MITSUBISHI ELECTRIC

AIR CONDITIONERS CITY MULTI Series Y

Models **PUHY-200TM, 250TM**
PUY-200TM, 250TM

Service Handbook

CITY MULTI

Safety precautions

Before installation and electric work

▶ Before installing the unit, make sure you read all the "Safety precautions".

▶ The "Safety precautions" provide very important points regarding safety. Make sure you follow them.

▶ This equipment may cause the adverse effect on the same supply system.

▶ Please report to or take consent by the supply authority before connection to the system.

Symbols used in the text

⚠ Warning:
Describes precautions that should be observed to prevent danger of injury or death to the user.

⚠ Caution:
Describes precautions that should be observed to prevent damage to the unit.

Symbols used in the illustrations

: Indicates an action that must be avoided.

: Indicates that important instructions must be followed.

: Indicates a part which must be grounded.

: Indicates that caution should be taken with rotating parts. (This symbol is displayed on the main unit label.) <Color: Yellow>

: Indicates that the main switch must be turned off before servicing. (This symbol is displayed on the main unit label.) <Color: Blue>

: Beware of electric shock (This symbol is displayed on the main unit label.) <Color: Yellow>

: Beware of hot surface (This symbol is displayed on the main unit label.) <Color: Yellow>

ELV : Please pay attention to electric shock fully because this is not Safety Extra Low-Voltage (SELV) circuit.
And at servicing, please shut down the power supply for both of Indoor Unit and Outdoor Unit.

⚠ Warning:
Carefully read the labels affixed to the main unit.

⚠ Warning:

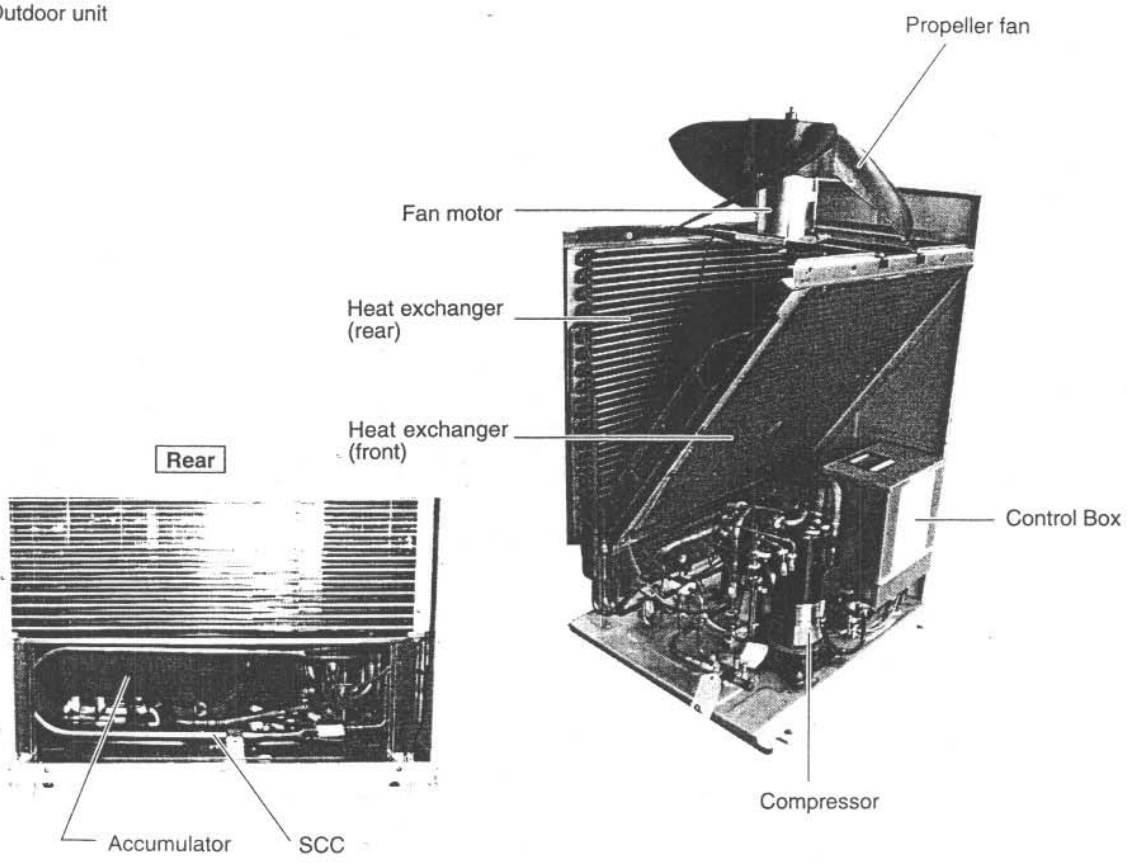
- **Ask the dealer or an authorized technician to install the air conditioner.**
  - Improper installation by the user may result in water leakage, electric shock, or fire.
- **Install the air unit at a place that can withstand its weight.**
  - Inadequate strength may cause the unit to fall down, resulting in injuries.
- **Use the specified cables for wiring. Make the connections securely so that the outside force of the cable is not applied to the terminals.**
  - Inadequate connection and fastening may generate heat and cause a fire.
- **Prepare for typhoons and other strong winds and earthquakes and install the unit at the specified place.**
  - Improper installation may cause the unit to topple and result in injury.
- **Always use an air cleaner, humidifier, electric heater, and other accessories specified by Mitsubishi Electric.**
  - Ask an authorized technician to install the accessories. Improper installation by the user may result in water leakage, electric shock, or fire.
- **Never repair the unit. If the air conditioner must be repaired, consult the dealer.**
  - If the unit is repaired improperly, water leakage, electric shock, or fire may result.
- **Do not touch the heat exchanger fins.**
  - Improper handling may result in injury.
- **If refrigerant gas leaks during installation work, ventilate the room.**
  - If the refrigerant gas comes into contact with a flame, poisonous gases will be released.
- **Install the air conditioner according to this Installation Manual.**
  - If the unit is installed improperly, water leakage, electric shock, or fire may result.
- **Have all electric work done by a licensed electrician according to "Electric Facility Engineering Standard" and "Interior Wire Regulations"and the instructions given in this manual and always use a special circuit.**
  - If the power source capacity is inadequate or electric work is performed improperly, electric shock and fire may result.
- **Securely install the cover of control box and the panel.**
  - If the cover and panel are not installed properly, dust or water may enter the outdoor unit and fire or electric shock may result.
- **When installing and moving the air conditioner to another site, do not charge the it with a refrigerant different from the refrigerant (R22) specified on the unit.**
  - If a different refrigerant or air is mixed with the original refrigerant, the refrigerant cycle may malfunction and the unit may be damaged.
- **If the air conditioner is installed in a small room, measures must be taken to prevent the refrigerant concentration from exceeding the safety limit even if the refrigerant should leak.**
  - Consult the dealer regarding the appropriate measures to prevent the safety limit from being exceeded. Should the refrigerant leak and cause the safety limit to be exceeded, hazards due to lack of oxygen in the room could result.
- **When moving and reinstalling the air conditioner, consult the dealer or an authorized technician.**
  - If the air conditioner is installed improperly, water leakage, electric shock, or fire may result.
- **After completing installation work, make sure that refrigerant gas is not leaking.**
  - If the refrigerant gas leaks and is exposed to a fan heater, stove, oven, or other heat source, it may generate noxious gases.
- **Do not reconstruct or change the settings of the protection devices.**
  - If the pressure switch, thermal switch, or other protection device is shorted and operated forcibly, or parts other than those specified by Mitsubishi Electric are used, fire or explosion may result.

Contents

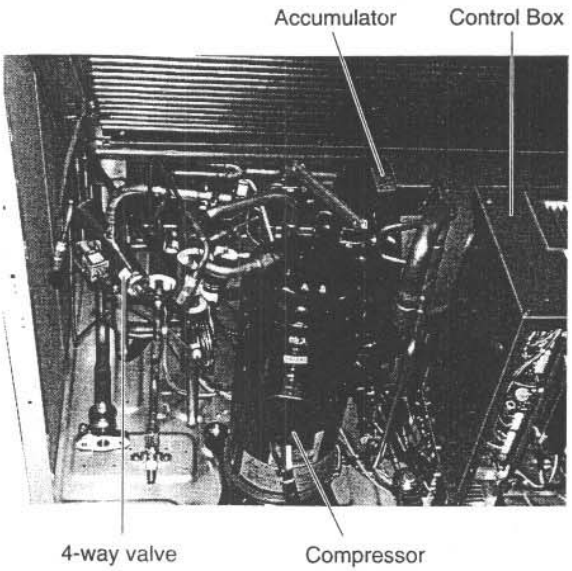
1 COMPONENT OF EQUIPMENT

[1] Appearance of Components

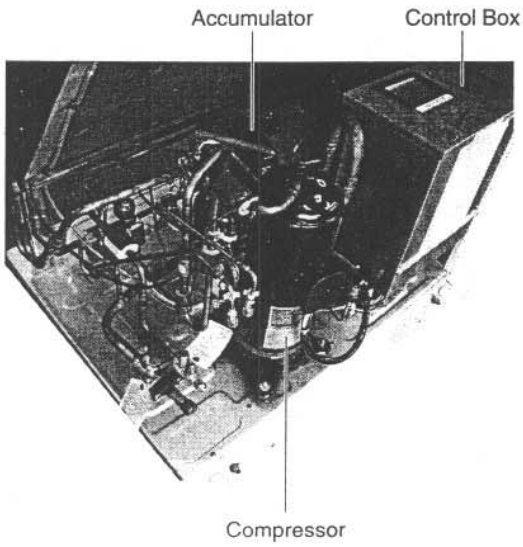
① Outdoor unit



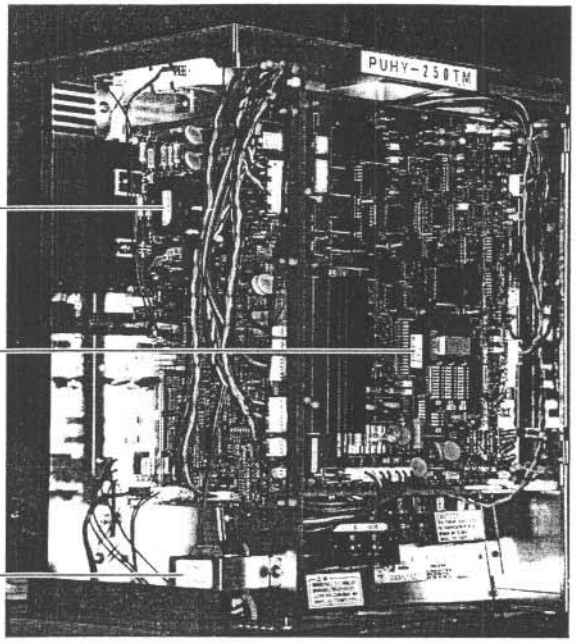
PUHY-TM

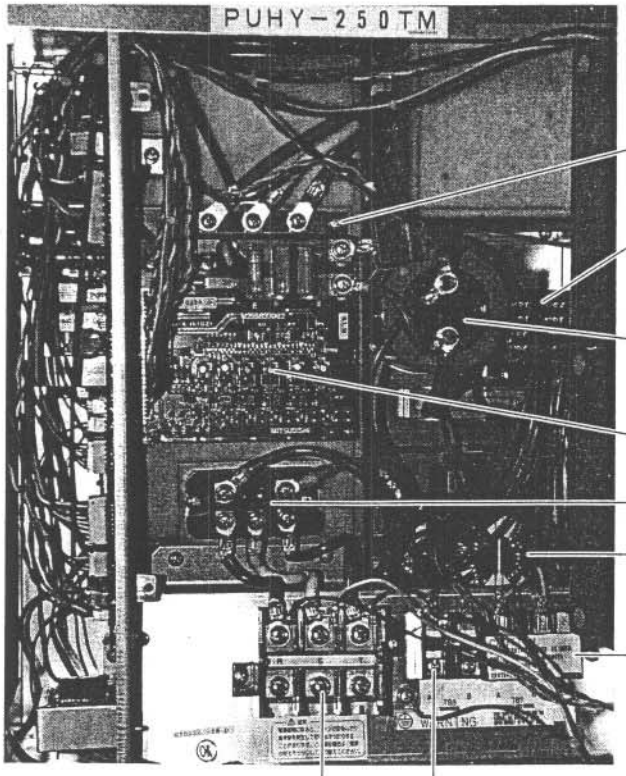


PUY-TM

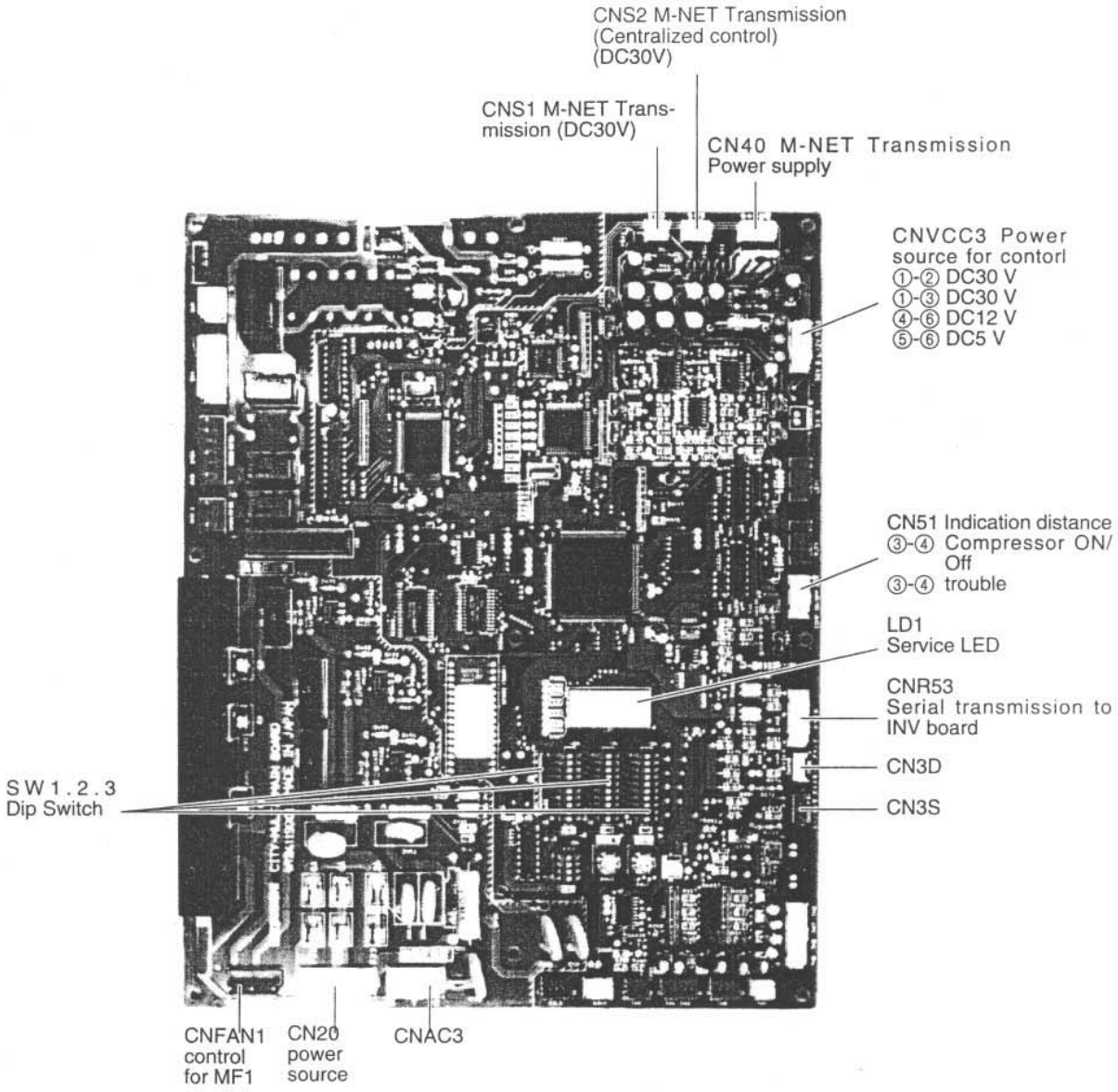


RearController Box

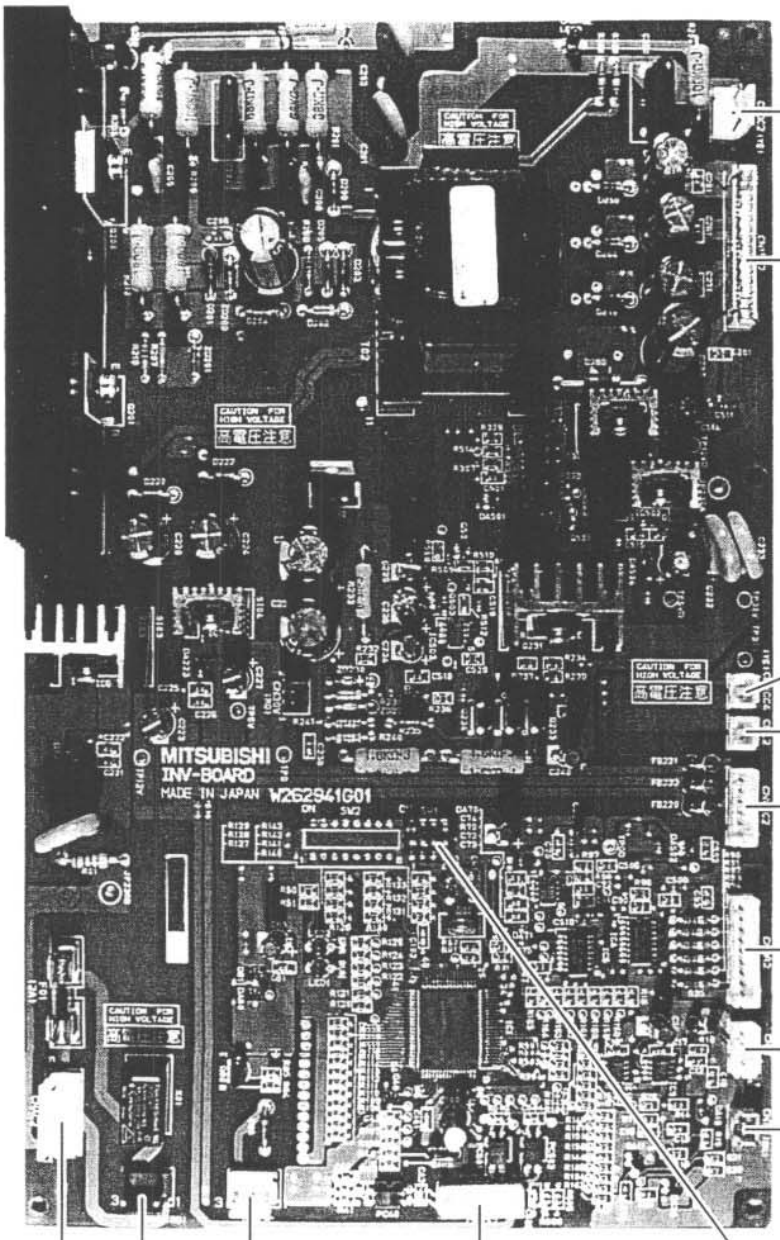




MAIN board


CNS2 M-NET Transmission
(Centralized control)
(DC30V)
CNS1 M-NET Trans-
mission (DC30V)
CN40 M-NET Transmission
Power supply
CNVCC3 Power
source for contorl
①-② DC30 V
①-③ DC30 V
④-⑥ DC12 V
⑤-⑥ DC5 V
CN51 Indication distance
③-④ Compressor ON/
Off
③-④ trouble
LD1
Service LED
CNR53
Serial transmission to
INV board
CN3D
CN3S
S W 1 . 2 . 3
Dip Switch
CNFAN1
control
for MF1
CN20
power
source
CNAC3

INV board



CNDC2
①-③ DC310 V

CN15V2
Power supply IPM control
①-② DC15 V
⑤-⑥ DC15 V
⑨-⑩ DC15 V
⑬-⑭ DC15 V

CNVCC4

CNL2
Choke coil

CNVCC2
power
supply

CNDR2
IPM control
signal

CNCT

CNTH

CNAC2
Power source
① L2
⑤ N

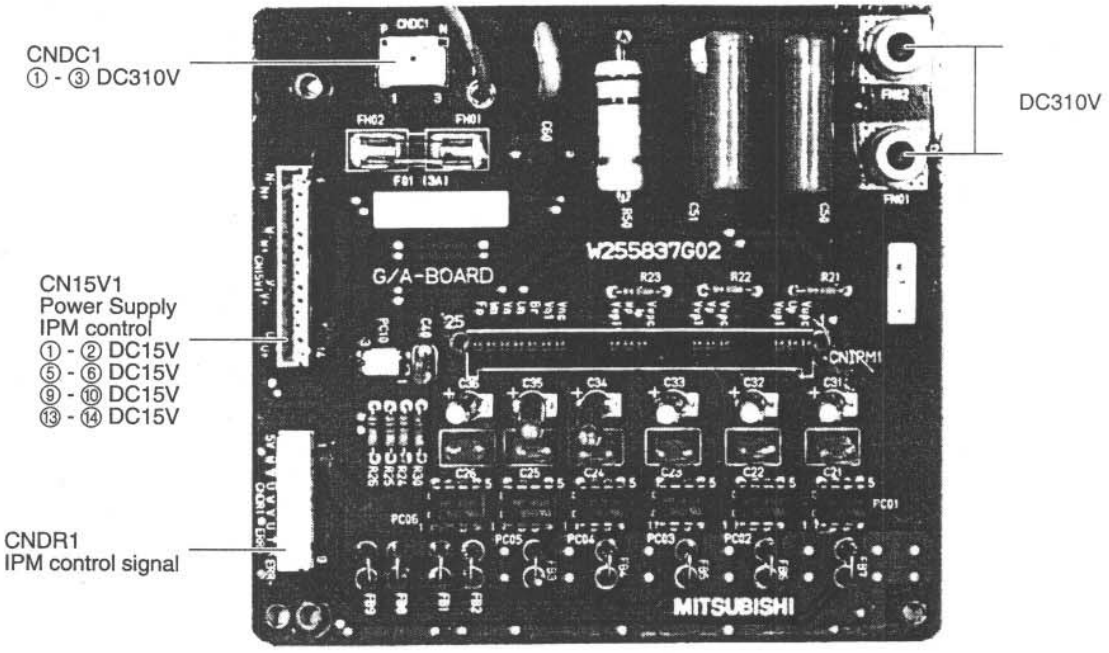
CNFAN
Control for
MF1

CN52C
Control for
52C

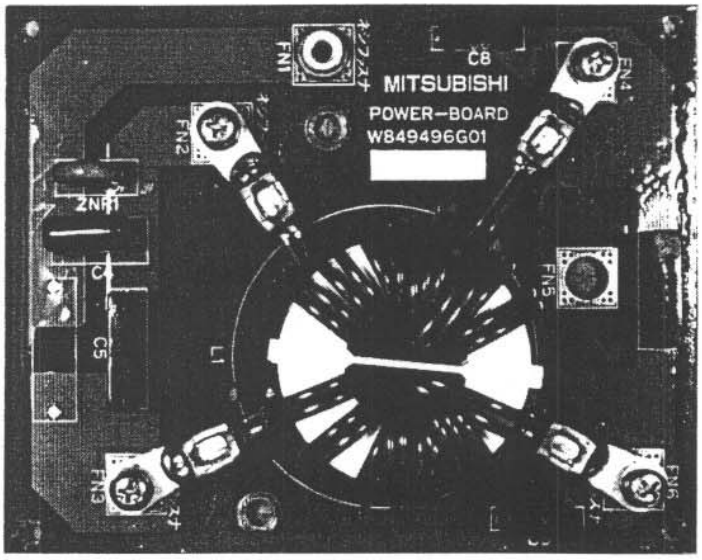
CNRS2
Serial transmission
to MAINboard

SW1

G/A board

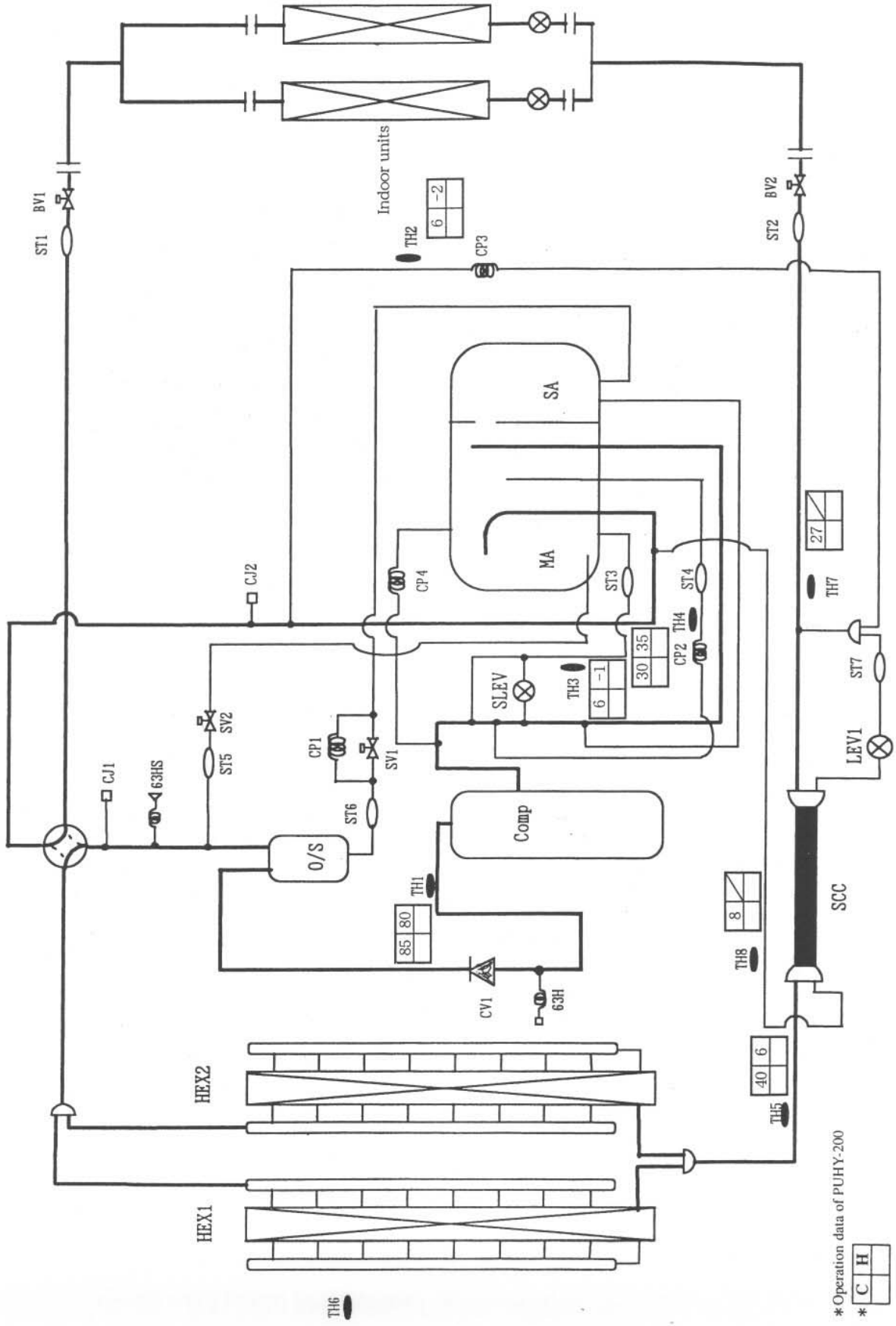


Power board



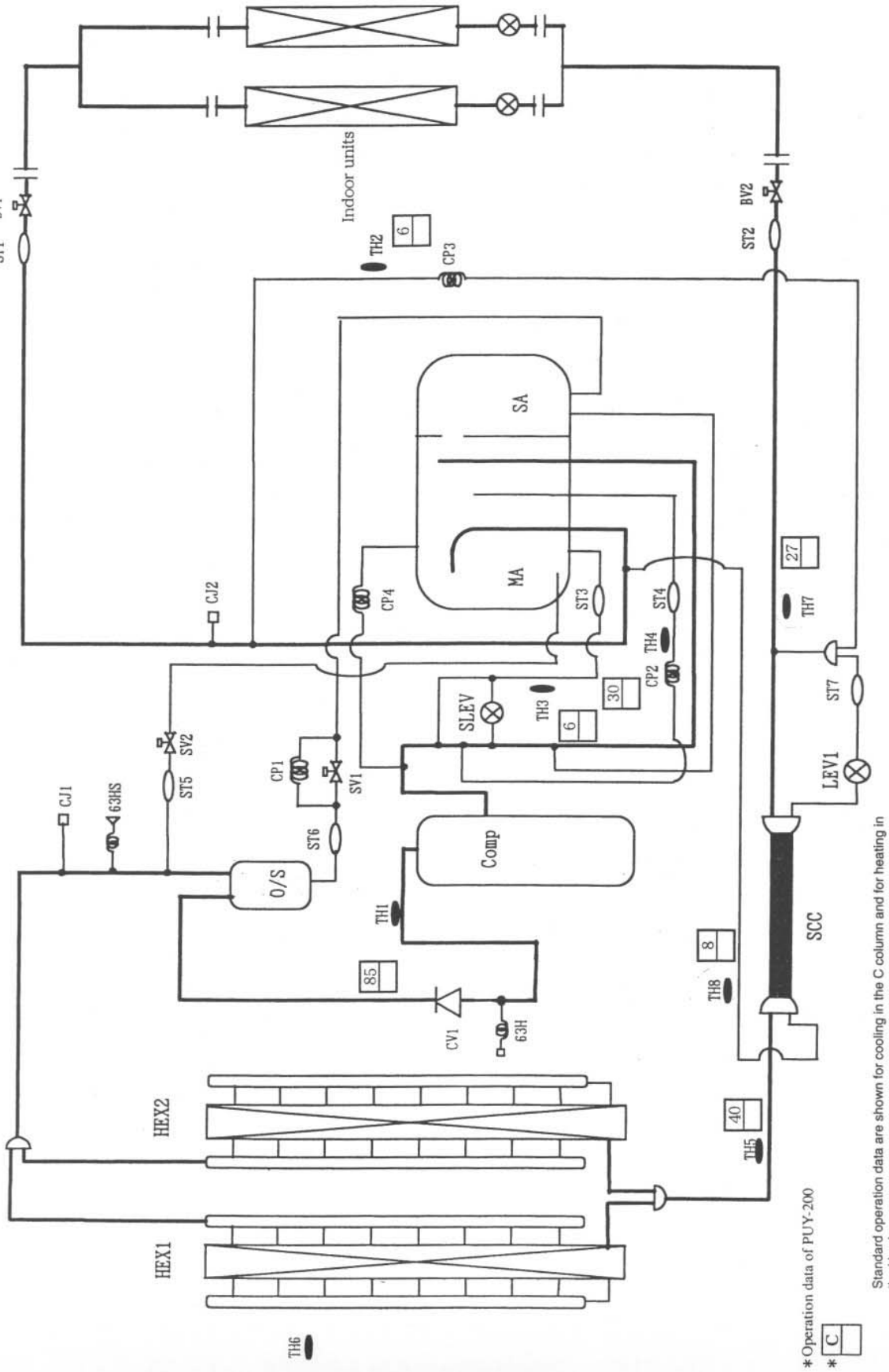
[2] Refirigerant Circuit Diagram and Thermal Sensor

① PUHY-200TM, 250TM



Refirigerant Circuit Diagram and Thermal Sensor

② PUY-200TM, 250TM

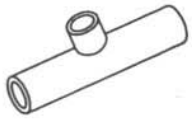
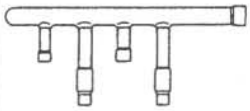
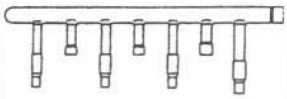
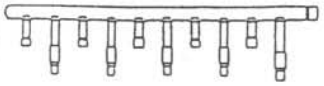


[3] Equipment composition

A. Outdoor Unit

PUHY-200TM PUY-200TM	PUHY-250TM PUY-250TM
	

B. Branch Pipe Kit

Branch joint	Branch header		
	4-connection	7-connection	10-connection
			
CMY-Y102S-F CMY-Y102L-F	CMY-Y104-E	CMY-Y107-E	CMY-Y1010-E

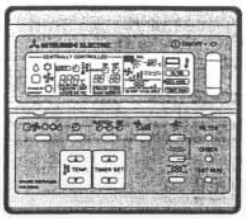
C. Indoor Unit

Model / Capacity	Cassette ceiling		Ceiling concealed	Wall mounted	Ceiling suspended
	4-way flow	2-way flow			
	PLFY-	PLFY-	PEFY-	PKFY-	PCFY-
20	–	20NLMD	20NM	20NAM	–
25	–	25NLMD	25NM	25NAM	–
32	32VGM	32NLMD	32NM	32NFM	–
40	40VGM	40NLMD	40NM	40NFM	40VGM
50	50NGM	50NLMD	50NM	50NFM	–
63	63NGM	63NLMD	63NM	–	63VGM
80	80NGM	80NLMD	80NM	–	–
100	100VGM	100NLMD	100NM	–	100VGM
125	125VGM	125NLMD	125NM	–	125VGM

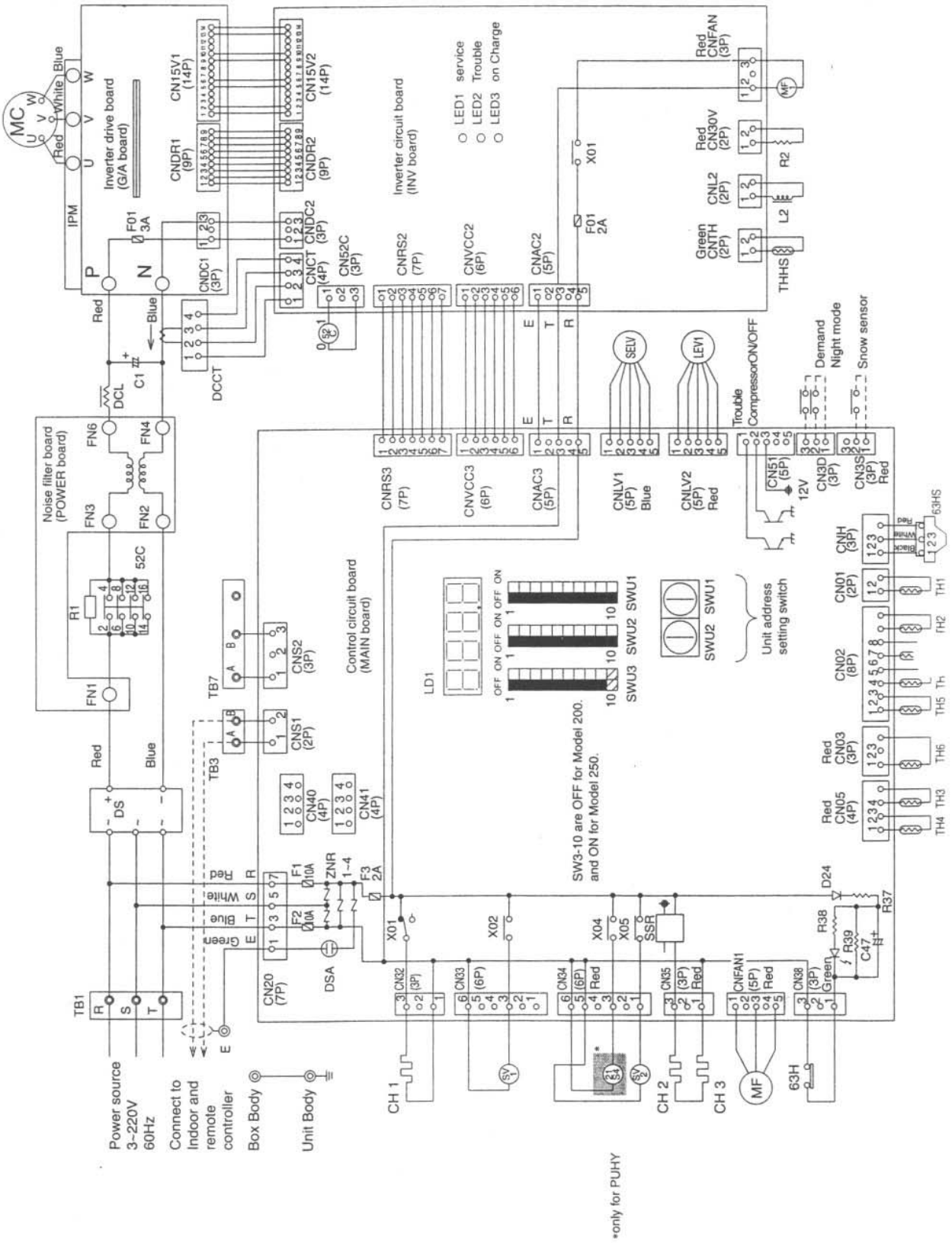
D. Option (Panel)

Model / Capacity	Decoration panel	
	PLP-	CMP-
20	–	32LW-F
25		
32	3	40LW-F
40		
50		63LW-F
63		
80		
100, 125	6	125LW-F

E. Remote Controller

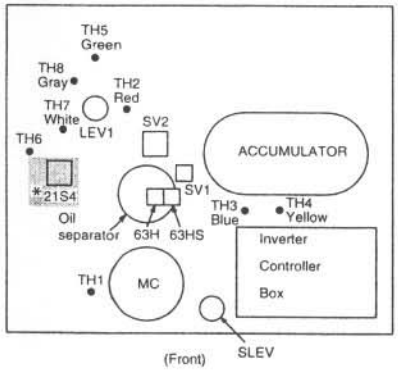
PAR-F25MA


[4] PUHY-200TM, 250TM/PUY-200TM, 250TM ELECTRICAL WIRING DIAGRAM



Symbol	Name	Symbol	Name	Symbol	Name	Symbol	Name
DC	Diode stack	CH1	Crankcase heater (Compressor)	TH8	Thermistor bypass outlet temp. detect at Sub-cool coil	TB7	Terminal block transmisson centralized control
IPM	Intelligent Power Module	CH2, CH3	Cord heater (Accumulator liquid level detect)	THHS	Rediator panel temp.detect	CNCT	Connector current
DCL	DC reactor (Power factor improvement)	21S4 *	4-way valve	63HS	High pressure sensor	CNVCC2,CNVCC3	Voltage
DCCT	Current Sensor	SV1, SV2	Solenoid valve (Discharge-suction bypass)	SLEV	Electronic expansion valve (Oil return)	CNRS2,CNRS3	Main-Inv Transmission
R1	Resistor rush current protect					CNAC2,CNAC3	AC Power source
R2	Resistor power regulation	63H	High pressure switch	LEV1	Electronic expansion valve (Sub-cool coil bypass)	CNDC2,CNDC3	DC buss voltage
ZNR1~4	Varistor	TH1	Thermistor discharge pipe temp.detect			CNDR2,CNDR3	INV Signal
C1	Capacitor Smoothing	TH2	saturation evapo.temp.detect	L2	Choke coil(Transmission)	CN15V1,CN15V2	Power source for operating IPM
52C	Magnetic contactor (Inverter main circuit)			X01, 2, 4, 5	Aux. relay		
		TH3	accumurator liquid temp.detect Upper	LD1	Luminous diode	E	Earth terminal
MC	Motor Compressor	TH4	Lower	SW1	Switch display selection self-diagnosis	CN40	Transmission power supply. from SC(MJ)
MF	Motor Fan Heat exchanger	TH5	pipe temp.detect	SW2, SW3	Switch function selection	CN41	from outdoor unit
MF1	Motor Fan Radiator panel	TH6	OA temp.detect	SWU1~2	Switch unit address set		
DSA	Surge absorber	TH7	liquid outlet temp. detect at Sub-cool coil	TB1	Terminal block power source		
SSR	Solid state relay			TB3	Terminal block transmisson		

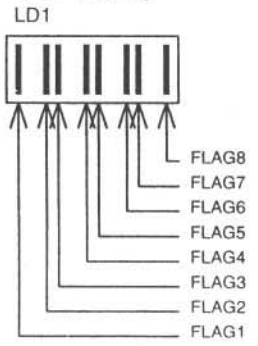
< Internal layout >



<Operation of self-diagnosis switch (SW1) and LED display>

Display		Display at LED lighting (blinking) Remarks SW1 operation								
		FLAG1	FLAG2	FLAG3	FLAG4	FLAG5	FLAG6	FLAG7	FLAG8	
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Relay output display (Lighting)	During compressor run	Crankcase heater	21S4 *	SV1	SV2			Always lighting	FLAG8 always lights at microcomputer power ON
(at factory shipment)	Check display (Blinking)	0000~9999 Display the address and error codes by turns								* Only for PUHY
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Relay output display 2							SSR		
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Check display2	0000~9999 Display the address and error codes by turns								Lights at emergency stop of left modes, Turns off by resetting
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Indoor unit mode	No. 1 unit	No. 2 unit	No. 3 unit	No. 4 unit	No. 5 unit	No. 6 unit	No. 7 unit	No. 8 unit	Lights at cooling Blinks at heating Turns off at stop/fan
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Indoor unit mode	No. 9 unit	No. 10 unit	No. 11 unit	No. 12 unit	No. 13 unit	No. 14 unit	No. 15 unit	No. 16 unit	
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Indoor unit mode	No. 1 unit	No. 2 unit	No. 3 unit	No. 4 unit	No. 5 unit	No. 6 unit	No. 7 unit	No. 8 unit	Lights at thermostat on Turns off at thermostat off
ON:1 OFF:0 1 2 3 4 5 6 7 8 9 10	Indoor unit mode	No. 9 unit	No. 10 unit	No. 11 unit	No. 12 unit	No. 13 unit	No. 14 unit	No. 15 unit	No. 16 unit	

<LED display>



[5] Standard operation data

① Cooling operation

Items \ Outdoor units					PUHY-200TM PUY-200TM				PUHY-250TM PUY-250TM			
Condition	Ambient temp.	Indoor		DB/WB	27.0/19.5				27.0/19.5			
		Outdoor			35.0/24.0				35.0/24.0			
	Indoor unit	Quantity		Set	4				4			
		Quantity in operation			4				4			
		Model		–	71	63	50	20	100	71	63	20
	Piping	Main pipe		m	5				5			
		Branch pipe			10	10	10	10	10	10	10	10
		Total piping length			45				45			
	Indoor unit fan notch			–	Hi	Hi	Hi	HI	HI	Hi	Hi	Hi
	Refrigerant volume			kg	12.2				14.2			
Outdoor unit	Total current			A	25.2				31.5			
	Volts			V	220				220			
LEV opening	Indoor unit			Pulse	280	440	380	260	380	280	440	260
	SC (LEV1)				75				81			
	Oil return (SLEV)				111				157			
Pressure	High pressure/Low pressure (after O/S) (before MA)			kg/cm²G	20.4/5.1				20.3/4.7			
Sectional temperature	Outdoor unit	Discharge (TH1)		°C	85				95			
		Heat exchanger outlet (TH5)			40				42			
		Accumulator	Inlet		7				5			
			Outlet		9				7			
		Suction (Comp)			7				10			
		low pressure saturation temperature (TH2)			6				4			
		Liquid level	Upper (TH4)		30				30			
			Lower (TH3)		6				5			
		Shell bottom (Comp)			60				60			
		SCC outlet (TH7)			27				27			
		Bypass outlet (TH8)			8				6			
	Indoor unit	LEV inlet			26				26			
		Heat exchanger outlet			10				10			

② Heating operation

Items \ Outdoor units				PUHY-200TM				PUHY-250TM			
Condition	Ambient temp.	Indoor	DB/WB	21.0/-				21.0/-			
		Outdoor		7.0/6.0				7.0/6.0			
	Indoor unit	Quantity	Set	4				4			
		Quantity in operation		4				4			
		Model	–	71	63	50	20	100	71	63	20
	Piping	Main pipe	m	5				5			
		Branch pipe		10	10	10	10	10	10	10	10
		Total piping length		45				45			
	Indoor unit fan notch		–	Hi	Hi	Hi	HI	HI	Hi	Hi	Hi
	Refrigerant volume		kg	12.2				14.2			
Outdoor unit	Total current		A	24.5				30.5			
	Volts		V	220				220			
LEV opening	Indoor unit		Pulse	310	510	450	260	350	310	510	260
	SC (LEV1)			0				0			
	Oil return (SLEV)			87				111			
Pressure	High pressure/Low pressure (after O/S) (before MA)		kg/cm²G	17.5/3.7				17.5/3.7			
Sectional temperature	Outdoor unit	Discharge (TH1)	°C	80				85			
		Heat exchanger inlet (TH5)		6				8			
		Accumulator Inlet		–1				–2			
		Accumulator Outlet		–1				–2			
		Suction (Comp)		–1				–2			
		low pressure saturation temperature (TH2)		–2				–2			
		Liquid level Upper (TH4)		35				38			
		Liquid level Lower (TH3)		–1				–1			
		Shell bottom (Comp)		35				44			
	Indoor unit	Heat exchanger inlet		71				71			
		LEV inlet		33				33			

[6] Function of dip SW and rotary SW

(1) Outdoor unit

Switch		Function	Function According to Switch Operation		Switch Set Timing	
			When Off	When On	When Off	When On
SWU	1~2	Unit Address Setting	Set on 000 or 051~100 with the dial switch.		Before power is turned on.	
SW1	1~8	For self diagnosis/ operation monitoring	LED Monitering Display		During normal operation when power is on.	
	9~10	–	–	–	Should be set on OFF.	
SW2	1	Centralized Control Switch	Centralized control not connected.	Centralized control connected.	Before power is turned on.	
	2	Deletion of connection information.	Storing of refrigeration system connection information.	Deletion of refrigeration system connection information.	Before power is turned on.	
	3	Deletion of error history.	–	Deletion	During normal operation when power is on.	
	4	Adjustment of Refrigerant Volume	Ordinary control	Refrigerant volume adjustment operation.	During normal operation when power is on.	Invalid 2 hours after compressor starts.
	5	–	–	–	–	
	6	Disregard ambient air sensor errors, fluid overflow errors.	Errors valid.	Disregard errors.	During normal operation when power is on.	
	7	Forced defrosting	Ordinary control	Start forced defrosting.	During normal operation when power is on.	10 minutes or more after compressor starts.
	8	Defrost prohibited timer	50 min.	90 min.	During normal operation when power is on. (Except during defrosting)	
	9	–	–	–	–	
	10	–	–	–	–	
SW3	1	SW3-2 Function Valid/ Invalid	SW3-2 Function Invalid	SW3-2 Function Valid	During normal operation when power is on.	
	2	Indoor Unit Test Operation	Stop all indoor units.	All indoor units test operation ON.	When SW3-1 is ON after power is turned on.	
	3	Defrosting start temperature of TH5.	-2°C	0°C	During normal operation when power is on.	
	4	Defrosting end temperature of TH5.	200TM : 12°C 250TM : 8°C	15°C	During normal operation when power is on. (Except during defrosting)	
		Opening angle of IC except when heater thermostat is ON during defrosting.	(no operation)	2000		
	5	–	–	–	–	
	6	–	–	–	When switching on the power.	
	7	Target Pd (High pressure)	18K	20K	During normal operation when power is on.	
	8	–	–	–	–	
	9	–	–	–	–	
	10	Models	Model 200	Model 250	When switching on the power.	

Note:

SWU1~2=00 when shipped from the factory. Other factory settings are indicated by shaded portions.

(2)Indoor unit

DIP SW1, 3

Switch		SW name	Operation by SW		Switch set timing		Remarks
			OFF	ON	OFF	ON	
SW1	1	Room temp. sensor position	Indoor unit inlet	Built in remote controller	At unit stopping (at remote controller OFF)		
	2	Clogged filter detect.	None	Provided			
	3	Filter duration	100h	2500h			
	4	OA intake	Ineffective	Effective			
	5	Remote display select.	Fan output display	Thermo. ON signal display			
	6	Humidifier control	At stationary heating	Always at heat.			
	7	Heating thermo. OFF airflow	Very low speed	Low speed			
	8	Heating thermo. OFF airflow	SW1–7 setting	Set airflow			
	9	Power failure automatic return	Ineffective	Effective			
	10	Power source start/stop	Ineffective	Effective			
SW3	1	Model selection	Heat pump	Cool.only			
	2	Louver	None	Provided			
	3	Vane	None	Provided			
	4	Vane swing function	None	Provided			
	5	Vane horizontal angle	1st setting	2nd setting			
	6	Vane angle set for cooling	Down blow B, C	Horizontal			Horizontal (ON)setting for PLFY-P.NLMD
	7	–	–	–			
	8	Heating 4deg up	Effective	Ineffective			Ineffective (OFF) setting for floor standing

Note 1: The shaded part [ ] indicates the setting at factory shipment. (For the SW not being shaded, refer to the table below.)

Switch \ Model		PLFY	PEFY	PCFY	PKFY
		NGM, VGM NLMD	NM	VGM	NFM, NAM
SW1	3	ON		OFF	
	6	ON			OFF
	7	OFF	ON	OFF	
SW3	2	OFF		ON	OFF
	3	ON	OFF	ON	OFF

Note 2: The DipSW setting is only effective during unit stopping (remote controller OFF) for SW1, 2, 3 and 4 commonly and the power source is not required to reset.)

3: When both SW1–7 and SW1–8 are being set to ON, the fan stops at the heating thermostat of OFF.

Setting of DIP SW2

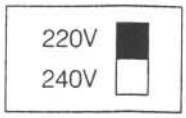
Model	20	25	32	40	50	63
Capacity (model name) code	4	5	6	8	10	13
SW2 setting						

Model	80	100	125
Capacity (model name) code	16	20	25
SW2 setting			

Setting of DIP SW4

Model	Circuit board used	SW4			
		1	2	3	4
PLFY-NLMD	Phase control	OFF	ON	ON	OFF
PEFY-20 ~ 63NM		ON	ON	ON	OFF
PEFY-80 ~ 125NM	Relay selection	ON	ON	ON	–
PLFY-VGM, NGM		OFF	OFF	ON	–
PCFY-VGM	Phase control	OFF	ON	OFF	ON
PKFY-NFM		ON	OFF	OFF	OFF
PKFY-NAM		–	–	–	–

Setting of DIP SW5



Switch		Function	Operation by switch	Switch set timing
SWA	1~3	Ceiling height setting	(PLFY-VGM, NGM) 3 2 1 *The ceiling height is changed by SWB setting. (PCF-VGM) 3 2 1	Always after powering
			Ceiling height: 3 → 3.5m; 2 → 2.8m; 1 → 2.3m	
SWA	1~3	For options	(PLFY-NLMD, PEFY-NM) 3 2 1 *As this switch is used by interlocking with SWC, refer to the item of SWC for detail.	Always after powering
SWB	1~3	Setting of air outlet opening	(PLFY-VGM, NGM) 2-way 3-way 4-way	Always after powering

SWA \ SWB	1	2	3
2-way	3.5m	3.8m	3.8m
3-way	3.0m	3.3m	3.5m
4-way	2.7m	3.0m	3.5m

Switch		Function	Operation by switch	Switch set timing
SWC	1~2	Airflow control	(PLFY-VGM, NGM, PCFY-VGM) Option Standard * Set to the option to install the high efficiency filter. (PLFY-NLMD)	Always after powering

Model	Standard
20 25	
32 40	
63 80	3 2 1 Option Standard SWA SWC
80 100 125	

[2] TEST RUN

[1] Before Test Run

(1) Check points before test run

1	Neither refrigerant leak nor loose power source/ transmission lines should be found.
2	Confirm that the resistance between the power source terminal block and the ground exceeds 1.0MΩ by measuring it with a DC500V megger. Do not run if it is lower than 1.0MΩ. Note) Never apply the megger to the MAIN board. If applied, the MAIN board will be broken.
3	Confirm that the Ball valve at both gas and liquid sides is being fully opened. Note) Certainly close the cap.
4	Be sure that the crankcase heater has been powered by turning the main power source on at least 12 hours before starting the test run. The shorter powering time causes compressor trouble.

(2) Caution at inverter check

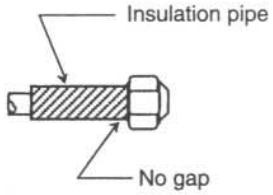
Because the inverter power portion in outdoor unit electrical part box have a lot of high voltage portion, be sure to follow the instructions shown below.

1	During energizing power source, never touch inverter power portion because high voltage (approx. 311V) is applied to inverter power portion.	
2	When checking,	
	▽1	Shut off main power source, and check it with tester, etc.
	▽2	Allow 10 minutes after shutting off main power source
	▽3	Open the MAIN board mounting panel, and check whether voltage of both ends of electrolytic capacitor is 20V or less.

(3) Check points for test run when mounting options

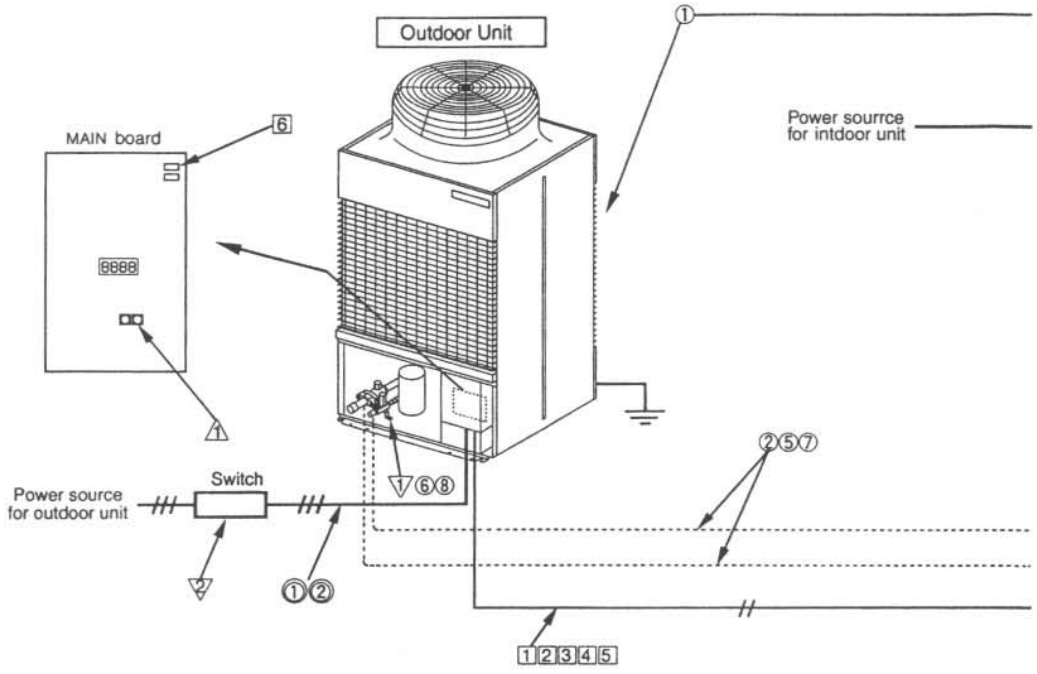
Built-in optional parts	Content of test run	Check point	Result
Mounting of drain water lifting-up mechanism	▽1 Release connector of pump circuit, check error detection by pouring water into drain pan water inlet.	Local remote controller displays code No. "2503", and the mechanism stops.	
		No overflow from drain pan.	
	▽2 After that, connect connector of circuit.	Drain water comes out by operations of drain pump.	
	▽3 Check pump operations and drainage status in cooling (test run) mode.	Sound of pump operations is heard, and drain water comes out.	
Mounting of permeable film humidifier	Check humidifier operations and water supply status in heating (test run) mode.	No water leak from connecting portions of each water piping.	
		Water is supplied to water supply tank, and float switch is operating.	

(4) Attention for mounting drain water lifting-up mechanism

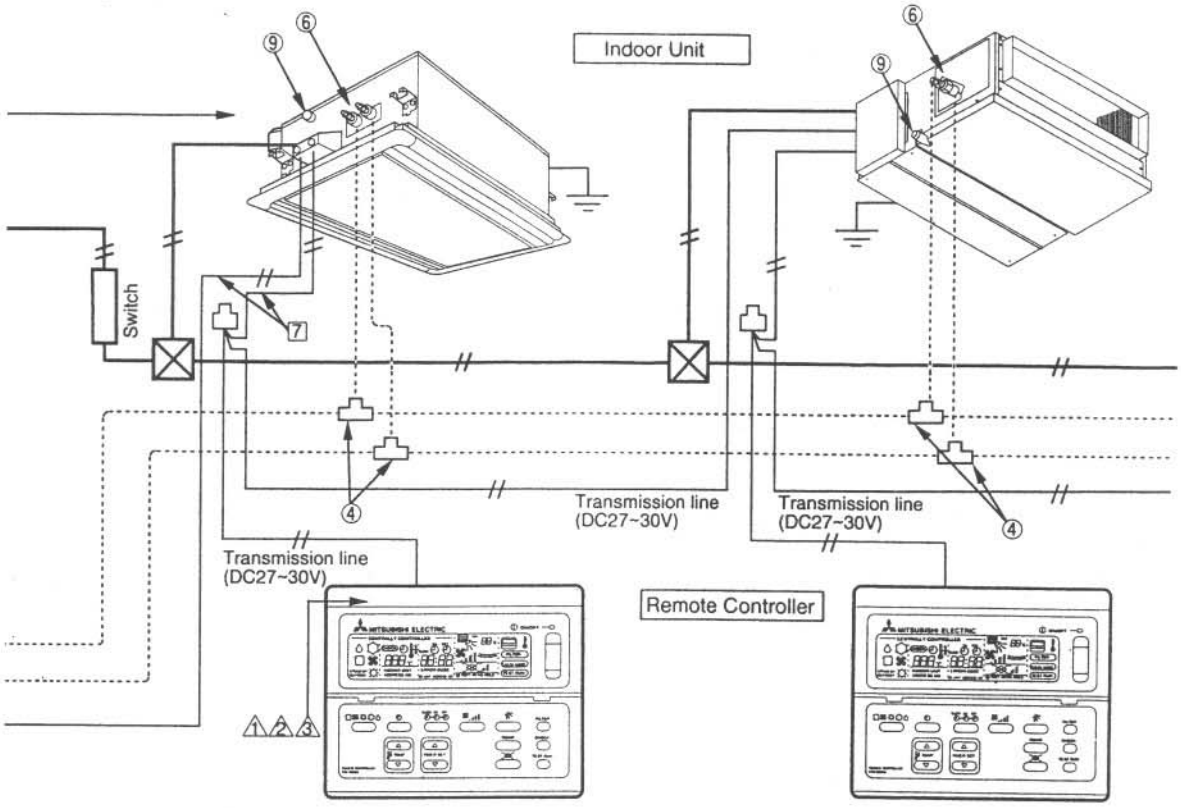
Work	Content of test run	Check point	Result
Disassembling and assembling of drain water lifting-up mechanism	▽1 Lead wire from control box not damaged.		
	▽2 Rubber cap properly inserted to drain water outlet of drain pan?		
	▽3 Insulation pipe of gas and liquid pipes dealt with as shown in the right figure?		
	▽4 Drain pan and piping cover mounted without gap?		
	▽5 Drain pan hooked on cut projection of the mechanism?		
Mounting of float switch	Float switch installed without contacting with drain pan?	▽1 Float switch moves smoothly.	
		▽2 Float switch is mounted on mounting board straightly without deformation.	
		▽3 Float switch does not contact with copper pipe.	
Electric wiring	▽1 No mistakes in wiring?	Wiring procedure is exactly followed.	
	▽2 Connectors connected surely and tightly?	Connector portion is tightly hooked.	
	▽3 No tension on lead wire when sliding control box?		

(5) Check points for system structure

Check points from installation work to test run.



Classification	Portion	Check item	Trouble
Installation and piping	①	Instruction for selecting combination of outdoor unit, and indoor unit followed? (Maximum number of indoor units which can be connected, connecting model name, and total capacity.)	Not operate.
	②	Follow limitation of refrigerant piping length? For example, 100m or less (total length : 220m) at the farthest.	Not cool (at cooling). Not heat (at heating).
	③	Connecting piping size of branch piping correct?	
	④	Branch pipe properly selected?	
	⑤	Refrigerant piping diameter correct?	
	⑥	Refrigerant leak generated at connection?	Not cool, not heat, error stop.
	⑦	Insulation work for piping properly done?	Condensation drip in piping.
	⑧	Specified amount of refrigerant replenished?	Not cool, not heat, error stop.
	⑨	Pitch and insulation work for drain piping properly done?	Water leak, condensation drip in drain piping.
Power source wiring	①	Specified switch capacity and wiring diameter of main power source used?	Error stop, not operate.
	②	Proper grounding work done on outdoor unit?	



Classification	Portion	Check item	Trouble
Transmission line	[1]	Limitation of transmission line length followed? For example, 200m or less (total length : 500m) at the farthest.	Erroneous operation, error stop.
	[2]	1.25mm² or more transmission line used? (Remote controller 10m or less 0.75mm²)	Erroneous operation, error stop.
	[3]	2-core cable used for transmission line?	Error stop in case multiple-core cable is used.
	[4]	Transmission line apart from power source line by 5cm or more?	Erroneous operation, error stop.
	[5]	One refrigerant system per transmission line?	Not operate.
	[6]	The short circuit connector is changed form CN41 to CN40 on the MAIN board when the system is centralized control? (Just one outdoor unit. Not all outdoor units.)	Not operate.
	[7]	• No connection trouble in transmission line?	Error stop or not operate.
System set	△1	Address setting properly done? (Remote controller, indoor unit and outdoor unit.)	Error stop or not operate.
	△2	Setting of address No. done when shutting off power source?	Can not be properly set with power source turned on.
	△3	Address numbers not duplicated?	Not operate.
	△4	Turned on SW3-8 on indoor unit circuit board when mounting room thermistor sensor?	Set temperature not obtained at heating operations (Thermostat stop is difficult)
Before starting	▽1	Refrigerant piping ball valve (Liquid pressure pipe, gas pressure pipe) opened?	Error stop.
	▽2	Turn on power source 12 hours before starting operations?	Error stop, compressor trouble.

[2] Test Run Method

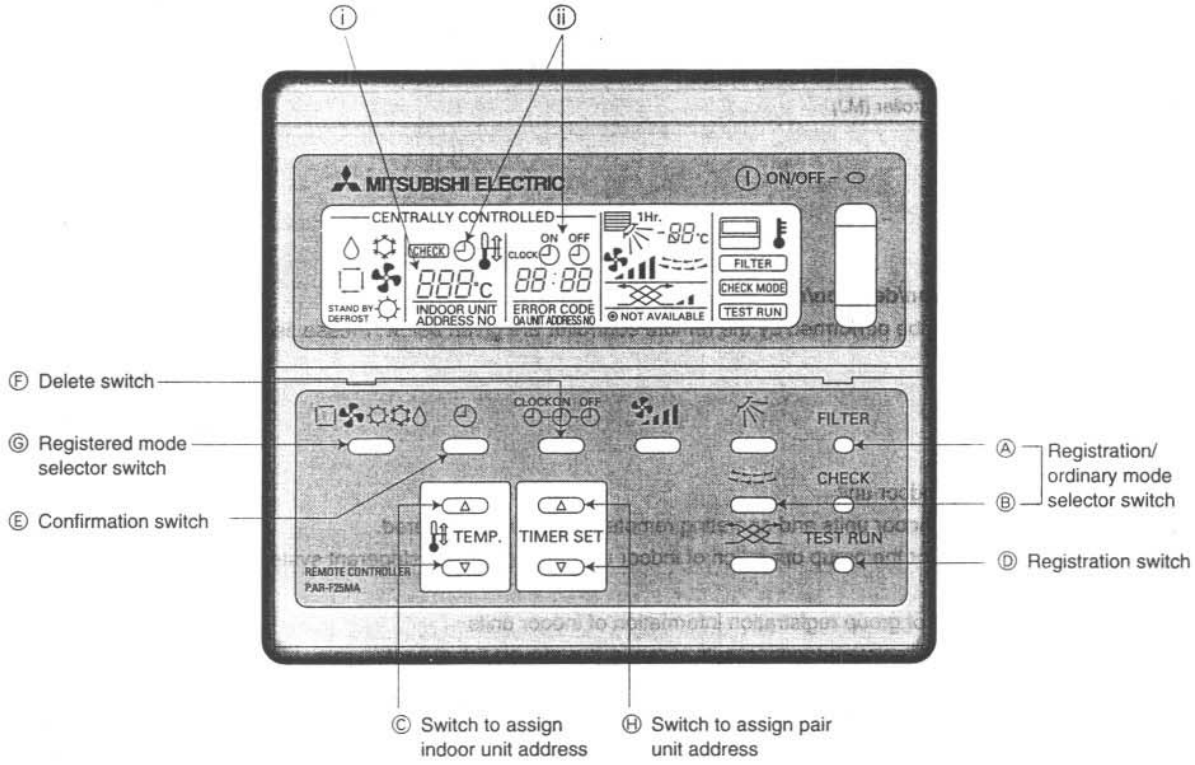
	Operation procedure
①	Turn on universal power supply at least 12 hours before getting started → Displaying "HO" on display panel for about two minutes
②	Press TEST RUN button twice → Displaying "TEST RUN" on display panel
③	Press ☐ selection button → Make sure that air is blowing out
④	Press ☐ select button to change from cooling to heating operation, and vice versa → Make sure that warm or cold air is blowing out
⑤	Press adjust button → Make sure that air blow is changed
⑥	Press or button to change wind → Make sure that horizontal or downward blow is adjustable.
⑦	Make sure that indoor unit fans operate normally
⑧	Make sure that interlocking devices such as ventilator operate normally if any
⑨	Press ON/OFF button to cancel test run → Stop operation

Note:
1. If check code is displayed on remote controller or remote controller does not operate normally.
2. Test run automatically stops operating after two hours by activation of timer set to two hours.
3. During test run, test run remaining time is displayed on time display section.
4. During test run, temperature of liquid pipe in indoor unit is displayed on remote controller room temperature display section.
5. When pressing adjust button, depending on the model, "This function is not available" may be displayed on remote controller. However, it is not a malfunction.

3 GROUPING REGISTRATION OF INDOOR UNITS WITH REMOTE CONTROLLER

(1) Switch function

• The switch opeation to register with the remote controller is shown below:



Name	Symbol of switch	Name of actual switch	Description
Registration/ordinary mode selection switch	Ⓐ + Ⓑ	(FILTER) + ≈	This switch selects the ordinary mode or registered mode (ordinary mode represents that to operate indoor units). *To select the registered mode, press the (FILTER) + ≈ switch continuously for over 2 seconds under stopping state. [Note] The registered mode can not be obtained for a while after powering. Pressing the (FILTER) + ≈ switch displays "Under CENTRALIZED CONTROL".
Switch to assign indoor unit address	Ⓒ	(▲)(▼) of TEMP	This switch assigns the unit address for "INDOOR UNIT ADDRESS No."
Registration switch	Ⓓ	(TEST RUN)	This switch is used for group/pair registration.
Confirmation switch	Ⓔ	◴	This switch is used to retrieve/identify the content of group and pair (connection information) registered.
Delete switch	Ⓕ	CLOCK ◴ ON ◴ OFF ◴	This switch is used to retrieve/identify the content of group and pair (connection information) registered.
Registered mode selector switch	Ⓖ	□ ✣ ☼ ☼ 💧	This switch selects the case to register indoor units as group (group setting mode) or that as pair (pair setting mode). *The unit address is shown at one spot (i) for the group setting mode while at two spots (ii) for the pair setting mode.
Switch to assign pair unit address	Ⓗ	(▲)(▼) of TIMER SET	This switch assigns the unit address of "PAIR ADDRESS No."

(2) Attribute display of unit

- At the group registration and the confirmation/deletion of registration/connection information, the type (attribute) of the unit is displayed with two English characters.

Display	Type (Attribute) of unit/controller
IC	Indoor unit connectable to remote controller
OC	Outdoor unit
RC	Local remote controller
SC	System controller (MJ)

[Description of registration/deletion/retrieval]

- The items of operation to be performed by the remote controller are given below. Please see the relating paragraph for detail.

[1] Group registration of indoor unit
- The group of the indoor units and operating remote controller is registered.
- It is usually used for the group operation of indoor units with different refrigerant system.

[2] Retrieval/identification of group registration information of indoor units
- The address of the registered indoor units in group is retrieved (identified).

[3] Retrieval/identification of registration information
- The connection information of any unit (indoor/outdoor units, remote controller or the like) is retrieved (identified).

[4] Deletion of group registration information of indoor units
- The registration of the indoor units under group registration is released (deleted).

[5] Deletion of the address not existing
- This operation is to be conducted when "6607" error (No ACK error) is displayed on the remote controller caused by the miss setting at test run, or due to the old memory remained at the alteration/modification of the group composition.

⚠ **Caution:**
When MELANS (MJ-103MTRA for example) is being connected, do not conduct the group/pair registration using the remote controller. The group/pair registration should be conducted by MELANS. (For detail, refer to the instruction exclusively prepared for MELANS.)

(3) Group registration of indoor unit

1) Registration method

• Group registration of indoor unit..... [1]

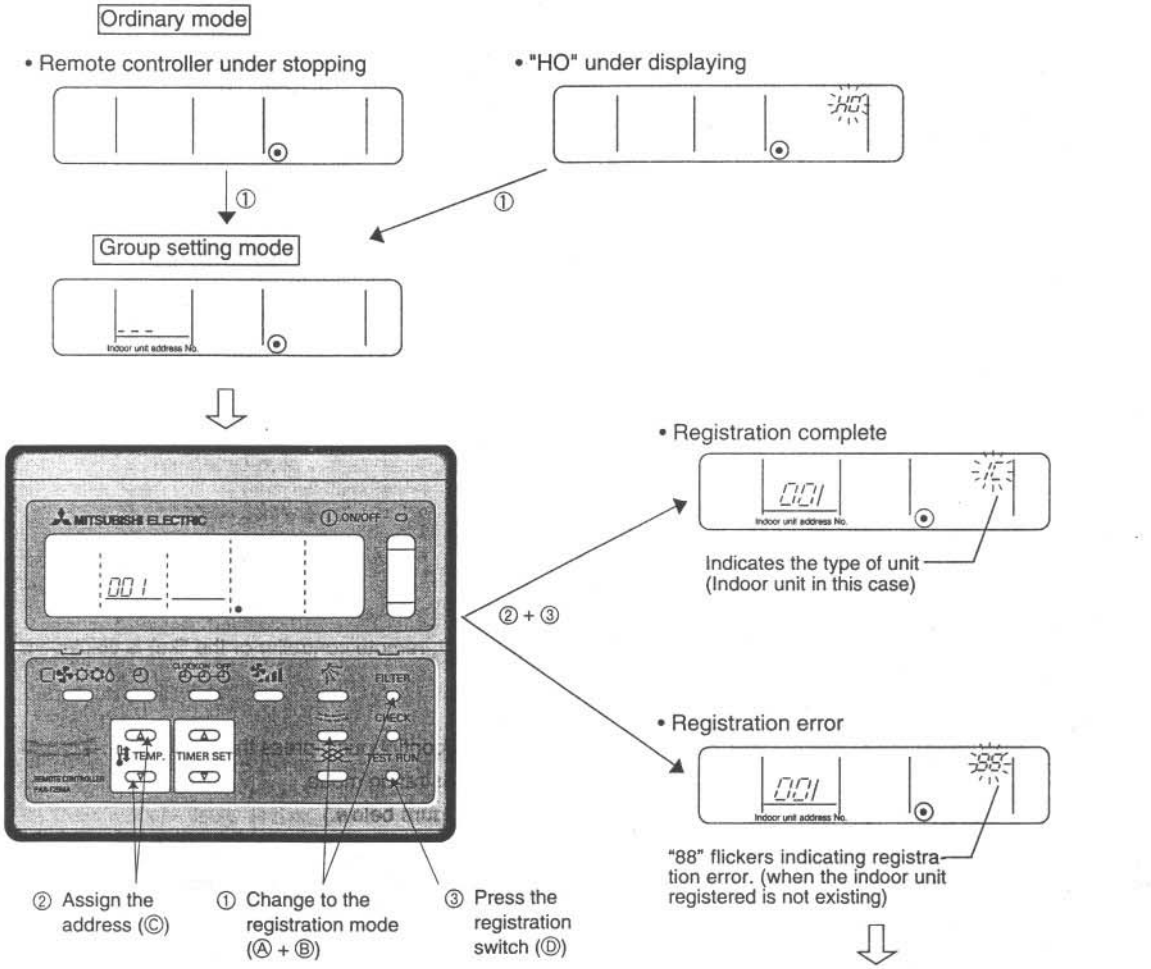
The indoor unit to be controlled by a remote controller is registered on the remote controller.

[Registration procedure]

① With the remote controller under stopping or at the display of "HO", continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the registration mode. (See the figure below.)

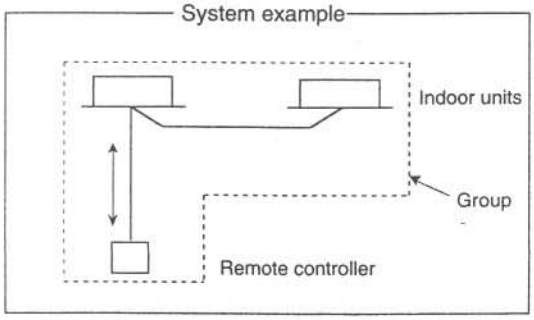
② Assign the indoor unit address to "Indoor address No." by operating th (▲) (▼)(Room temperature adjustment) (Ⓒ). Then press the (TEST RUN) switch (Ⓓ) to register. In the figure below, the "INDOOR UNIT ADDRESS No." is being set to 001.

③ After completing the registration, press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the original ordinary mode (with the remote controller under stopping).



• Confirm the indoor unit address No.

• Confirm the connection of the transmission line.



2) Method of retrieval/confirmation

• Retrieval/confirmation of group registration information on indoor unit..... [2]

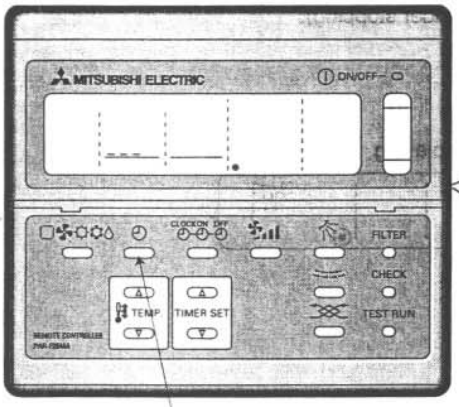
The address of the indoor unit being registered on the remote controller is displayed.

[Operation procedure]

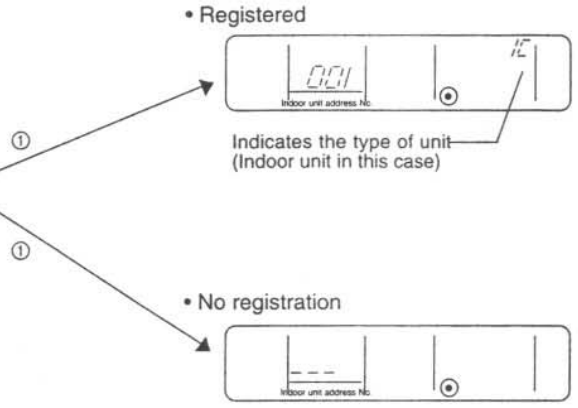
① With the remote controller under stopping or at the display of "HO", continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the registration mode.

② In order to confirm the indoor unit address already registered, press switch (Ⓔ). (See figure below.) When the group of plural sets is registered, the addresses will be displayed in order at each pressing of switch (Ⓔ).

③ After completing the registration, continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the original ordinary mode (with the remote controller under stopping).



① Press the switch for confirmation (Ⓔ)



Note: Only one address will be displayed when the registration is one even the switch is how often pressed.

• Retrieval/confirmation of registration information ..... [3]

The registered information on a certain unit (indoor unit, outdoor unit, remote controller or the like) is displayed.

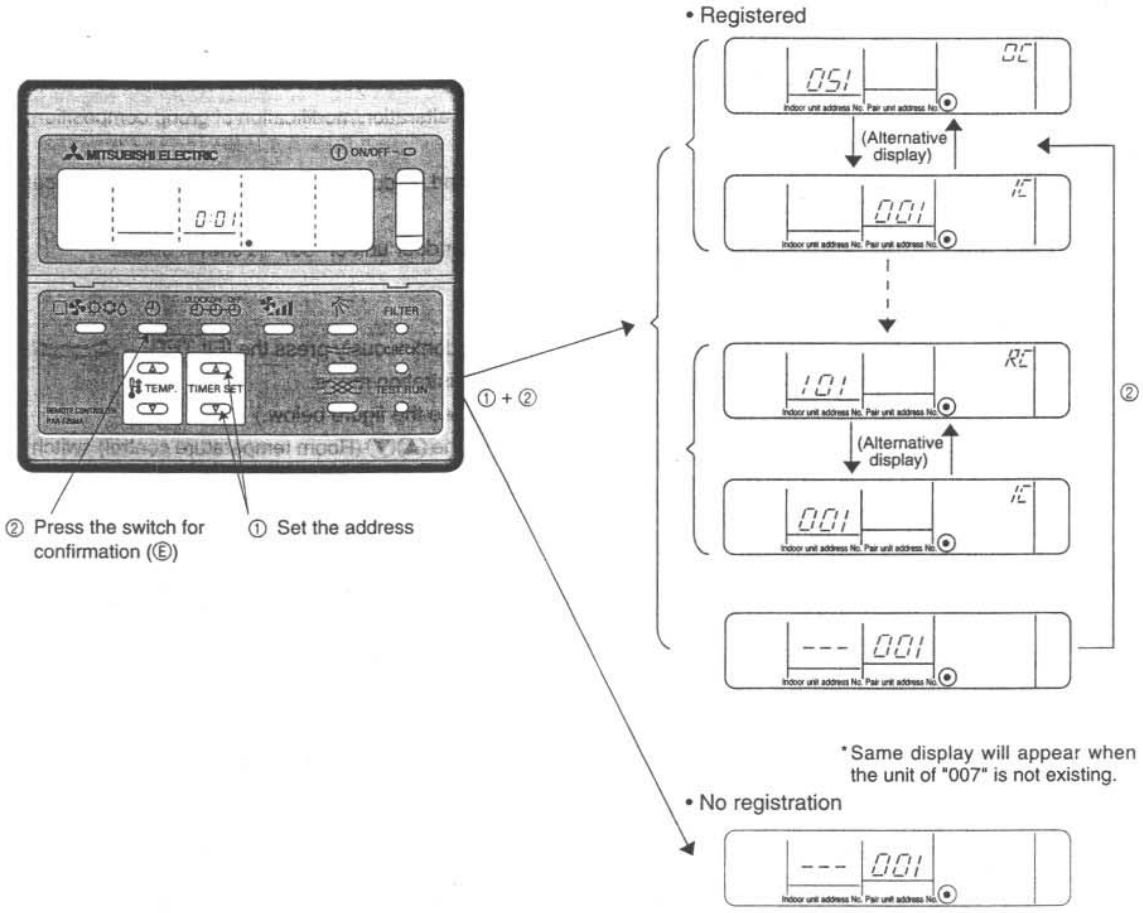
[Operation procedure]

① With the remote controller under stopping or at the display of "HO", continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the registration mode.

② Operate switch (Ⓖ) for the pair setting mode. (See figure below.)

③ Assign the unit address of which registration information is desired to confirm with the (▲) (▼) (Room temperature adjustment) switch (Ⓒ). Then press the switch (Ⓔ) to display it on the remote controller. (See figure below.) Each pressing of switch (Ⓔ) changes the display of registered content.
(See figure below.)

④ After completing the retrieval/confirmation, continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the original ordinary mode (with the remote controller under stopping).



3) Method of deletion

• Deletion of group registration information of indoor unit ..... [4]

[Operation procedure]

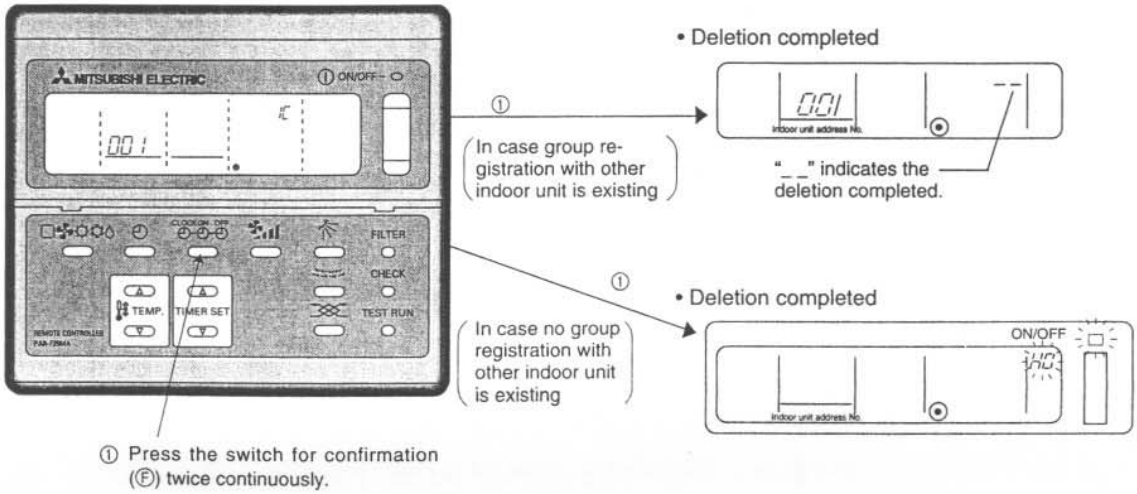
① With the remote controller under stopping or at the display of "HO", continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the registration mode.

② Press the switch (Ⓔ) to display the indoor unit address registered. (As same as [2])

③ In order to delete the registered indoor unit being displayed on the remote controller, press the CLOCK ON OFF (Ⓕ) switch two times continuously. At completion of the deletion, the attribute display section will be shown as "_ _". (See figure below.)

Note: Completing the deletion of all indoor units registered on the remote controller returns to "HO" display.

④ After completing the registration, continuously press the (FILTER) + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the original ordinary mode (with the remote controller under stopping).



4) Deletion of information on address not existing

• Deletion of information on address not existing 5

This operation is to be conducted when "6607" error (No ACK error) is displayed on the remote controller caused by the miss setting at test run, or due to the old memory remained at the alteration/modification of group composition, and the address not existing will be deleted.

Note: The connection information (connection between indoor unit and outdoor unit) on the refrigerant system can not be deleted.

An example to delete the system controller of "250" from the indoor unit of "007" is shown below.

[Operation procedure]

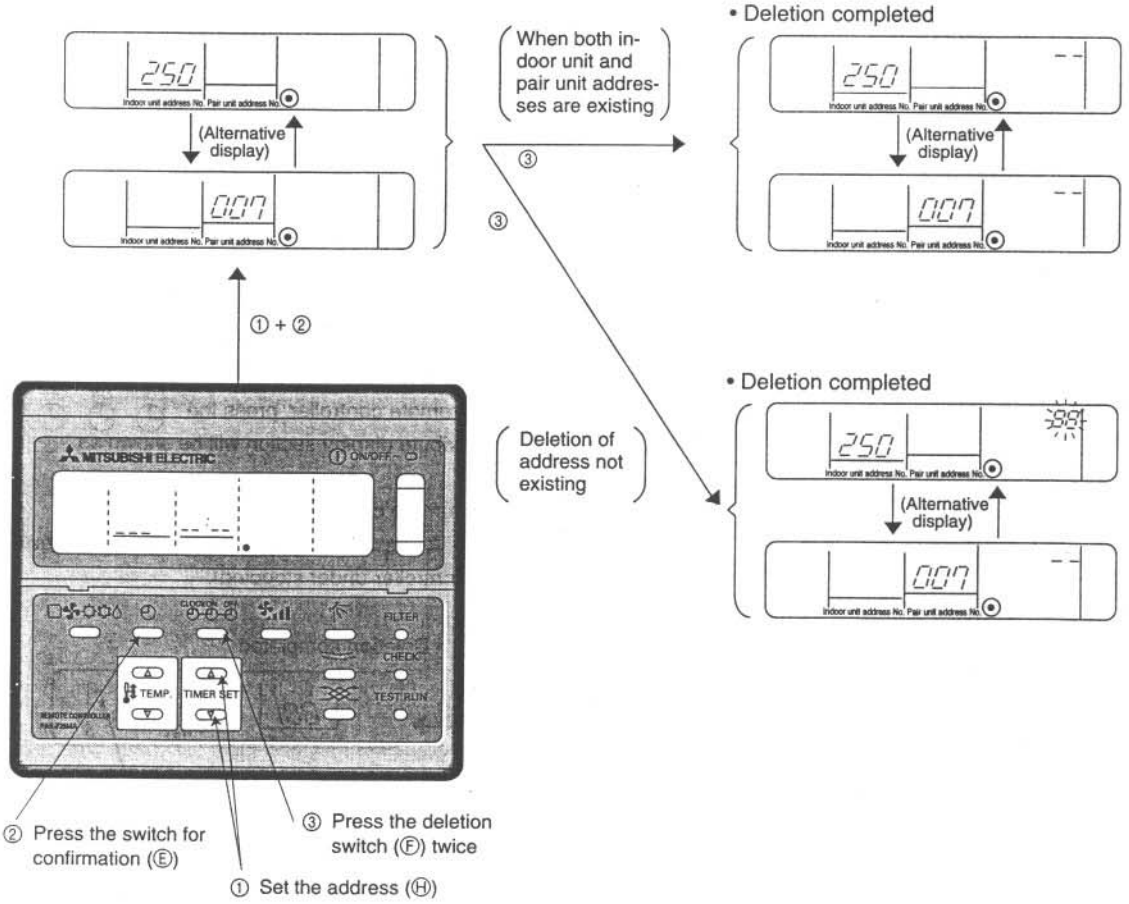
① With the remote controller under stopping or at the display of "HO", continuously press the FILTER + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to change to the registration mode.

② Operate switch (Ⓖ) for the pair setting mode (ⓘⓘ). (See the figure below.)

③ Assign the unit address existing to "PAIR UNIT ADDRESS No." with the ▲▼ (Room temperature control) switch (Ⓒ), and press switch (Ⓔ) to call the address to be deleted. (See the figure below.) As the error display on the remote controller is usually transmitted from the indoor unit, "PAIR UNIT ADDRESS No." is used as the address of the indoor unit.

④ Press the CLOCK ON OFF switch (Ⓕ) twice. (See the figure below.)

⑤ After completing the deletion, continuously press the FILTER + switch (Ⓐ + Ⓑ) at the same time for 2 seconds to return to the original ordinary mode (with the remote controller under stopping).



4 CONTROL

[1] Control of Outdoor Unit

(1) Initial processing

- When turning on power source, initial processing of microcomputer is given top priority.
- During initial processing, control processing corresponding to operation signal is suspended. The control processing is resumed after initial processing is completed. (Initial processing : Data processing in microcomputer and initial setting of each LEV opening, requiring approx. 2 minutes at the maximum.)

(2) Control at staring

- In case unit is started within 2 hours after turning on power source at low outdoor air temperature (cooling : +5˚C or less heating : +5˚C or less), the unit does not start operating for 30 minutes at the maximum.

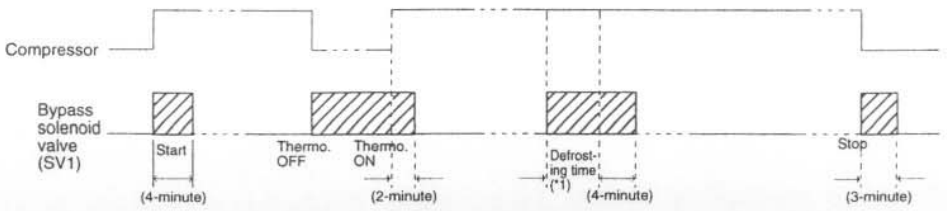
(3) Bypass, capacity control

- Solenoid valve consists of bypass solenoid valve (SV1, SV2) bypassing between high pressure side and low pressure side. The following operation will be provided.

1) Bypass solenoid valves SV1 and SV2 (both "open" when turned on)

Item	SV1		SV2	
	ON (Open)	OFF (Close)	ON (Open)	OFF (Close)
When starting compressor	Turned on for 4 minutes		—	
After thermost "ON is returned and after 3 minutes restart	Turned on for 2 minutes		—	
When compressor stops in cooling or heating mode	Always turned on		—	
After operation stops	Turned on for 3 minutes		—	
During defrosting operations (See figure below *1)	Always turned on		—	
During oil recovery operations	Always turned on in oil recovery operation after low frequency continuous operations		—	
During 20Hz operations, at fall in low pressure saturation temperature. (ET) (3 minutes or more after starting)	—		When low pressure saturation temp. (ET) is -30˚C or less	When low pressure saturation temp. (ET) is -15˚C or more
When high pressure rises (Pd)	When Pd reaches 27.5kg/cm²G or more	When Pd is 24kg/cm²G or less 30 seconds	When Pd reaches 26kg/cm²G or more	When Pd is 23kg/cm²G or less after 30 seconds
When high pressure rises (Pd) during 20Hz operations (3 minutes after starting)	—		Turned on when high pressure (Pd) exceeds pressure limit	When high pressure (Pd) is 20kg/cm²G or less
When discharge temperature rises (3 minutes after starting)	—		When temp. exceeds 130˚C and Pd reaches 15kg/cm²G or more	When discharge temp. is 115˚C or less

* Ex. SV1



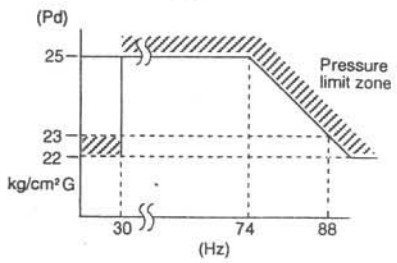
(4) Frequency control

- Depending on capacity required, capacity control change and frequency change are performed to keep constant evaporation temperature (0°C) in cooling operations, and high pressure (18kg/cm²G) in heating operation.
- Frequency change is perfprmed at the rate of 3Hz/second across 20 ~ 110Hz range.

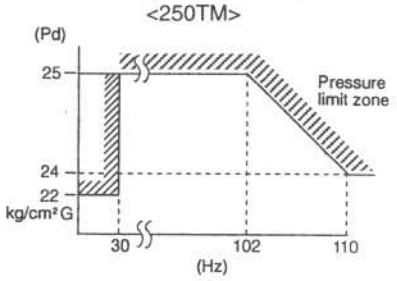
1) Frequency control starting
   - 60Hz is the upper limit for 3 minutes after starting.
   - 75Hz is the upper limit within 2 hours after turning on power source, and 30 minutes after starting compressor.

2) Pressure limit
   The upper limit of high pressure (Pd) is set for each frequency.
   When the limit is exceeded, frequency is reduced every 10 seconds.
   (Frequency decrease rate (Hz) : 22% of the present value)

<200TM>



<250TM>



3) Discharge temperature limit
   Discharge temperature (Td) of compressor is detected during operation. If the upper limit is exceeded, the frequency is reduced. (Change rate : 5% of the present value)
   - 30 seconds after starting compressor, control is performed every minute.
   - Operation temperature is 130°C.

4) Periodical frequency control
   Frequency controll is periodically performed except for the frequency controls at operation start, status change, and protection.

   ① Cycle of periodical frequency control
   Periodical frequency control is performed every minute after the time specified below has passed.
   - 20 sec after starting compressor or finishing defrostoing operations
   - 20 sec after frequency control by discharge temperature or pressure limit

   ② Amount of frequency change
   The amount of frequency change is controlled corresponding to evaporation temperature (ET) and high pressure (Pd).

③ Back up of frequency control by bypass valve

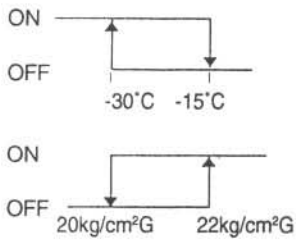
During 20Hz operations, frequency is backed up by turning on (opening) bypass valve (SV2).

- Cooling

  During 20Hz operations 3 minutes after starting compressor, bypass valve is turned on when ET is -30°C or less, and turned off when ET is -15°C or more.

- Heating

  During 20Hz operations 3 minutes after starting compressor, SV2 turned on when high pressure (Pd) exceeds pressure limit (See previous page.), and turned off when Pd falls to 20kg/cm²G or less.



(5) Oil return control (Electronic expansion valve <SLEV>)

Oil return LEV (SLEV) opening is dependent on frequency and outdoor air temperature.

SLEV is closed (0) when compressor stops, and SLEV is set (64) for 10 minutes after starting compressor.

(Number of pulse)

Operation mode	Frequency / Outdoor air temp.	20 ~ 74Hz	75 ~96Hz	97Hz or more
Cooling (Dry)	28°C or more	111	111	157
	20 ~ 30°C	87	87	134
	22°C or less	64	64	87
Operation mode	Frequency / Outdoor air temp.	20 ~ 74Hz	75 ~96Hz	97Hz or more
Heating	–	87	87	111

Note : 1. Differential of outdoor air temperature is 2 degrees.
2. The opening shown above may be expanded for preventing rise in discharge temperature (at Td > 90°C).

(6) Subcool coil control (electronic expansion valve <LEV1>)

- The amount of super heat detected from the bypass outlet temperature of subcool coil (TH8) is controlled to be within a certain range for each 20 sec.
- The opening angle is corrected and controlled depending on the outlet/inlet temperature of subcool coil (TH5, TH7) and the discharge temperature.
- However, the valve will be closed (0) at heating and compressor stopping.
- It will fully open at defrosting.

(7) Defrost operation control

1) Starting of defrost operations
   - After integrated 50 minutes of compressor operations, defrosting operations start when –2°C or less of piping temperature (TH5) is detected for 10 consecutive minutes.
   - Forcible defrosting operations start by turning on forcible defrost switch (SW2-7) if 10 minutes have already elapsed after compressor start or completion of defrosting operations.

2) Completion of defrosting operations

   Defrosting operations stop when 10 minutes have passed since start of defrosting operation, or piping temperature (TH5) reaches 12°C (200TM), 8°C (250TM) or more.

   (Defrosting operations do not stop for 2 minutes after starting, except when piping temperature exceeds 20°C.)

3) Defrosting prohibition

   Defrosting operations do not start during oil recovery, and for 10 minutes after starting compressor.

4) Trouble during defrosting operations

   When trouble is detected during defrosting operations, the defrosting operations stop, and defrosting prohibition time decided by integrated operation time of compressor is set to be 20 minutes.

5) Change in number of operating indoor units during defrosting operations
- In case number of operating indoor units changes during defrosting operations, the defrosting operations continue, and control of unit number change is performed after the defrosting operations are finished.
- Even in case all indoor units stop or thermostat is turned off during defrosting operations, the defrosting operations do not stop until expected defrosting activities are completed.

(8) Control of liquid level detecting heater

Detect refrigerant liquid level in accumulator, and heat refrigerant with liquid level heater for judging refrigerant amount. 6 steps of duty control is applied to liquid level heater depending on frequency and outdoor air temperature, 1minute after starting compressor.

(9) Judgement and control of refrigerant amount

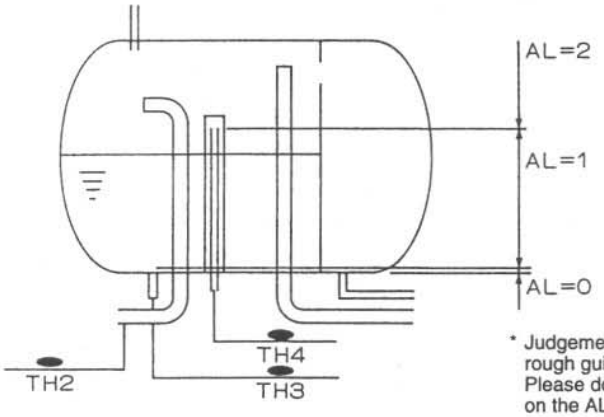
Judge refrigerant amount by detecting refrigerant liquid surface accumulator.

1) Judgement of accumulator liquid level

Return refrigerant from accumulator liquid level detecting circuit to compressor inlet pipe, detect piping temperature, and judge liquid level.

When heated with heater, liquid refrigerant temperature is almost equal to low pressure saturation temperature, and gas refrigerant temperature is a little higher than low pressure saturation temperature. By comparing these temperatures with low pressure saturation temperature ET (TH2) in accumulator inlet portion, refrigerant liquid level can be judged.

Accumulator liquid level is judged in 3 steps as shown in the figure, from low pressure saturation temperature ET (TH2) and liquid level detecting temperatures (TH3, TH4). After deciding refrigerant status (Liquid : TH3 and TH4 are ET +5°C or less Gas : TH3 and TH4 are ET +5°C or more), judge liquid level by comparing TH3 and TH4.



* Judgement by the AL is at best only a rough guideline.
Please do not add refrigerant based on the AL reading alone.

2) Control of refrigerant amount

Cooling

① Prohibition of liquid level detection
- Liquid level is detected in normal conditions except for the following:
  For 6 minutes after starting unit, and during unit stopping.

② In case AL=2 is detected for 3 consecutive minutes during liquid level detection (control at excessive refrigerant replenishment and trouble mode)
- Changed to intermittent fault check mode preceded by 3 minutes restart prevention. But it is not abnormal when the discharge SH is high. Error stop is observed when trouble is detected again in the same intermittent fault check mode (for 30 minutes after unit stops for intermittent fault check).
- When turning on liquid level trouble ignore switch (SW2-6), error stop is not observed, and 3 minutes restart prevention by intermittent fault check mode is repeated. However, LED displays overflow.
  (Turning SW2-6 on makes the error of TH6 < outdoor air sensor > ineffective.)

③ When operation mode shows "Stop," excessive or insufficient refrigerant display and excessive or insufficient refrigerant ignore display are extinguished.

Heating

① Prohibition of liquid level detection

Liquid level is detected in normal conditions except for the following.

- For 6 minutes after starting unit, and during unit stopping (including restart after overflow ignored).
- During defrosting operations and for 6 minutes after defrosting.

② In case AL=2 is detected for 3 consecutive minutes during liquid level detection (control at excessive refrigerant replenishment and trouble mode)

- Changed to intermittent fault check mode preceded by 3 minutes restart prohibition. But it is not abnormal when the discharge SH is high. Error stop is observed when trouble is detected again in the same intermittent fault check mode (for 30 minutes after unit stops for intermittent fault check).
- When turning on liquid level trouble ignore switch (SW2-6), error stop is not observed, and 3 minutes restart prevention by intermittent fault check mode is repeated. However, LED displays overflow.
  (Turning SW2-6 on makes the error of TH6 < outdoor air sensor > ineffective.)

(10) Refrigerant recovery control

Refrigerant recovery is conducted to prevent refrigerant from accumulating in the stopped unit (fan unit), the unit under cooling mode and that with heating thermostat being turned off.

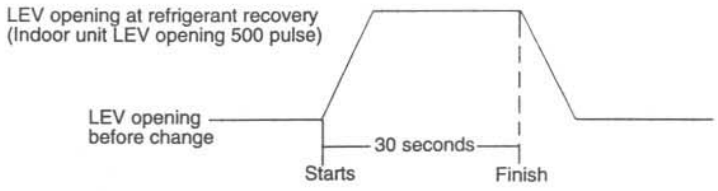
1) Start of refrigerant recovery

① Refrigerant recovery is started when the two items below are fully satisfied.

- 30 minutes has passed after finishing refrigerant recovery.
- The level detector detects AL = 0 for 3 minutes continuously, or when the discharge SH is high.

2) Refrigerant recovery operation

- Refrigerant is recovered by opening LEV of the objective indoor units (indoor units under stop. fan, and cooling modes, and that with heating thermostat being turned off) for 30 seconds.



- The regular capacity control of the outdoor unit and the regular LEV control of the indoor unit are not applied during refrigerant recovery operation, but are fixed with the value before the recovery operation. These controls will be conducted one minute after finishing the recovery operation.
- Defrosting operation is prohibited during the recovery operation, and it will be conducted after finishing the recovery operation.

(11) Control of outdoor unit fan and outdoor unit heat exchanger capacity

1) Control system

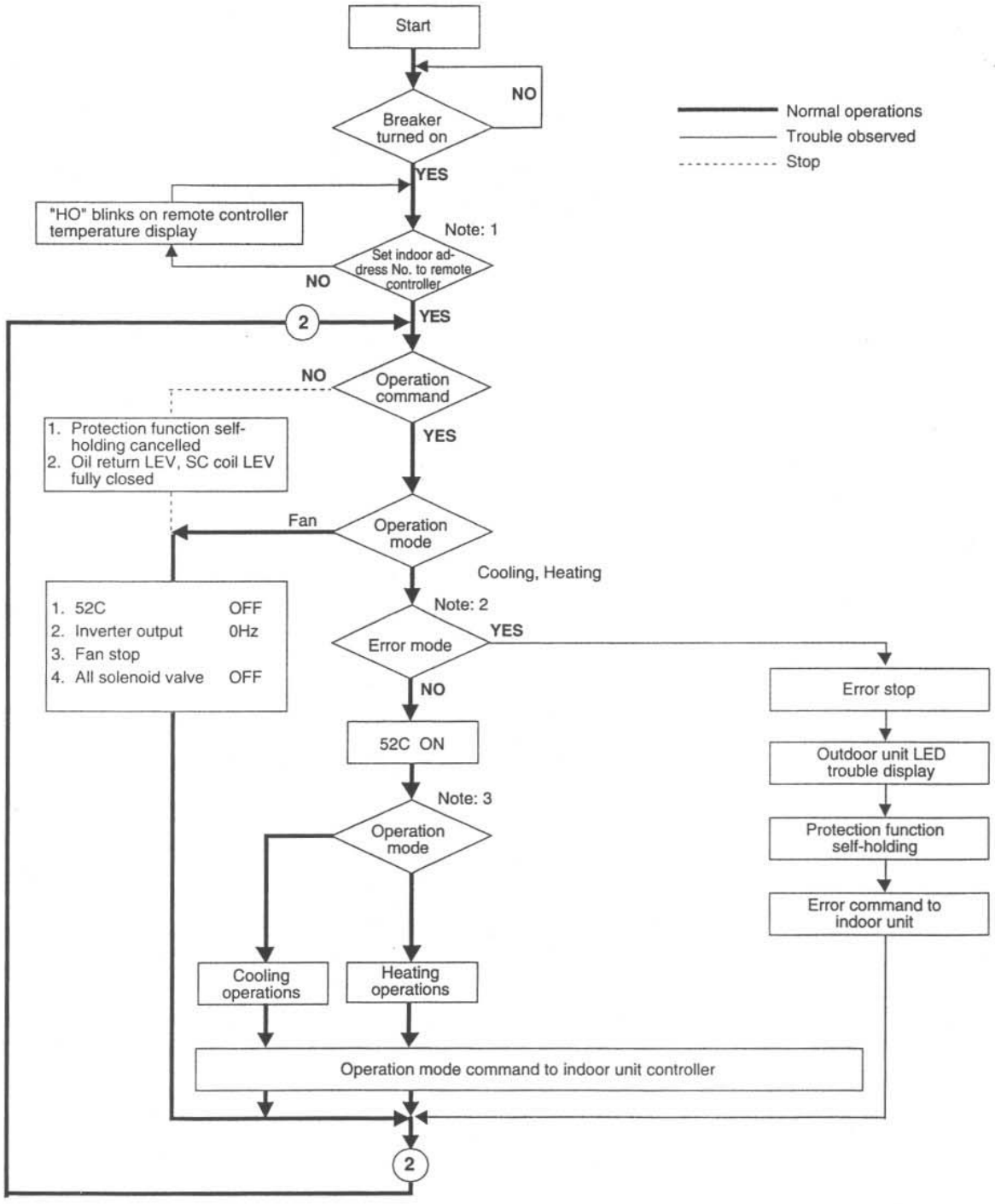
Depending on capacity required, control outdoor fan flow rate with phase control, for maintaining evaporation temperature (0°C when TH6 ≧ 20°C, lower than 0°C when TH6<20°C) in cooling operations, and high pressure 18kg/cm²G in heating operations.

2) Control

- Outdoor unit fan stops when compressor stops.
- Fan is in full operation for 5 seconds after starting.
- Outdoor unit fan stops during defrosting operations.

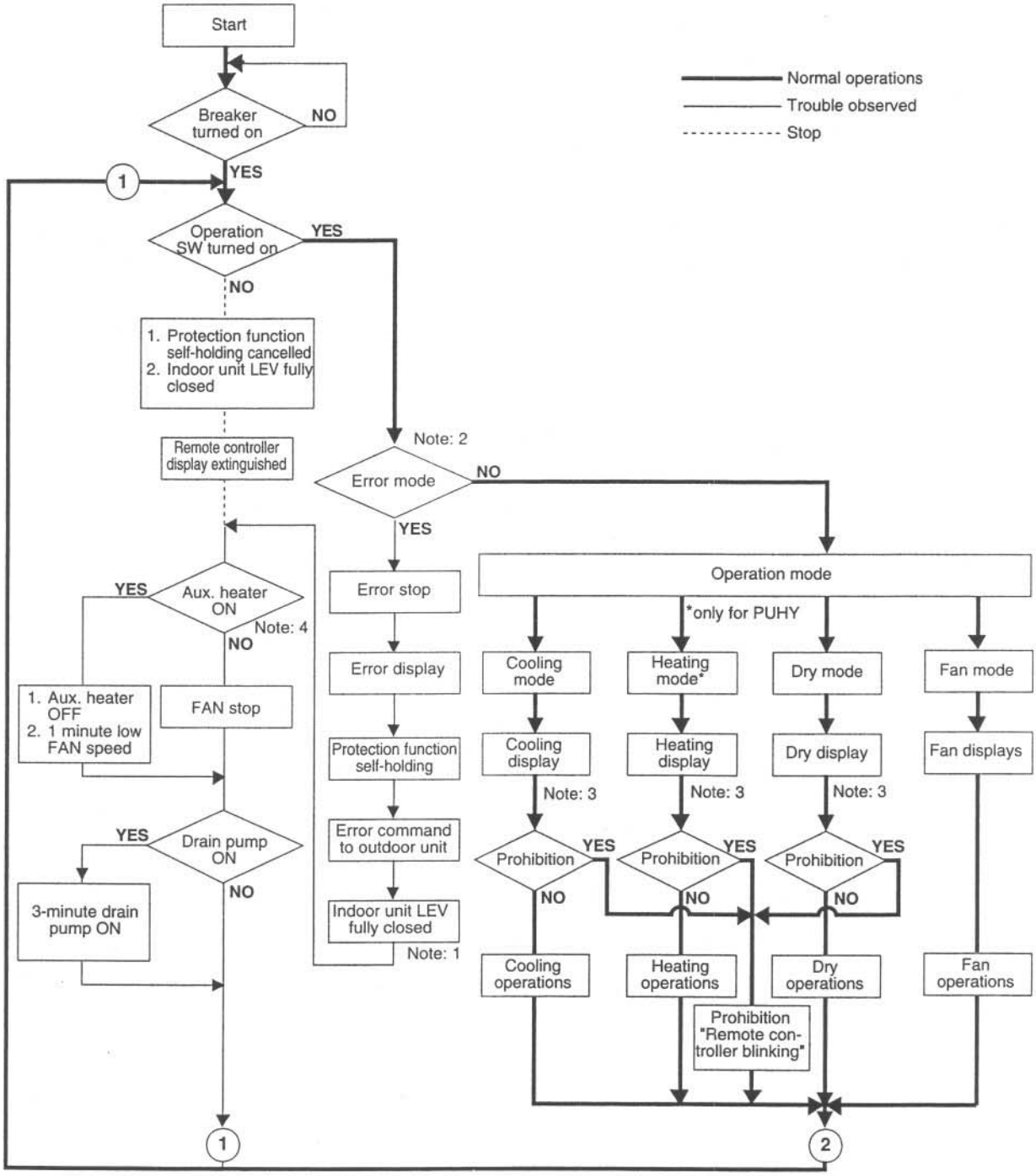
[2] Operation Flow Chart

(1) Outdoor unit (Cooling, heating modes)



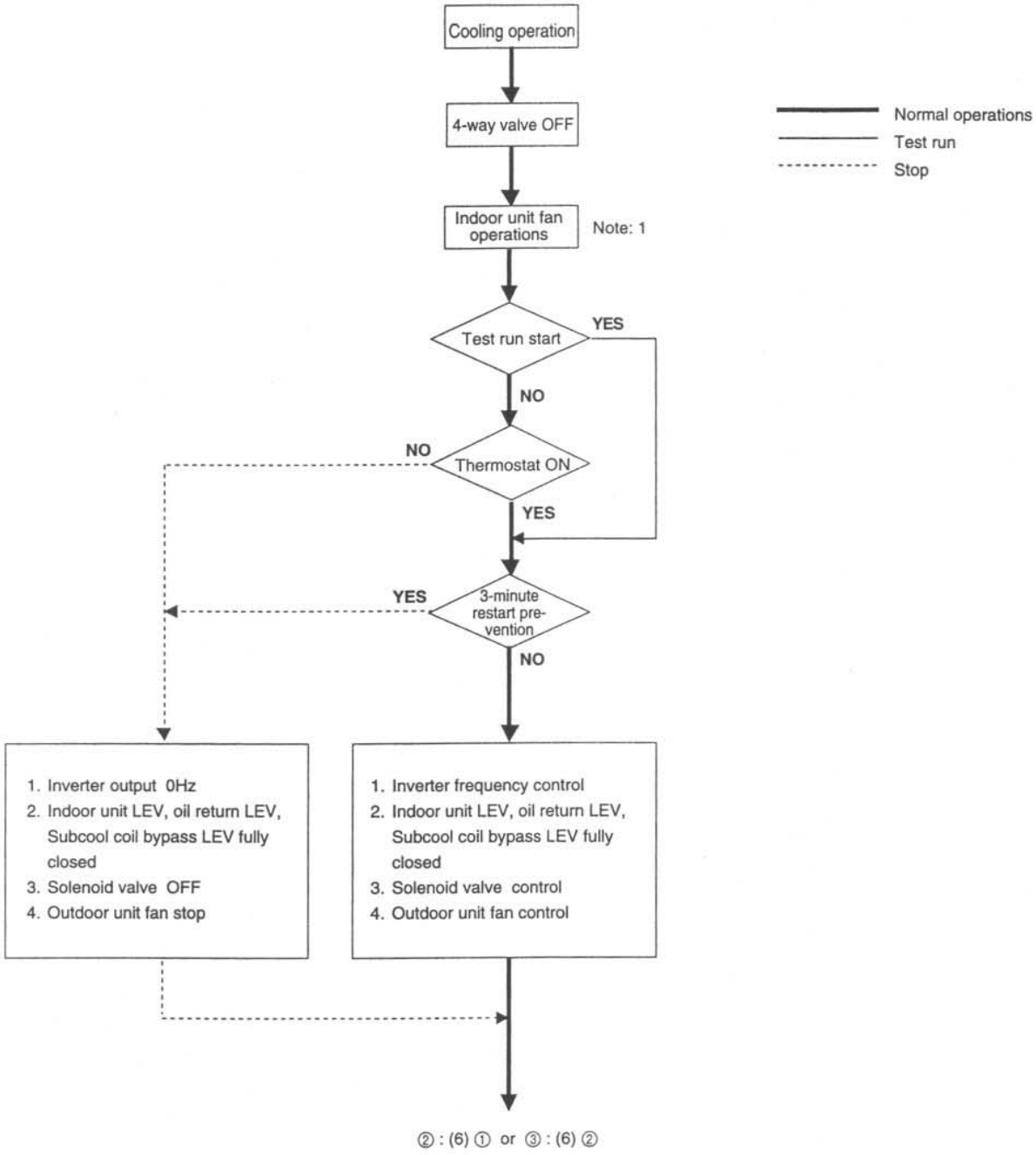
Note: 1	For about 2 minutes after turning on power source, address and group information of outdoor unit, indoor unit, and remote controller are retrieved by remote controller, during which "HO" blinks on and off on remote controller. In case indoor unit is not grouped to remote controller, "HO" display on remote controller continues blinking even after 2 minutes after turning on power source.
Note: 2	Two trouble modes included indoor unit side trouble, and outdoor unit side trouble. In the case of indoor unit side trouble, error stop is observed in outdoor unit only when all the indoor units are in trouble. However, if one or more indoor units are operating normally, outdoor unit shows only LED display without undergoing stop.
Note : 3	Operation mode conforms to mode command by indoor unit. However, when outdoor unit is being under cooling operation, the operation of indoor unit will be prohibited even by setting a part of indoor units under operation, or indoor unit under stopping or fan mode to heating mode. Reversely when outdoor unit is being heating operation, the same condition will be commenced.

(2) Indoor unit (Cooling, heating, dry, and fan modes)



Note : 1	At indoor unit LEV fully closed, the opening angle indicates 60.
Note : 2	The error mode includes that of indoor unit and that of outdoor unit. In the former case, the indoor unit in question only stops in error mood, while in the later case, all indoor units connected to the outdoor unit stop in error mode.
Note: 3	The operation mode follows the mode command from the indoor unit. However, when the outdoor unit is under cooling operation, the operation of the indoor unit will be prohibited even a part of indoor units or indoor unit under stopping or fan mode is put into heating mode. Contrarily, when the outdoor unit is under heating operation, the same condition will be commenced.
Note: 4	The auxiliary heater can only be equipped to the product of special specification.

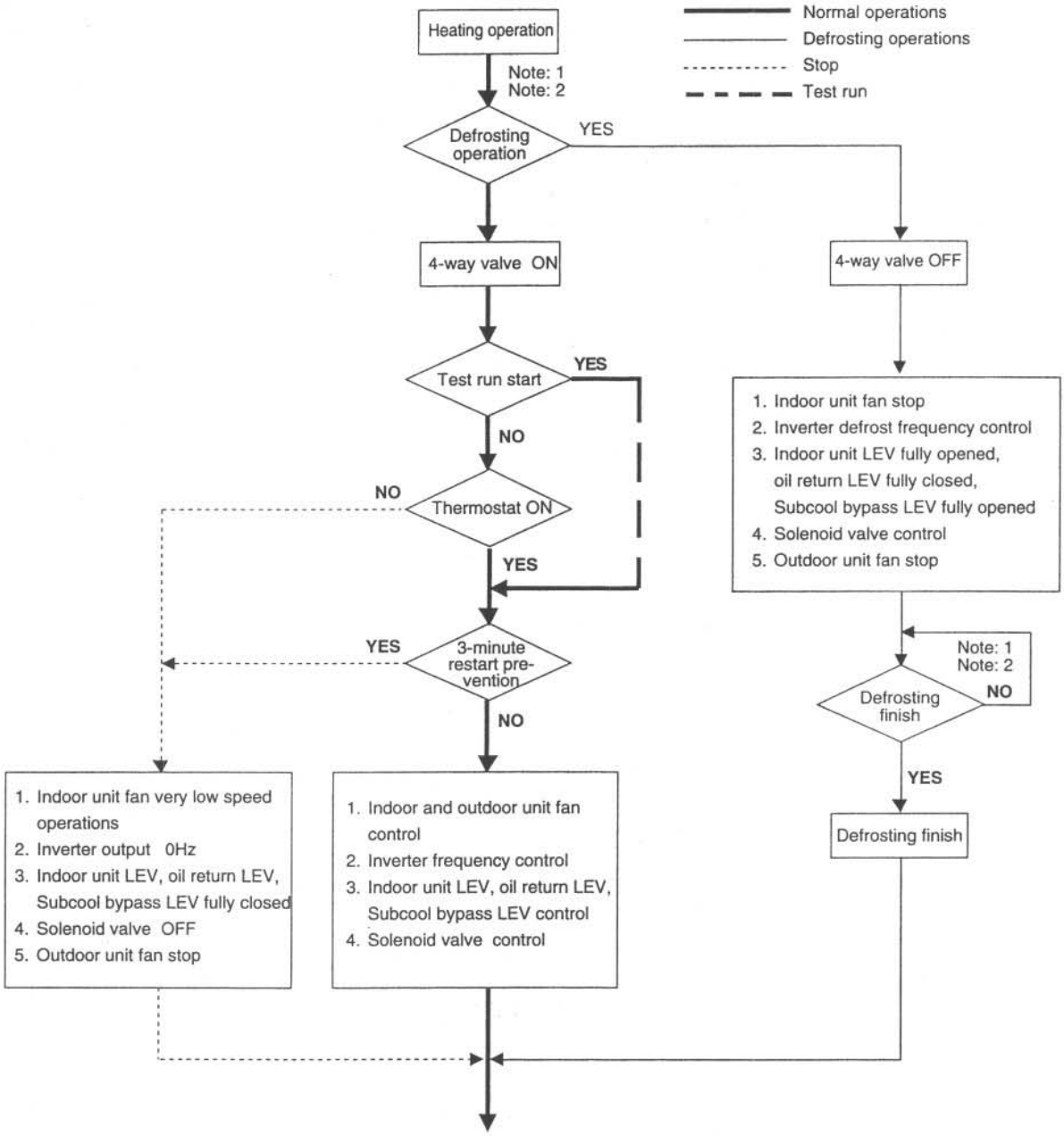
(3) Cooling operation



② : (6) ① or ③ : (6) ②

Note : 1	Indoor unit fan operates at set notch in cooling operation regardless of thermostat ON/OFF.

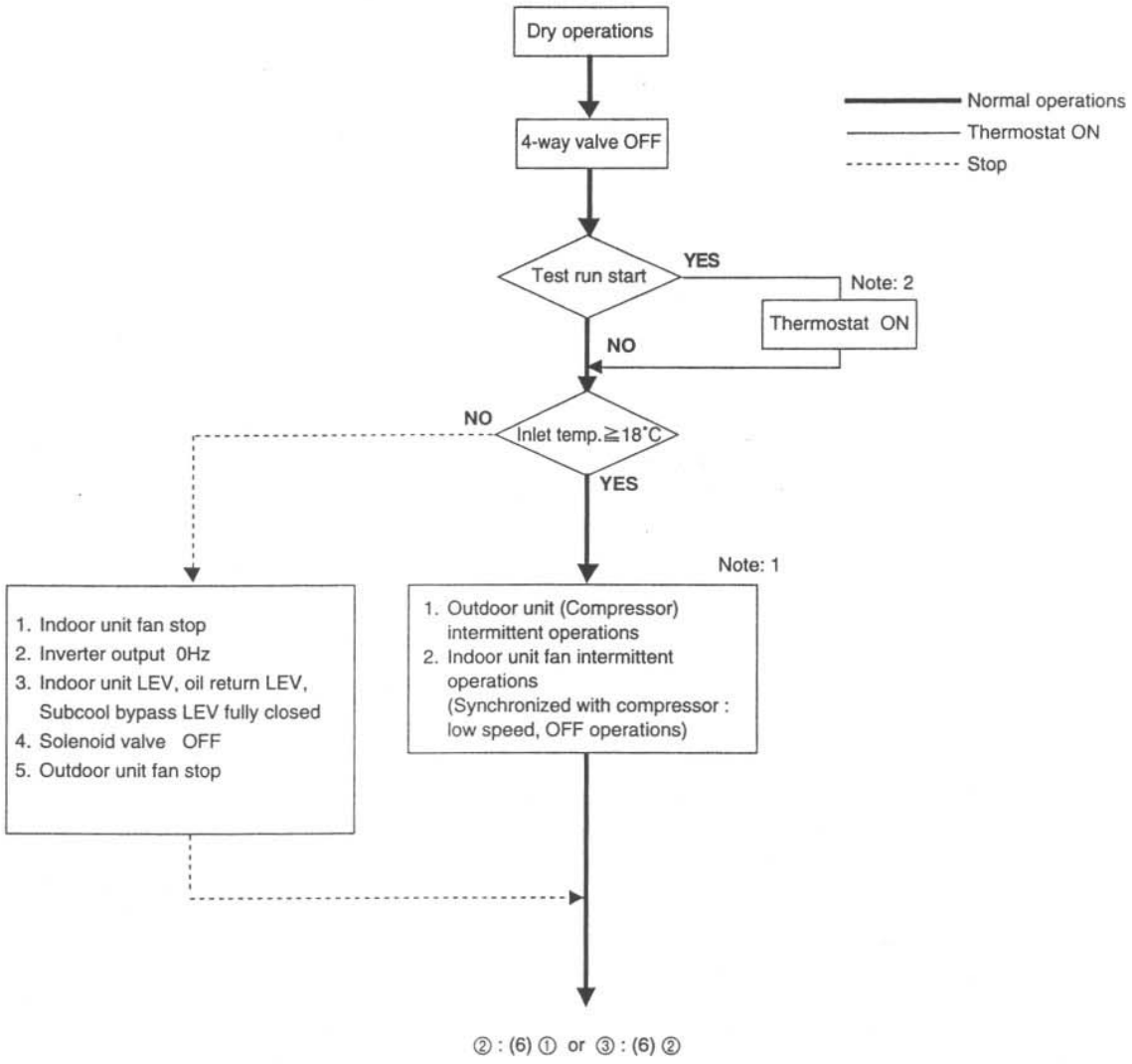
(4) Heating operation (Only for PUHY)



①: (6) ④ or ③: (6) ②

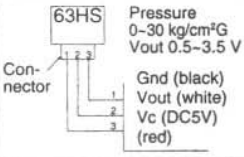
Note : 1	When outdoor unit starts defrosting, it transmits defrost operations command to indoor unit, and the indoor unit starts defrosting operations. Similarly when defrosting operation stops, indoor unit returns to heating operation after receiving defrost end command of outdoor unit.	
Note : 2	Defrosting start condition :	After integrated 50 minutes of compressor operations, and –2°C or less outdoor unit coil temperature.
	Defrosting end condition :	After 15 minutes of defrosting operation or the outdoor unit coil temperature having risen to 12°C (200TM), 8°C (250TM) or more for 200TM and 250TM.

(5) Dry operation



Note : 1	When indoor unit inlet temperature exceeds 18°C, outdoor unit (compressor) and indoor unit fan start intermittent operations synchronously. Operations of outdoor unit, indoor unit LEV and solenoid valve accompanying compressor are the same as those in cooling operations.
Note : 2	Thermostat is always kept on in test run, and indoor and outdoor unit intermittent operation (ON) time is a little longer than normal operations.

[3] List of Major Component Functions

	Name	Symbol (function)	Part code	Application	Specification	Check method
Outdoor unit	Compressor	MC		Adjust refrigerant circulation by controlling operating frequency and capacity control valve with operating pressure.	Low pressure shell scroll type with capacity control mechanism Winding resistance: Each phase 0.107Ω (20°C)	
	Pressure sensor	63HS		1) High press. detection. 2) Frequency control and high pressure protection		
	Pressure switch	63H		1) High pressure detection 2) High pressure protection	Setting 30kg/cm²G OFF	Continuity check
	Thermistor	TH1 (discharge)		1) Discharge temperature detection 2) High pressure protection	R_{120}=7.465kΩ $B_{25/120}$=4057	Resistance value check
				20°C : 250KΩ 70°C : 34kΩ 30°C : 160KΩ 80°C : 24kΩ 40°C : 104KΩ 90°C : 17.5kΩ 50°C : 70KΩ 100°C : 13.0kΩ 60°C : 48KΩ 110°C : 9.8kΩ	$Rt = 7.465\exp\{4057(\frac{1}{273+t} - \frac{1}{393})\}$	
		TH2 (low pressure saturation temperature)		1) Detects the saturated vapor temperature. 2) Calculates the refrigerant circulation configuration. 3) Controls the compressor frequency. 4) Controls the outdoor unit's fan air volume.	R_0=15kΩ $B_{0/100}$=3460 $Rt = 15\exp\{3460(\frac{1}{273+t} - \frac{1}{273})\}$ 0°C : 15kΩ 10°C : 9.7kΩ 20°C : 6.4kΩ 25°C : 5.3kΩ 30°C : 4.3kΩ 40°C : 3.1kΩ	Resistance value check
		TH3 TH4 (liquid level detection)		Detection of refrigerant liquid level inside accumulator by temperature difference of TH2, TH3 and TH4		
		TH5 (piping temperature)		1) Frequency control 2) Defrost control and liquid level detection at heating		
		TH6 (outdoor air temperature)		1) Outdoor air temperature detection 2) Fan control, liquid level heater, and opening setting for oil return		
		TH7 (subcool coil outlet temperature)		Subcool coil bypass LEV (LEV1) control		
		TH8 (subcool coil bypass outlet temperature)		Subcool coil bypass LEV (LEV1) control		
		THHS		1) Detects the inverter cooling fin temperature. 2) Provides inverter overheating protection. 3) Controls the control box cooling fan.	R_{50}=17kΩ $B_{25/50}$=4170 $Rt = 17\exp\{4170(\frac{1}{273+t} - \frac{1}{273+50})\}$ -20°C : 605.0kΩ 50°C : 17.0kΩ -10°C : 323.3kΩ 60°C : 11.5kΩ 0°C : 180.9kΩ 70°C : 8.0kΩ 10°C : 105.4kΩ 80°C : 5.7kΩ 20°C : 63.8kΩ 90°C : 4.1kΩ 30°C : 39.9kΩ 100°C :3.0kΩ 40°C : 25.7kΩ	

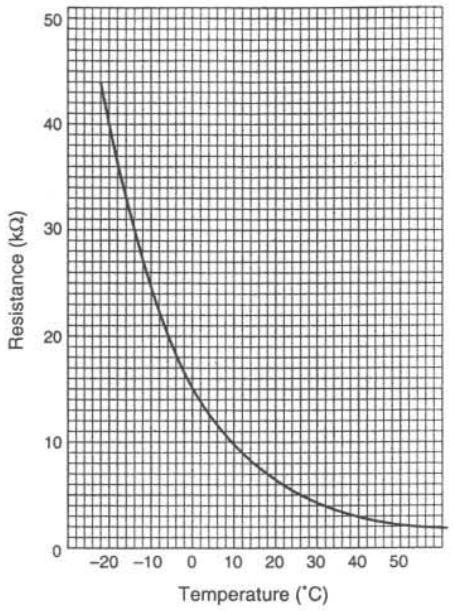
	Name	Symbol (function)	Part code	Application	Specification	Check method
Indoor unit Outdoor unit	Solenoid valve	SV1 (discharge - suction by-pass)		1) High/low press. bypass at starting/ stopping and capacity control at low load 2) Discharge press. rise suppression	AC 220V Open at energizing and close at deenergizing	Continuity check by tester
		SV2 (discharge - suction by-pass)		Capacity control and high press. rise suppression (backup for frequency control)	AC 220V Open at energizing and close at deenergizing	
	Electronic expansion valve	SLEV		Adjustment of liquid refrigerant (oil) return foam accumulator	DC12V stepping motor drive Valve opening 0~480 pulse	
		LEV1 (SC coil)		Adjustment of bypass flow rate from outdoor unit liquid line at cooling		
	Liquid level detection heater	CH2, CH3 (accumulator liquid level detection)		Heating of refrigerant in accumulator liquid level detection circuit	Cord heater : 2.8kΩ (1.4kΩ+1.4kΩ) AC220V 20W (10W + 10W)	Resistance value check
	Electronic expansion valve	LEV		1) Adjust superheat of outdoor unit heat exchanger outlet at cooling. 2) Adjust subcool of indoor unit heat exchanger at heating.	DC12V Opening of stepping motor driving valve 60~2,000 pulses	Continuity check with tester for white-red-orange yellow-brown-blue
	Thermistor	TH21 (inlet air temperature)		Indoor unit control (thermostat)	R_0 = 15kΩ $B_{0/100}$ = 3460	Resistance value check
		TH22 (piping temperature)		1) Indoor unit control (freeze prevention, hot adjust, etc.) 2) LEV control in heating operation (Subcool detection)	$R_t = 15\exp\{3460(\frac{1}{273+t} - \frac{1}{273})\}$ 0°C : 15kΩ 10°C : 9.7kΩ 20°C : 6.4kΩ 25°C : 5.3kΩ 30°C : 4.3kΩ 40°C : 3.1kΩ	
		TH23 (gas side piping temperature)		LEV control in cooling operation (Superheat detector)		

[4] Resistance of Temperature Sensor

Thermistor for low temperature

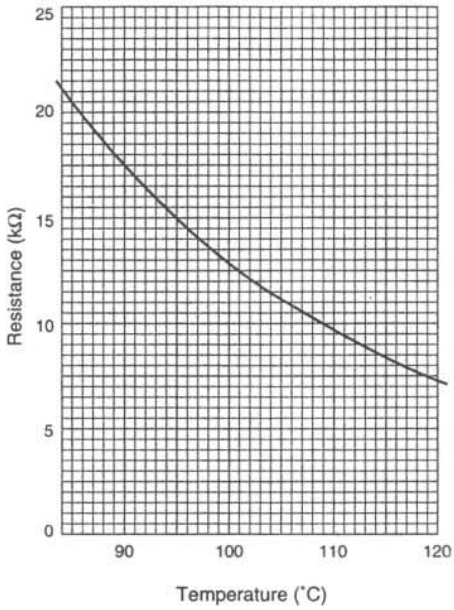
Thermistor R_0 = 15kΩ ± 3% (TH2 ~ 9)

$R_t = 15\exp\{3460\,(\frac{1}{273+t} - \frac{1}{273})\}$



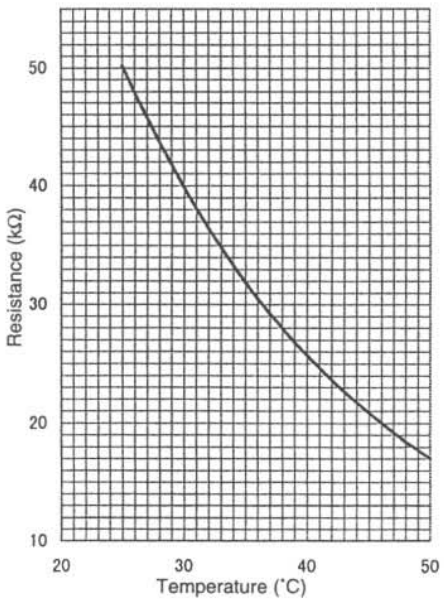
Thermistor R_{120} = 7.465kΩ ± 2% (TH1)

$R_t = 7.465\exp\{4057\,(\frac{1}{273+t} - \frac{1}{393})\}$



Thermistor R_{50} = 17kΩ ± 2% (THHS)

$R_t = 17\exp\{4170\,(\frac{1}{273+t} - \frac{1}{273+50})\}$



5 REFRIGERANT AMOUNT ADJUSTMENT

By clarifying the relationship between the refrigerant amount and operating characteristics for Y Series, conduct service activities such as decision on the amount and adjustment of refrigerant on the market.

[1] Operating characteristics and refrigerant amount

The followings are operating characteristics and refrigerant amount which draw special attention.

1	During cooling operations, required refrigerant amount tends to increase (refrigerant in accumulator decreases) in proportion to increase in the number of operating indoor units. However, the change of increase rate is small.		
2	During heating operations, liquid level of accumulator is the highest when all the indoor units are operating.		
3	Discharge temperature hardly changes when increasing or decreasing refrigerant amount with accumulator filled with refrigerant.		
4	Tendency of discharge temperature	During cooling operations, discharge temperature tends to rise at overload than low temperature. During heating operations, discharge temperature tends to rise at low temperature than overload.	Comparison including control system
		The lower operating frequency is, the higher discharge temperature tends to become because of deteriorated compressor efficiency.	
5	Compressor shell temperature is 20~70 degrees higher than low pressure saturation temperature (ET) when refrigerant amount is appropriate. → Judged as over replenishment when temperature difference from low pressure saturation temperature (ET) is 10 degrees or less.		

[2] Adjustment and judgement of refrigerant amount

(1) Symptom

The symptoms shown in the table below are the signs of excess or lack of refrigerant amount. Be sure to adjustment amount in refrigerant amount adjustment mode, by checking operation status, judging refrigerant amount, and performing selfdiagnosis with LED, for overall judgement of excess or lack of refrigerant amount.

1	Error stop at 1500 remote controller display (excessive refrigerant replenishment)	Excessive refrigerant replenishment
2	Operating frequency does not fully increase, thus resulting in insufficient capacity	Insufficient refrigerant replenishment
3	Error stop at 1102 remote controller display (discharge temperature trouble)	

(2) Refrigerant Volume Adjustment Operation

1) Operating Characteristics Refrigerant Volume

Characteristic items related to operating characteristics and the refrigerant volume are shown below.

1	If the number of indoor units in operation increases during cooling, the required volume of refrigerant tends to increase (the amount of refrigerant in the accumulator tends to decrease), but the change is minimal.		
2	The fluid level in the accumulator is at its highest when all the indoor units are operating during heating.		
3	If there is refrigerant in the accumulator, even if the volume of refrigerant is increased or decreased, there is practically no change in the outlet temperature.		
4	Tendency of discharge Temperature	During cooling, the discharge temperature rises more easily when there is an overload than when the temperature is low.	Comparison when control is included.
		During heating, the discharge temperature rises more easily when the temperature is low than when there is an overload.	
		The lower the operating frequency, the less efficient the compressor is, making it easier for the discharge temperature to rise.	
5	The compressor shell temperature becomes 20~70 deg. higher than the low pressure saturation temperature (ET) if the refrigerant volume is appropriate. If the difference with the low pressure saturation temperature (ET) is 10 deg. or less, it can be judged that the refrigerant is overcharged.		

2) Adjusting and Judging the Refrigerant Volume

① Symptoms

Overcharging with refrigerant can be considered as the cause of the following symptoms. When adjusting the refrigerant volume, be sure that the unit is in the operating condition, and carry out refrigerant volume judgment and self-diagnosis by the LED's, judging overall whether the volume of refrigerant is in excess or is insufficient. Perform adjustments by running the unit in the refrigerant volume adjustment mode.

1	Emergency stop occurs when the remote control display is at 1500 (refrigerant overcharge).	Refrigerant overcharge
2	The operating frequency doesn't rise high enough and capacity is not achieved.	Insufficient refrigerant
3	Emergency stop occurs when the remote control display is at 1102 (outlet temperature overheating).	

② Refrigerant Volume

a Checking the Operating Condition

Operate all the indoor units on cooling or on heating, checking the discharge temperature, sub-cooling, low pressure saturation temperature, inlet temperature, shell bottom temperature, fluid level, fluid step, etc. and rendering an overall judgment.

Note :

Depending on the operating state, AL = 0 has the meaning does not mean that there is insufficient refrigerant.

	Condition	Judgment
1	Discharge temperature is high. (125°C or higher)	Refrigerant volume tends toward insufficient.
2	Low pressure saturation temperature is extremely low.	
3	Inlet superheating is high (if normal, SH = 20 deg or lower).	
4	Shell bottom temperature is high (the difference with the low pressure saturation temperature is 70 deg. or greater)	
5	Shell temperature is low (the difference with the low pressure saturation temperature is 10 deg. or lower).	Refrigerant volume tends toward overcharge.
6	Fluid level AL = 2	

b Cautions When Judging the Fluid Level

If you are judging the fluid level, be sure to use it only after making sure the fluid level sensor function (sensor and heater) is operating normally.

	Check Items	Judgment
1	Fluid Heater Disconnection Check	Normal if the resistance is 2.8 kΩ ± 7%.
2	Fluid Heater Output Check Turn 1 ON on the self-diagnosis switch (SW1)  , and output the signal for the heater relay to LED 7, then check the voltage of the heater terminal (AC 198~242 V) (leave the heater connections as they are).	Normal if AC 198~242 V is output together with the LED lighting.
3	Inlet superheating is high (if normal, SH = 20 dg or lower).	

c Check the refrigerant volume by self-diagnosis using the LED.

Set the self-diagnosis switch (SW1) as shown below and check the past information (history) concerning the refrigerant volume.

Set SW1 as shown in he figure at right. 

If LD8 lights up, it indicates the refrigerant charge abnormal delay state just before emergency stop due to refrigerant overcharge (1500).

③ Additional Refrigerant Charge Volume

At the time of shipping from the factory, the outdoor unit is charged with the amount of refrigerant shown in the following table, but since no extension piping is included, please carry out additional charging on-site.

Outdoor Unit Model Name	PU(H)Y-200TM	PU(H)Y-250TM
Refrigerant Charge Volume	6.5 kg	8.5 kg

Calculation Formula

Calculate the additional refrigerant volume by calculating the size of the extension fluid piping and its length (units: m).

Additional Refrigerant Volume (kg) = $(0.12 \times L_1) + (0.06 \times L_2) + (0.024 \times L_3) + \alpha$

L1: Length of ø12.7 fluid pipe (m)
L2: Length of ø9.52 fluid pipe (m)
L3: Length of ø6.35 fluid pipe (m)
α: refer to the α calculation table.

In the calculation results, round up fractions smaller than 0.01 kg. (Example: 18.54 kg → 18.6 kg)

(α Calculation Table)

Total Capacity of Connected Indoor Units	α
~90	1.0 kg
91~180	1.5
181~370	2.0
371~462	2.5

3) Refrigerant Volume Adjustment Mode Operation

① Procedure

Depending on the operating conditions, it may be necessary either to charge with supplementary refrigerant, or to drain out some, but if such a case arises, please follow the procedure given below.

▽1 Switching the function select switch (SW2-4), located on the outdoor unit's control board, ON starts refrigerant volume adjustment mode operation and the following operation occurs.

Operation	①	During cooling, LEV1 on the outdoor unit opens slightly wider than normal.
	②	During heating, ordinary operation is carried out.

▽2 Additionally, if the self-diagnosis switch (SW1) on the outdoor unit's control board is set to 

, the accumulator's fluid level is indicated by the LED lighting position.

AL = 0 (No fluid in accumulator)
AL = 1 (Fluid in accumulator)
AL = 2 (Overcharge)

Notes 1 Even if AL = 1 for a short time after operation in the refrigerant volume adjustment mode starts, as time passes (as the refrigeration system stabilizes), it may change to AL = 0.

① If it is really AL = 1

Cases where AL = 1, TH5 - TH7 in the outdoor unit is 5 deg or greater and the SH of all indoor units is 6~13 deg.

② Cases where AL = 1 now, but there is a possibility that it will change to AL = 0 as time passes.

TH5 - TH7 in the outdoor unit is not 5 deg., or the SH of at least one of the indoor units is not deg.

Notes 2 A refrigerant volume adjustment performed in the cooling mode must be done with a gauge reading of 14 kg/cm² or higher. If the pressure does not reach 14 kg/cm², adjust in the heating mode.

Notes 3 In cases where a high pressure of 14 kg/cm² or greater cannot be maintained with low temperature outside air (20~25 deg.) in cooling mode operation, and high pressure changes at the border of 14 kg/cm², use TH1, TH5, TH7 and Tc to adjust the refrigerant volume. TH1, TH5 and TH7 can be displayed using the self-diagnosis switch (SW1) on the outdoor unit's control board.

Notes 4 Judgment by the AL is at best only a rough guideline. Please do not add refrigerant based on the AL reading alone. (Be sure to obtain calculations of the correct amount before adding refrigerant.)

TH1 Self-diagnosis Switch

TH5 Self-diagnosis Switch

TH7 Self-diagnosis Switch

Tc Self-diagnosis Switch

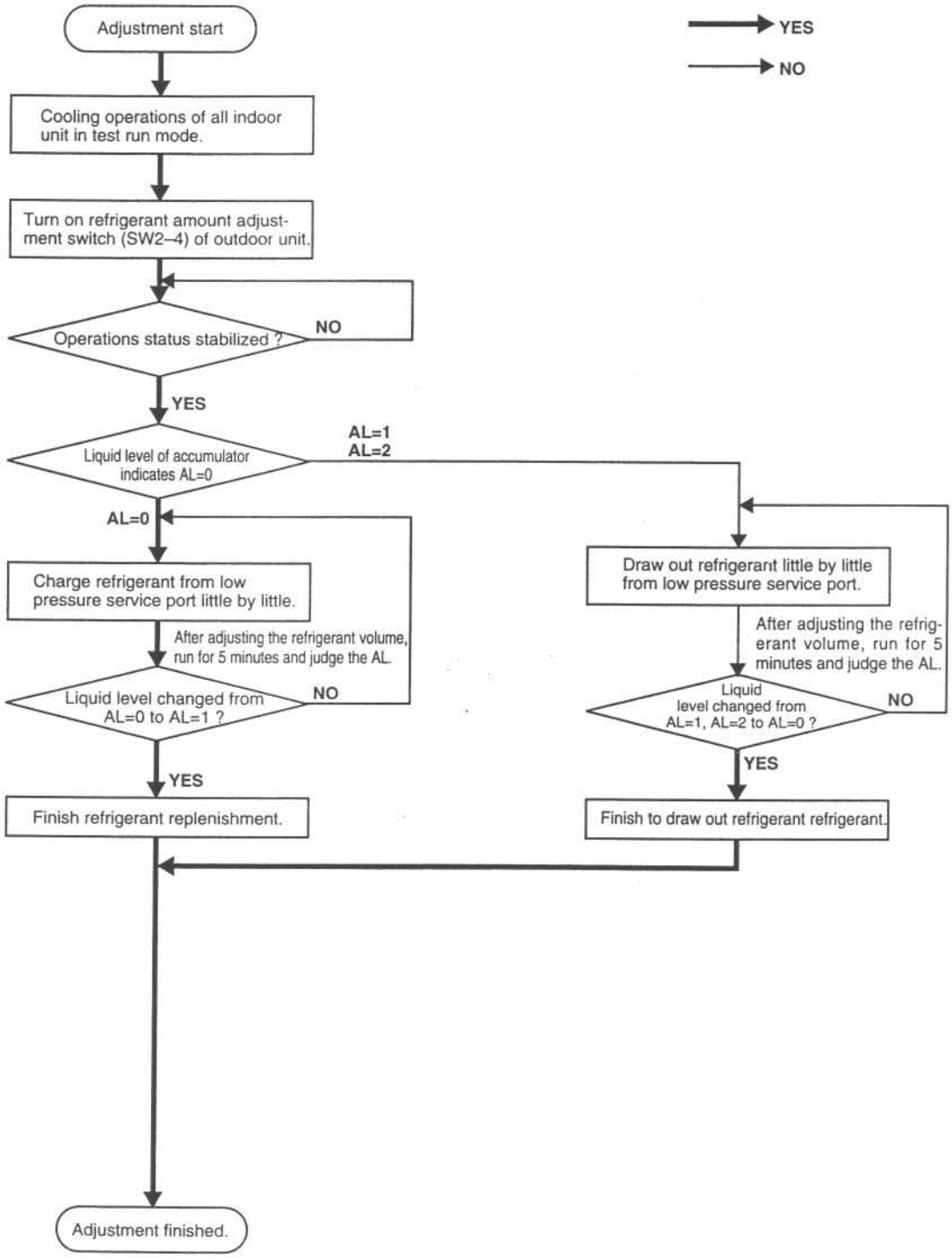
Using these, judge TH1, Tc - TH5 and Tc - TH7.

However, if you are adjusting the cooling refrigerant volume by this procedure, do not turn Dip SW2-4 ON.

Treatment	A	In cases where cooling is being done in the refrigerant volume adjustment mode, if ② above applies, please perform accumulator level AL judgment after waiting until TH5 - TH7 in the outdoor unit is at 5 deg or higher and the SH of all the indoor units reaches 6~9 deg.
	C	For the SH of indoor units, turn the self-diagnosis switch for the outdoor unit ON, then monitor by the lighting position of the LED.

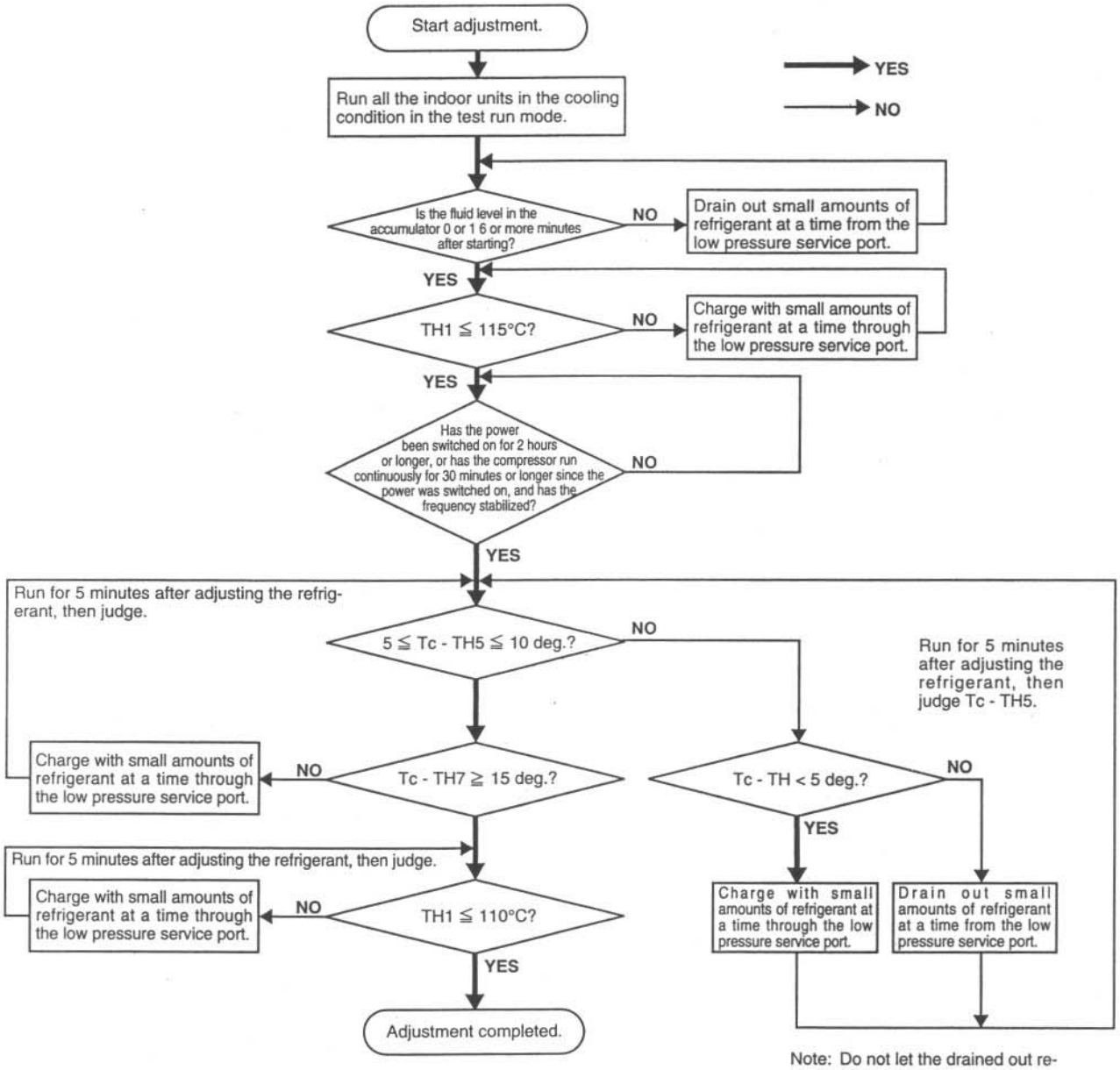
When supplementing the refrigerant volume, please be careful to charge with liquid refrigerant.

(3) **Refrigerant adjustment in cooling season (When the high pressure is 14 kg/cm² or greater)**



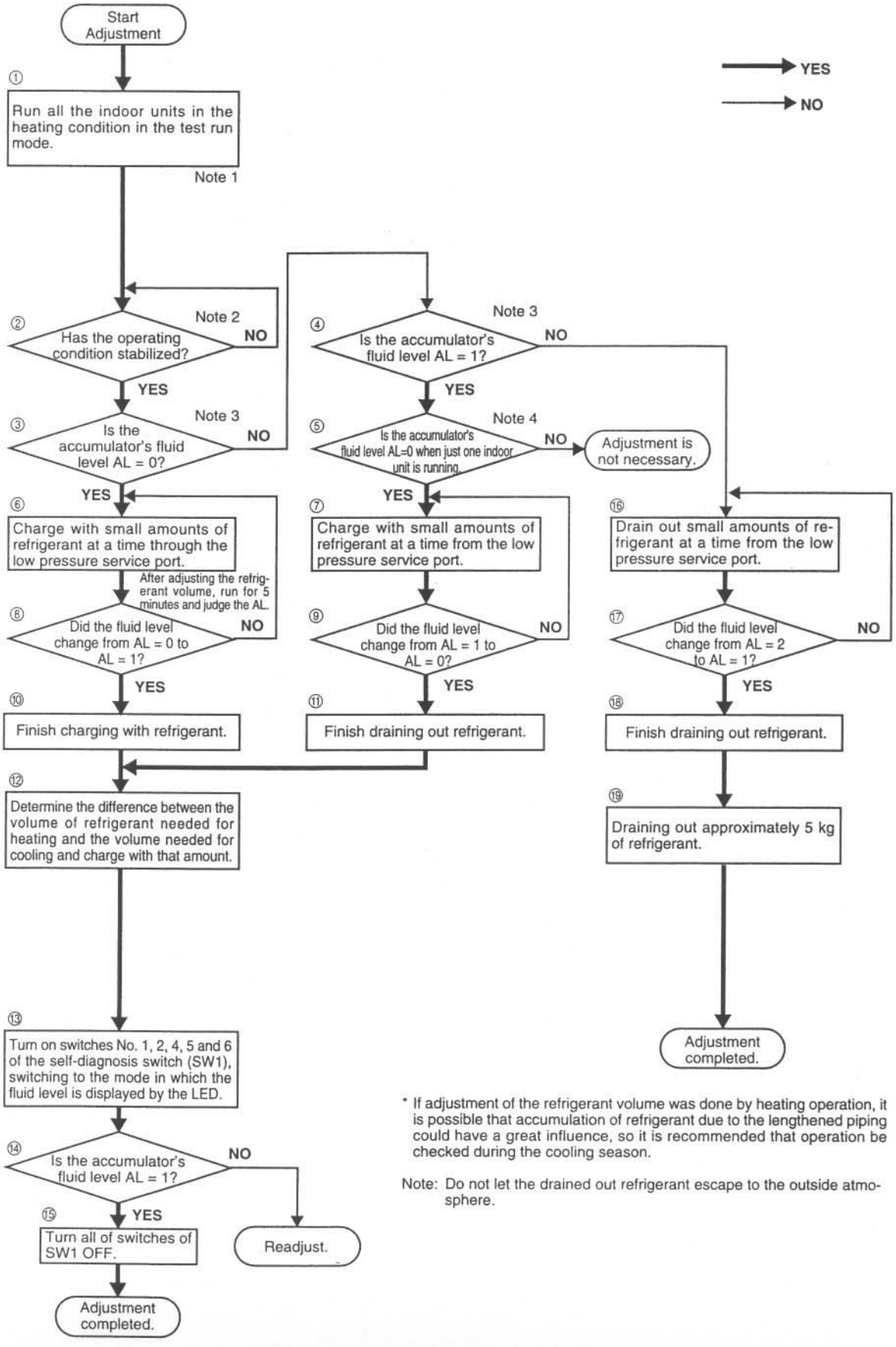
⚠ **Caution :**
Do not let the drained out refrigerant escape to the outside atmosphere.

Flow Chart (When a high pressure pressure cannot be maintained at 14 kg/cm²G in the intermediate period)



Note: Do not let the drained out refrigerant escape to the outside atmosphere.

(4) Refrigerant adjustment in heating season



* If adjustment of the refrigerant volume was done by heating operation, it is possible that accumulation of refrigerant due to the lengthened piping could have a great influence, so it is recommended that operation be checked during the cooling season.

Note: Do not let the drained out refrigerant escape to the outside atmosphere.

Note 1 If there are any units which are not operating, it will cause refrigerant to accumulate, so by all means operate all the indoor units. Also, in order to prevent stable operation from being disrupted by the thermostat going OFF, set the trial operation mode.

Note 2 If the high pressure is stabilized, it is safe to judge that the operation condition is stable.
Judge that operation is stabilized or not stabilized by whether the compressor starts after 3 or more minutes have passed.

Note 3 When turning on SW1 to 

, the LED will display the fluid level.

Note 4 If AL = 1, it indicates basically that adjustment is not necessary, but when the fluid level is on the low side even if it is in the AL = 1 region, if one unit only is run and refrigerant is accumulating in the units that are stopped, it may result in there being insufficient refrigerant, so at such a time, adjustment is necessary.

Note 5 Determine the difference in the volume of refrigerant necessary for cooling and for heating as follows, and carry out supplementary charging in accordance with the table below.

* The piping length is the total pipe length calculated for a fluid pipe with a ø12.7 size.

Pipe Length	60 m or less	60~90 m	90 m or longer
Additional Refrigerant Volume	8 kg	10 kg	12 kg

If the fluid pipe size is ø 9.52, the actual length is 0.50
If the fluid pipe size is ø 6.35, the actual length is 0.2.

Note 6 When turning on SW1 to 

, the LED will display the fluid level.

Note 7 If the adjustment in items ⑥~⑪ is sure, AL will not become AL = 2 even if the MAX refrigerant volume is charged. Therefore, in the case of AL = 2, it can be judged that there was overcharging in items ⑥ and ⑧, or that there was a mistake in the calculations in ⑫.