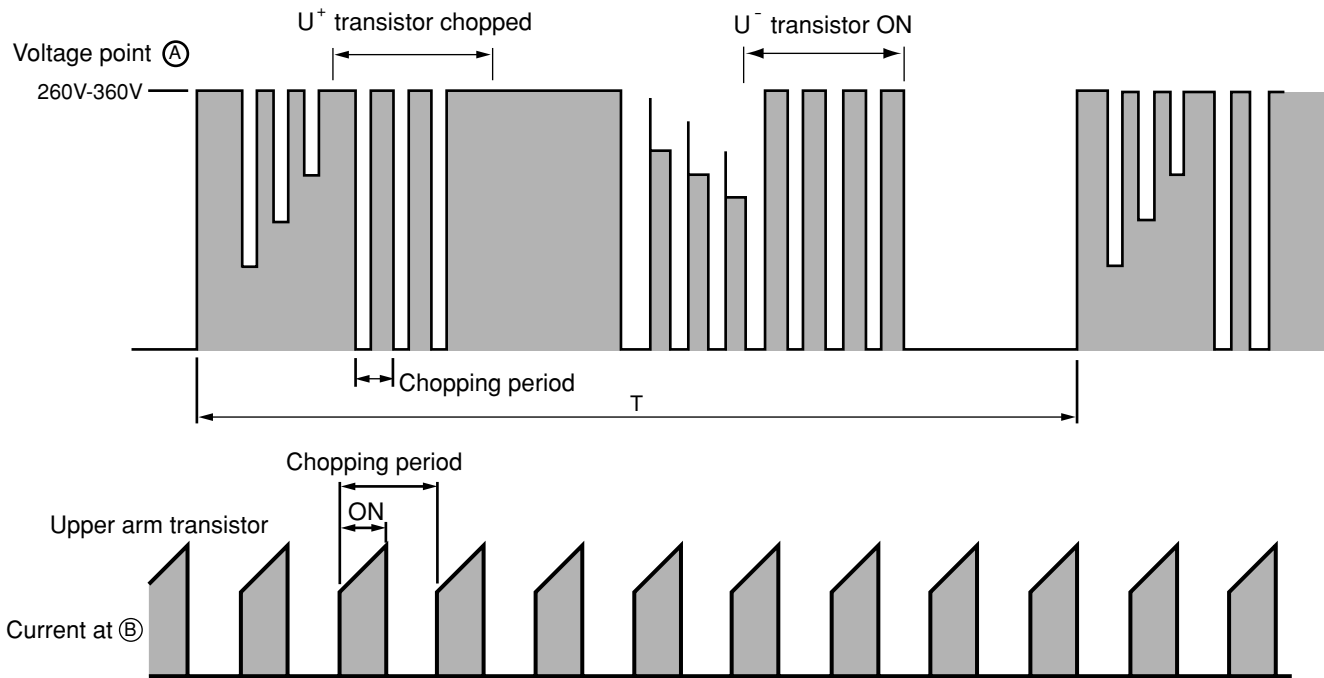


Fig. 3-3 Voltage waveform at each point

- When power is supplied $U^+ \rightarrow U^-$, because of that U^+ is chopped, current flows as shown below; ②

 - (1) When U^+ transistor is ON: U^+ transistor \rightarrow U coil \rightarrow V coil \rightarrow V^- transistor \rightarrow DC current detection resistor \rightarrow Point ② (Fig. 3-1)
 - (2) When U^+ transistor is OFF: (by inductance of motor coil) U coil \rightarrow V coil \rightarrow V^- transistor \rightarrow Return diode \rightarrow Point ① (Fig. 3-4)

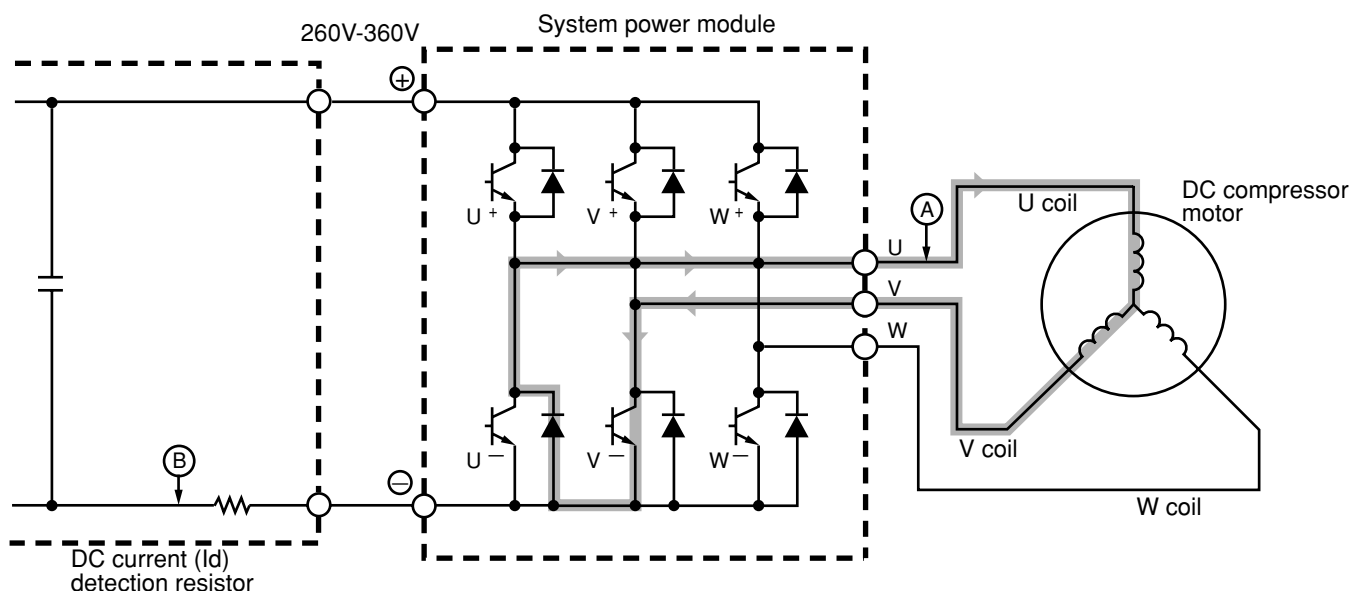


Fig. 3-4 Power module circuit (U^+ is ON, V^- is ON)

- Since current flows at point (B) only when U^+ transistor is ON, the current waveform at point (B) becomes intermittent waveform as shown in Fig. 3-3. Since current at point (B) is approximately proportional to the input current of the air conditioner, input current is controlled by using DC current (I_d) detection resistor.

<Reference>

If power module is detective, self diagnosis lamps on the control P.W.B. may indicate as shown below:

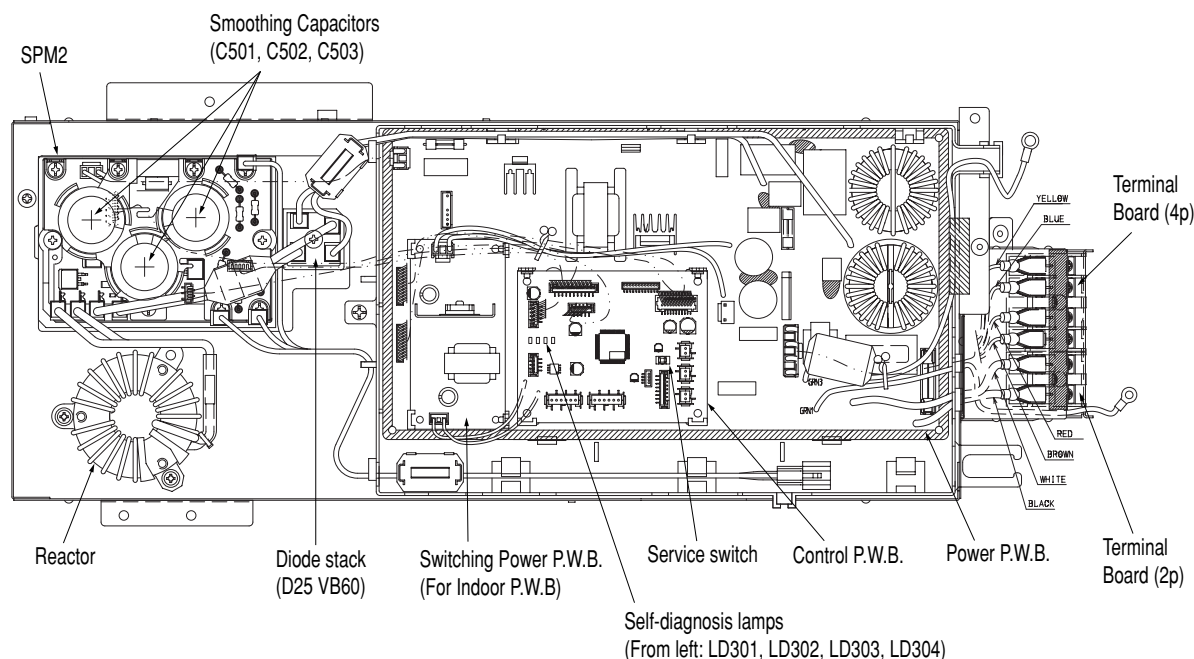


Table 3-1

Self-diagnosis	Self-diagnosis lamp and mode	
I_p (peak current cut)	LD301	Blinks 2 times
Abnormal low speed rotation	LD301	Blinks 3 times
Switching incomplete	LD301	Blinks 4 times

* From results of power module simple inspection (inspection mode when operated with compressor lead disconnected), LD310 blinks four times about 2 seconds later: Unit has not entered the normal operation.

4. Power Circuit for P.W.B.

- Fig. 4-1 shows the power circuit for P.W.B.

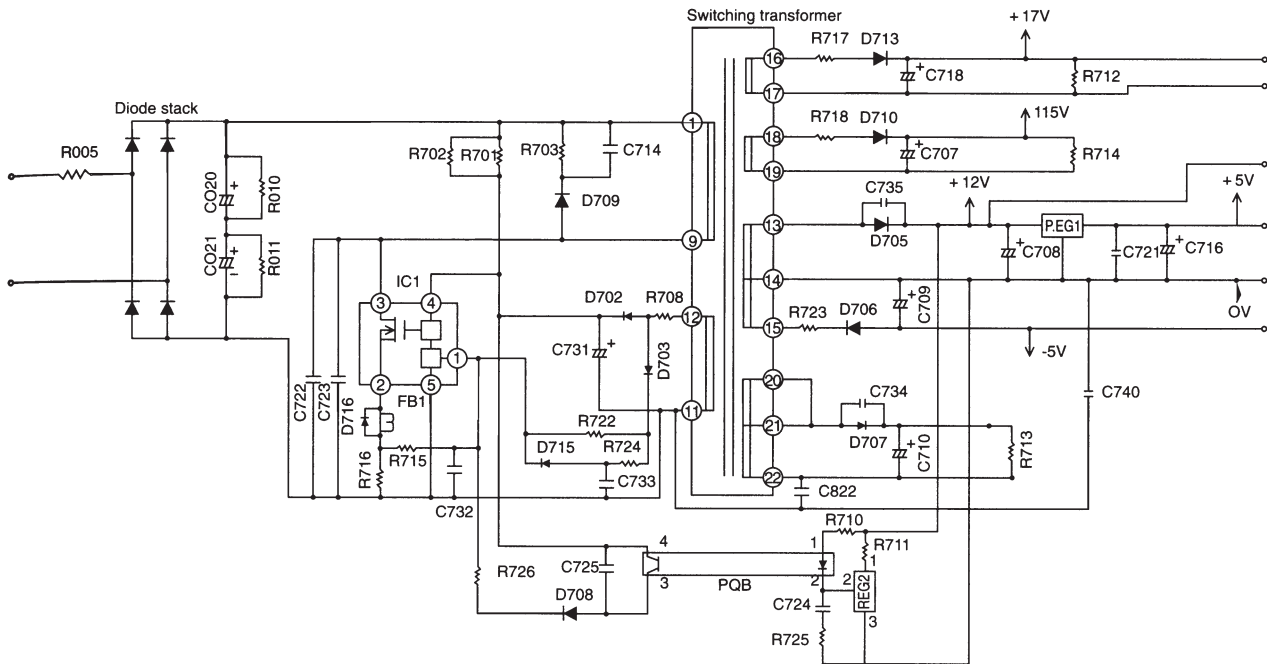


Fig. 4-1 Power circuit for P.W.B.

- In the power circuit for P.W.B., power voltage for microcomputer, peripheral circuits, and system power module drive and, as well as DV35V, are produced by switching power circuit.
- Switching power circuit performs voltage conversion effectively by switching transistor IC1 to convert DC330V voltage to high frequency of about 20kHz to 200kHz.
- Transistor IC1 operates as follows:

(1) Shifting from OFF to ON

- DC about 330V is applied from smoothing capacitors C020 ⊕ and C021 ⊖ in the control power circuit. With this power, current flows to pin ④ of IC1 via R701 and R702 and IC1 starts to turn ON. Since voltage in the direction of arrow generates at pin ⑫ of Switching Transformer at the same time, current passing through R708 and D702 is positive-fed back to IC1.

(2) During ON

- The drain current at IC1 increase linearly. During this period, the gate voltage and current become constant because of the saturation characteristics of the transformer.

(3) Shifting from ON to OFF

- This circuit applies a negative feedback signal from the 12V output. When the voltage across C708 reaches the specified value, REG2 turns on and current flows to PQ8 ①-②. This turns the secondary circuits on, sets IC1 pin ① to "Hi", and turns IC1 off.

(4) During OFF

- While IC1 is on, the following energy charges the primary windings of the transformer:

Energy = $LI^2/2$. Here, L : Primary inductance

I : Current when IC1 is off

This energy discharges to the secondary windings during power off. That is, C707-C710, C718 is charged according to the turn ratio of each winding.

- At the start, an overcurrent flows to IC1 because of the charged current at C707-C710, C718.
- The drain current at IC1 generates a voltage across R716. If it exceeds the IC1 base voltage, it sets the IC gate voltage to "Hi".
- R716 limits the gate voltage to prevent excessive collector current from flowing to IC1.
- This SW power circuit uses a frequency as low as 20kHz, especially at a low load (when both the indoor and outdoor units stop): This reduces power loss in standby status.

<Reference>

If the power circuit for P.W.B. seems to be faulty:

(1) Make sure that 5V, 12V, 15V, 17V and -5V on the control P.W.B. power voltage are the specified values.

(2) When only the 5V output is low:

REG 1 (regulator) faulty, 5V-0V shorted, output is too high, or REG 1 is abnormal.

(3) When 12V and 5V are abnormal:

The following defects can be considered:

① Fan, operation, power, rush prevention relay (shorting in relay, etc.)

② REG 1 (regulator is abnormal), etc.

Shorting on primary circuits.

When shorting occurs in the secondary circuits, there is no abnormality in the primary circuits because of overcurrent protection.

The voltage rises when an opening occurs in the primary circuits, or the feedback system is abnormal.

(4) When 15V/17V power supply is abnormal:

D710, D713 or drive circuit is abnormal.

(5) When all voltage are abnormal:

IC1, R716, may possibly be defective. Also D cable may possibly be reverse connected.

※ If IC1 is abnormal, be aware that other components, such as the power module, REG (regulator), etc. are possibly defective.

[When the switching power supply seems to be abnormal, the voltage between IC1 pin ④ (to be measured at the leads of R202 and R201) and IC1 pin ⑤ (to be measured at R216 lead) may be between 11 and 16V. This is because the protection circuit of IC1 is operating.]

5. Reversing valve control circuit

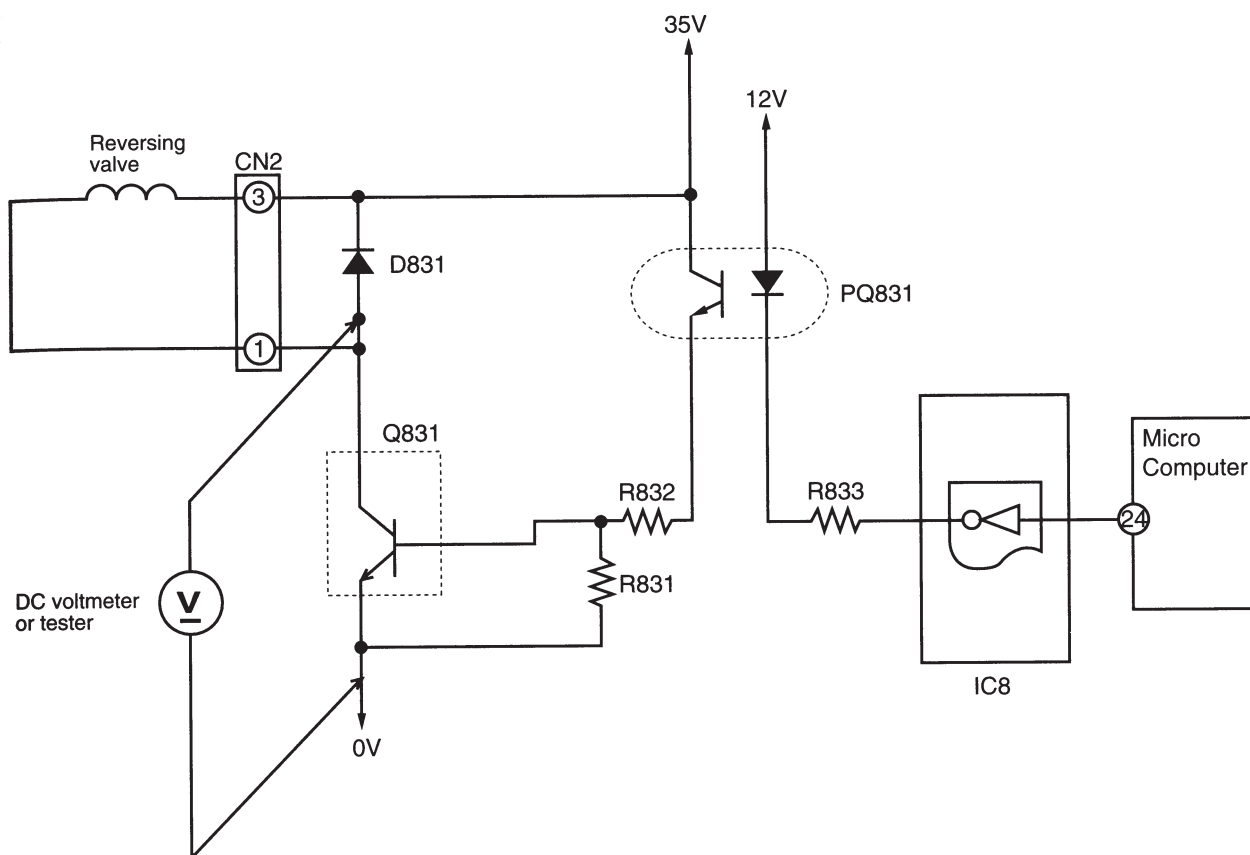


Fig. 5-1

- By reversing valve control circuit you can switch reversing valve ON/OFF (Heating ON) according to instruction from indoor microcomputer and depending on operation condition. Voltage at each point in each operation condition is approximately as shown below when measured by tester. (When collector voltage of Q831 is measured)

Table 5-1

Operation condition		Collector voltage of Q831
Cooling	General operation of Cooling	About 35V
Heating	In normal heating operation	About 0.8V
	MAX. rotation speed instructed by indoor microcomputer after defrost is completed	About 0.8V
	Defrosting	About 35V
Dehumidifying	Sensor dry	About 35V

6. Rotor magnetic pole position detection circuit

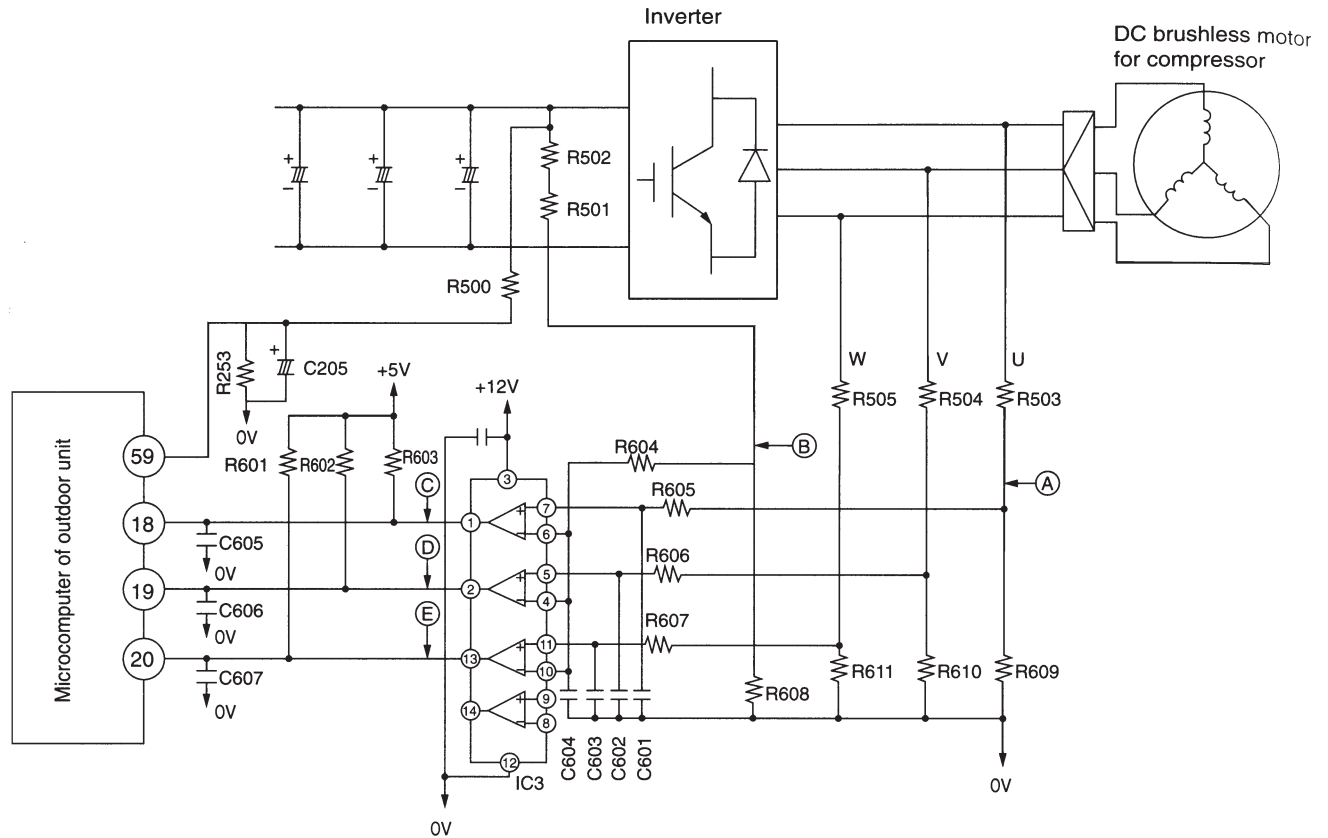


Fig. 6-1 Rotor magnetic pole position detection circuit

When the DC brushless motor is rotated, it also operates as power generator, generating reverse electromotive force according to number of rotations. This reverse electromotive force is voltage-divided by R503-R505 and R604-R611, and appears as point (A) voltage. IC3 compares and digitalizes point (A) voltage with point (B) voltage (in which DC voltage (Vd) is voltage-divided by R501, R502 and R608), and inputs this to microcomputer as position detection signals for points (C), (D) and (E). Microcomputer switches inverter using optimum timing based on position detection signals, in order to control the rotation of the brushless motor.

7. Peripheral circuits of microcomputer

- Fig. 7-1 shows the microcomputer and its peripheral circuits.
Table 7-1, the basic operations of each circuit block and Fig. 7-2, the system configuration.

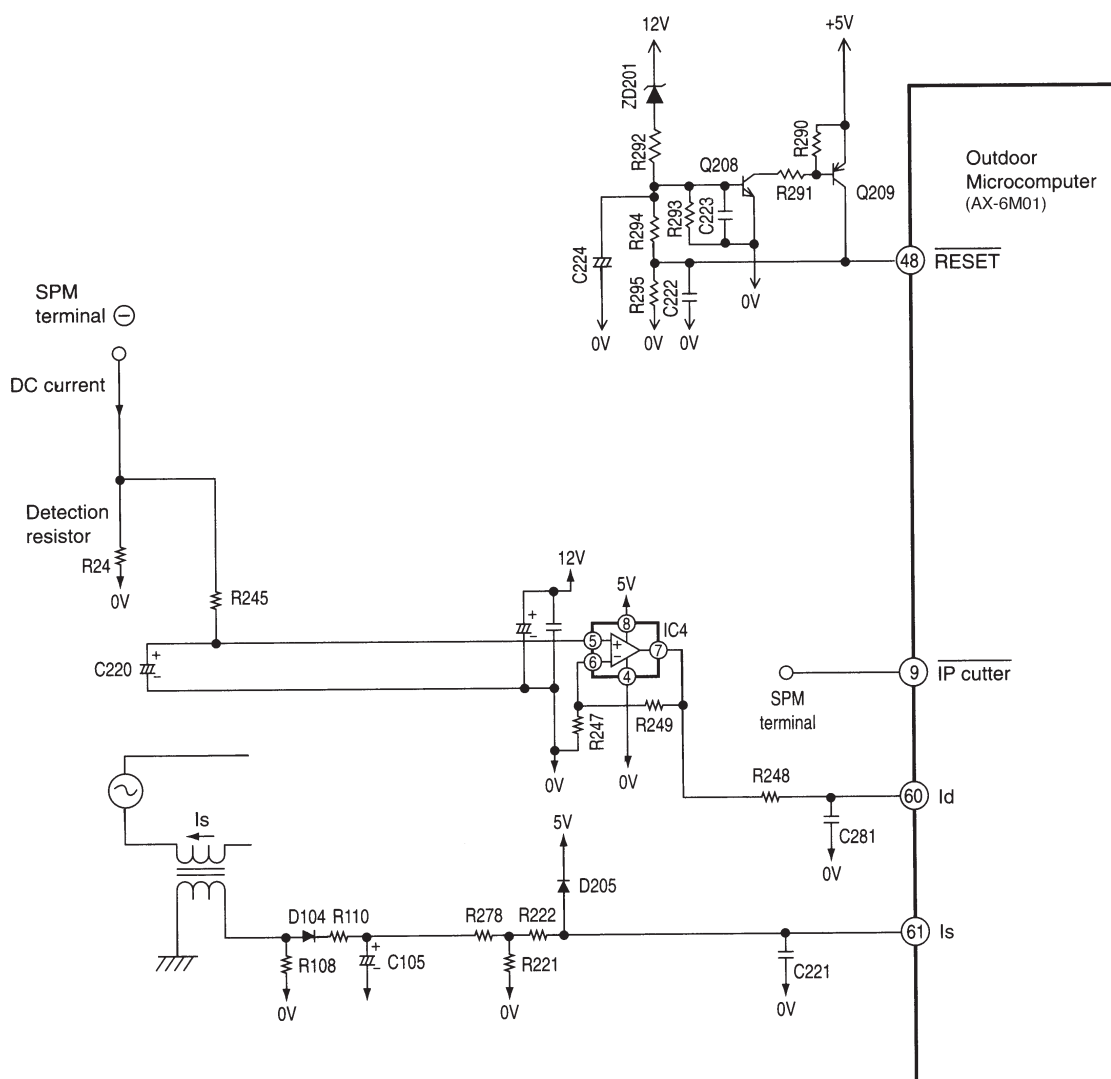


Fig. 7-1 Peripheral circuit of microcomputer (AX-6M01)

Table 7-1

Circuit block	Basic operation
Peak current cutoff circuit	This circuit detects DC current flowing to power module: When over-current (instantaneous value) flows, it stops upper and lower arm drive circuits and also produces I_p signal to stop microcomputer.
Overload external judgment circuit	This circuit detects DC current flowing to power module and produces signal to notify microcomputer of overload status.
Voltage amplifier circuit	This circuit voltage-amplifies DC current level detected by detection resistor and sends it to microcomputer. In addition, setting of internal/external overload judgment is performed.
Reset circuit	This circuit produces reset voltage.

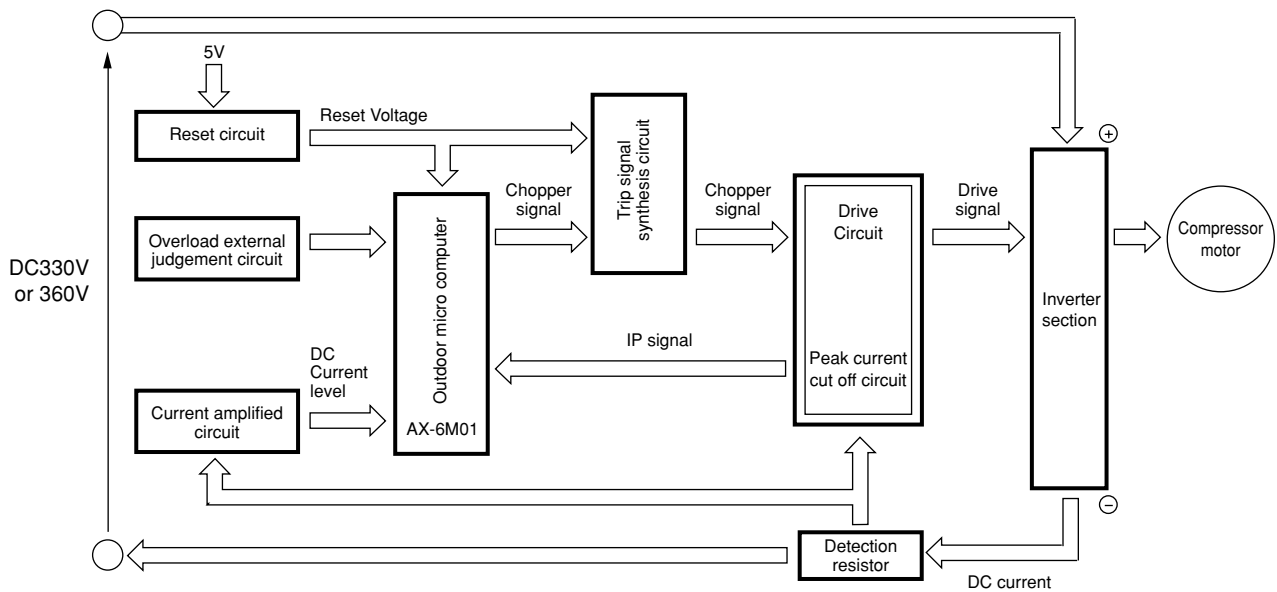


Fig. 7-2

- The following gives details of operation for each circuit:

7-1 Peak current cut off circuit

Fig.7-3 shows peak current cut off circuit and waveforms at each point.

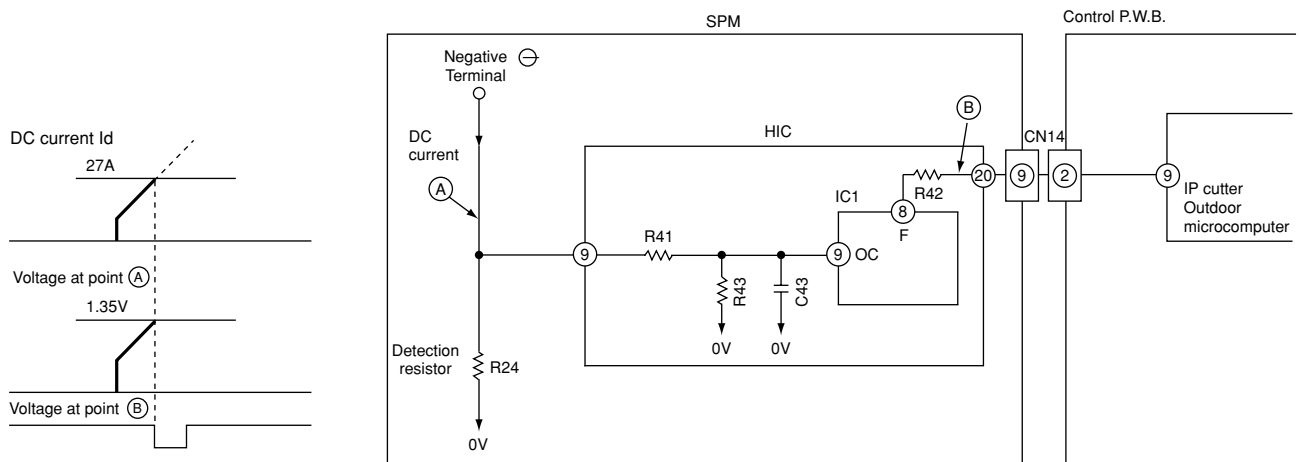


Fig. 7-3

- Ip cut circuit detects instantaneous surge current and stops inverter to protect components such as SPM.
- As shown in diagram, when current exceeding 24A flows, voltage at point (A) detected by detection resistor is input to pin ⑨ of INV-HIC, and voltage divided by R41 and R43 is input to pin ⑨ of IC1. Since this voltage exceeds threshold of IC1, LO is output from pin ⑧ (voltage at point (B)). When LO is input to pin ⑨ of microcomputer, microcomputer stops drive output.
- When drive output of microcomputer stops, all drive outputs are set to HI, and IC1 of HIC is initialized to enter drive signal waiting status. Microcomputer again outputs drive signal 3 minutes later to re-start operation.

8. Overload control circuit (OVL control)

- Overload control decelerates speed of compressor reducing load when the load to protect compressor, electronics parts and power breaker, when operation enters overload status due to increase of load for room temperature adjustment.
- To judge overload, DC current and set value are compared.
- Fig. 8-1 shows the overload control system configuration and Fig. 8-2 shows characteristic diagram of overload judgement values. There are two judgements. One is external judgment: External set value and DC current value are compared for judgment regardless of rotation speed. The other is internal judgment: set value varying according to rotation speed programmed in microcomputer is compared with DC current value for judgment.

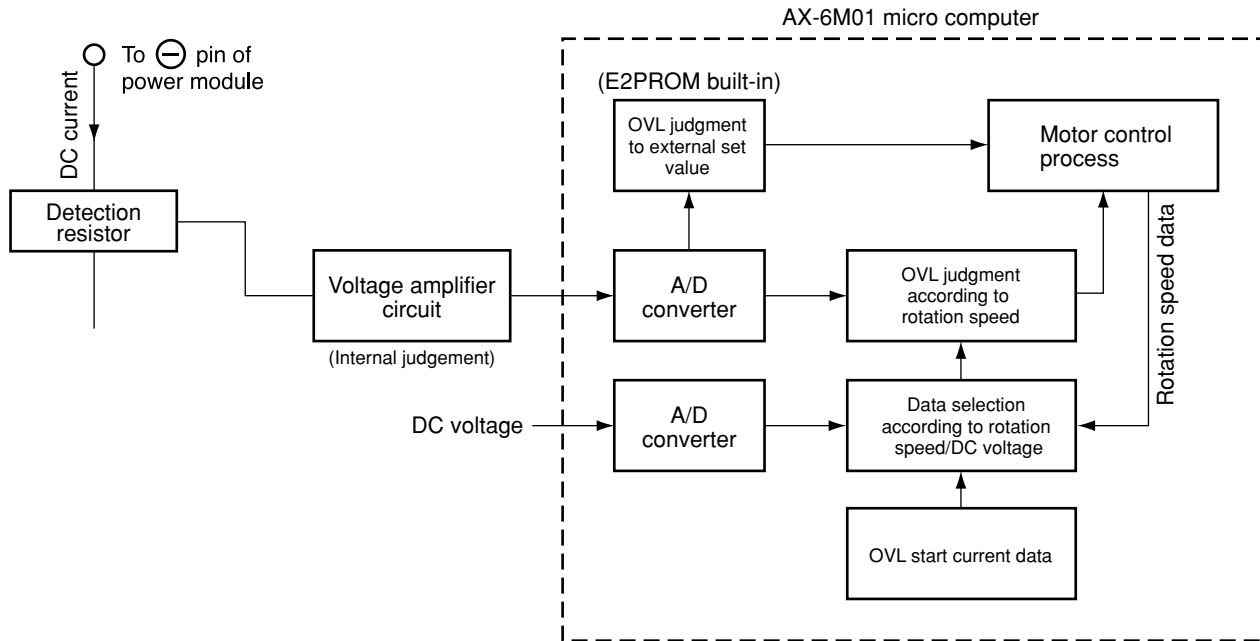


Fig. 8-1 Overload Control System Configuration

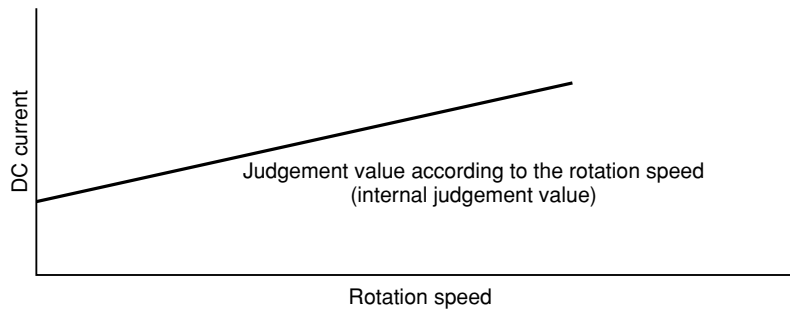


Fig. 8-2

(1) Overload external judgement circuit

- Voltage generated from current flowing in shunt R is balanced by R245 and C220 and input to pin ⑤ of IC4. Then voltage-amplified value is input to pin ⑥ of microcomputer to compare with internal data of EEPROM. When values correspond, microcomputer enters overload control.
- Fig. 8-4 shows the rotation speed control. When value at pin ⑥ of microcomputer exceeds set value, rotation speed of compressor decelerates to reduce load regardless of rotation speed commanded from indoor unit.

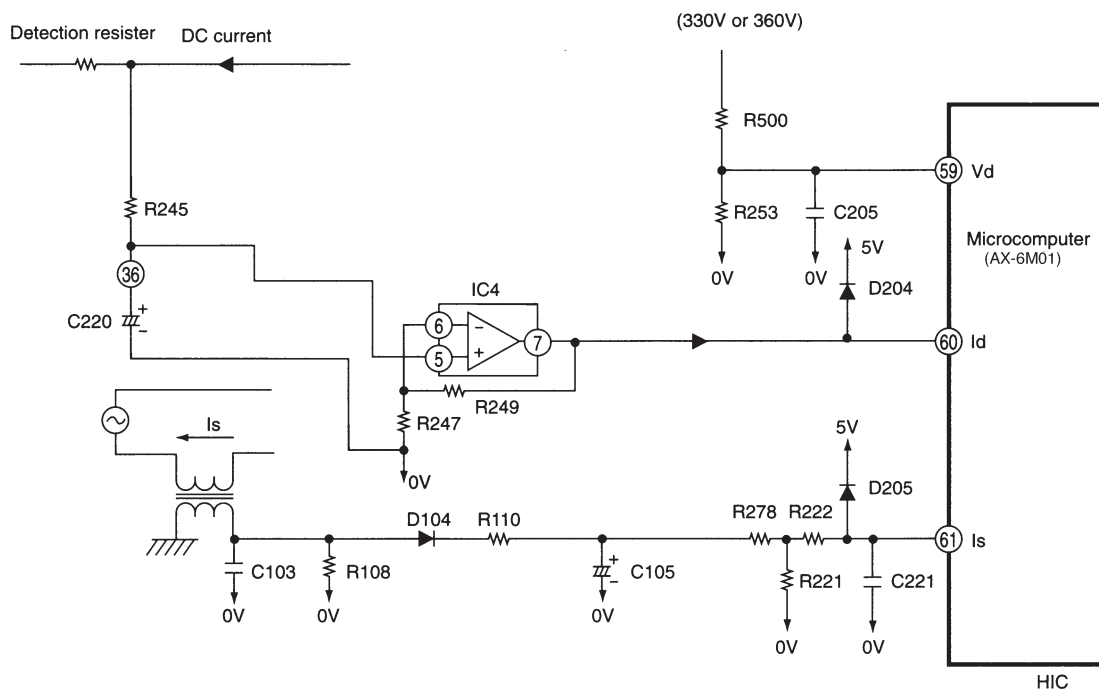


Fig. 8-3

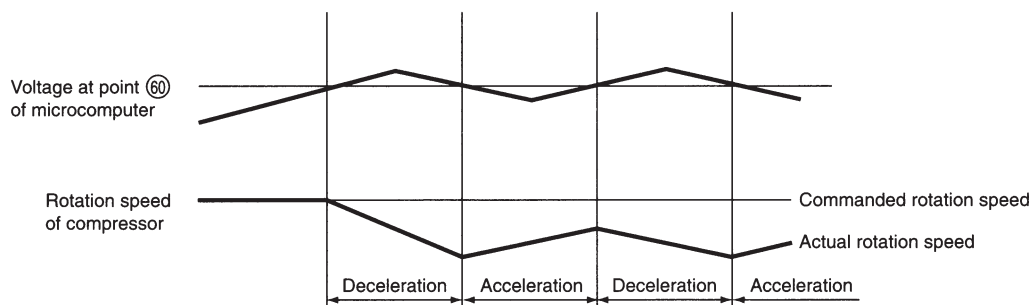


Fig. 8-4

(2) Voltage amplifier circuit

- Voltage amplifier circuit voltage-amplified DC current level detected by converting to voltage using detection resistor and sends this to microcomputer. Microcomputer A/D-converts it and then compares with internal data to judge over-load control.

[During overload control]

- Voltage generated from DC current flowing to detection resistor is balanced by resistor R245 and C220, then input to pin ⑤ of IC4. IC4 composes non-inverting amplifies, combined with peripheral components.
- As shown in Fig. 8-5, a value varying according to rotation speed is programmed in microcomputer: When DC current value exceeds this set value, overload control is set. Control of compressor motor is the same as that in external judgment.
- Set value is determined by amplification rate of voltage amplifier circuit programmed by software.
Amplification rate : High → DC current : Low
Amplification rate : Low → DC current : High

- R500 and R253, detect DC current in current circuit. Microcomputer compensates for overload set value so that the following is obtained:

$\left\{ \begin{array}{l} \text{DC voltage: High} \rightarrow \text{DC current: Low} \\ \text{DC voltage: Low} \rightarrow \text{DC current: High} \end{array} \right.$

(Since load level is expressed by DC voltage x DC current, this is intended to perform the same load judgement even when the voltage varies.)

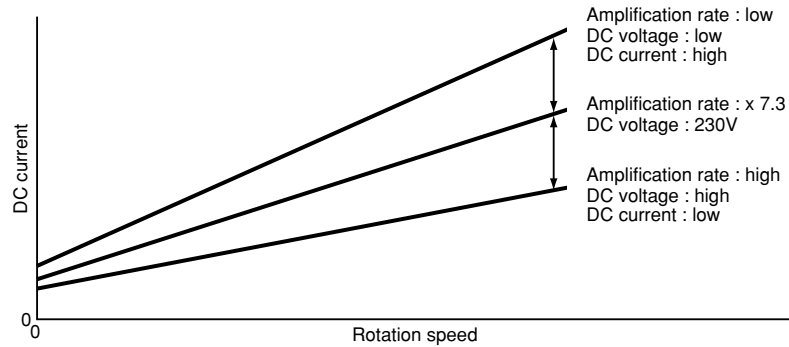


Fig. 8-5

[When starting current control]

- It is necessary to keep starting current (DC current) fixed to ensure smooth starting of DC motor for compressor.
- For RAM-40QH5, starting current control is performed by software.
- Starting current will change reflect to change in power voltage. The control system deals with change in voltage as shown below.

- (1) As shown in Fig. 8-6, U⁺ and V⁻ transistors on power module are turned on to apply current to winding of motor.
- (2) As shown in Fig. 8-7, ON time of W⁺ transistor changes according to DC voltage level so that starting current is about 10A.

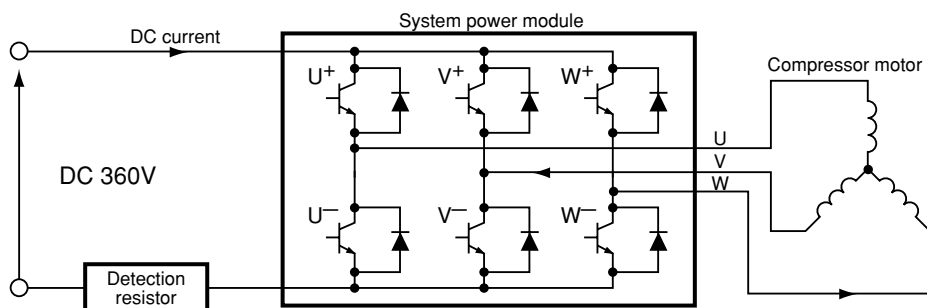


Fig. 8-6

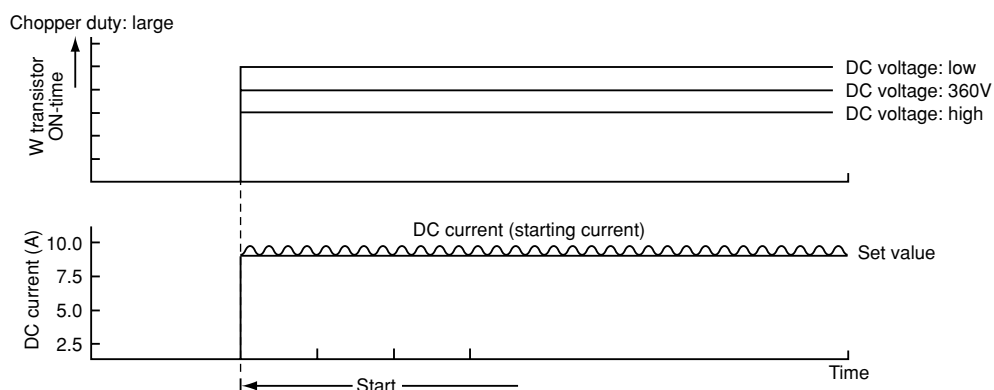


Fig. 8-7

9. Reset Circuit

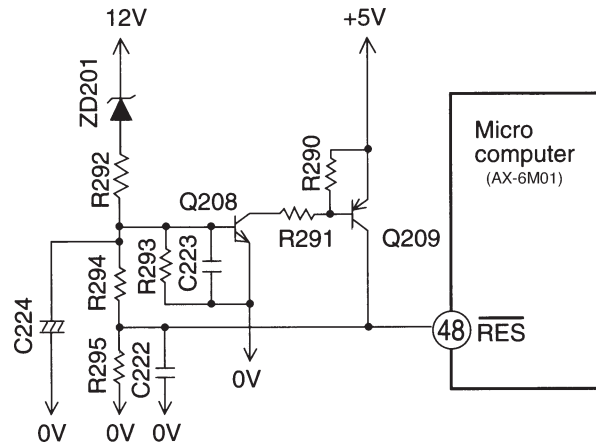


Fig. 9-1

- Reset circuit performs initial setting of the microcomputer program when power is turned on.
- Microcomputer resets program with reset voltage set to Lo, to enable operation at Hi level.
- Fig. 9-1 shows the reset circuit, and Fig. 9-2 shows waveform at each point when power is turned on/off.
- After power is turned on, 12V line and 5V line voltages rise: When 12V line voltage reaches 7.2V (Zener voltage of ZD201), ZD201 turns ON and Q208 and Q209 turn on, and reset voltage becomes Hi. Reset voltage is not set to Hi until VDD of microcomputer rises to 5V, enabling operation, due to ZD201.
- After power turns off, when 12V line voltage drops, ZD201 also turns OFF. However, Q208 is left ON since reset voltage is fed back by R294, until 12V line drops to about 7.6V. This prevents chattering of reset voltage due to voltage change in 12V line.

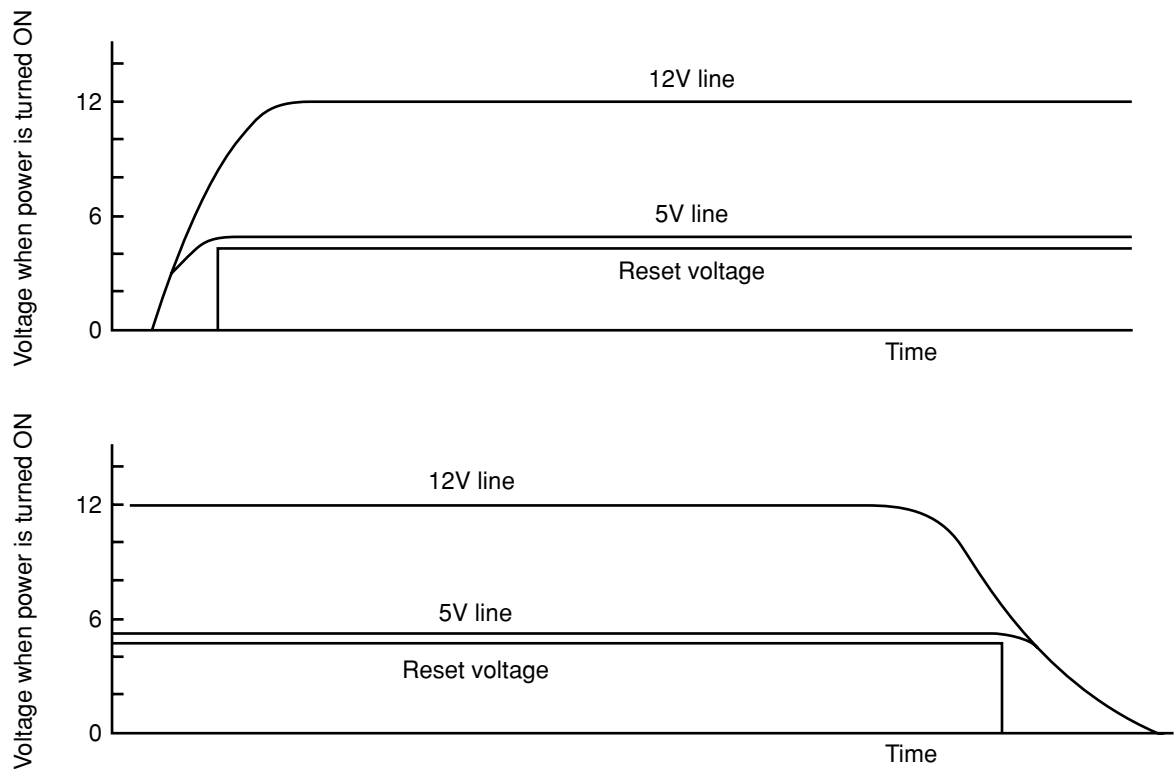


Fig. 9-2

10. Temperature Detection Circuit

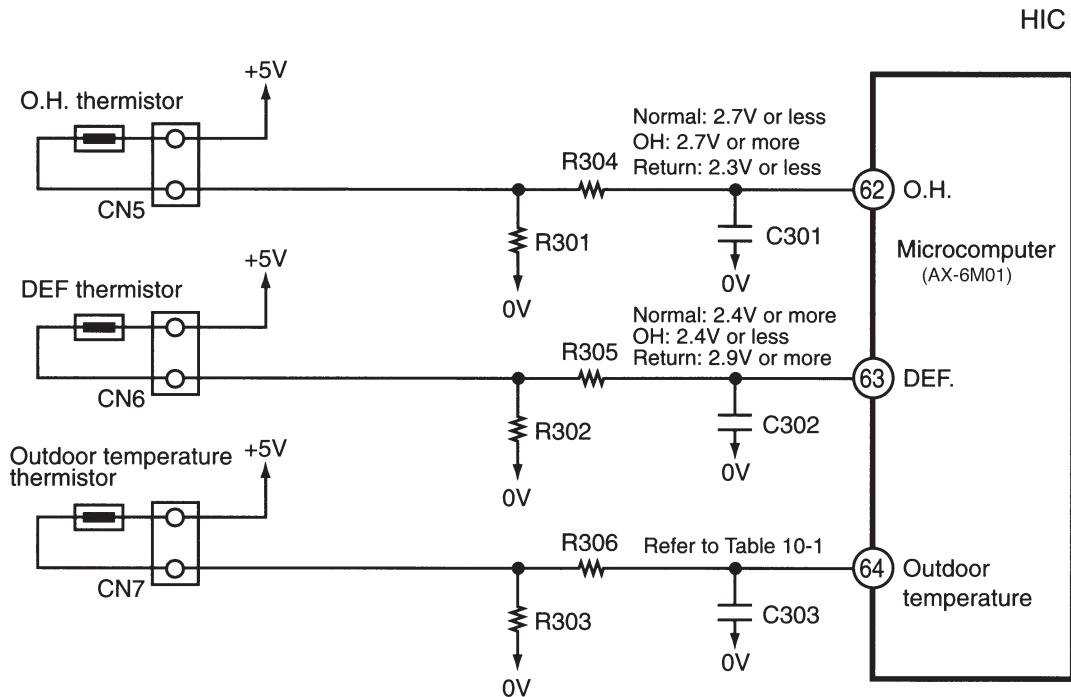


Fig. 10-1

- Compressor head surface temperature is detected by OH thermistor circuit, defrost operation temperature is detected by DEF thermistor circuit, and outdoor temperature is detected by outdoor temperature thermistor circuit.
- Thermistor is a negative resistance element with the following characteristic: Resistance falls when temperature rises, and increases when temperature falls.
- When compressor is over-heated, resistance of OH thermistor decreases and voltage at pin ⑥② of microcomputer rises.
- Voltage at pin ⑥② of microcomputer is compared with set value stored inside: If voltage exceeds set value, microcomputer judges over-heating and stops operation.
- If outdoor heat exchanger is frosted, heat exchanger temperature will rapidly drop. In response, resistance of DEF thermistor increases and voltage at pin ⑥③ of microcomputer falls. When the voltage falls under the set value, microcomputer enters defrost control mode.
- During defrost operation, microcomputer transfers indoor unit defrost condition command from IF transmission output at SDO pin of interface (pin ⑦⑩ and ⑦⑫ of microcomputer).
- Outdoor temperature is always read in (voltage at pin ⑥④ of microcomputer) by outdoor temperature thermistor, and then transferred to indoor unit side. According to this value, compressor rotation speed control and operation selection (outdoor fan ON/OFF, etc.) in dehumidifying mode are performed.

Represented value of the relationship between outdoor temperature and voltage are shown below.

Table 10-1

Outdoor temperature (°C)	-10	0	10	20	30	40
Voltage at pin ① of CN7 (V)	1.19	1.69	2.23	2.75	3.22	3.62

<Reference>

When the thermistor is open or heat is shut off, pins ⑥② to ⑥④ of microcomputer are set to about 0 V; when thermistor is short-circuited, pins ⑥② to ⑥④ of microcomputer are set to about 5V, and LD301 blinks 7 times. However, OH thermistor detects only short-circuit as error: It will enter a blink mode after 12 minutes or more has elapsed from the start of compressor operation.

11. Drive Circuit

Fig. 11-1 shows the drive circuit.
The circuits for U phase, V phase and W phase have the same Configuration.

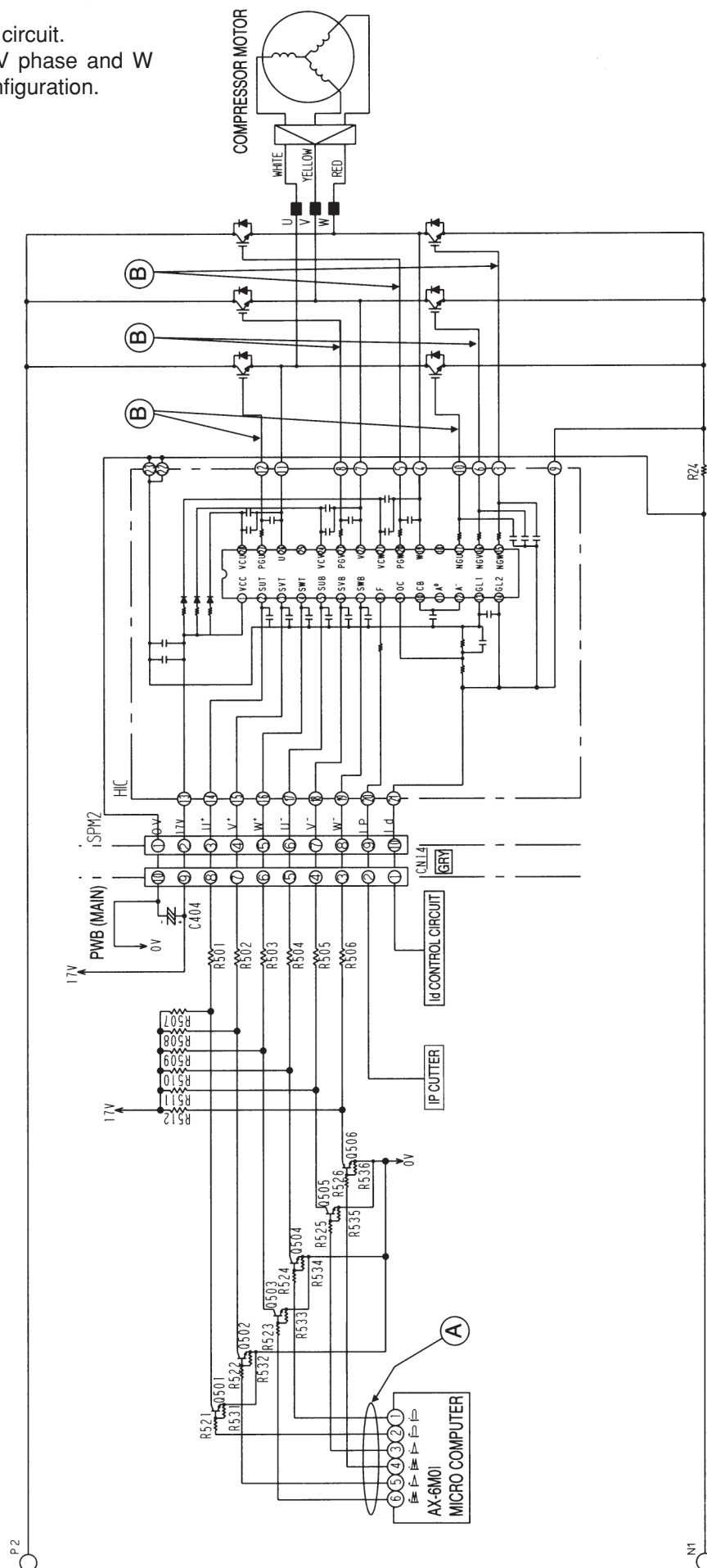


Fig. 11-1

- Fig 11-2, 0 to 5V chopper signal is output from microcomputer for each phase. The signal output from microcomputer is input to IC, inverted due to active LO, and 0 to 15V chopper signal is obtained. This signal is then applied to transistor gate of each phase to drive.

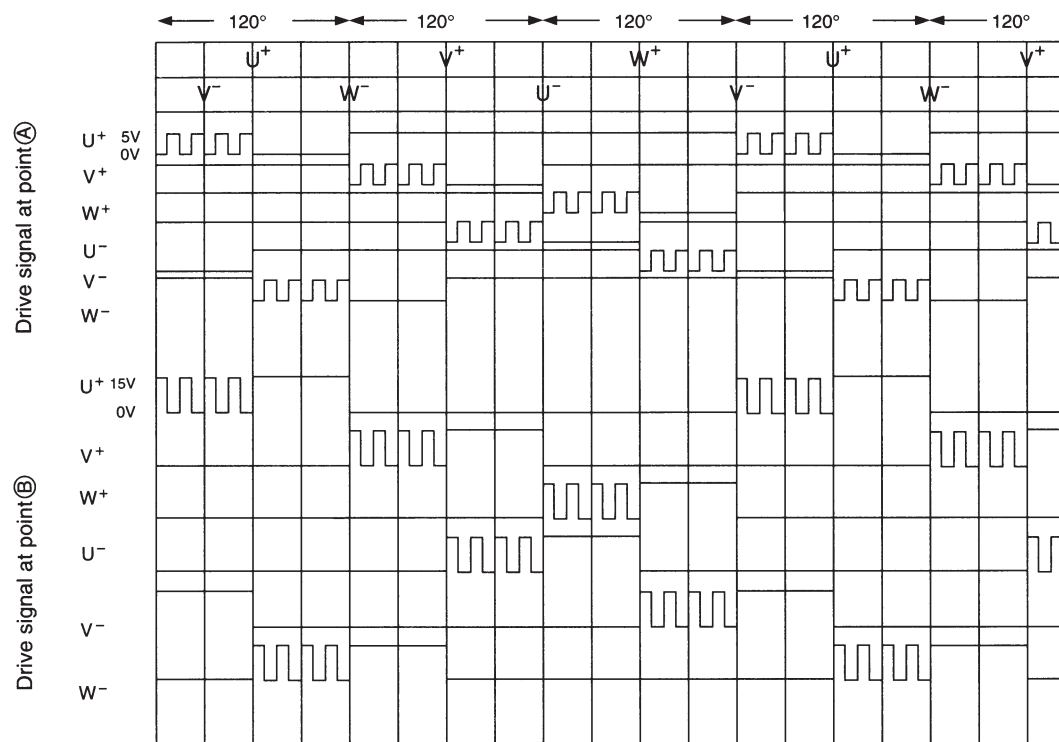


Fig. 11-2

12. Electric expansion valve

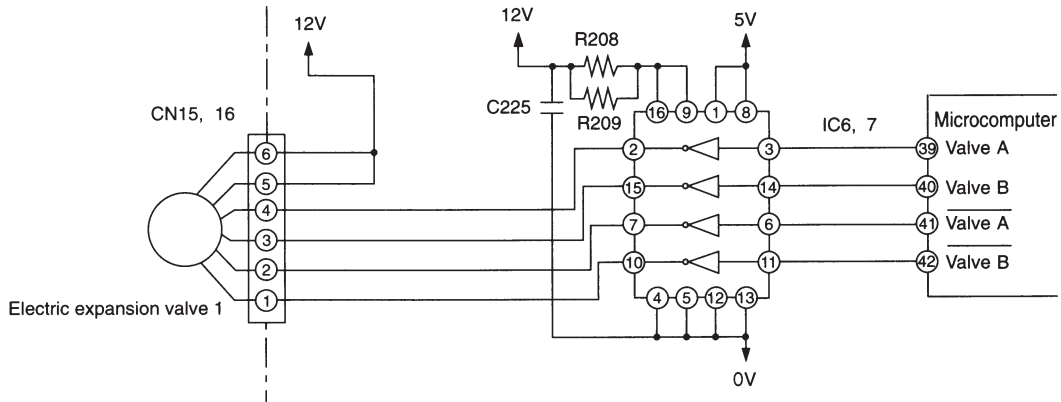


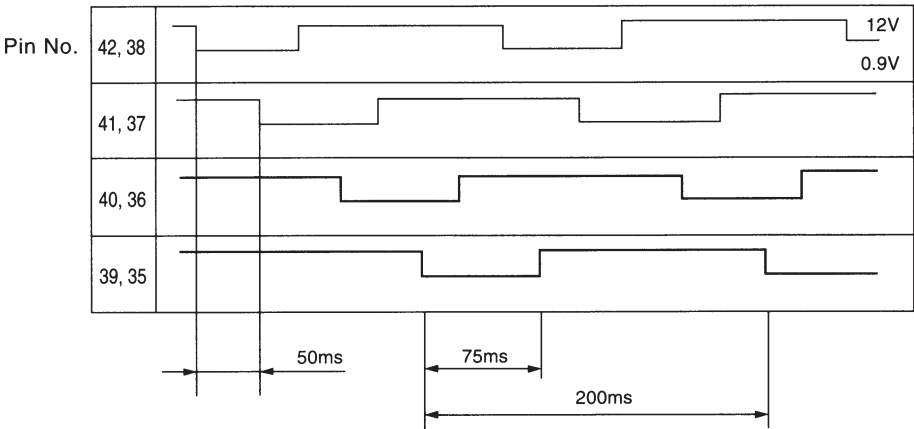
Fig 12-1

- The electric expansion valve is driven by DC 12V. Power is supplied to 1 or 2 phase winding to switch magnetic pole of winding in order to control opening degree.
- Relationship between power switching direction of phase and open/close direction is shown below.
When power is supplied, voltages at pins ④ to ① of CN 15 and CN 16 are about 0.9V; they are about 12V when no power is supplied. When power is reset, initialization is performed for 10 or 20 seconds.
During initialization, measure all voltages at pins ④ to ① of CN15 and CN16 using tester. If there is any pin with voltage that has not changed from around 0.9V or 12V, expansion valve or microcomputer is defective.
- Fig 12-2 shows logic waveform when expansion valve is operating.

Table 12-1

Pin phase No.	Lear wire	Drive status							
		1	2	3	4	5	6	7	8
④	White	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
③	Yellow	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
②	Orange	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
①	Blue	OFF	OFF	OFF	OFF	OFF	ON	ON	ON

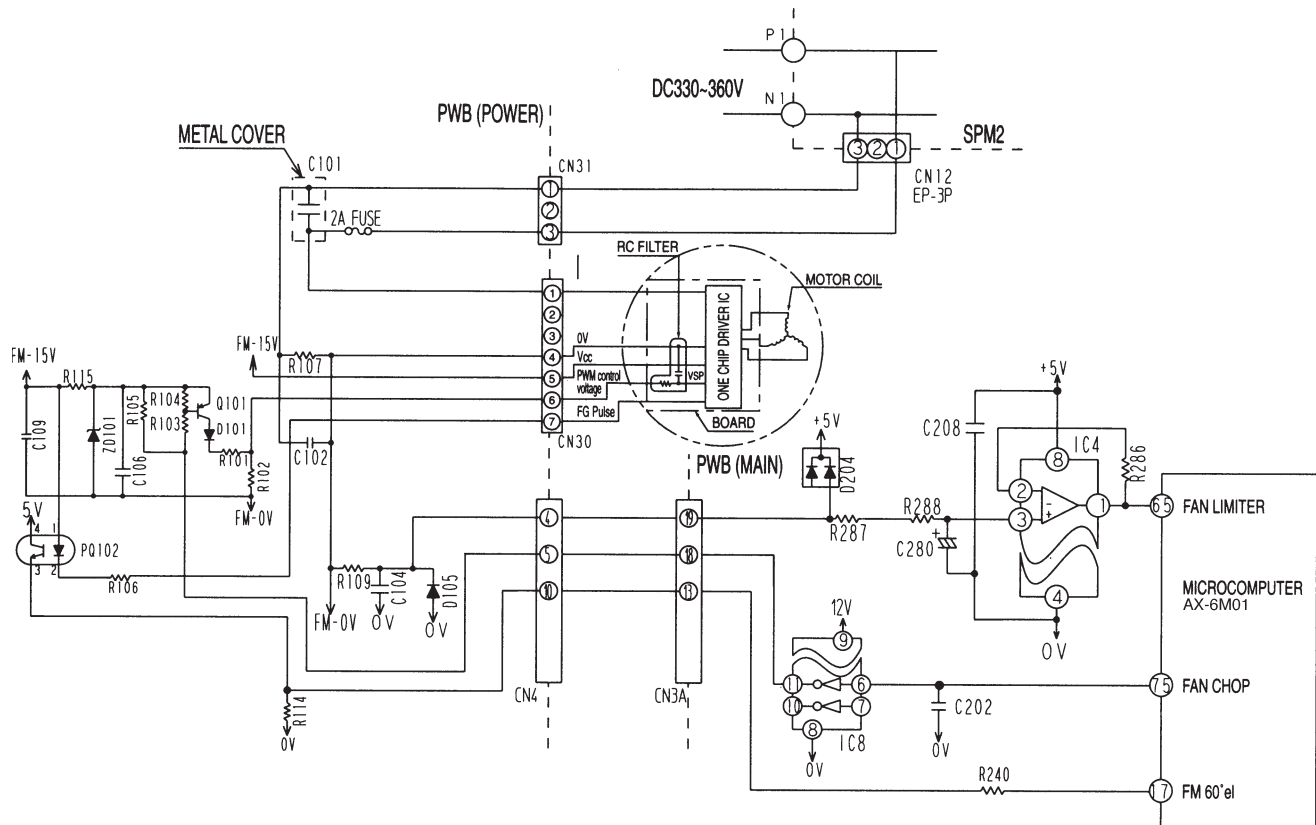
Operation mode
1→2→3→4→5→6→7→8 VALVE CLOSE
8→7→6→5→4→3→2→1 VALVE OPEN



With explosion valve control, opening degree is adjusted to stabilize target temperature, by detecting temperature of compressor head.

The period of control is about once per 20 seconds, and output a few pulses.

Outdoor DC Fan Motor control circuit



- This model uses DC Fan Motor which is including controller circuit into the Motor shell.
- This DC Fan Motor will rotate by control voltage apply to Vsp input. (Voltage range: 1.7 to 7V DC)
Vsp high : Faster; Vsp low: slower; Vsp lower than 1.7V: stop
- Motor will output FG pulse by following this motor revolution.
- Outdoor Microprocessor will output PWM control signal from FAN CHOP terminal by following the instruction from indoor Microprocessor.
- This PWM control signal will convert to Vsp voltage by smoothing circuit (Q101 & RC filter)
- Fan motor will start to rotate when Vsp was proceeding over than 1.7V, and generate FG pulse by rotation speed.
- FG pulse will feed back to Outdoor Microprocessor through PQ102.
- PQ102 is the isolator between Microprocessor circuit and DC Fan Motor circuit, which has to match the Fan Motor revolution with instructed revolution. Such as...

FG feedback: Faster – Instruction: Slower ... Decrease pulse width

FG feedback: Slower – Instruction: Faster ... Increase pulse width

- FG pulse is also used for Fan Motor fail detection
- Microprocessor will monitor FG pulse 30 seconds after start the fan motor. If there is no signal detected, it will consider that the Fan Motor was malfunction and stop the operation. In this case, LD301 on control PWB will blink 12 times. (Fan Motor lock detected)
- R107 and IC4 are used for Fan Motor over current detection.

< Reference >

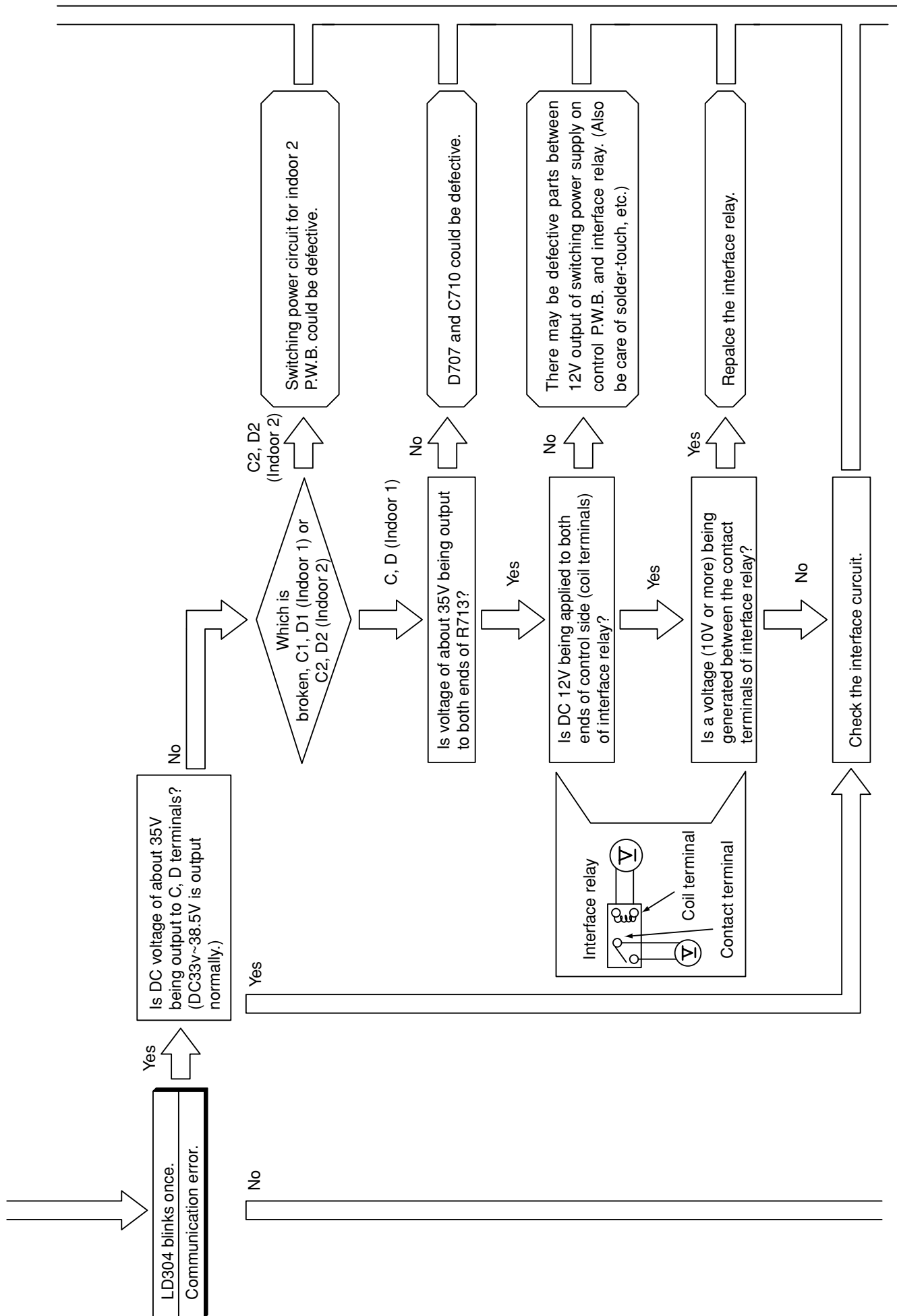
- When stop operation with LD301 blinks 12 times, it may be a DC Fan Motor broken.
- In this case, please check CN30 and CN31 connection first. It makes Fan Motor Lock also if those connectors are in misconnection.
- If 2A Fuse was burned it is possible that the DC Fan Motor may be damaged too.
- DC Fan Motor has broken when 2A Fuse was burned. Please replace both DC Fan Motor and 2A Fuse together.
- Fan lock detecting system may be actuated when something has disturb the Fan rotation by inserting materials into propeller fan or ice has growing inside of outdoor unit by snowing.
- Fan lock detecting system may be actuated by strong wind (ex. 17m/sec or above) against the Fan rotation. In this case, unit will be restart again after a while.
- Fan lock detecting system may be actuated even though the DC Fan Motor is rotating correctly, the possible cause is due to Motor problem or PQ102 on board or control board problem.

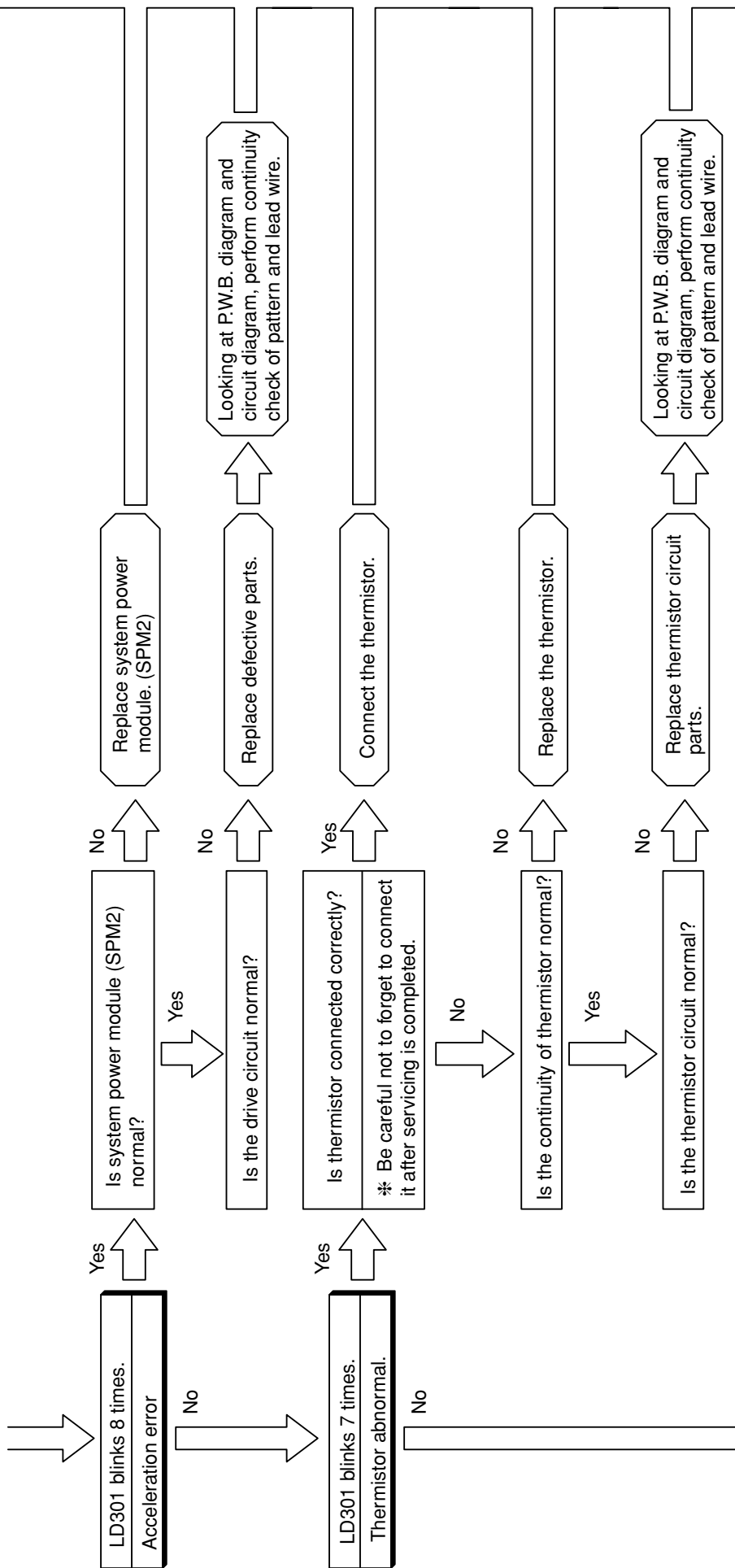
< Caution >

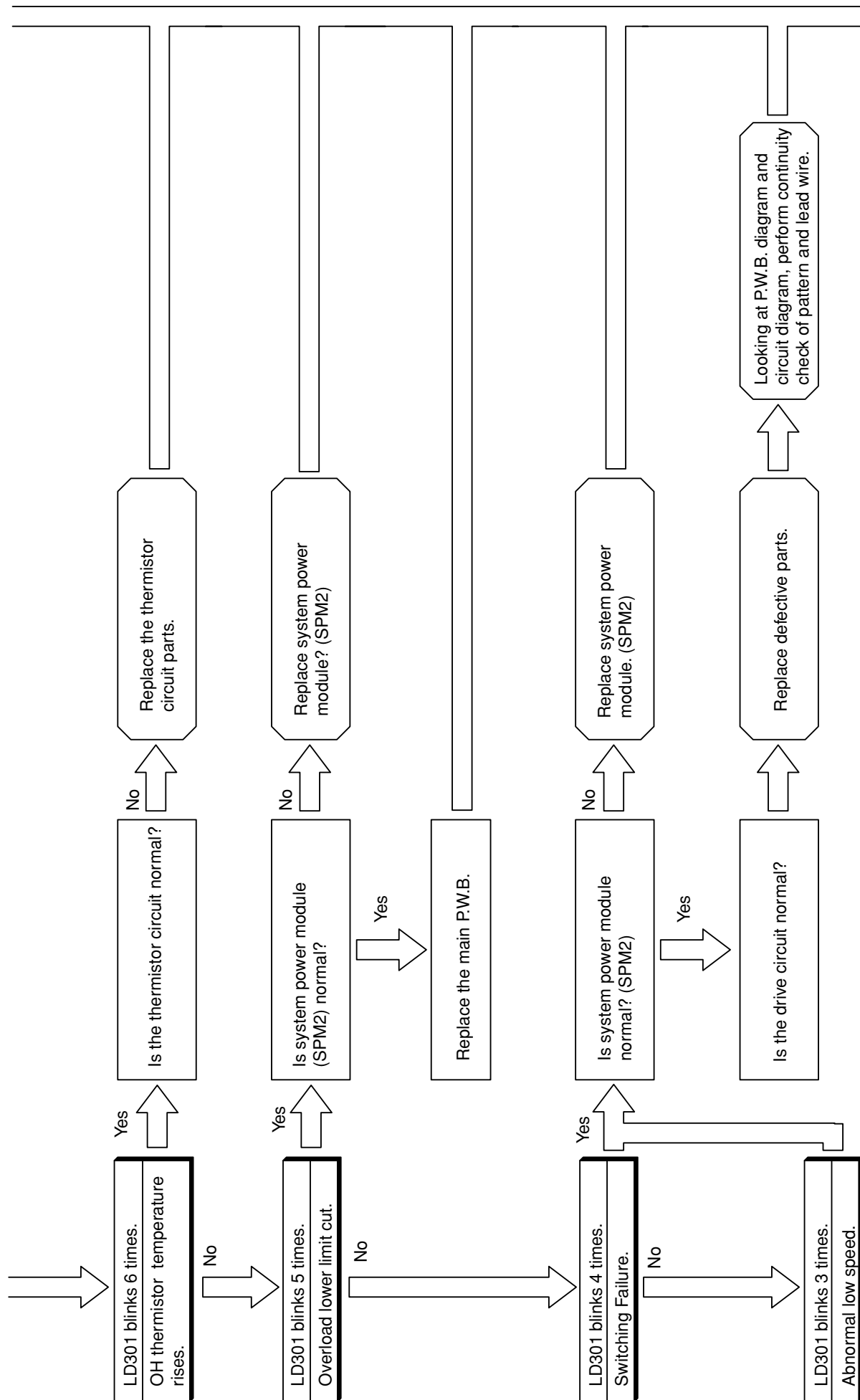
- Please take precaution while servicing Fan Motor circuit, because it carries DC330~360V supply.
- It is impossible to troubleshoot the Fan Motor because its circuit is integrated and conceal in the Fan Motor.

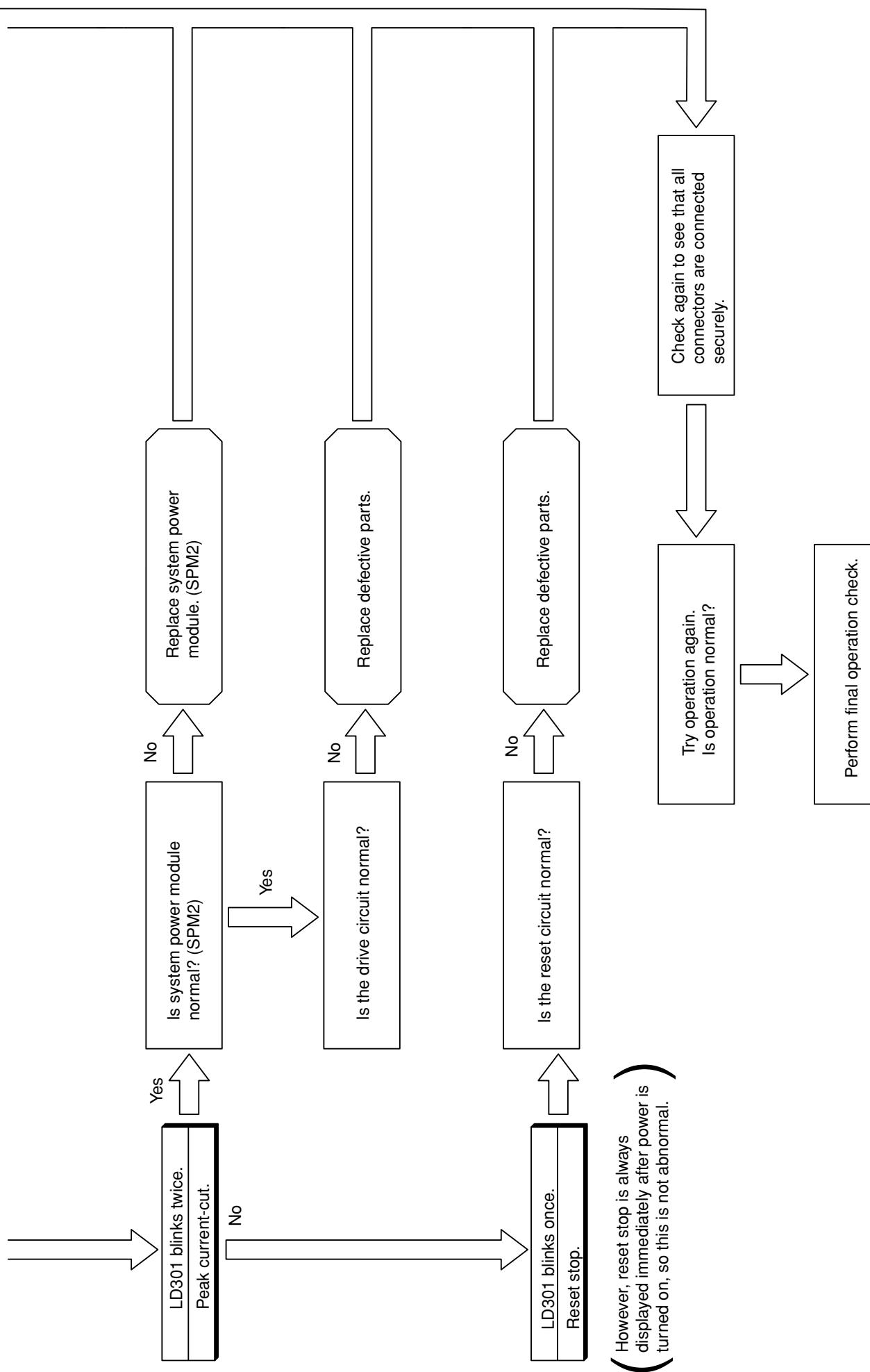
MODEL RAM-35QH5





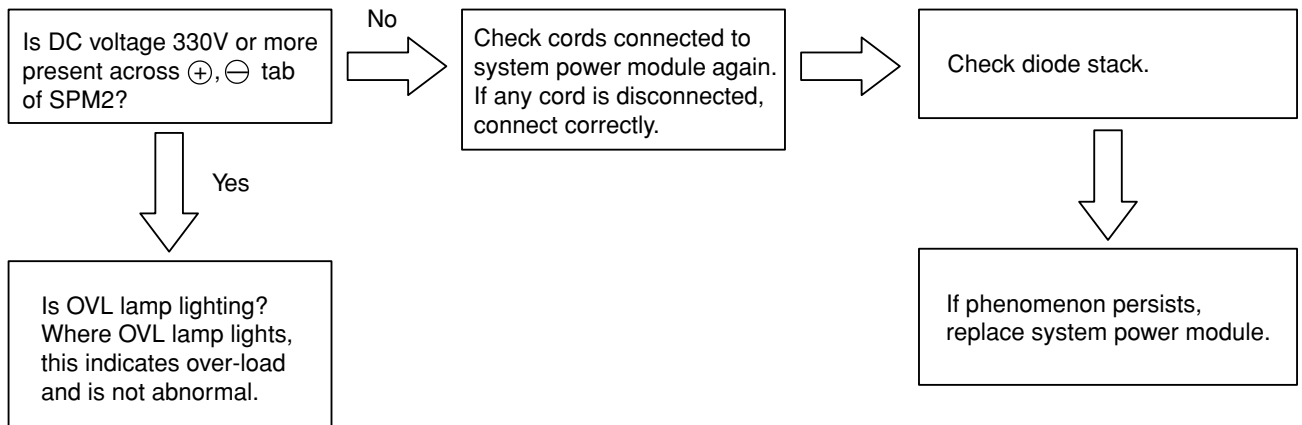






PAM CIRCUIT

Phenomenon 1 (Rotation speed does not increase)



Over-voltage error (blinks 15 times): System power module (SPM2) is abnormal.

OPERATION USING SERVICE SWITCH OF OUTDOOR UNIT

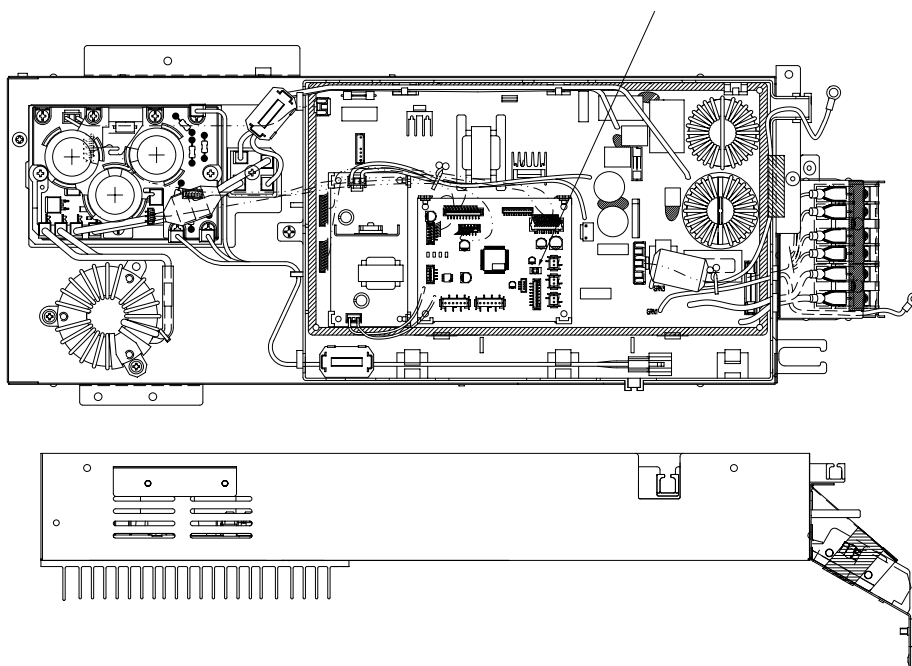
MODEL RAM-35QH5

1. Turn OFF power switch, then turn ON again.
2. Remove electrical parts box lid.
3. Press service switch for 1 second or more. (waiting at least 20 seconds after power switch is turned on.)

At this time, LD303 (red) lights and unit operates in forced cooling mode.

Never operate
continuously for 5
minutes or more

Service switch (Forced-cooling operation starts
by pressing for 1 second or more, and pressing
for 1 second or more again stops operation.)



(Note)

- (1) When checking is performed using service switch of outdoor unit, if both indoor units are not connected to interface signal (DC35V) **C.D terminals**, LD304 (outdoor communication error indicator) will display **communication error by blinking once**.
- (2) If operating is performed with compressor connector disconnected, LD301 will blink 4 times and operation will not start.

After operation using service switch is completed, turn the power switch OFF and then ON again.

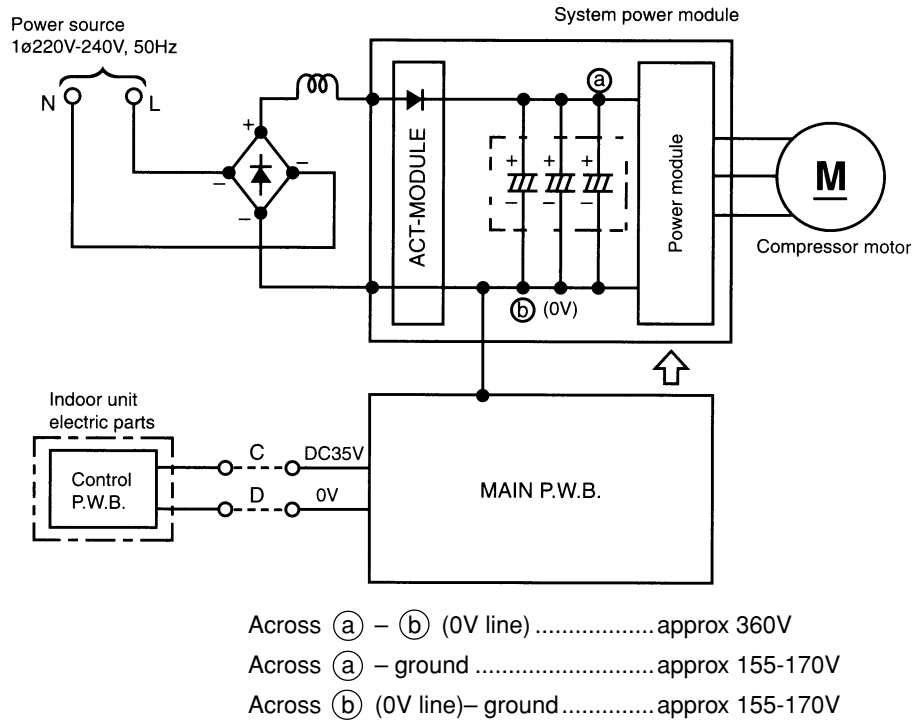
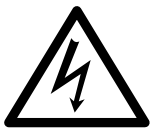
TROUBLE SHOOTING

Model RAM-35QH5

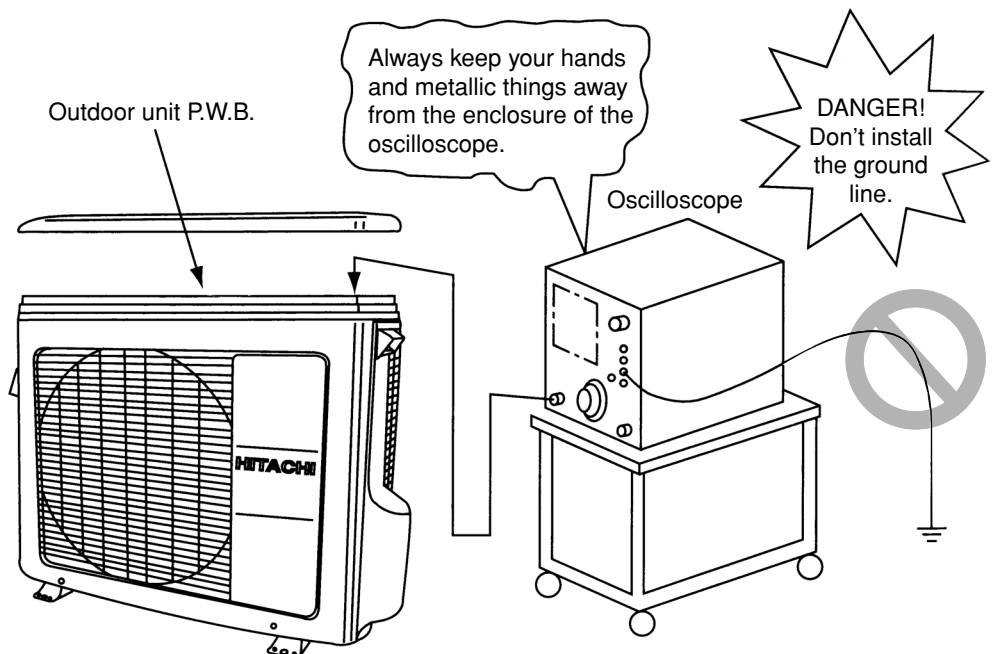
PRECAUTIONS FOR CHECKING



1. Remember that the 0V line is biased to 155-170V in reference to the ground level.
2. Also note that it takes about 10 minutes until the voltage fall after the power switch is turned off.



When using an oscilloscope, never ground it. Don't forget that high voltages as noted above may apply to the oscilloscope.



DISCHARGE PROCEDURE AND HOW TO CUT OFF POWER TO POWER CIRCUIT



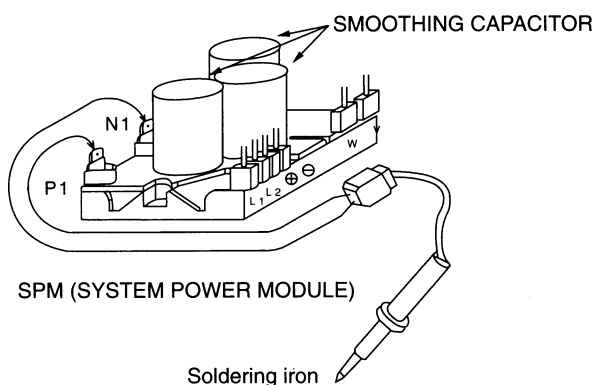
WARNING



Caution:

- Voltage of about 360V is charged at both ends of smoothing capacitors 400 μ F X 3.
- High voltage (DC 360V) is also charged at screw and terminal sections of system power module.
- During continuity check for each circuit of electrical parts in outdoor unit is performed, to prevent secondary trouble, disconnect red/gray wire connected to system power module (SPM2) from diode stack. (Also be sure to perform discharging of smoothing capacitor.)

1. Turn off the power switch of indoor unit or disconnect power plug.
2. Wait for 10 minutes or more after power is turned off and then remove electrical parts box lid. As shown below, Apply soldering iron of 30-75W for 15 seconds or more to P1 and N1 black/white lead receptacles on system power module to discharge voltage from smoothing capacitor.
Do not loosen or remove screws of system power module: If screw is loose, voltage will not be discharged.
3. Before operation check of each part of circuit, remove receptable of red/gray lead connected to system power module from diode stack.

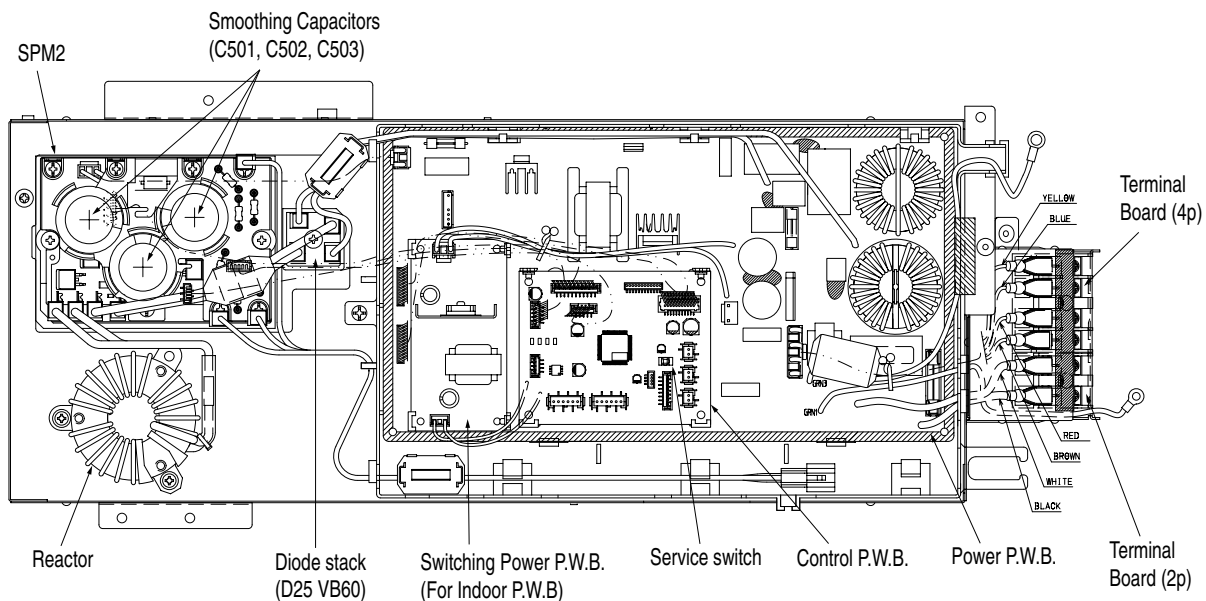
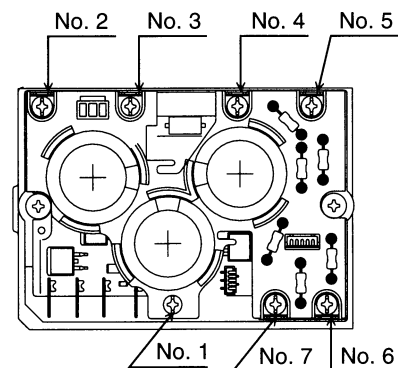


Do not use soldering iron with transformer: Doing so will blow thermal fuse inside transformer.

As shown left, apply soldering iron to metal parts (receptacles) in sleeve corresponding to P1 and N1 terminals of system power module (SPM2).

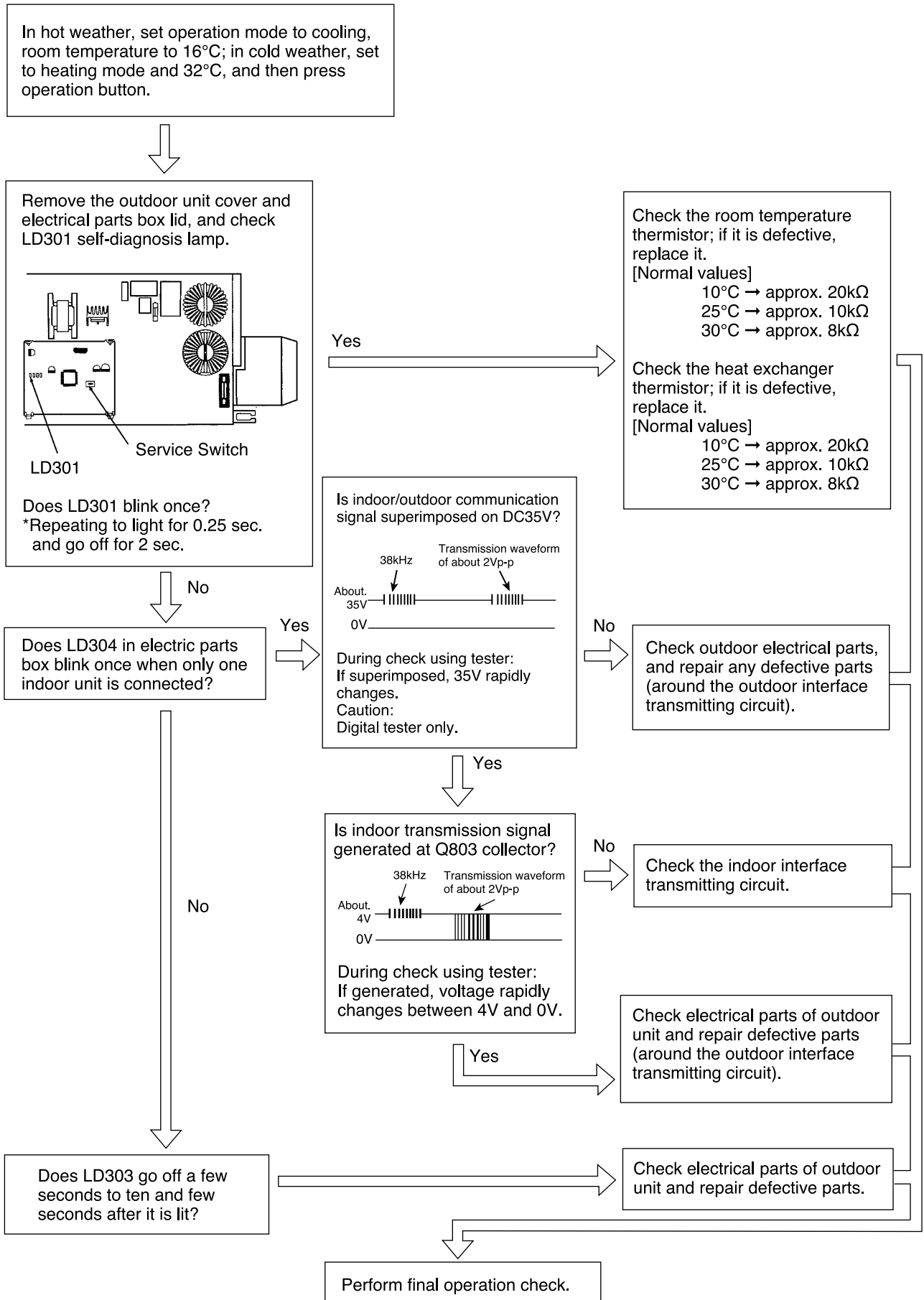
Screws of system power module (SPM2) are live parts: Do not touch them. Screw tightening torque and method are strictly specified.

When the screw is loosened or removed once, be sure to tighten according to the procedure shown on the right, with tightening torque of $0.8 \pm 0.2 \text{ N} \cdot \text{m}$.



RAM-35QH5

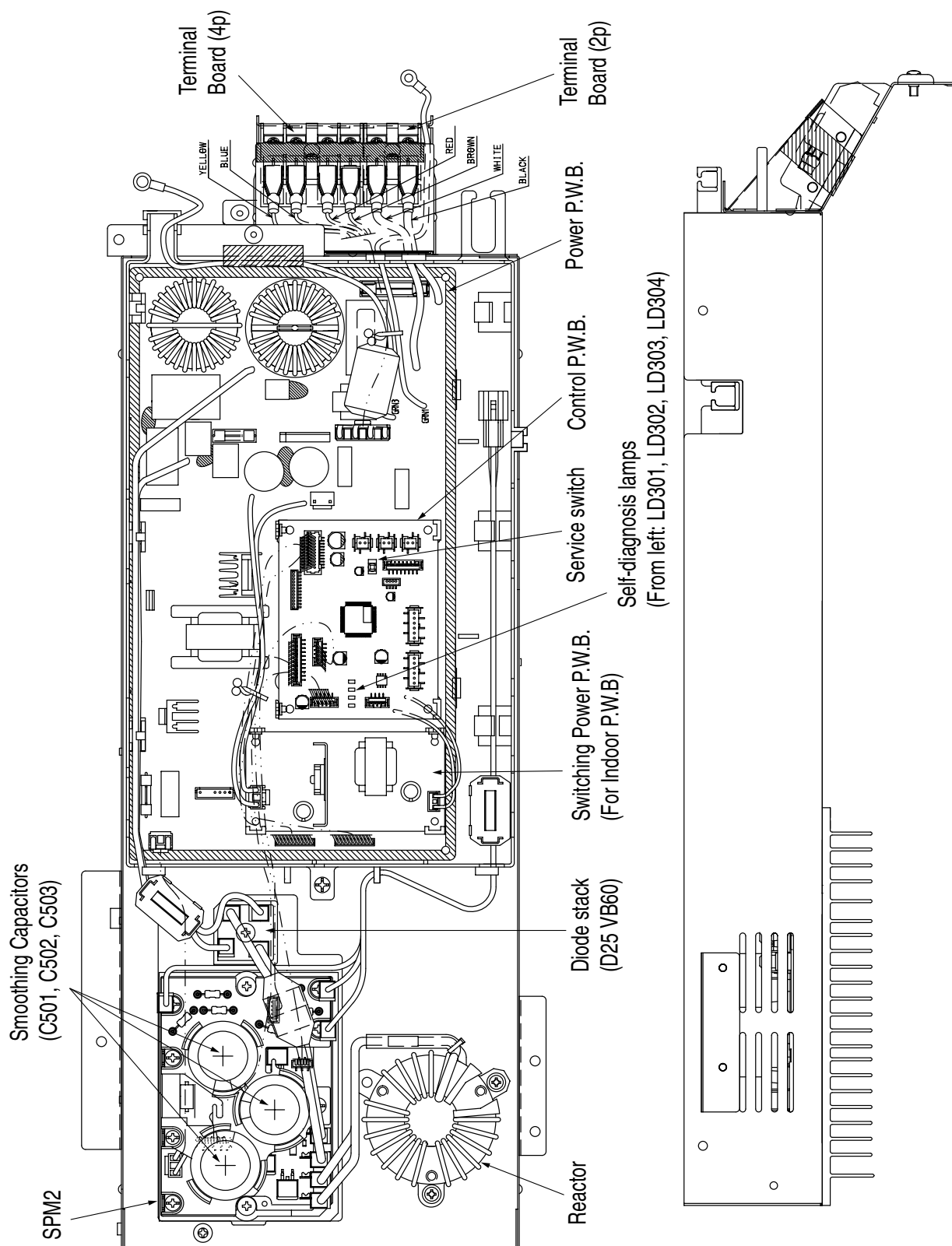
1. Outdoor unit does not operate (remote control signal can be received)



LIGHTING MODE SELF-DIAGNOSIS LAMP

RAM-35QH5

1 Location of self-diagnosis lamp



2 Lighting mode self-diagnosis lamp

RAM-35QH5

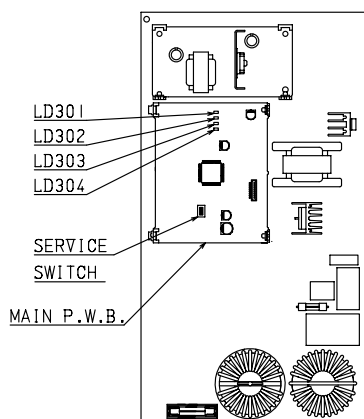
⚠ ⚡ DANGER
(DC360V)

- WAIT FOR TEN-MINUTE(MIN) AFTER TURNING OFF THE POWER SWITCH WHEN SERVICE WORK IS BEING DONE.
- SHOULD BE CONFIRM TO VOLTAGE LESS THAN DC 10V BY REFERRING TO SERVICE MANUAL DISCHARGE PROCEDURE PAGE.

- DO NOT TOUCH SCREW OF SYSTEM POWER MODULE DUE TO HIGH VOLTAGE.
- DO NOT TOUCH OTHER PARTS AT THE CASE OF PUSHING SERVICE SWITCH.

SERVICE OPERATION

REFRIGERANT WITHDRAWAL OR SINGLE OPERATION OF THE OUTDOOR UNIT, SHALL SWITCH OFF THE EXCLUSIVE BREAKER FIRST. PUT THE SWITCH TO ON POSITION BACK AND WAIT AT LEAST 1 MINUTE. THEN PUSH THE SERVICE SWITCH WHICH IS ON THE CIRCUIT BOARD FOR MORE THAN 1 SECOND. (THERE WILL BE A COOLING CYCLE) TO PRESERVE PARTS FROM DAMAGE, MUST NOT OPERATE IT FOR MORE THAN 5 MINUTES. TO PAUSE, PUSH THE SERVICE SWITCH AT LEAST 1 SECOND. IN CASE TO START OPERATING ONCE AGAIN PLEASE SWITCH OFF THE POWER BACK.

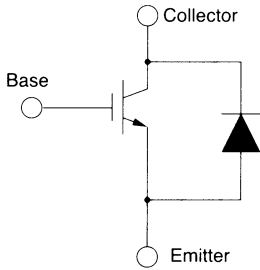
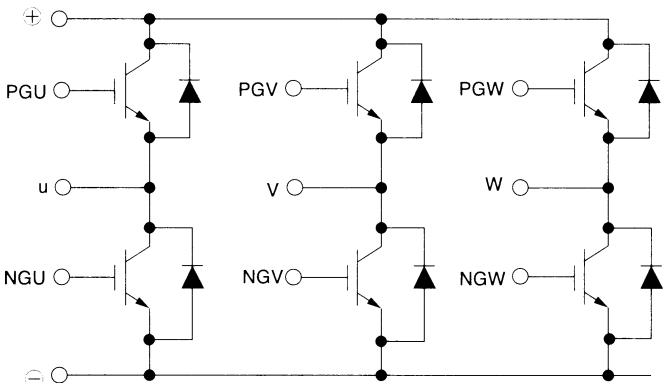
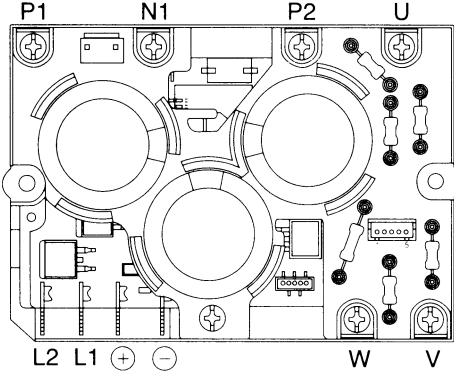


SELF-DIAGNOSIS LIGHTING MODE ■:LIT ▨:BLINKING □:OFF

LD301 RED	LD302 RED	SELF-DIAGNOSIS NAME	DETAILS	MAIN CHECK POINT
		[1] DURING OPERATION	LD303 (RED) LIGHTS. ■	
□	□	NORMAL OPERATION	COMPRESSOR OPERATION	NOT MALFUNCTION
■	□	OVERLOAD (1)	<p>THE ROTATION SPEED IS AUTOMATICALLY CONTROLLED TO PROTECT THE COMPRESSOR IN THE OVERLOAD CONDITION.</p>	THIS SHOWS AN OVERLOAD, NOT MALFUNCTION.
□	■	OVERLOAD (2)		
■	■	OVERLOAD (3)		
		[2] DURING STOP	LD303 (RED) GOES OFF. □	
□	□	NORMAL STOP	INDOOR THERMOSTAT OFF. MAIN OPERATION OFF.	NOT MALFUNCTION.
▨	□	RESET STOP	WHEN STOPPED WITH POWER RESET. (NORMAL WHEN POWER HAS BEEN TURNED ON.)	P.W.B.s (POWER CIRCUIT, MICROCOMPUTER, ETC.)
▨	□	PEAK CURRENT CUT	OVERCURRENT IS DETECTED.	① SYSTEM POWER MODULE ② COMPRESSOR ③ P.W.B.s
▨	□	ABNORMAL LOW SPEED ROTATION	POSITION DETECTION SIGNAL IS NOT INPUT DURING OPERATION.	① SYSTEM POWER MODULE ② COMPRESSOR ③ P.W.B.s
▨	□	SWITCHING FAILURE	SWITCHING FROM LOW FREQUENCY SYNC START TO POSITION DETECTION OPERATION FAILURE.	① SYSTEM POWER MODULE ② COMPRESSOR ③ P.W.B.s
▨	□	OVERLOAD LOWER LIMIT CUT	UNDER THE LOWER LIMIT OF ROTATION SPEED WITH OVERLOAD CONTROL CIRCUIT OPERATED.	① OUTDOOR UNIT IS EXPOSED TO DIRECT SUNLIGHT OR ITS AIRFLOW BLOCKED. ② FAN MOTOR ③ FAN MOTOR CIRCUIT ④ THE VOLTAGE IS EXTREMELY LOW.
▨	□	OH THERMISTOR TEMP. RISE	OH THERMISTOR OPERATED.	① LEAK OF REFRIGERANT ② COMPRESSOR ③ OH THERMISTOR CIRCUIT ④ FAN MOTOR ⑤ FAN MOTOR CIRCUIT
▨	□	THERMISTOR ABNORMAL	THERMISTOR IS OPEN OR SHORTED.	① THERMISTOR ② CONNECTION OF THERMISTOR DEFECTIVE ③ THERMISTOR CIRCUIT
▨	□	ACCELERATION DEFECTIVE	NO ACCELERATION OVER THE LOWER LIMIT OF THE ROTATION SPEED.	① LEAK OF REFRIGERANT ② COMPRESSOR
▨	□	ABNORMAL POWER VOLTAGE	POWER VOLTAGE IS ABNORMALLY LOW.	① POWER VOLTAGE ② CONNECTION OF REACTOR
▨	□	FAN LOCK ERROR	OUTDOOR FAN RPM IS NOT ROTATE AS INTENDED RPM	① FAN MOTOR ② FAN MOTOR CIRCUIT
▨	□	EEPROM READ ERROR	MICROCOMPUTER CANNOT READ THE DATA IN EEPROM.	P.W.B.s (POWER CIRCUIT, EEPROM, ETC.)
▨	□	ACTIVE CONVERTER DEFECTIVE	OVERVOLTAGE IS DETECTED BY SYSTEM POWER MODULE	SYSTEM POWER MODULE
LD303 GRN	LD304 GRN	NORMAL		
▨	▨	COMMUNICATIONS ERROR	COMMUNICATIONS BETWEEN INDOOR UNIT AND OUTDOOR UNIT ARE INTERRUPTED	① CABLE IS WRONG CONNECTED ② CABLE IS OPEN ③ INTERFACE CIRCUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT

※ EXAMPLE OF BLINKING (5 TIMES) 2SEC (■: LIGHTS FOR 0.25 SEC AT INTERVAL OF 0.25 SEC.)

TROUBLESHOOTING OF THE SYSTEM POWER MODULE

Type	GT15V31ISM
Element circuit	
Internal circuit of the module	
Terminal symbol of system module ※ See next page for values measured by tester	 <p>※ Do not disassemble the system power module when troubleshooting is performed.</p>

HOW TO CHECK POWER MODULE

Checking power module using tester

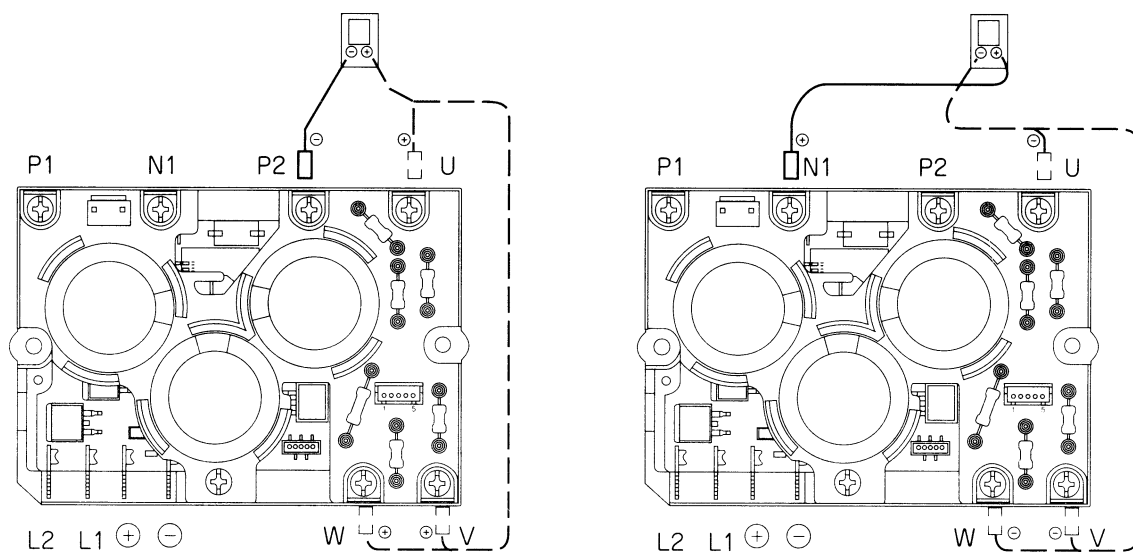
Set tester to resistance range ($\times 100$)

If indicator does not swing in the following conductivity check, the power module is normal.

(In case of digital tester, since built-in battery is set in reverse direction, \oplus and \ominus terminals are reversed.)

CAUTION

If inner circuit of power module is disconnected (open), the indicator of tester will not swing and this may assumed as normal. In this case, if indicator swings when \oplus and \ominus terminals are connected in reverse of diagram below, it is normal. Furthermore, compare how indicator swings at U, V and W phases. If indicator swings the same way at each point, it is normal.



CHECKING THE REFRIGERATING CYCLE

(JUDGING BETWEEN GAS LEAKAGE AND COMPRESSOR DEFECTIVE)

Troubleshooting procedure (No operation, No heating, No cooling)

If the indoor pipe or service valve becomes frosted during heating of one unit, check the operation of Reversing valve.



Connect U.V.W phase leads to the power module again and operate the air conditioner.



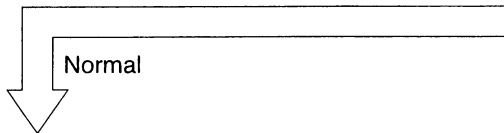
Is the self-diagnosis lamp mode as shown on the right?

YES

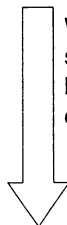


Stop to operate and check the gas pressure in balancing mode.

Normal

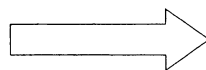


Checking the power module.



When the self-diagnosis lamp lights in the same condition as above.

The compressor is defective. Replace it and seal refrigerant.
(If the compressor checker for an inverter type air conditioner is available, re-check using it.)



Perform a final check of operation.

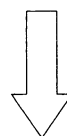
Lighting mode Selfdiagnosis Lamp	Blinks 2 times	Blinks 3 times	Blinks 4 times	Blinks 5 times	Blinks 6 times	Blinks 8 times
LD301						
Time until the lamp lights	2-3 seconds			Approx 10 seconds	Within approx 30 minutes	Approx 10 seconds
Possible malfunctioning part	Compressor				Gas leakage	Compressor

Blinking

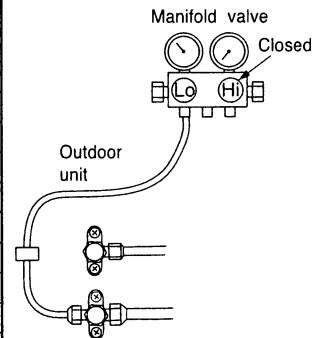
Outdoor air temperature (°C)	Charge port pressure	
	Mpa(G)	kgf/cm²(G)
50	2.96	{30.14}
45	2.62	{26.72}
40	2.31	{23.58}
35	2.03	{20.73}
30	1.78	{18.14}
25	1.55	{15.79}
20	1.34	{13.66}
15	1.15	{11.74}
10	0.98	{10.02}
5	0.83	{8.48}
0	0.70	{7.10}
-5	0.58	{5.89}
-10	0.47	{4.81}

(R410A)

Abnormal
Gas leaking

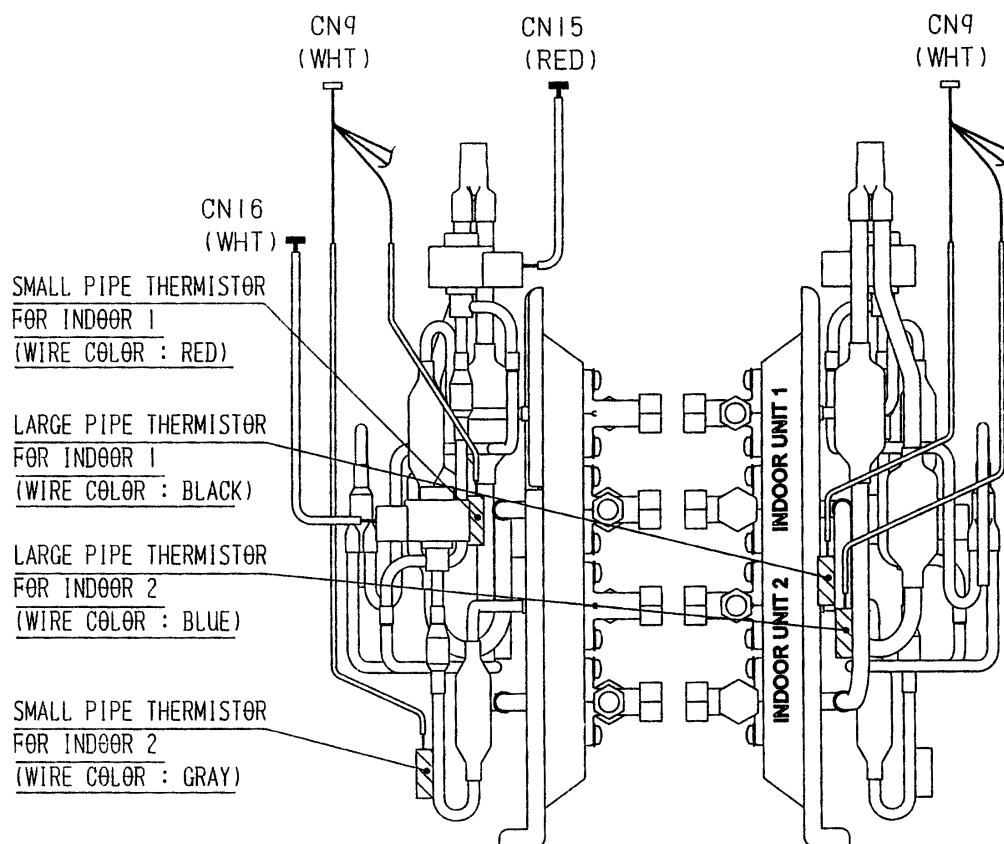


Gas leaks.
Repair and seal refrigerant.



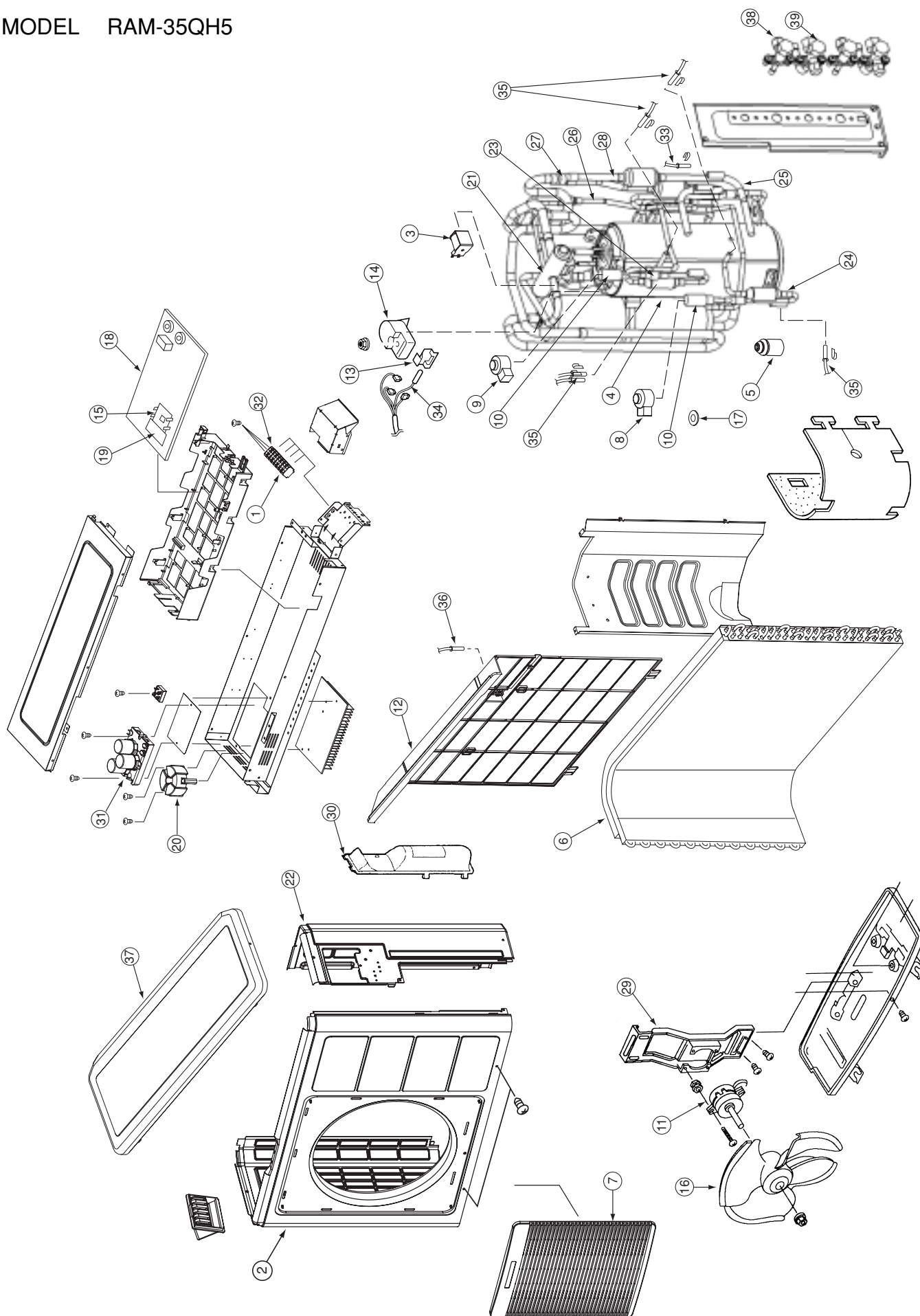
ELECTRIC EXPANSION VALVE & PIPE THERMISTOR POSITION CHARTS

MODEL RAM-35QH5



PARTS LIST AND DIAGRAM

MODEL RAM-35QH5



MODEL RAM-35QH5

NO.	PART NO. RAM-35QH5		Q'TY / UNIT	PARTS NAME
1	PMRAC-63CA1	S02	1	2P TERMINAL
2	PMRAC-51CA1	S01	1	CABINET
3	PMRAC-70YHA1	998	1	COIL (REVERSING VALVE)
4	PMRAM-35QH5	S01	1	COMPRESSOR
5	RAC-2226HV	805	3	COMPRESSOR RUBBER
6	PMRAM-40QH5	S10	1	CONDENSER
7	PMRAC-09CHA1	903	1	D-GRILL
8	PMRAC-25NH4	S03	1	ELECTRICAL EXPANSION COIL
9	PMRAM-40QH5	S02	1	ELECTRICAL EXPANSION COIL
10	PMRAM-65QH4	S03	2	EXPANSION VALVE
11	PMRAC-40CNH2	S19	1	FAN MOTOR 40W
12	PMRAC-51CA1	908	1	NET
13	PMRAC-25NH4	S09	1	OVERHEAT THERMISTOR SUPPORT
14	PMRAC-25NH4	910	1	OVERLOAD RELAY COVER
15	PMRA-35QH5	S02	1	P.W.B. (MAIN)
16	PMRAC-25CNH2	S02	1	PROPELLER FAN
17	KPNT1	001	6	PUSH NUT
18	PMRAM-40QH5	S15	1	PWB (POWER)
19	PMRAS-51CHA1	R13	1	PWB (SW. POWER)
20	PMRAC-40CNH2	S08	1	REACTOR
21	PMRAM-35QH5	S03	1	REVERSING VALVE
22	PMRAM-40QH5	S03	1	SIDE PLATE (R)
23	PMRAM-40QH5	908	1	STRAINER (COND 1)
24	PMRAM-40QH5	909	1	STRAINER (COND 2)
25	PMRAM-35QH5	S04	1	STRAINER (COND)
26	PMRAM-40QH5	912	1	STRAINER (PIPE)
27	PMRAM-40QH5	913	1	STRAINER (ST-PIPE-AS-1)
28	PMRAM-40QH5	914	1	STRAINER (ST-PIPE-AS-2)
29	PMRAC-25NH4	S14	1	SUPPORT (FAN MOTOR)
30	PMRAM-40QH5	905	1	SV COVER
31	PMRAC-40CNH2	S01	1	SYSTEM POWER MODULE
32	PMRAC-25NH4	S13	1	TERMINAL BOARD (4P)
33	PMRAM-40QH5	S11	1	THERMISTOR (DEFROST)
34	PMRAC-40CNH2	S14	1	THERMISTOR (OH)
35	PMRAM-40QH5	S06	1	THERMISTOR-V
36	PMRAC-19SH4	S01	1	THERMISTOR (OUTSIDE TEMPERATURE)
37	PMRAC-51CA1	909	1	TOP COVER
38	PMRAC-X13CX	902	2	VALVE 2S
39	PMSMARTY235M	902	2	VALVE 3S

HITACHI