MITSUBISHI ELECTRIC

Changes for the Better

CONDENSING UNIT

DATA BOOK

MODEL

ECOV-X37, 55VA (-BS)

CONTENTS

ECOV-X-VA (-BS)

CONTENTS

1-1. Specifications

Item				Unit	ECOV-X37VA(-BS) <5HP>
Nominal output				kW	3.7
Suction pressure saturation temperature range				°C	-35 ~ -5
Refrigerant type				–	R744
Installation conditions				–	Outdoor installation
				°C	Ambient temperature -25 ~ +43
Power supply				–	3-phase 4-wire 380-400-415V 50Hz
Electrical Characteristics	Power consumption		<Note 1>	kW	6.25
	Operating current			A	10.8-10.3-9.9
	Power factor		<Note 5>	%	87.6
	Starting current			A	8.0
Operating frequency				Hz	35 ~ 66
Refrigerating capacity		ET=-10	<Note 1>	kW	10.0
SEPR				–	2.53
Compressor	Model			–	HXK17FA-Y (Scroll)
	Displacement volume			m^3/h	4.1
	Crank case heater			W	45
Lubricant	Type			–	MEL220
	Charged amount	Compressor		L	2.7
		Others		L	–
Condenser	Heat exchanger type			–	Salt-resistant corrugated fin & aluminum micro channel
	Fan	Motor output		W	74 × 2
		Fan diameter		mm	ø550 × 2
	Air flow rate			m^3/min	154.8
	Saturation pressure adjustment device			–	Electronic fan controller
Liquid receiver		Capacity		L	11
Capacity control				–	Inverter type
Startup method				–	Inverter startup
High-pressure-cut prevention function				–	Standard
Protection device <Note 3>	Pressure switch <high pressure/low pressure>			–	High pressure: Standard (Mechanical) Low pressure: Standard (Digital)
	Overcurrent protection			–	Standard
	Thermal switch (discharge pipe)			–	Standard (Mechanical)
	Thermal switch (compressor inner thermostat)			–	–
	Fuse	For surge absorber curcuit		–	250V 6.3A × 3
		For control circuit		–	250V 3.15A × 1, 6A × 2, 6.3A × 1
		For condenser fan		–	250V 5A × 2
		For condenser fan power supply		–	250V 6.3A × 2
	Reverse phase preventer			–	–
	Oil temperature detection protection			–	Standard
Built-in device <Note 3>	Pressure gauge			–	Standard <Discharge, Liquid>
	Suction accumulator			–	Standard
	Oil separator			–	Standard
Communication				–	MODBUS®
Accessories		Spare fuse		–	6A
		Other		–	Connector for emergency operation
				–	Termination resistance for MODBUS®
External finish				–	MUNSELL 5Y 8/1
External dimensions <Height × Width × Depth>				mm	1,600 × 1,455 × 506 (+ 38)
Weight	Package weight			kg	311
	Net weight			kg	290
Pipe size		Suction pipe		mm	ø15.88
		Liquid pipe		mm	ø9.52
		Hot gas pipe		mm	–
Maximum piping length (equivalent)				m	50
Sound pressure level			<Note 2>	dB (A)	54.5 (51.0)
Electrical wiring <Note 6>	Electric wire size		<Note 4>	mm^2<m>	5.5 <61>
	Maximum Circuit Amp (MCA)			A	20
	Overcurrent protection			A	Local switch: 25/Branch switch: 25
	Switch capacity			A	Local switch: 25/Branch switch: 25
	Control circuit wire size			mm^2	2
	Grounding wire diameter			mm^2	3.5

Note

1. Measurement conditions are as follows.
   Ambient temperature: 32°C, Evaporation temperature: -10°C, Suction gas temperature: 0°C
   Compressor operating frequency: 61Hz
   Fan control: Target condensation temperature = Ambient temperature + 5°C
2. Measurement conditions of sound pressure level are as follows.
   Ambient temperature: 32°C, Evaporation temperature: -10°C
   Measurement location: Distance from the front of the unit 1m, height 1m
   Compressor operating frequency: 66Hz
   Fan control: Target condensation temperature = Ambient temperature + 5°C
   Measurement conditions for the value in brackets are as follows.
   Compressor operating frequency: 61Hz
   Fan control: Target condensation temperature = Ambient temperature + 10°C
3. A pressure relief device, a sight glass and a dryer must be installed on the liquid pipe. Please procure these parts locally.
4. The figures in the angle brackets in the "Electric wire size" row indicate the maximum wire length where the voltage drop is 4V or less.
5. Power condenser cannot be installed.
6. Install an earth leakage breaker.
   Refer to the chart below to select proper earth leakage breaker.
   *Additionally, leaked current varies depending on wire length, wire routing, or presence of devices that emit high-frequency.
   Unit nominal output/Setting value
   under 2.2kW/sensitivity 15mA 0.1s
   2.2kW ~ 5.5kW/sensitivity 30mA 0.1s
   Select High-harmonic typed earth leakage breaker if the unit has inverter compressor.

1. Product specification

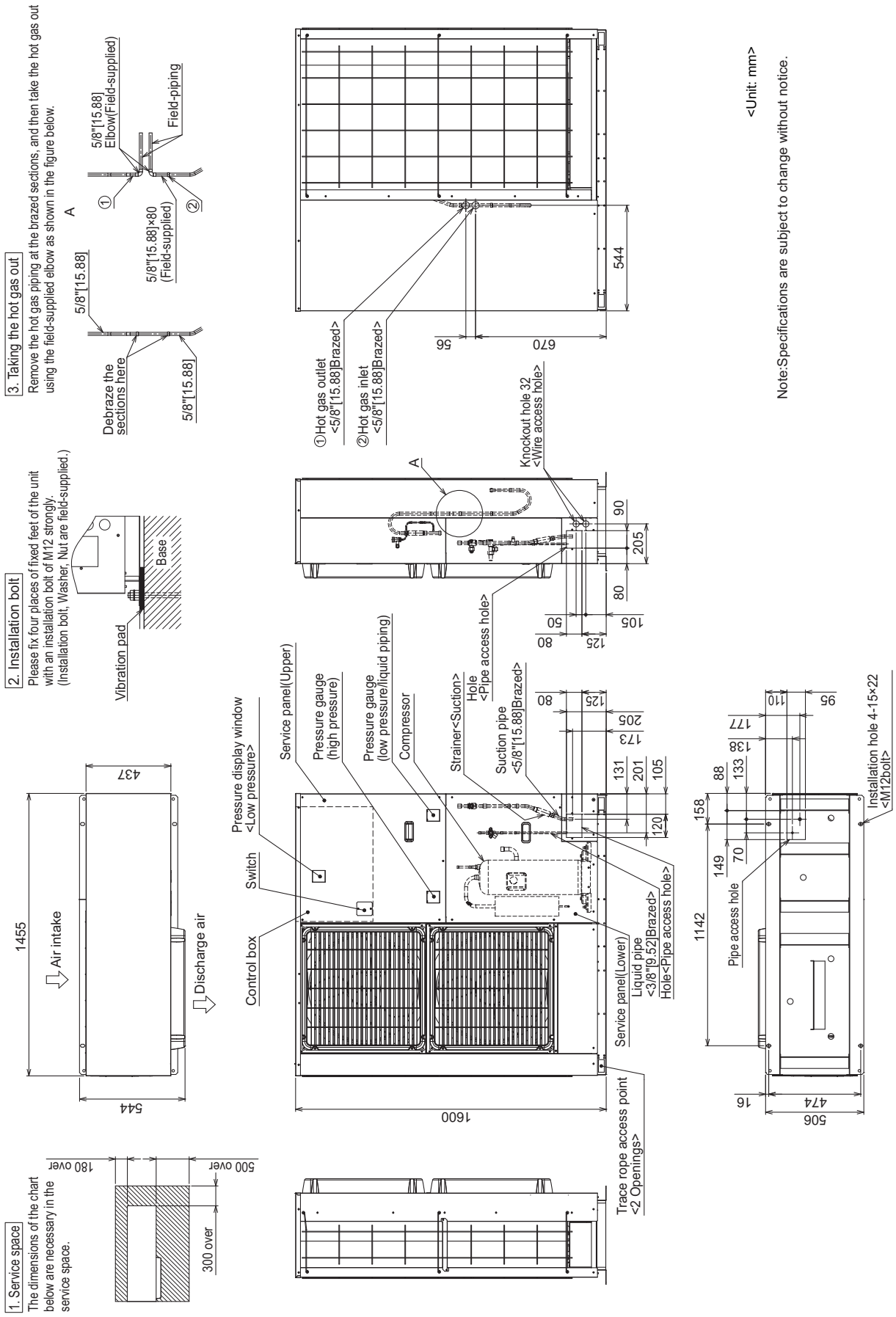
Item				Unit	ECOV-X55VA(-BS) <8HP>
Nominal output				kW	5.5
Suction pressure saturation temperature range				°C	-35 ~ -5
Refrigerant type				–	R744
Installation conditions				–	Outdoor installation
				°C	Ambient temperature -25 ~ +43
Power supply				–	3-phase 4-wire 380-400-415V 50Hz
Electrical Characteristics	Power consumption		<Note 1>	kW	10.0
	Operating current			A	17.3-16.5-15.9
	Power factor		<Note 6>	%	87.6
	Starting current			A	8.0
Operating frequency				Hz	35 ~ 95
Refrigerating capacity		ET=-10	<Note 1>	kW	16.0
SEPR				–	2.60
Compressor	Model			–	HXK17FA-Y (Scroll)
	Displacement volume			m^3/h	5.9
	Crank case heater			W	45
Lubricant	Type			–	MEL220
	Charged amount	Compressor		L	2.7
		Others		L	–
Condenser	Heat exchanger type			–	Salt-resistant corrugated fin & aluminum micro channel
	Fan	Motor output		W	74 × 2
		Fan diameter		mm	ø550 × 2
	Air flow rate			m^3/min	154.8
	Saturation pressure adjustment device			–	Electronic fan controller
Liquid receiver		Capacity		L	11
Capacity control				–	Inverter type
Startup method				–	Inverter startup
High-pressure-cut prevention function				–	Standard
Protection device <Note 4>	Pressure switch <high pressure/low pressure>			–	High pressure: Standard (Mechanical) Low pressure: Standard (Digital)
	Overcurrent protection			–	Standard
	Thermal switch (discharge pipe)			–	Standard (Mechanical)
	Thermal switch (compressor inner thermostat)			–	–
	Fuse	For surge absorber curcuit		–	250V 6.3A × 3
		For control circuit		–	250V 3.15A × 1, 6A × 2, 6.3A × 1
		For condenser fan		–	250V 5A × 2
		For condenser fan power supply		–	250V 6.3A × 2
	Reverse phase preventer			–	–
	Oil temperature detection protection			–	Standard
Built-in device <Note 4>	Pressure gauge			–	Standard <Discharge, Liquid>
	Suction accumulator			–	Standard
	Oil separator			–	Standard
Communication				–	MODBUS®
Accessories		Spare fuse		–	6A
		Other		–	Connector for emergency operation
				–	Termination resistance for MODBUS®
External finish				–	MUNSELL 5Y 8/1
External dimensions <Height × Width × Depth>				mm	1,600 × 1,455 × 506 (+ 38)
Weight	Package weight			kg	311
	Net weight			kg	290
Pipe size		Suction pipe		mm	ø15.88
		Liquid pipe	<Note 2>	mm	ø9.52
		Hot gas pipe		mm	–
Maximum piping length (equivalent)				m	50
Sound pressure level			<Note 3>	dB (A)	57.0 (54.0)
Electrical wiring <Note 7>	Electric wire size		<Note 5>	mm^2<m>	5.5 <61>
	Maximum Circuit Amp (MCA)			A	20
	Overcurrent protection			A	Local switch: 25/Branch switch: 25
	Switch capacity			A	Local switch: 25/Branch switch: 25
	Control circuit wire size			mm^2	2
	Grounding wire diameter			mm^2	3.5

Note

1. Measurement conditions are as follows.
   Ambient temperature: 32°C, Evaporation temperature: -10°C, Suction gas temperature: 0°C
   Compressor operating frequency: 95Hz
   Fan control: Target condensation temperature = Ambient temperature + 5°C
2. If the liquid pipe length exceeds 30 m, set the pipe diameter to 12.7 mm.
3. Measurement conditions of sound pressure level are as follows.
   Ambient temperature: 32°C, Evaporation temperature: -10°C
   Measurement location: Distance from the front of the unit 1m, height 1m
   Compressor operating frequency: 95Hz
   Fan control: Target condensation temperature = Ambient temperature + 5°C
   Measurement conditions for the value in brackets are as follows.
   Compressor operating frequency: 95Hz
   Fan control: Target condensation temperature = Ambient temperature + 10°C
4. A pressure relief device, a sight glass and a dryer must be installed on the liquid pipe. Please procure these parts locally.
5. The figures in the angle brackets in the "Electric wire size" row indicate the maximum wire length where the voltage drop is 4V or less.
6. Power condenser cannot be installed.
7. Install an earth leakage breaker.
   Refer to the chart below to select proper earth leakage breaker.
   *Additionally, leaked current varies depending on wire length, wire routing, or presence of devices that emit high-frequency.
   Unit nominal output/Setting value
   under 2.2kW/sensitivity 15mA 0.1s
   2.2kW ~ 5.5kW/sensitivity 30mA 0.1s
   Select High-harmonic typed earth leakage breaker if the unit has inverter compressor.

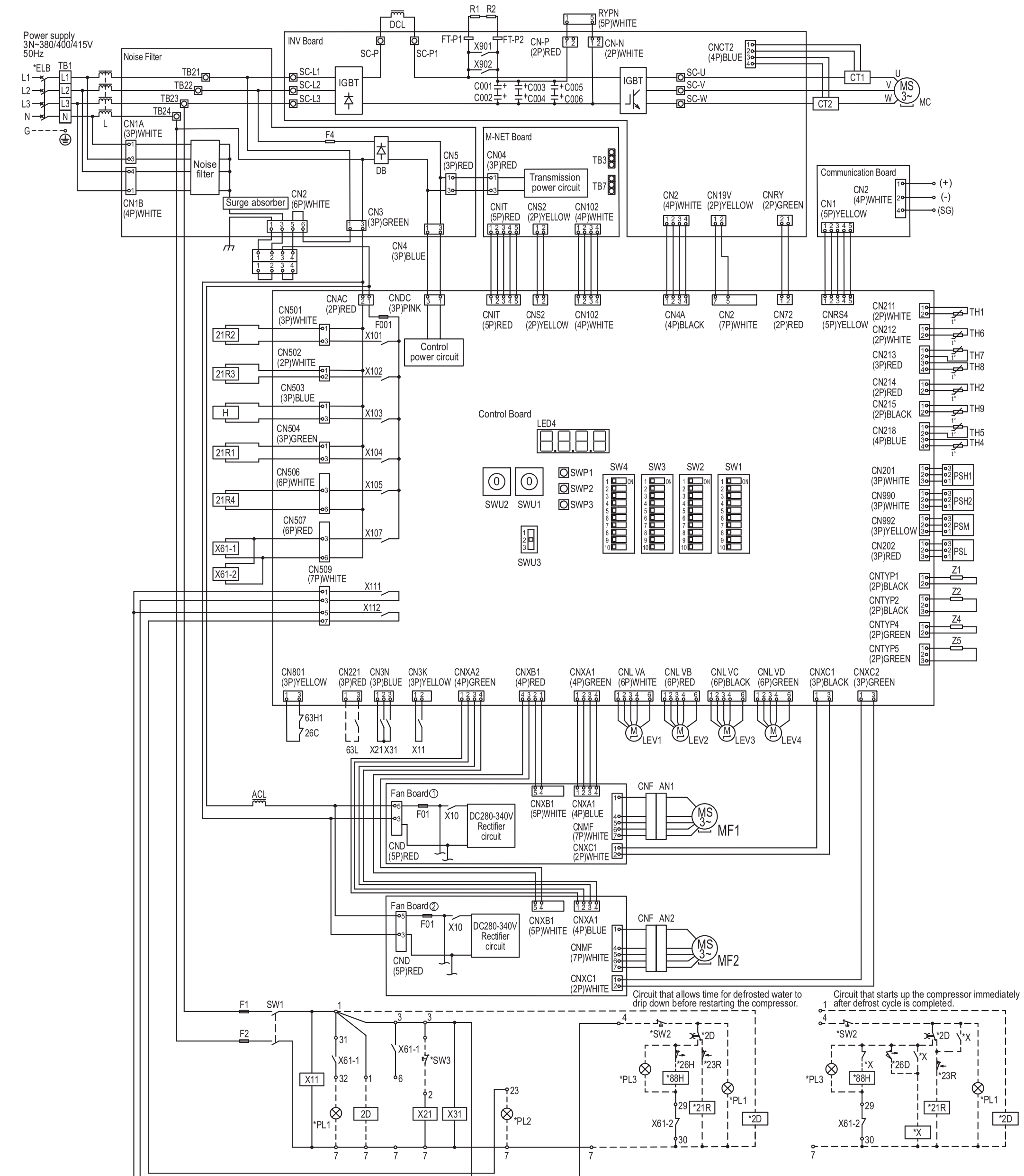
1-2. External dimensions

ECOV-X37, 55VA (-BS)



1-3. Electrical wiring diagram

ECOV-X37VA(-BS)



Note:Specifications are subject to change without notice.

Note 1. Those items marked with an asterisk are field-supplied.
2. Dotted lines in the diagram are field wiring.The circuit in the diagram is that of the pump down system.
3. The current carried by the circuits connected between terminals 23-7 and 4-2 must be between 0.01 and 0.3 A.
4. The arrows pointing the contact points indicate the ON/OFF operation of the contacts when pressure and/or temperature rises.
5. The b-contact at X61-2 is part of the circuit that prevent the condensing unit and the electric defrost heater from being simultaneously energized. To operate multiple evaporators individually, connect terminal 7 and 88H.
6. If PL1 is connected somewhere between terminal 32-7, it will light up and turn off according to the on/off status of the compressor. If it is connected on the downstream of SW2, it will light up and turn off according to the switch operation, regardless of the on/off status of the compressor.
7. Refer to the DATA BOOK for the temporary measures for handling the errors.
8. X103, X111, and X112 indicate the output contacts, and they operate as follows.

X103	ON when the compressor is stopped. OFF when the compressor is in operation.
X111	ON when the unit is in normal operation (operable). OFF when the unit is in error (inoperable).
X112	ON when the unit is in error (inoperable). OFF when the unit is in normal operation (operable).

9. The DIP switch, rotary switch, and slide switch located in the center of the main board show default settings.
10. SW3, which is connected between terminals 2 and 3, must have a minimum contact capacity of 11 mA or below.

Symbol	Component	Symbol	Component
ACL	AC reactor	SW1	Switch (ON/OFF)
C	Electrolytic capacitor	TH1	Thermistor <discharge pipe temperature>
CT1	Current sensor	TH2	Thermistor <compressor oil temperature>
CT2	Current sensor	TH4	Thermistor <gascooler outlet pipe temperature>
DCL	DC reactor	TH5	Thermistor <heat exchanger outlet pipe temperature>
DB	Diode bridge	TH6	Thermistor <outside air temperature>
F1	fuse(6A)	TH7	Thermistor <suction pipe temperature>
F2	fuse(6A)	TH8	Thermistor <liquid pipe temperature>
IGBT	IGBT module	TH9	Thermistor <oil pipe temperature>
L	Choke coil (for high frequency noise reduction)	X101~X113	Auxiliary relay (Control board)
LEV1	Linear expansion valve <decompression>	X61-1	Auxiliary relay
LEV2	Linear expansion valve <injection>	X61-2	Auxiliary relay
LEV3	Linear expansion valve <injection>	X901,X902	Magnetic relay (invertor main circuit)
LEV4	Linear expansion valve <oil>	Z1	resistor
MC	Motor (compressor)	Z2	resistor
MF1	Motor (fan)	Z4	resistor
MF2	Motor (fan)	Z5	resistor
PSH1	Pressure sensor (high pressure)	21R1	Solenoid valve
PSH2	Pressure sensor (low pressure)	21R2	Solenoid valve
PSM	Pressure sensor (low pressure)	21R3	Solenoid valve
PSL	Pressure sensor (low pressure)	21R4	Solenoid valve
R1	Resistor (in-rush current)	63H1	Pressure switch <high pressure>
R2	Resistor (in-rush current)	26C	Thermostat <discharge>
*ELB	Earth leakage breaker	*2D	Time switch (defrost)
*PL1	Pilot lamp (normal operation:green)	*21R	Solenoid valve (liquid)
*PL2	Pilot lamp (error:red)	*23R	Temperature controller (inside the unit)
*SW2	Switch (run-Stop:Pumpdown)	*26D	Temperature switch (defrost end)
*SW3	Switch (error reset)	*26H	Temperature switch (overheat protection)
*X	Auxiliary relay	*88H	Solenoid contactor (heater)

Signal specifications

Signal type	Terminal No.	Output signal	Current value range
Alarm signal	7-23	220~240V	0.01~0.3A
Compressor operation signal	6-7	220~240V	0.01~0.3A
Condensing unit operation signal	4-7	220~240V	0.01~0.3A

ECOV-X55VA(-BS)

Note 1. Those items marked with an asterisk are field-supplied.
2. Dotted lines in the diagram are field wiring.The circuit in the diagram is that of the pump down system.
3. The current carried by the circuits connected between terminals 23-7 and 4-2 must be between 0.01 and 0.3 A.
4. The arrows pointing the contact points indicate the ON/OFF operation of the contacts when pressure and/or temperature rises.
5. The b-contact at X61-2 is part of the circuit that prevent the condensing unit and the electric defrost heater from being simultaneously energized. To operate multiple evaporators individually, connect terminal 7 and 88H.
6. If PL1 is connected somewhere between terminal 32-7, it will light up and turn off according to the on/off status of the compressor. If it is connected on the downstream of SW2, it will light up and turn off according to the switch operation, regardless of the on/off status of the compressor.
7. Refer to the DATA BOOK for the temporary measures for handling the errors.
8. X103, X111, and X112 indicate the output contacts, and they operate as follows.

X103	ON when the compressor is stopped. OFF when the compressor is in operation.
X111	ON when the unit is in normal operation (operable). OFF when the unit is in error (inoperable).
X112	ON when the unit is in error (inoperable). OFF when the unit is in normal operation (operable).

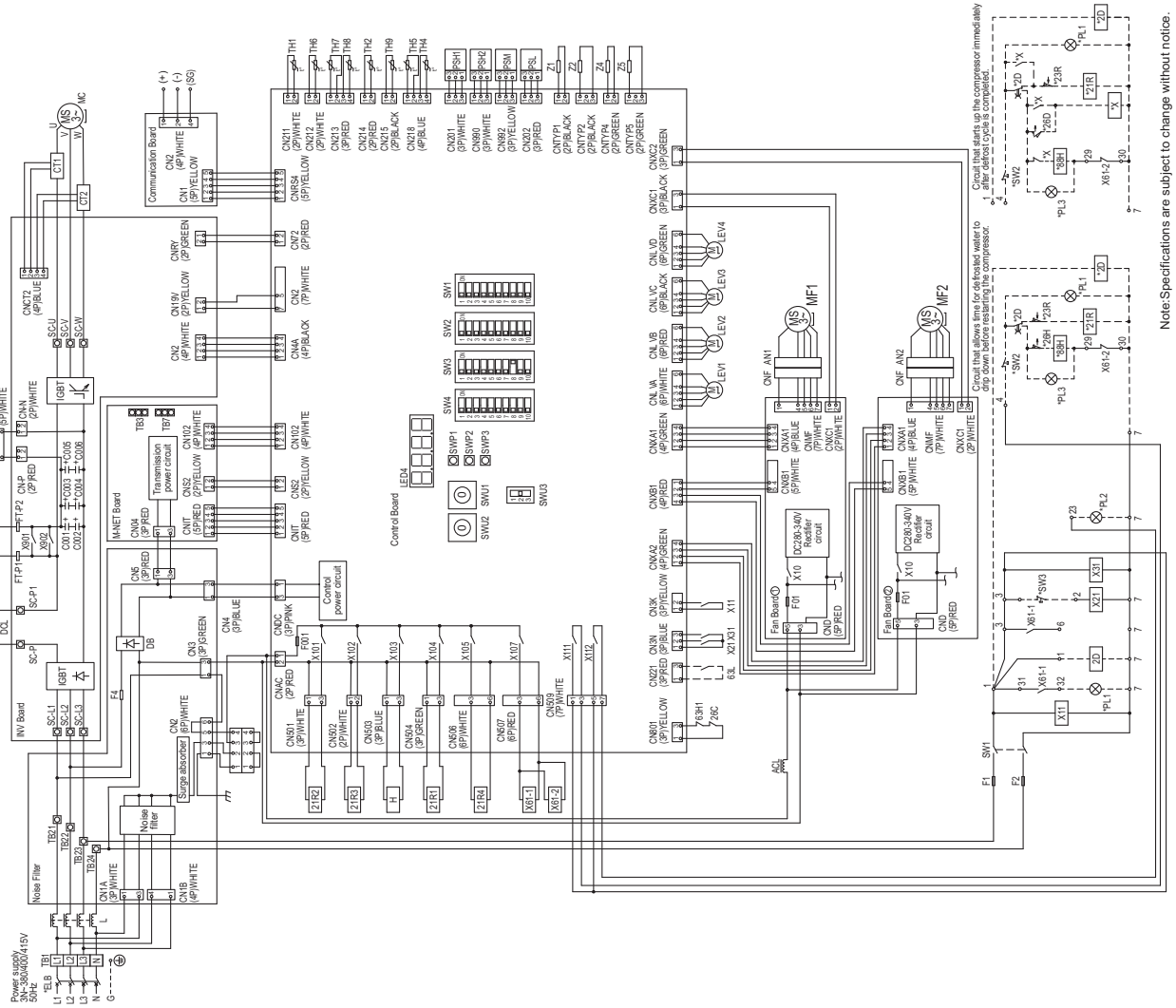
9. The DIP switch, rotary switch, and slide switch located in the center of the main board show default settings.
10. SW3, which is connected between terminals 2 and 3, must have a minimum contact capacity of 11 mA or below.

Symbol	Component	Symbol	Component
ACL	AC reactor	SW1	Switch (ON/OFF)
C	Electrolytic capacitor	TH1	Thermistor <discharge pipe temperature>
CT1	Current sensor	TH2	Thermistor <compressor oil temperature>
CT2	Current sensor	TH4	Thermistor <gascooler outlet pipe temperature>
DCL	DC reactor	TH5	Thermistor <heat exchanger outlet pipe temperature>
DB	Diode bridge	TH6	Thermistor <outside air temperature>
F1	fuse(6A)	TH7	Thermistor <suction pipe temperature>
F2	fuse(6A)	TH8	Thermistor <liquid pipe temperature>
IGBT	IGBT module	TH9	Thermistor <oil pipe temperature>
L	Choke coil (for high frequency noise reduction)	X101~X113	Auxiliary relay (Control board)
LEV1	Linear expansion valve <decompression>	X61-1	Auxiliary relay
LEV2	Linear expansion valve <injection>	X61-2	Auxiliary relay
LEV3	Linear expansion valve <injection>	X901,X902	Magnetic relay (invertor main circuit)
LEV4	Linear expansion valve <oil>	Z1	resistor
MC	Motor (compressor)	Z2	resistor
MF1	Motor (fan)	Z4	resistor
MF2	Motor (fan)	Z5	resistor
PSH1	Pressure sensor (high pressure)	21R1	Solenoid valve
PSH2	Pressure sensor (low pressure)	21R2	Solenoid valve
PSM	Pressure sensor (low pressure)	21R3	Solenoid valve
PSL	Pressure sensor (low pressure)	21R4	Solenoid valve
R1	Resistor (in-rush current)	63H1	Pressure switch <high pressure>
R2	Resistor (in-rush current)	26C	Thermostat <discharge>

*ELB	Earth leakage breaker	*2D	Time switch (defrost)
*PL1	Pilot lamp (normal operation:green)	*21R	Solenoid valve (liquid)
*PL2	Pilot lamp (error:red)	*23R	Temperature controller (inside the unit)
*SW2	Switch (run-Stop:Pumpdown)	*26D	Temperature switch (defrost end)
*SW3	Switch (error reset)	*26H	Temperature switch (overheat protection)
*X	Auxiliary relay	*88H	Solenoid contactor (heater)

Signal specifications

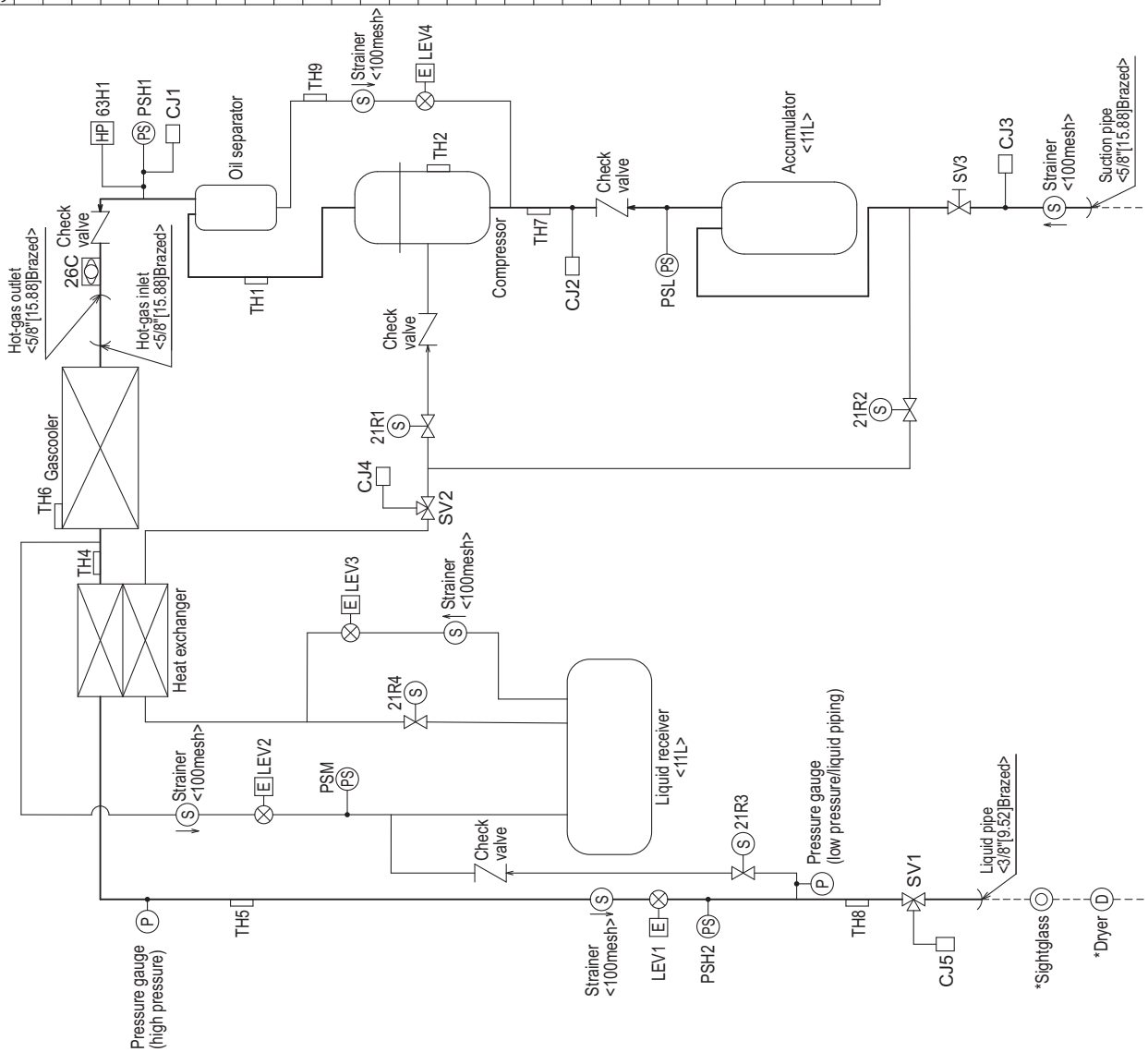
Signal type	Terminal No.	Output signal	Current value range
Alarm signal	7-23	220~240V	0.01~0.3A
Compressor operation signal	6-7	220~240V	0.01~0.3A
Condensing unit operation signal	4-7	220~240V	0.01~0.3A



1-4. Refrigerant circuit diagram

Symbol	Component	Trigger threshold
CJ1	Check joint	
CJ2	Check joint	
CJ3	Check joint	
CJ4	Check joint	
CJ5	Check joint	
LEV1	Electronic expansion valve	
LEV2	Electronic expansion valve	
LEV3	Electronic expansion valve	
LEV4	Electronic expansion valve	
PSH1	Pressure sensor <high pressure>	
PSH2	Pressure sensor <low pressure>	
PSM	Pressure sensor <low pressure>	
PSL	Pressure sensor <low pressure>	
SV1	Stop valve	
SV2	Stop valve	
SV3	Stop valve	
TH1	Thermistor <discharge pipe temperature>	
TH2	Thermistor <compressor oil temperature>	
TH4	Thermistor <gascooler outlet pipe temperature>	
TH5	Thermistor <heat exchanger outlet pipe temperature>	
TH6	Thermistor <outside air temperature>	
TH7	Thermistor <suction pipe temperature>	
TH8	Thermistor <liquid pipe temperature>	
TH9	Thermistor <oil pipe temperature>	
21R1	Solenoid valve	Open while energized
21R2	Solenoid valve	Open while energized
21R3	Solenoid valve	Open while energized
21R4	Solenoid valve	Open while energized
26C	Thermostat <discharge>	135°C OFF,115°C ON
63H1	Pressure switch <first high pressure>	12MPa OFF,8.5MPa ON

Note1.Those items marked with an asterisk are field-supplied.



1-5. Sound level

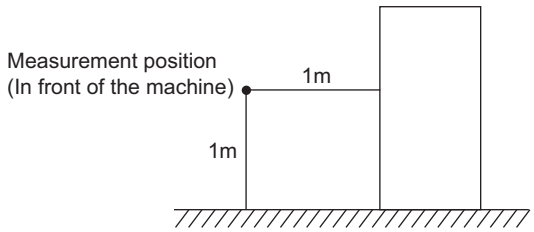
(1) Before replacing the fan, switch off the main power on the condensing unit.

Measurement conditions

Power supply 3-phase 400V 50Hz

Refrigerant R744 (CO_2)

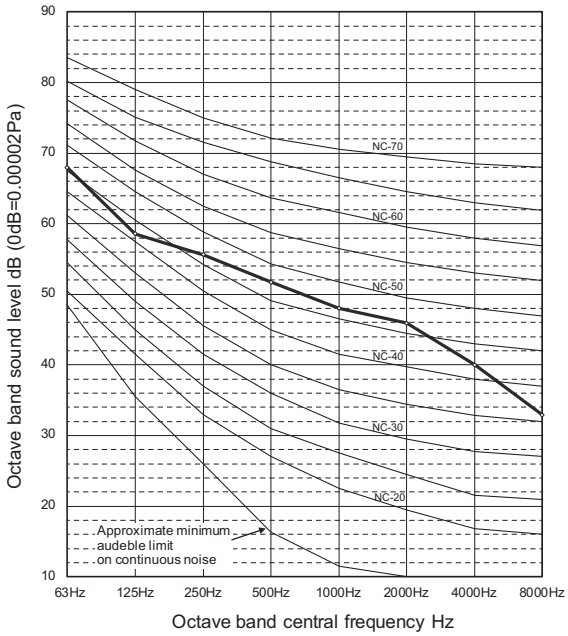
Measurement position



Note: The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JIS standard.
The sound pressure level actually measured at the installation site is usually higher than the value due to the influence of ambient noise and echoes.

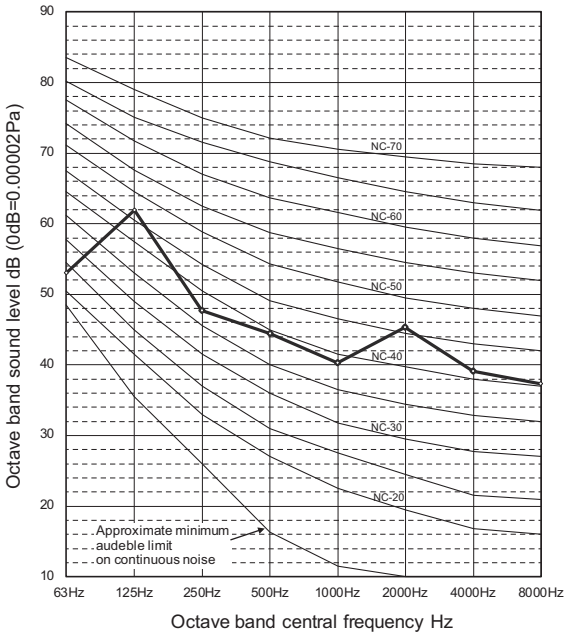
■ ECOV-X37VA

Standard operation



Octave band	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	A Scale
Octave band sound level (dB)	68.0	58.6	55.6	51.8	48.0	46.0	40.0	33.0	54.5

Low noise operation



Octave band	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	A Scale
Octave band sound level (dB)	52.9	61.8	47.6	44.4	40.2	45.2	39.0	37.3	51.0

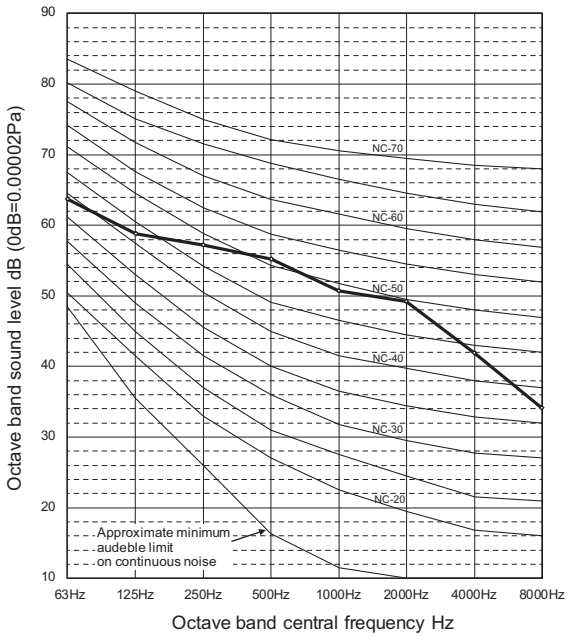
Measurement conditions

Evaporation temperature	-10°C
Ambient temperature	32°C
Target condensation temperature	Ambient temperature +5°C
Compressor operating frequency	66Hz

Evaporation temperature	-10°C
Ambient temperature	32°C
Target condensation temperature	Ambient temperature +10°C
Compressor operating frequency	61Hz

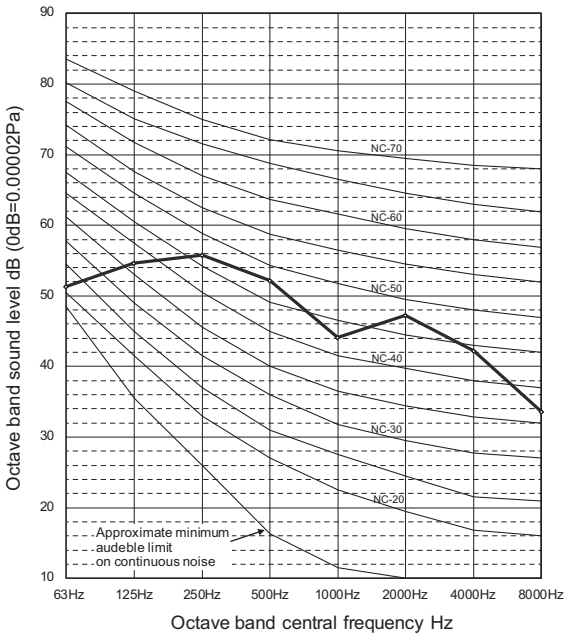
■ ECOV-X55VA

Standard operation



Octave band	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	A Scale
Octave band sound level (dB)	63.7	58.8	57.2	55.2	50.7	49.2	41.9	34.1	57.0

Low noise operation



Octave band	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	A Scale
Octave band sound level (dB)	51.3	54.7	55.7	52.1	44.1	47.2	42.2	33.6	54.0

Measurement conditions

Evaporation temperature	-10°C
Ambient temperature	32°C
Target condensation temperature	Ambient temperature +5°C
Compressor operating frequency	95Hz

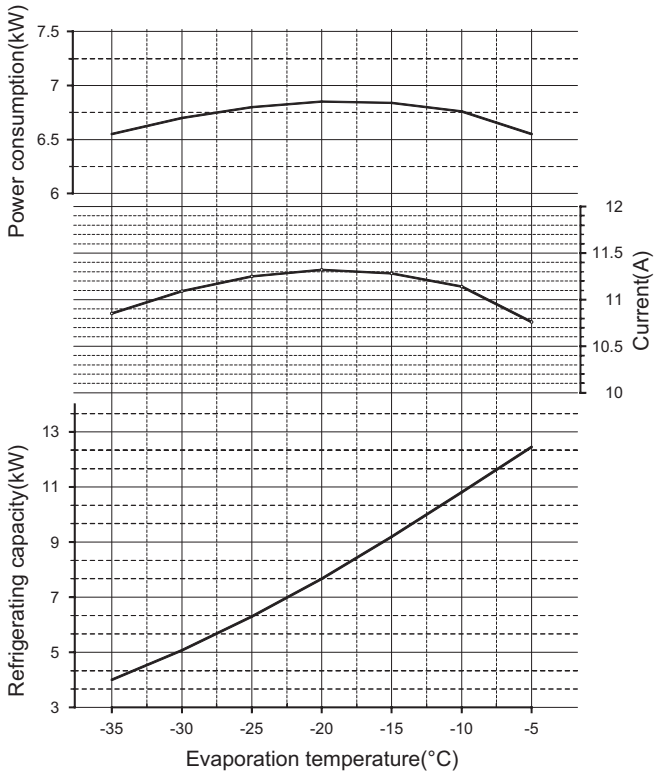
Evaporation temperature	-10°C
Ambient temperature	32°C
Target condensation temperature	Ambient temperature +10°C
Compressor operating frequency	95Hz

1-6. Capacity tables

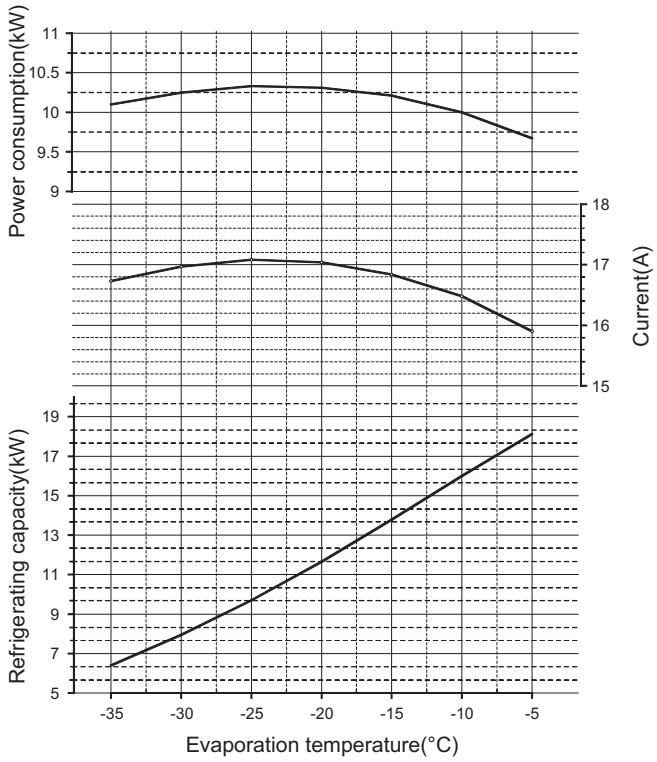
Power supply : 3-phase 4-wire 400V 50Hz
Superheat at the condensing unit inlet : 10K
Ambient temperature : 32°C

Note. When operating at a condenser intake air temperature of 37°C or higher, refer to the "Correction by temperature" for refrigerating capacity.

■ ECOV-X37VA
Operating frequency : 66Hz



■ ECOV-X55VA
Operating frequency : 95Hz



1-7. Correction by temperature

Model name	Item	Ambient temperature [°C]	Evaporation temperature [°C]						
			-35	-30	-25	-20	-15	-10	-5
ECOV-X37VA	Refrigerating capacity [kW]	5	5.70	7.28	9.01	10.8	12.8	14.7	16.7
		10	5.38	6.87	8.51	10.3	12.1	14.0	15.9
		15	5.07	6.46	8.00	9.67	11.4	13.3	15.1
		20	4.75	6.05	7.50	9.08	10.8	12.6	14.3
		25	4.44	5.64	7.00	8.50	10.1	11.8	13.5
		32	4.00	5.07	6.30	7.67	9.19	10.8	12.4
		37	3.69	4.66	5.79	3.67	4.47	5.57	6.96
		40	2.25	2.86	3.54	3.51	4.29	5.36	6.71
		43	2.15	2.72	3.38	3.36	4.11	5.15	6.47
ECOV-X55VA	Refrigerating capacity [kW]	5	9.11	11.4	13.9	16.5	19.2	21.8	24.3
		10	8.61	10.8	13.1	15.6	18.2	20.8	23.1
		15	8.11	10.1	12.3	14.7	17.2	19.7	22.0
		20	7.61	9.49	11.6	13.8	16.2	18.6	20.9
		25	7.10	8.85	10.8	12.9	15.2	17.5	19.7
		32	6.40	7.95	9.71	11.7	13.8	16.0	18.1
		37	5.28	6.54	7.99	4.17	5.08	6.33	7.91
		40	2.25	2.86	3.54	3.99	4.88	6.09	7.63
		43	2.15	2.72	3.38	3.82	4.67	5.85	7.35

Note1. The refrigerating capacity of each condition shows the maximum value.
Note2. The refrigerating capacity is measured at superheat 10K of the condensing unit inlet.

1-8. Correction by refrigerant piping length

ECOV-X37VA

Ambient temperature: 35°C

Suction pipe	Evaporation temperature	Equivalent piping length (m)					
		0	10	20	30	40	50
mm	°C	Refrigerating capacity (kW)					
ø15.88 (Standard)	-5	12.0	11.8	11.6	11.5	11.3	11.2
	-10	10.3	10.1	10.0	9.88	9.77	9.66
	-12	9.70	9.53	9.41	9.28	9.17	9.08
	-15	8.79	8.64	8.53	8.42	8.32	8.23
	-17	8.21	8.06	7.97	7.87	7.77	7.69
	-20	7.37	7.24	7.16	7.07	6.99	6.91
	-25	6.07	5.97	5.90	5.82	5.76	5.70
	-30	4.89	4.80	4.75	4.69	4.64	4.60
	-35	3.82	3.75	3.72	3.67	3.64	3.60
ø19.05	-5	12.0	11.9	11.8	11.8	11.7	11.7
	-10	10.3	10.2	10.2	10.1	10.1	10.1
	-12	9.70	9.61	9.57	9.52	9.48	9.44
	-15	8.79	8.71	8.67	8.63	8.59	8.56
	-17	8.21	8.13	8.10	8.06	8.02	8.00
	-20	7.37	7.30	7.27	7.24	7.21	7.18
	-25	6.07	6.01	5.99	5.96	5.94	5.92
	-30	4.89	4.84	4.82	4.80	4.78	4.77
	-35	3.82	3.78	3.77	3.75	3.74	3.73

ECOV-X55VA

Ambient temperature: 35°C

Suction pipe	Evaporation temperature	Equivalent piping length (m)					
		0	10	20	30	40	50
mm	°C	Refrigerating capacity (kW)					
ø15.88 (Standard)	-5	17.5	16.9	16.5	16.2	15.8	15.5
	-10	15.3	14.8	14.4	14.1	13.8	13.5
	-12	14.4	14.0	13.6	13.3	13.0	12.8
	-15	13.2	12.8	12.5	12.2	11.9	11.7
	-17	12.4	12.0	11.7	11.4	11.2	10.9
	-20	11.2	10.9	10.6	10.3	10.1	9.91
	-25	9.38	9.09	8.87	8.65	8.46	8.29
	-30	7.67	7.43	7.26	7.08	6.93	6.79
	-35	6.09	5.91	5.77	5.64	5.51	5.41
ø19.05	-5	17.5	17.2	17.1	16.9	16.8	16.7
	-10	15.3	15.1	14.9	14.8	14.7	14.6
	-12	14.4	14.2	14.1	14.0	13.8	13.7
	-15	13.2	13.0	12.9	12.8	12.7	12.6
	-17	12.4	12.2	12.1	12.0	11.9	11.8
	-20	11.2	11.1	11.0	10.9	10.8	10.7
	-25	9.38	9.25	9.17	9.08	9.01	8.94
	-30	7.67	7.56	7.50	7.43	7.37	7.31
	-35	6.09	6.01	5.96	5.90	5.86	5.82

- Please read the following safety precautions carefully before installing the unit to ensure safety.
- To ensure your safety, be sure to observe the precautions described in this section.

⚠ WARNING
Indicates a risk of death or serious injury.

⚠ CAUTION
Indicates a risk of serious injury or structural damage.

⚠ WARNING

All electric work must be performed by qualified personnel.
Air tightness test must be performed by qualified personnel.
Brazing work must be performed by qualified personnel.

2-1. General precautions

⚠ WARNING

Do not use the type of refrigerant other than the one indicated on the nameplate and in the manuals for the unit. Doing so may cause the pipes or the units to burst or explode, or cause a fire during use, during repair, or at the time of disposal of the unit. It may also be in violation of applicable laws. MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.

This appliance can be used by children aged from 8 years and above and persons with reduced physical, sensory or mental capabilities or lack of experience and knowledge if they have been given supervision or instruction concerning use of the appliance in a safe way and understand the hazards involved. Children shall not play with the appliance. Cleaning and user maintenance shall not be made by children without supervision.

Do not install the unit in a place where large amounts of oil, steam, organic solvents, or corrosive gases, such as sulfuric gas, are present or where acidic/alkaline solutions or sprays containing sulfur are used frequently. These substances can compromise the performance of the unit or cause certain components of the unit to corrode, which can result in refrigerant leakage, water leakage, injury, electric shock, malfunctions, smoke, or fire.

Do not try to defeat the protective features of the unit or make unauthorized setting changes. Forcing the unit to operate by defeating the safety features of the devices such as the pressure switch or the temperature switch, making unauthorized changes to the switch settings, or using accessories other than the ones recommended by Mitsubishi Electric may result in smoke, fire, burst pipes or units, or an explosion.

To reduce the risk of injury from falling tools, keep children away while installing, inspecting, or repairing the unit.

The refrigeration system is under high pressure. Do not tamper with it. Contact qualified service personnel before disposal.
Tampering with the system may result in refrigerant or water leakage, injury, electric shock, or fire.

Always replace a fuse with one with the correct current rating. The use of improperly rated fuses or a substitution of fuses with steel or copper wire may result in fire.

To reduce the risk of burns or electric shock, do not touch any electrical parts with bare hands during or immediately after stopping operation.

To reduce the risk of short circuit, current leakage, electric shock, malfunctions, smoke, or fire, do not splash water on electric parts.

To reduce the risk of electric shock, malfunctions, smoke, or fire, do not operate the switches/buttons or touch other electrical parts with wet hands.

Do not change the settings for the safety or protective features of the unit. Incorrect settings may cause the unit to burst or explode.

To reduce the risk of pipe burst or explosion, do not allow gas refrigerant and refrigerant oil to be trapped in the refrigerant circuit.

To reduce the risk of injury or electric shock, stop the unit and turn off the main power before cleaning, maintaining, or inspecting the unit. Coming in contact with the fan and other rotating parts may cause injury.

To reduce the risk of burns or frost bites, do not touch the refrigerant pipes or refrigerant circuit components with bare hands during and immediately after operation.

Do not touch the pipes with bare hands. Pipes become hot, posing a risk of burn injury.

Keep the space well ventilated. Refrigerant leaking into an air-tight space can cause oxygen deprivation. Refrigerant (CO_2) concentration above 0.1% can adversely affect health. If leaked refrigerant comes in contact with fire, toxic gas may be generated.

When tightening or loosening the check joint, use two spanners. The use of a single spanner may cause the pipe to twist and become damaged, resulting in refrigerant leakage, oil spatter, or oxygen deprivation.

Design the refrigerant circuit so that the circuit will meet all specifications. Refrigerant circuits that do not meet the specifications may cause electric leakage, fire, or burst pipes or units.

Stop the unit, turn off the unit, and contact your dealer or a customer service center if any abnormality (e.g., a burning smell) is noticed. Continued use of the unit may result in an electric shock, damage to the refrigerant circuit components, or fire.

To reduce the risk of electric shock, smoke, or fire due to infiltration of dust and water, properly install all required covers on the unit.

To reduce the risk of electric shock, smoke, or fire due to infiltration of dust and water, properly install all required covers and panels on the terminal box and control box.

To reduce the risk of injury from the unit falling or falling over, periodically check the installation base for damage.

This appliance is intended to be used by expert or trained users in shops, in light industry and on farms, or for commercial use by lay persons.

Consult an authorized agency for the proper disposal of the unit. Refrigerant oil and refrigerant that may be left in the unit pose a risk of fire, explosion, or environmental pollution.

⚠CAUTION

Do not place flammable objects or use flammable spray near the unit. Doing so may result in fire ignition, fire, or explosion.

Do not operate the unit without panels and safety guards properly installed. Coming in contact with the rotating parts, high-voltage parts, or high-temperature parts poses injury, electric shock, or burn injury hazards.

To reduce the risk of injury, do not sit, stand, or place objects on the unit.

Do not install the unit over things that are vulnerable to water damage from condensation dripping.

To reduce the risk of injury, do not touch the fan blades, heat exchanger fins, or sharp edges of components with bare hands.

Wear protective gear to keep oil spatter from getting on your skin.

Wear protective gear before touching any electrical components. Touching high-temperature or high-voltage components with bare hands poses burn or electric shock hazards. Some components (e.g., terminals) on the circuit boards or terminal blocks carry voltage for several minutes after the ON/OFF switch or the main power is turned off, posing electric shock hazards.

To reduce the risk of injury, do not insert fingers or foreign objects into air inlet/outlet grills of the fan.

To reduce the risk of injury, always wear protective gear when working on the unit.

Do not release refrigerant into the atmosphere. Have it properly disposed of by an authorized agency according to the applicable laws and regulations.

2-2. For transporting the unit

⚠WARNING

Lift the unit by placing the slings at designated locations. Support the unit securely at four points to keep it from slipping and sliding. If the unit is not properly supported, it may fall and cause personal injury.

⚠ CAUTION

To reduce the risk of injury, do not carry the unit by the PP bands that are used on some packages.

To reduce the risk of injury, products weighing 20 kg or above must be carried by two or more people.

2-3. For installation

⚠WARNING

Do not install the unit where there is a risk of leaking flammable gas. If flammable gas accumulates around the unit, it may ignite and cause a fire or explosion.

To reduce the risk of injury from coming in contact with the unit, install the unit where it is not accessible to people other than maintenance personnel.

Do not install the unit indoor, in a depressed space, or in a halfway basement. Leaked refrigerant can accumulate in these types of spaces.

To reduce the risk of injury, properly dispose of the packing materials. Plastic bags pose suffocation hazard to children.

A pressure relief device shall be installed in the high pressure side.
Failure to do so may result in a burst.

All installation work must be performed by the dealer or qualified personnel according to the instructions detailed in the Installation Manual. Improper installation work may cause refrigerant leakage, water leakage, injury, electric shock, or fire.

Remove packing materials from the unit before operating the unit. Note that some accessories may be taped to the unit. Properly install all accessories that are required. Failing to remove the packing materials or failing to install required accessories may result in refrigerant leakage, oxygen deprivation, smoke, or fire.

Take appropriate measures to safeguard against refrigerant leakage and resultant oxygen starvation. Install a refrigerant leak detector as required by the applicable regulations for a given space.

Any additional parts must be installed by the dealer or qualified personnel. Only use the parts specified by Mitsubishi Electric. Installation by unauthorized personnel or use of unauthorized parts or accessories may result in water leakage, injury, electric shock, or fire.

Properly install the unit in accordance with all applicable instructions and regulations. Failure to do so may cause the unit to topple over or fall down and cause personal injury.

Install the unit horizontally, using a level. A unit installed on an inclined surface can result in water leakage or topple over and cause injury.

To reduce the risk of injury from units falling or falling over, install the unit on a surface that is strong enough to support its weight.

⚠ CAUTION

To reduce the risk of rain water or drain water from entering the room and damaging the interior, drainage work must be performed by your dealer or qualified personnel according to the instructions detailed in the Installation Manual.

2-4. For piping work

⚠ WARNING

Use caution when operating the refrigerant service valve. Refrigerant may spew out and cause oxygen starvation, frost bites, or injuries.

To prevent a burst or an explosion, do not heat the unit with refrigerant gas in the refrigerant circuit.

To reduce the risk of refrigerant catching fire and causing burns, remove the refrigerant gas and the residual refrigerant oil in the pipes before heating them.

To reduce the risk of oxygen deprivation or gas poisoning, check for gas leakage with an appropriate leak detector, and keep fire sources away.

To reduce the risk of pipe damage, refrigerant leakage, or oxygen deprivation, use pipes that meet the pipe thickness specifications, which vary by the type of refrigerant used, pipe diameter, and pipe material.

Conduct an air-tightness test at the pressure specified on the unit and in the installation manual. Conducting an air tightness test above the specified pressure may result in damage to the unit and resultant refrigerant leakage, which can cause oxygen deprivation.

Evacuate the refrigerant circuit using a vacuum pump. Allowing the type of gasses other than the one specified to infiltrate into the refrigerant circuit may result in a burst or an explosion.

Insulate pipe connections after completing the air tightness test. Performing an air tightness test with the pipe being insulated may lead to failure to detect refrigerant leakage and cause oxygen deprivation.

To reduce the risk of explosion or deterioration of refrigerant oil caused by chloride, do not use oxygen, flammable gas, or refrigerant that contains chloride as a pressurizing gas.

To reduce the risk of pipe damage and resultant refrigerant leakage or oxygen deprivation, keep the field-installed pipes out of contact with the edges of components.

⚠ CAUTION

To reduce the risk of a burst or an explosion due to an abnormal pressure rise, do not allow any substances other than R744 (such as air) to enter the refrigerant circuit.

To keep the ceiling and floor from getting wet due to condensation, properly insulate the pipes.

2-5. For wiring work

⚠ WARNING

Replace damaged circuit boards immediately. Continued use of damaged circuit boards may result in abnormal heat generation or fire.

To reduce the risk of wire breakage, overheating, smoke, or fire, properly secure the wires in place and provide adequate slack in the wires so as not to stress the terminals.

To reduce the risk of wire breakage, overheating, smoke, or fire, keep undue force from being applied to the wires.

Tighten terminal screws to the specified torque. Loose screws or wire contact may cause smoke or fire.

To reduce the risk of injury or electric shock, turn off the main power before performing electrical work.

All electric work must be performed by a qualified electrician according to the local regulations, standards, and the instructions detailed in the Installation Manual. Use specified electrical wires and a dedicated circuit. Capacity shortage in the power supply circuit or improper installation may result in electric shock, malfunction, smoke, or fire.

To reduce the risk of electric shock, smoke, or fire, install an inverter circuit breaker on the power supply to each unit.

Use properly rated breakers and fuses (earth leakage breaker for inverter circuit, local switch <switch + fuse>, no fuse breaker). The use of breaker with a breaking capacity greater than the specified capacity may cause electric shock, malfunctions, smoke, or fire.

To reduce the risk of current leakage, overheating, smoke, or fire, use properly rated wires with adequate current carrying capacity.

Do not let bare wires protrude from the terminal block. Bare wires coming in contact with each other may cause electric shock, smoke, or fire.

Proper grounding must be provided by a licensed electrician. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod, or telephone wire. Improper grounding may result in electric shock, smoke, fire, or malfunction due to electrical noise interference.

⚠ CAUTION

To reduce the risk of current leakage, wire breakage, smoke, or fire, keep the wiring out of contact with the refrigerant pipes and other parts, especially sharp edges.

To reduce the risk of short circuit, electric shock, or malfunctions, keep wire shavings out of the terminal blocks.

2-6. For relocation and repairs

⚠ WARNING

Do not alter or modify the unit. The unit must only be moved, disassembled, or repaired by your dealer or qualified personnel. Unauthorized alteration, modification, or installation of the unit by unqualified personnel may result in refrigerant leakage, water leakage, injury, electric shock, or fire.

If the supply cord is damaged, it must be replaced by the manufacturer, its service agent, or similarly qualified persons in order to avoid a hazard.

To reduce the risk of short circuit, current leakage, electric shock, smoke, or fire, do not perform maintenance work in the rain.

To reduce the risk of injury, electric shock, or fire, properly reinstall all removed components after completing repair work.

R744 is cold. Avoid skin contact with R744.

To reduce the risk of frost burn, wear leather gloves before touching the refrigerant hose or the valve.

⚠ CAUTION

To reduce the risk of short circuit, electric shock, malfunctions, or fire, keep circuit boards dust free, and do not touch them with bare hands or tools.

To reduce the risk of refrigerant or water leakage, check the pipe supports and insulation for damage during inspection or repair, and replace or repair the ones that are found to be deteriorated.

The pressure of the refrigerant system using R744 is high. When removing R744 for maintenance or other purposes from the system, fix the refrigerant hose, and remove R744 gradually.

When removing R744 from the system, wrap the tip of the hose with a cloth, and remove R744 gradually. Refrigerant in the dry ice state may spew out along with a large amount of oil.

When removing R744 from the system, keep R744 away from plants and the building structures.

Observe all applicable local laws and regulations for the removal of R744.

2-7. Additional precautions

To avoid damage to the unit, use appropriate tools to install, inspect, or repair the unit.

Recover all refrigerant in the unit, and dispose of it properly according to any applicable laws and regulations.

Do not repeatedly turn on and off the main power supply switch in less than 10 minutes. Doing so may stress the compressor and cause the compressor to malfunction.

Operate the unit within the specified usage range. The use of the unit outside the specified operation range may cause the unit to malfunction.

Do not block the inlets or outlets of the unit. Obstruction of air flow may reduce the performance of the unit or cause the unit to malfunction.

Do not touch the switches on the unit or the components of the refrigerant circuit for no good reason. Doing so may change the operating mode and result in damage to the unit.

Only use R744. The use of refrigerant other than R744 may result in damage to the refrigerant system components.

Provide a maintenance access to allow for the inspection of pipes above the ceiling or the buried pipes.

Take appropriate measures against electrical noise interference when installing the air conditioning units in hospitals or facilities with radio communication capabilities. Inverter, high-frequency medical, or wireless communication equipment as well as power generators may cause the air conditioning system to malfunction. Air conditioning system may also adversely affect the operation of these types of equipment by creating electrical noise.

Direct the blazing torch flame away from the adjacent wires and sheet metal to keep them from being overheated and damaged.

Prepare tools for exclusive use with R744. Do not use the following tools if they have been used with other types of refrigerant: gauge manifold, charging hose, refrigerant leak detector, check valve, refrigerant charge spout, vacuum gauge, and refrigerant recovery equipment. If other types of refrigerant, refrigerant oil, or water remaining on these tools enter the refrigerant circuit, the refrigerant oil in the new system may deteriorate and the equipment may malfunction.

Use a vacuum pump with a check valve so that the vacuum pump oil will not backflow into the refrigerant circuit and cause the refrigerant oil to deteriorate.

Have a set of tools for exclusive use with R744. Consult your nearest Mitsubishi Electric Dealer.

Keep dust, dirt, and water off the charging hose. Infiltration of dust, dirt, or water into the refrigerant circuit may cause the refrigerant oil to deteriorate or damage the compressor.

Use refrigerant piping and couplings that are suitable for use with R744. Keep the inner and outer surfaces of pipes and couplings clean and free of such contaminants as sulfur, oxides, dust, dirt, shaving particles, oil, and moisture. Failure to do so may result in the deterioration of refrigerant oil and compressor failure.

Store the piping materials indoors, and keep both ends of the pipes sealed until immediately before brazing. Keep elbows and other joints in plastic bags. Infiltration of dust, dirt, or water into the refrigerant circuit may cause the refrigerant oil to deteriorate or damage the compressor.

To reduce the risk of oxidized film from entering the refrigerant pipe and causing the refrigerant oil to deteriorate or damaging the compressor, braze pipes under nitrogen purge.

Do not use the existing pipes. The high and low pressures in R744 systems are higher than those in the systems using other types of refrigerants, and the use of pipes not suitable for R744 may result in damage to the unit.

Charge the refrigerant from the high-pressure side. Charging the refrigerant from the low-pressure side may result in compressor damage.

Do not use a charging cylinder.

To reduce the risk of power capacity shortage, always use a dedicated power supply circuit.

To reduce the risk of both the breaker on the unit side and the upstream breaker from tripping and causing problems, split the power supply system or provide protection coordination between the earth leakage breaker and no-fuse breaker.

Have a backup system, if failure of the unit has a potential for causing significant problems or damages.

The installer must carry an R744 leak detector when installing or uninstalling the unit.

2-8. Installation process and safety precautions for use with R744

<Steps for installation>	<Safety precautions for use with R744>	<Page>
Determination of installation area		
Check of condensing unit specifications	• Check that the unit is intended for use with R744. • Check the design pressure. (High pressure 12.0 MPa, Low pressure 8.0 MPa) • Use new pipes only.	
Drawing of working diagrams		
Installation of showcase/unit cooler	• Check that the unit is intended for use with R744.	
Refrigerant piping work (Dry, clean, tight) *1	• Check that the inside of the pipes is in proper condition. • Braze the pipes under nitrogen purge. • Use a torque wrench to tighten nuts. • Carry an R744 leak detector.	P34
Drain piping work		
Electrical wiring		
Foundation work of condensing unit		
Installation of condensing unit		P28
Refrigerant piping work Refer to *1.	• Do not allow the refrigerant oil to be exposed to air for more than 10 minutes, even during servicing. • Install a safety valve on the high-pressure side.	P34
Air tightness test	• Perform an air tightness test. (Design pressure for refrigerant pipes and indoor units 8.0 MPa) x 24 hours The condensing unit has been subjected to an air tightness test prior to shipping.	P39
Heat-insulting work		
Vacuum drying	•Perform vacuum drying for one hour after the vacuum level reaches 266Pa on the vacuum gauge. •Use a specified vacuum pump with a check valve.	P40
Refrigerant charging	•Use the proper amount of refrigerant and the proper amount of additionally charged refrigerant. •Charge the system with liquid refrigerant only. •Use a specified gauge manifold and a specified charging hose. •Write down the amount of the charged refrigerant on the rating nameplate with an indelible pen.	P44
Electric wiring of condensing unit		P46
Target evaporation temperature setting		
Test run	• Check that the unit is not under short-cycling operation. • Check that the target evaporating temperature is appropriate.	P52
Leakage check		
Providing guidance on the usage to the end users		

2-8-1. Characteristics of R744

R744 is a natural refrigerant with the ozone depletion potential of zero and the global warming potential of 1.
The pressure of R744 at the normal temperature (25°C) is as high as 6.4 MPa, which is approximately five times that of R404A (1.24 MPa), requiring more stringent safety precautions.

2-8-2. Notes for the handling of R744

Seek appropriate treatment if exposed to R744.

(1) If R744 was inhaled

Move to an area with fresh air. Keep warm, and seek medical attention immediately.

(2) Skin contact with R744

Do not rub the affected area. Warm the affected area with lukewarm water, wrap a piece of gauze around, and seek medical attention immediately.

(3) If R744 gets in the eyes

Rinse the affected area with clean water, and seek medical attention immediately.

2-8-3. Precautions for working with R744

The pressure of the refrigerant system using R744 is high. When removing R744 for maintenance or other purposes from the system, fix the refrigerant hose, wrap the tip of the hose with a cloth, and remove R744 gradually.
R744 is cold. Avoid skin contact with R744.
Wear leather gloves before touching the refrigerant hose or the valve.

3-1. Usage conditions

Usage	-	Low/Medium temperature
Refrigerant type	-	R744
Evaporation temperature	°C	-35 to -5
Suction pressure	MPa	1.10 to 2.94
Heat level of suction gas	K	10 to 40
Suction gas temperature	°C	18 or below
Discharge pressure	MPa	2.75 to 11.0
Discharge gas temperature	°C	120 or below
Compressor shell bottom temperature	°C	80 or below
Ambient temperature	°C	-25 to 43
Power supply voltage	-	3-phase 4-wire 380/400/415 V ± 10%, 50 Hz
Voltage imbalance	%	2 or less
Connected pipe length (suction/liquid)	m	50 or below*1*2*3
Installation location	-	Outdoor*4

*1. Length that meets the piping work conditions stated in the Installation Manual, guarantees the proper oil return to the unit, and prevents refrigerant overcharge.
*2. Indicates an equivalent length.
*3. Refer to the relevant pages for details about the connected pipe length and allowable amount of refrigerant to be charged.
*4. Refer to the relevant pages. (page 28)

3-2. Usage conditions/environment

Follow the condition/environment specified below for installation.

Do not install the unit on moving vehicles such as cars or ships.

Do not install the unit in a place where acidic solutions or sprays containing sulfur are used frequently.

Avoid unsuitable places (hot springs, places where chemicals are frequently used) for installation.

Install the unit in an area where the noise from the unit will not disturb the neighbors.

Do not install the unit in a place where it is subjected to radiant heat from other heat sources.

Properly install the unit on a stable, load-bearing surface.

Do not install the unit in any environment where it can be exposed to airborne iron or copper powder, acidic or alkaline atmosphere, or an accumulation of a large amount of sand containing sea salt particles. Such environments can cause corrosion of the aluminum pipes.

Do not install the unit in a place where large amount of oil, steam, ammonia, or corrosive gas such as sulfuric gas is present. (Such place includes near a chimney opening.)

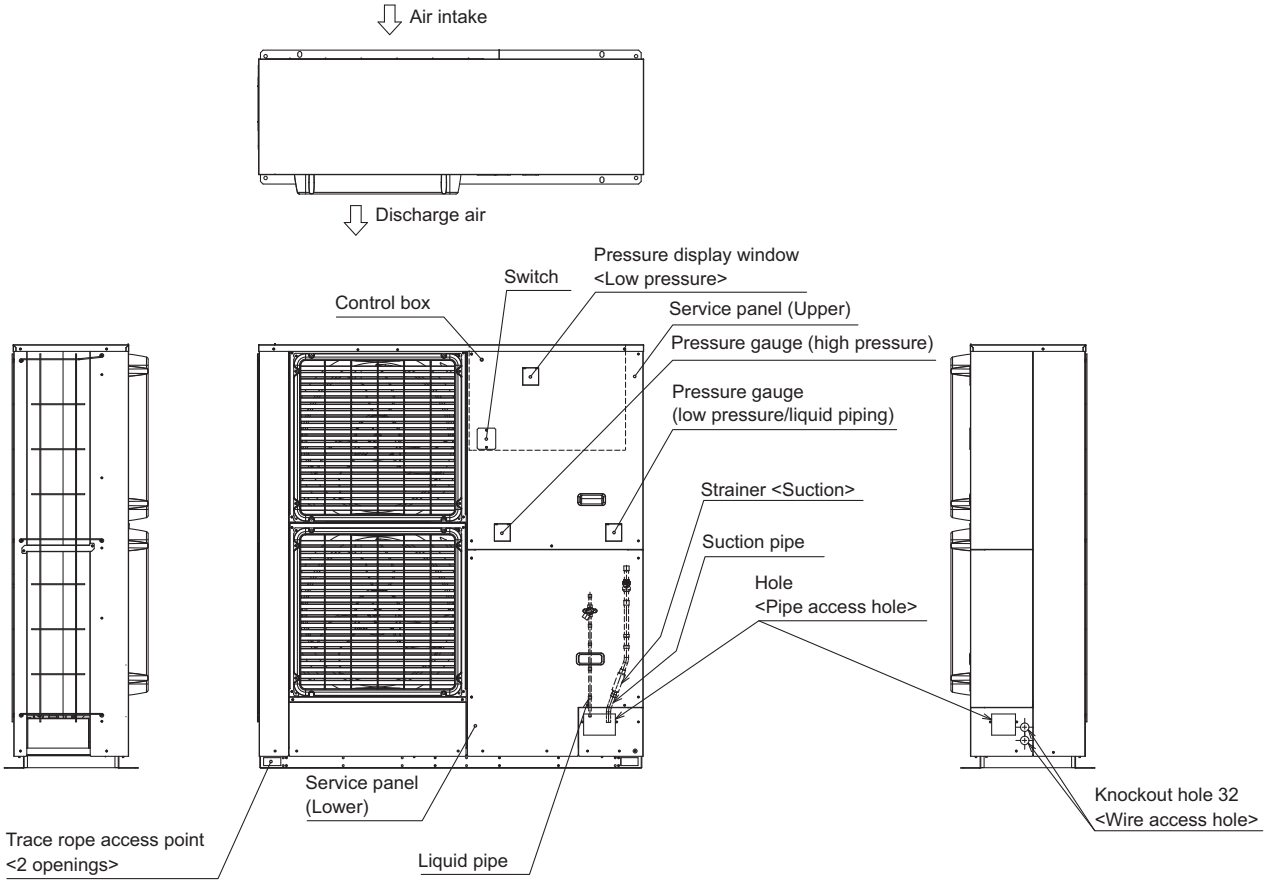
Do not install the unit in a space that is not large enough as specified in the DATA BOOK. (Page 29)

Do not install the unit in an area with heavy snowfall exceeding the tolerance of snow prevention work advised in the DATA BOOK. (Page 30)

Do not install the unit in an area where the air is stagnant, such as indoors, in a halfway basement, or in a depressed space.

4-1. Unit components

4-1-1. ECOV-X37VA, ECOV-X55VA



4-2. Package contents

Type	ECOV-X37VA, ECOV-X55VA
Fuse*1	6A
Connector for emergency operation*1	1
Termination resistance for MODBUS® *1,*2	1

*1 Packaged in the control box.

*2 For usage, refer to the MODBUS® Interface Manual.
Please contact the local distributor for the MODBUS® Interface Manual.

4-3. Transporting and unpacking the unit

(1) Transporting the unit

- Do not lift the unit. The unit must not be lifted and carried by hand.
  The handles on the unit are intended to be used for positioning during installation.
- If PP bands are used on the package of the unit, do not lift the unit in a way that applies a load on any of the PP bands.
- The unit must be upright during transportation and installation.

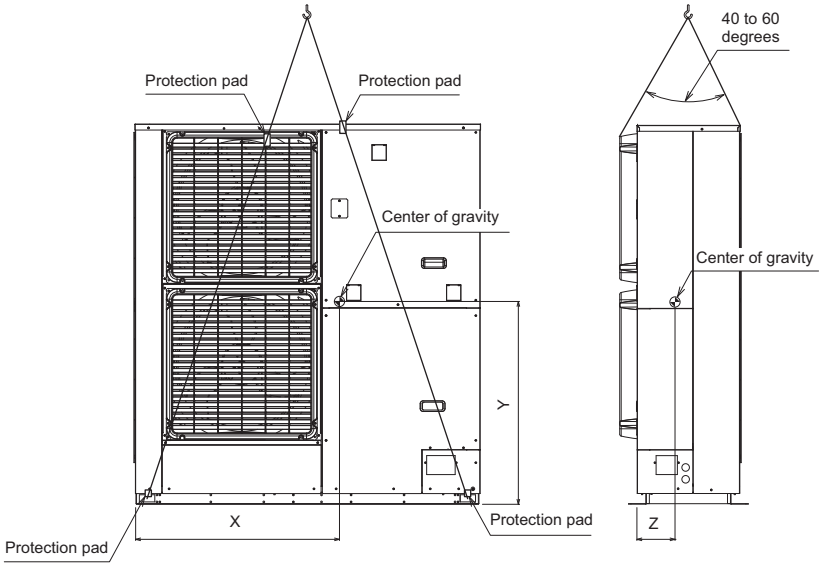
(2) Unpacking the unit

- Plastic bags can pose suffocation and choking hazards. Keep out of the reach of children and tear them before disposal.

(3) Lifting the unit

- If the unit needs to be lifted for installation, pass ropes through the two hanging parts at right and left under the unit.
- The ropes must support the unit at four points. Take measures to prevent any shock to the unit while it is lifted.
- The roping angle must be within 40 to 60 degrees as shown in the figure below.
- Use two ropes with sufficient length. <7 m or longer>
  The thickness of the ropes must match the size of the rope suspension parts.
  If the ropes are too thin, they may break and cause the unit to fall.
- The surfaces of the unit that come into contact with the ropes may be scratched if unprotected. Use rags or cloths to protect the surfaces.

Center of gravity



Model	ECOV-X37VA, ECOV-X55VA
Weight (kg)	290
X (mm)	857
Y (mm)	608
Z (mm)	215

5-1. Precautions for installing the unit

Note

- Protect and maintain the pipes to prevent infiltration of contaminants such as water and dirt.
- Nitrogen purge is required to prevent formation of oxide scale while brazing the pipes.

The unit contains a scroll compressor. The usage of this unit is different from that of a unit containing a reciprocating compressor. Improper use may cause damage to the compressor. Read carefully and follow the directions below.

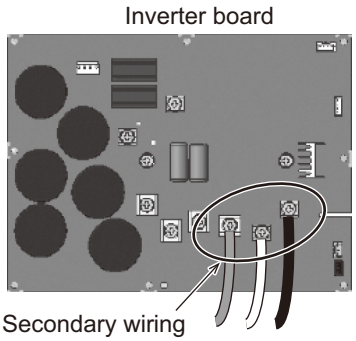
(1) Use R744 refrigerant.
The design pressure on the high-pressure side is 12 MPa, and that on the low-pressure side is 8 MPa. (Refer to "5-2-1. Refrigerant pipes".)
Only use the refrigerant that is specified by Mitsubishi Electric.

(2) Entire compressor is hot.
The entire compressor is hot during operation and immediately after stoppage. Wait for the pressure and temperature inside the compressor to drop, especially before conducting a test run, maintenance, or servicing.

(3) Use ester oil as refrigerant oil.
Ester oil is used for this unit. Ester oil easily absorbs moisture and tends to cause deterioration of the refrigerant oil or formation of sludge (hydrate). Therefore, complete vacuum drying is required.

Ensure to follow the basic requirements and precautions for piping work to prevent infiltration of water or dirt.

(4) Do not change the wiring connection on the secondary side.
Do not change the phase of the wiring between the Inverter board and the compressor.
Do not change the phase at the compressor terminal block.



(5) Vacuum drying without specified tools is prohibited.
Vacuum drying must be performed by a specialist. Do not force the unit to operate with the refrigerant service valve (ball valve) <suction> closed. Refer to the relevant pages for the vacuum drying procedures. (page 40)

(6) Forced stop of the evaporator fan is prohibited.
Do not operate the unit with the evaporator fan stopped (except for the short period of time immediately after defrosting).
Close the solenoid valve <liquid> and pump down-stop the unit before stopping the evaporator fan.

(7) Closing the refrigerant service valve <suction> during operation is prohibited.
Pump down operation, which causes a sudden decrease in the low pressure (for example, by closing the refrigerant service valve (ball valve) <suction> during operation) may cause the refrigerant to foam, resulting in migration of a large amount of refrigerant oil out of the compressor and damage to the compressor.
Spend at least 30 seconds decreasing the pressure, for example, from 1.2 MPa to 1.0 MPa.

5-2. Specifications of general commercial parts

5-2-1. Refrigerant pipes

Do not reuse the existing pipes!

(1) Piping materials/Wall thickness

The design pressures of the liquid line and suction line are as shown in the table below.

Liquid line (Unit outlet)	Suction line (Unit inlet)	Hot gas routing line
8.0 MPa	8.0 MPa	12.0 MPa

The thickness of pipes to be used depends on the type of refrigerant used, pipe diameter, and pipe material. Use pipes with appropriate thickness for a given application.

The pipe sizes for the liquid line (unit outlet) and suction line (unit inlet) are as shown in the table below.

mm (in.)

Liquid line (Unit outlet)	Suction line (Unit inlet)
ø9.52 (3/8)	ø15.88 (5/8)

(2) Copper pipe bending

Make sure that no wrinkles form when bending copper pipes. Such wrinkles may reduce the pipe thickness and/or increase the resistance to refrigerant flow.

(3) Brazing material

In a corrosive atmosphere, such as where there is a high sulfurous acid gas concentration, use silver filler. Do not use low-temperature fillers as they do not have sufficient strength.

(4) Flux

Select the flux according to the type and shape of substrate, filler type, and brazing method.

(5) Insulation

Refer to the relevant pages for details about heat insulation. (page 45)

(6) Electrical wiring

For more information on transmission lines (MODBUS®), refer to the MODBUS® Interface Manual.
Refer to the relevant pages for more information on the power line, grounding wire, and control wire (220-240 V). (page 48)

(7) Dryer

Refer to the relevant page for details about the dryer. (page 36)

(8) Sight glass

Refer to the relevant page for details about the sight glass. (page 36)

6-1. Statutory compliance

Select an installation location that is in compliance with the applicable laws and regulations related to noise, vibration, and installation environment.

6-2. Consideration for pollution prevention and environment protection

Select an installation location in consideration of pollution prevention and environment protection.

6-3. Selecting the installation site

Select an installation location that meets the following requirements so that the unit functions properly.

6-3-1. Installation environment and restrictions

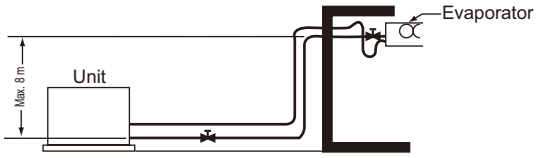
- Select a place where the gas cooler inlet air temperature is -25 to 43°C and there is good airflow.
- Do not install the unit in a location where the gas cooler is exposed to direct sunlight. Take appropriate measures to protect the unit from the sunlight as necessary.
- Install the unit in a location where the noise or vibrations from the unit will not be a problem. (The unit must be installed according to the applicable laws and regulations.)
- Do not place any inflammable materials (such as foamed styrol and cardboards) near the unit.
- Select a place where there is plenty of space for operation or servicing.
- Take appropriate measures to prevent unauthorized access to the installation site and machine room.
- Do not install the unit indoor, in a depressed space, or in a halfway basement.
- A pressure relief device must be installed on the high pressure side.
- Install a gas leak detector according to the applicable laws and regulations.
- **The all-aluminum heat exchanger may corrode if it comes into contact with substances contained in water spray.**
  Do not spray water on the unit.
- Do not install the unit in any environment where it can be exposed to airborne iron or copper powder, acidic or alkaline atmosphere, or accumulation of a large amount of sand containing sea salt particles. Such environments can cause corrosion in the aluminum pipes.
- Provide a certain amount of space around the unit for operation, maintenance, servicing, and heat dissipation. Insufficient space may decrease the refrigerant capacity and cause an operation failure.

6-4. Height difference between devices

6-4-1. Height difference between the condensing unit and the evaporator

(1) When installing the evaporator above the unit

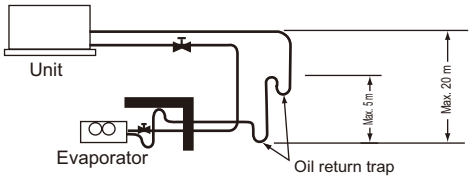
Keep the height difference (between the end part of the liquid pipe on the unit and the one on the evaporator) within 8 m.
A large height difference may cause a pressure drop due to the head difference of liquid refrigerant, generating flash gas.



When the evaporator is installed above the unit

(2) When installing the evaporator below the unit

Keep the height difference (between the highest suction pipe and the lowest suction pipe) within 20 m.
A large height difference may cause a poor oil return to the compressor, resulting in a compressor failure. Install an oil return trap at every 5 m.



When the evaporator is installed below the unit

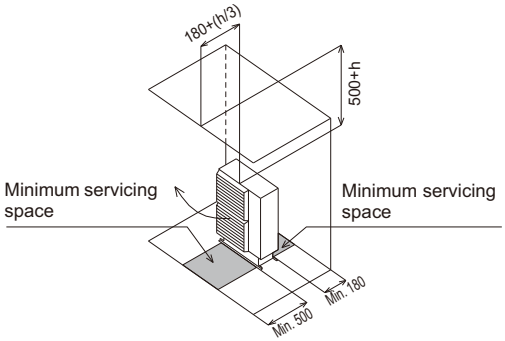
6-5. Required space

- Minimum installation spaces are shown below that are required for the use of the unit at the maximum ambient operating temperature. Up to three units can be installed side by side in each block.
- Letters "D" and "h" in the figure represent arbitrary values. (e.g. 100, 200)
  (The air flow direction is upward in the examples.)

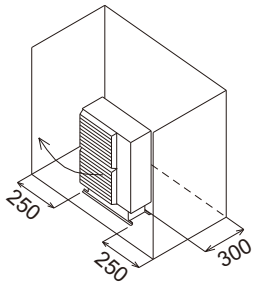
6-5-1. Installation examples: Maximum ambient operating temperature of 43°C

(Unit: mm)

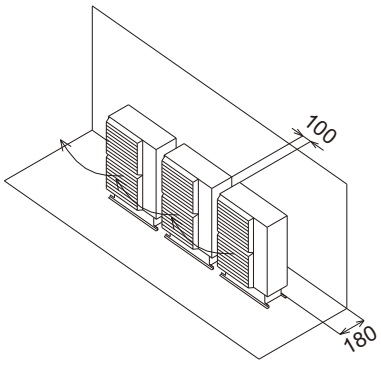
(1) Installation of a single unit with objects blocking the rear and top of the unit (unblocked on the sides and at the top)



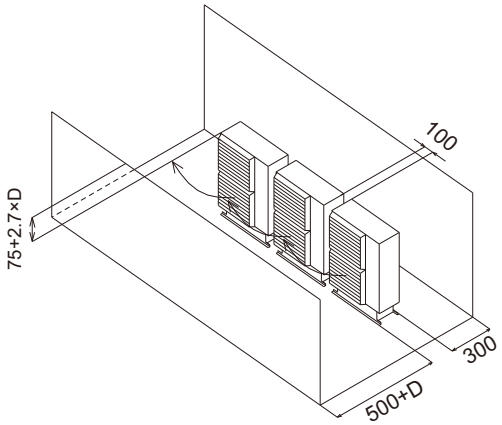
(2) Installation of a single unit with objects blocking both sides and the rear of the unit (unblocked in the front and at the top)



(3) Side-by-side installation of multiple units with objects blocking the rear of the units (unblocked in the front, on the sides, and at the top)



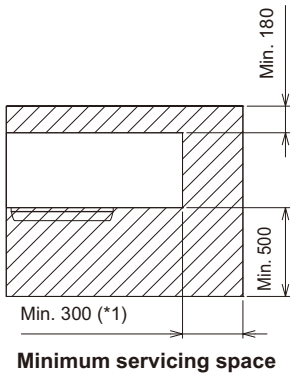
(4) Side-by-side installation of multiple units with objects blocking the rear and front of the units (unblocked on the sides and at the top)



6-5-2. Minimum servicing space

Provide a space around the unit for installation work and maintenance as shown in the figure.

*1 To route the pipe from the right side of the unit, a space of approximately 300mm is required on the right side.



Minimum servicing space

6-6. Measures against strong winds

Precautions for installing the unit in a place exposed to strong winds

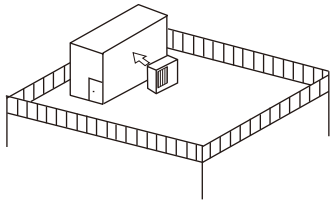
This unit is standard-equipped with air deflector grills to protect itself against headwinds. However, if the unit is installed on a roof or in an isolated place with no surrounding buildings, take appropriate measures so that the air discharge outlet on the unit is not exposed to winds. If strong winds blow directly into the air discharge outlet, the unit cannot hold sufficient air and will fail to operate properly.

If powder snow is expected to blow on the front side of the unit in winter, install a wall in front of the unit to keep the snow from entering the unit. When powder snow blows directly into the air discharge outlet while the unit is stopped, the snow entering the unit may cause operation problems.

(1) Installing the unit near a wall

Install the unit so that the air discharge outlet will face the wall. Leave 500 mm between the unit and the wall.

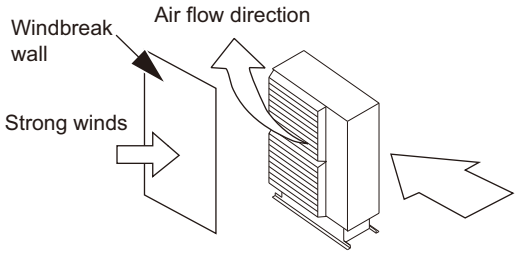
If the wall height exceeds the unit height, refer to the installation examples in the previous section to determine the amount of the space between the unit and the wall.



(2) Installing the unit in a place exposed to winds

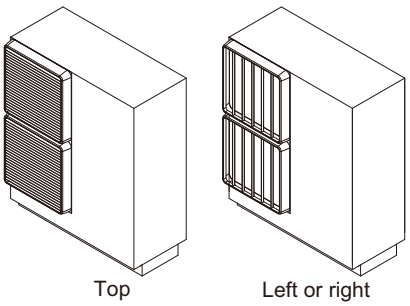
Install the unit so that the air discharge outlet is perpendicular to the direction of the winds.

If powder snow is expected to blow directly into the air discharge outlet, install a wall in front of the unit to keep the snow from entering the unit. Leave 500 mm between the unit and the wall.



Do not direct the air discharge outlet downward.

- Air deflector grills can direct the air upward (factory setting), to the left, or to the right. Select the air flow direction to suit the local installation conditions. (Refer to the figures on the right.)



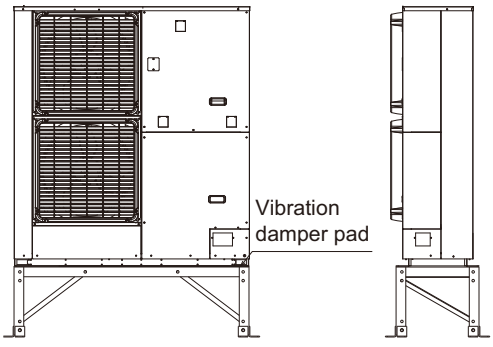
Air deflector grill installation examples

6-7. Measures against snow

6-7-1. Installing the unit in a winter snow area

Install the unit on a raised base (locally procured).

If the unit is not installed on a raised base and not operated for a long time, moisture will accumulate inside the unit, forming rust.



Example of installing the unit on a raised base

- Perform installation work when the building is ready for the installation of the unit.
- Do not install the unit indoor, in a depressed space, or in a halfway basement.

7-1. Installation on the foundation

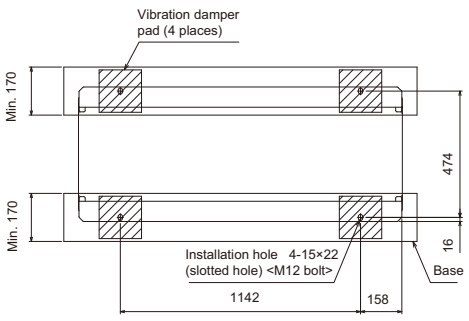
- Form the base on a level surface (inclination no more than 1.5°) and with strong and solid materials such as concrete and angle steel to prevent the unit from toppling over under strong winds or earthquakes.
- Weakness or inclination of the base may cause abnormal vibrations or noise.
- Weakness of the base may cause the unit to vibrate, resulting in looseness or crack in the pipes.
- Generally, the base for the unit is formed with concrete. A mass of the base needs to be more than three times the weight of the unit to support the unit and to absorb vibration. It is recommended that the mass of the base is more than three times the weight of the unit.
  Alternatively, the unit may be directly connected to a construction with strong foundation.

7-2. Installation bolt

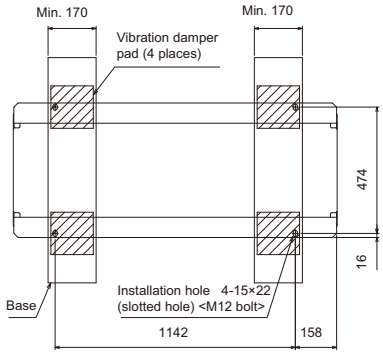
- Secure the unit with anchor bolts as shown in the figure below so that the unit will not topple over.
  (M12 installation bolts are to be locally procured.)
- Be sure to bolt down 4 points.
- Select the installation dimensions from the available installation holes shown in the external dimensions diagram according to the base.

(Unit: mm)

Dimensions
<Holes in lateral direction (recommended)>

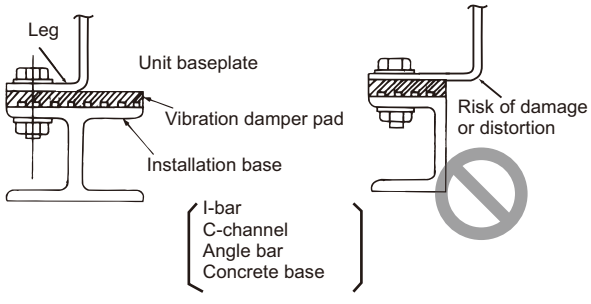


Dimensions
<Holes in depth direction (recommended)>

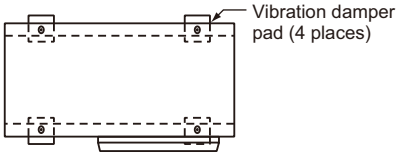


7-3. Anti-vibration measures

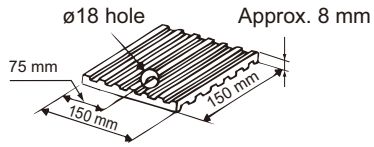
- Vibrations and noise may be transmitted from the unit through walls and floors, depending on the installation conditions. Take appropriate anti-vibration measures (e.g., vibration damper pad, vibration isolation base) as needed. (See the figure on the right.)
- The size of damper pad depends on the size and shape of the unit installation hole.



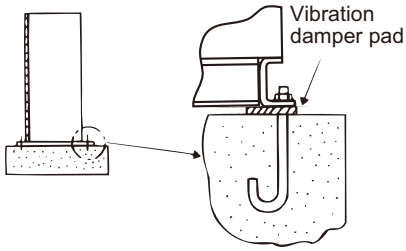
Sample of unit installation



• Sandwich the damper pad between the unit and the base.



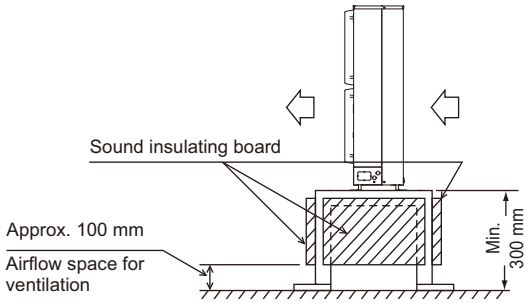
Vibration damper pad (example)



Sample of concrete base

7-4. Sound insulation work

Attach sound insulation boards around the unit when installing the unit on a base that is more than 300mm tall. (See the figure on the right.)
However, keep a space of approximately 100mm over the boards because complete insulation may interrupt the ventilation in the unit (or the machine room or the control box may not be cooled).



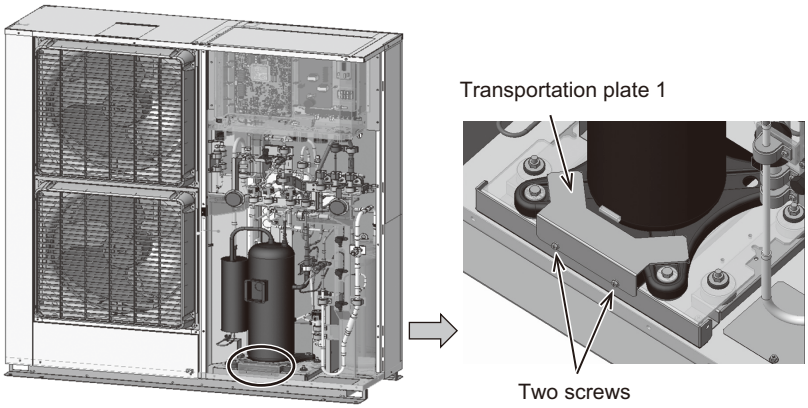
7-5. Removing protection materials for transportation

Remove the packing materials from the unit and properly dispose of them after the installation.
Unit operation without removing the packing materials may cause injury or damage the unit.

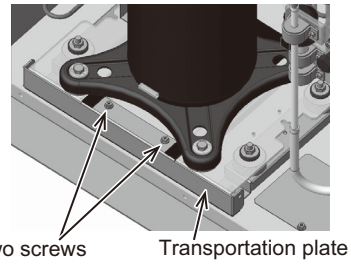
Procedures for removing the plates for transportation

Procedures

1. Unscrew two screws to remove transportation plate 1.



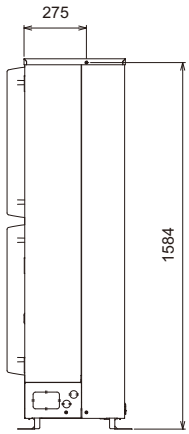
2. Unscrew two screws to remove transportation plate 2.



7-6. Fixing the top of the unit to the wall

In addition to anchoring the unit's installation legs to the base, fix the top of the unit to prevent it from falling over due to winds, as necessary. Remove one screw from the right side of the top panel, and use the screw hole to fix the top of the unit.
(Use the left side as necessary on site.)
As a fixing screw, locally procure a self-tapping screw (M5 screw length ±12 mm).

(Unit: mm)



Fixing hole on the top panel

8-1. General information

Do not reuse the existing pipes!

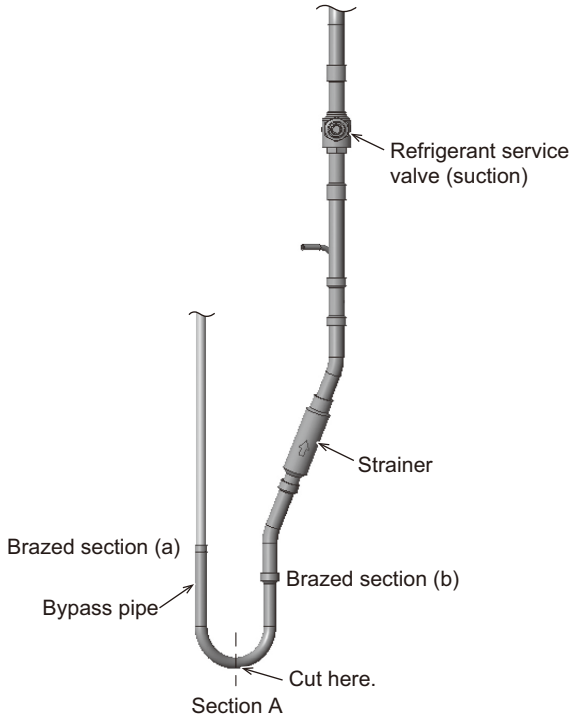
- Improper design and installation of refrigerant piping may affect the function and life of cooling equipment, or occurrence of problems. Design and install a water piping system according to the applicable regulations and the following instructions.

8-1-1. Removing the bypass pipe

The unit is charged with nitrogen gas prior to the shipment from the factory.
To prevent infiltration of water or contaminants, do not leave the pipe open until immediately before connecting the pipe. To connect the bypass pipe, remove the gas in the pipe. Then weld the pipe after checking that the residual pressure is not left.

(1) Removing the bypass pipe

To remove the pipe that bypasses the suction pipe and liquid pipe, first cut the bypass pipe at the section labeled (A) to remove the nitrogen gas from the pipe, and then debraze the pipe from sections labeled (a) and (b) in the figure on the right.
Do not directly heat the brazed sections using a burner or other heating device to remove the bypass pipe.



Note

- When brazing the suction pipe or liquid pipe, use a slate board to protect the control devices and wires from the torch flame.

8-1-2. Notes on water and contaminants

Ester oil is used for this unit as refrigerant oil. Ester oil easily absorbs moisture and tends to cause deterioration of the refrigerant oil or formation of sludge (hydrate).
Use caution to prevent infiltration of contaminants such as water and dirt during piping work.

Note

- Protect and maintain the pipes to prevent infiltration of contaminants such as water and dirt.
- Nitrogen purge is required to prevent formation of oxide scale while brazing the pipe.

1) Storage location
Store the pipes indoors. (Warehouse at site or owner's warehouse)
If the pipes are left outdoors, dust, dirt, or moisture may infiltrate and contaminate the pipes.

2) Sealing the pipe ends
Seal both ends of the pipes until just before brazing.
Keep elbow pipes and T-joints in plastic bags.

8-1-3. Pipe size

Select the size of the suction pipe and liquid pipe according to the diameter of the connection port of the condensing unit, not of the evaporator.

Select the size of the suction pipe in consideration of oil return and pressure loss.

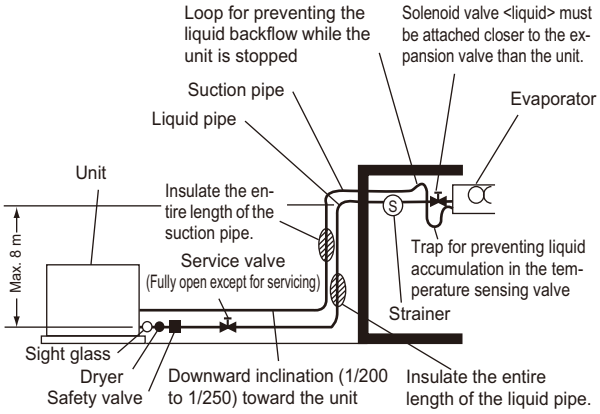
Model	Suction pipe [mm (in.)]	Liquid pipe [mm (in.)]
ECOV-X37VA	ø15.88 (5/8)	ø9.52 (3/8)
ECOV-X55VA	ø15.88 (5/8)	ø9.52 (3/8)

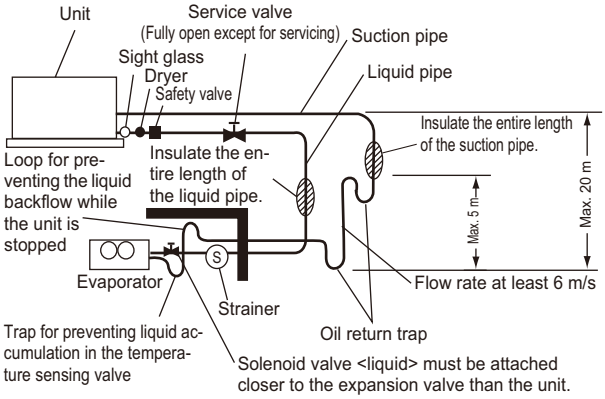
The pipe sizes shown above are standard pipe sizes.

The suction pipe of ø15.88 (5/8) needs a reducer (locally procured).
The design pressure of the liquid pipe and the suction pipe is 8.0 MPa. Use pipes that can withstand the above design pressure.
For ECOV-X55VA, when the pipe length is 30 m or longer, use a liquid pipe having a diameter of one size larger.

8-1-4. Height difference between devices

When the unit is installed in a high place, ensure there is enough space for transporting a heavy load such as a refrigerant cylinder during servicing or test runs, and install the service valve at the most appropriate place for servicing.





8-1-5. Supporting the pipes

Support the pipes in proper distance. Install a bent pipe or a slide valve (horizontal loop) to absorb expansion and contraction of the pipes that is caused by temperature fluctuation.

8-1-6. Notes on contaminants while flaring the pipes

Follow the instructions below to prevent abrasive components contained in sandpaper and cutting tools from entering the refrigerant circuit because those components can cause failures of the compressor and valves.

- To deburr pipes, use a reamer or other deburring tools, not sandpaper.
- To cut pipes, use a pipe cutter, not a grinder or other tools that use abrasive materials.
- When cutting or deburring pipes, do not allow cutting chips or other foreign matters to enter the pipes.
- If cutting chips or other foreign matters enter pipes, wipe them off the inside of the pipes.

Purge the pipes of dust with nitrogen gas or dry air before connecting the pipes.
(Do not use the tools that generate a large amount of shaving particles, such as saw and grind stone.)

8-2. Installation of suction pipe

8-2-1. Installing the horizontal pipe

Install the horizontal pipe in such a way that it has a downward inclination (at least 1/200) towards the unit.

8-3. Installation of liquid pipe

8-3-1. Installing the solenoid valve <liquid>

Install the solenoid valve <liquid> right in front of the expansion valve (upstream side). Installing the solenoid valve near the outdoor unit may cause capacity shortage to the pump down and the high pressure switch may cut the unit.

8-3-2. Installing the strainer <liquid>

Install the strainer at the solenoid valve <liquid> inlet. Check the strainer during test run and remove contaminants.

8-3-3. Installing the dryer

Be sure to attach a dryer to the unit outlet (liquid pipe).
When installing the dryer, do not leave the dryer open for more than 30 seconds. Install the dryer in the correct orientation.
Failure to install the dryer may cause damage to the compressor.
Procure a dryer locally.
Select the most suitable dryer that meets the following criteria.

- R744-compatible
- With a 100% molecular sieve solid core
- Design pressure of 8.0 MPa or higher

8-3-4. Installing the sight glass

Provide a sight glass to the unit outlet (liquid pipe).
Procure a sight glass locally.
Select a sight glass that meets the following criteria.

- R744-compatible
- Design pressure of 8.0 MPa or higher
- With a water-level indicator

8-3-5. Installing a pressure relief device

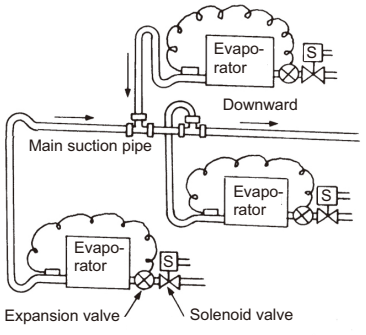
A pressure relief device must be installed on the liquid pipe.
Select a safety valve that has an activation threshold at or below 8.0 MPa.

8-3-6. When the ambient temperature around the pipe rises high

If the liquid pipe is heated by the effect of other heat source, flash gas is generated and a poor cooling problem occurs.
Route the liquid pipe where the temperature is low. Insulate the liquid pipe if it is installed in place where the temperature is high.

8-3-7. When the evaporator is installed below the main suction pipe

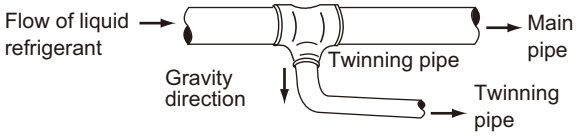
When an evaporator is installed below the main suction pipe, provide a small trap on the evaporator outlet to prevent the effect from the liquid refrigerant to the temperature sensing valve of the expansion valve. Provide an interlocking opposite trap above the main suction pipe to prevent the liquid refrigerant/oil from flowing from the main suction pipe to the riser pipe during stop operation.
A solenoid valve must be installed to each evaporator that is installed above the main suction pipe as shown in the figure on the right.



Suction pipe

8-3-8. When there are multiple evaporators in the system

Equalize the pressure loss of each pipe circuit to equalize the flowing amount of the refrigerant to each evaporator. Branching point must be below the pipe. If the twinning pipe is installed above the pipe, a sufficient amount of the liquid refrigerant is not fed to the branched circuit, causing a poor cooling problem.



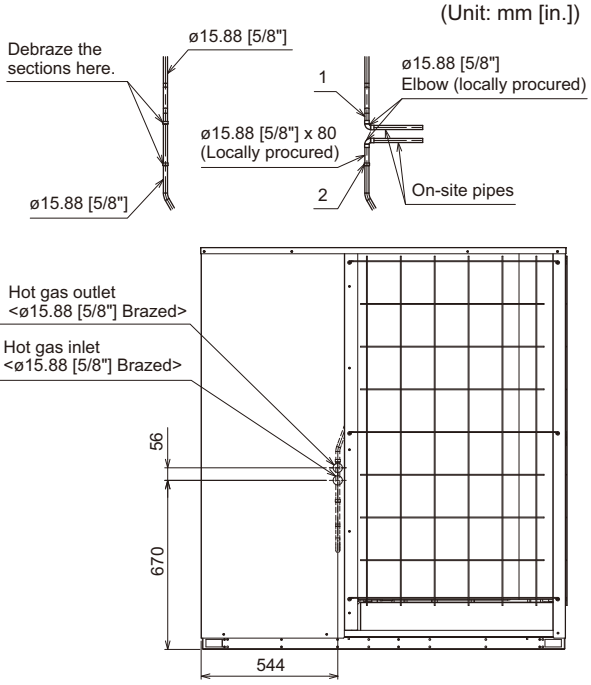
8-4. Installation of heat recovery port

- To perform heat recovery, route the hot gas pipe from the hot gas outlet on the back of the unit or in the middle of the discharge pipe. Remove the hot gas pipe at the brazed part. Cut the <outlet> at the straight pipe section, and route the <inlet> using an elbow. (See the figure on the right.)
- Use the pipe sizes in the following table after external unit routing. (Reducer is locally procured.)

Model	Pipe size [mm (in.)]	
	Unit port	Pipe locally procured
ECOV-X37, X55VA	ø12.7 (1/2)	ø15.88 (5/8)

Remove the hot gas pipe at the brazed sections, and then take the hot gas out using the locally procured elbow as shown in the figure below.

(Unit: mm [in.])



- Large piping vibration may be caused by pressure pulsation depending on the operating conditions of the unit, the shape and length of the pipes, and the method to support the pipes.
  If large vibration occurs during a test run, change the support intervals and the method for fixing the pipes to prevent vibration.
  When attaching support fittings on the building or ceiling, take appropriate anti-vibration measures to prevent the piping vibration from being transmitted to the building.
- Provide insulation or protective cover to the parts of the pipes that can come into contact with a human body.
- When brazing the pipes, cool down the pipes with a wet cloth if packings are used in the pipe fixing parts.
  The unit is filled with nitrogen gas. Remove the nitrogen gas before brazing the pipes.
- To avoid the thermal impact from the hot gas pipe, allow at least 10cm between the hot gas pipe and the liquid pipe.
- When brazing the suction pipe or liquid pipe, use a slate board to protect the control devices and wires from the torch flame.
  Minimize the welding flame so as to prevent the flame from touching the check joint.
- There is no set-up for hot gas defrosting.
  Due to the use of independent local hot gas (e.g. floor heating), only hot gas pipe routing is available.

8-5. Connecting pipes

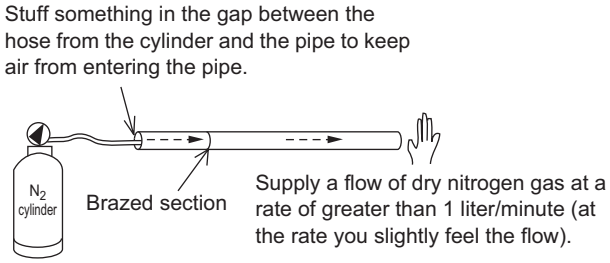
8-5-1. Brazing

- Use a clean copper pipe so as not to allow dirt and water to infiltrate inside the piping system.
- In a corrosive atmosphere, such as where there is high sulfurous acid gas concentration, use silver filler.
- Do not use low-temperature fillers because they do not have sufficient strength.
- When re-brazing, use the same filler material.
- Paint the brazed parts.
- Use an appropriate flux according to the type and shape of the substrate, filler type, and brazing method.
- Do not conduct refrigerant piping work outdoors when raining.
- If the installed pipes are left unconnected to any equipment, braze and seal both ends of the pipes.
- Flux generally contains chloride. Flux staying in the refrigerant circuit will cause sludge to form.

Procedures

1. When brazing, as shown in the figure below, heat the minimum necessary area to a temperature suitable for the filler material.
When brazing, supply a flow of an inert gas, such as dry nitrogen gas, through the pipes to prevent formation of oxide scale.
After finishing piping, keep the nitrogen gas flowing until the pipes have become cool enough to be touched by hand. (Be careful not to burn hands and fingers.)
After brazing, cool the pipes without using water.
Do not move the brazed pipes until the braze has solidified. (No vibration must be applied.)

2. Completely remove all the flux after brazing.



Brazing the pipe under nitrogen purge

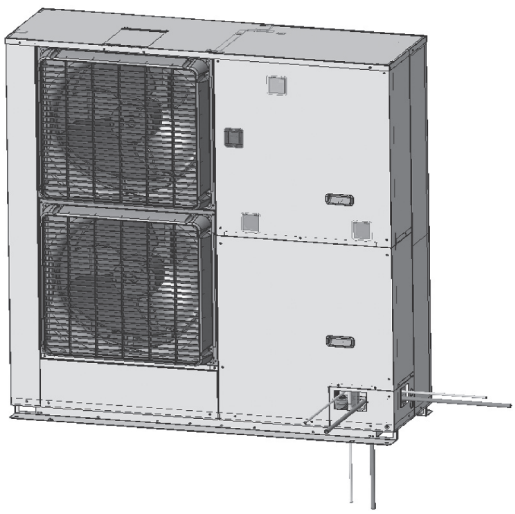
Note

- Ensure that the flame does not touch any surrounding wiring and plates during brazing. Prevent fire by using a metal plate as a shield and a wet towel.
  Contact with flame may cause fire damage and/or failure.
- When using anti-oxidant for brazing, check its components.
  (The anti-oxidant must not contain any components that may lead to corrosion of the pipes if it is mixed with refrigerant or refrigerant oil.)
- The dryer and filters (strainer, etc.) in the unit may be clogged with oxide scale, which shortens the unit life. Clean or replace the dryer and filters when they are clogged.
- Brazing must be performed by qualified personnel.

8-6. Pipe routing: Single and collective installations

(1) The pipe can be routed from the front, right, or bottom of the unit. When multiple units are installed collectively or consecutively, any unit that has another unit on its right cannot have a pipe routed on its right side.

(2) Install the pipes so that they are out of contact with the wires, panels, and compressor.



9-1. Air tightness test

9-1-1. Purpose of air tightness test

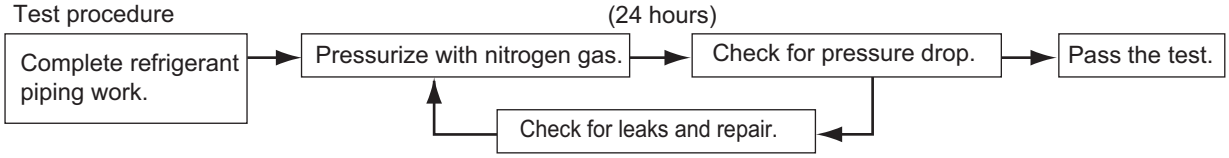
Check for any refrigerant leakage in the refrigerant pipes and the indoor unit.
The condensing unit has been subjected to an air tightness test prior to shipping.

9-1-2. Air tightness test pressure

When the refrigerant piping is completed, perform the air tightness test before insulating the pipes.
The condensing unit has been tested prior to shipping.
The air tightness test pressure must be at or higher than the design pressure. Refer to 9-1-3. Air tightness test procedure for details.
The pressure used for the air tightness test must not exceed 8.0 MPa to protect the unit.
The design pressure for the refrigerant pipes and the indoor unit is shown in the table below.

Design pressure for refrigerant pipes and indoor unit
8.0 MPa

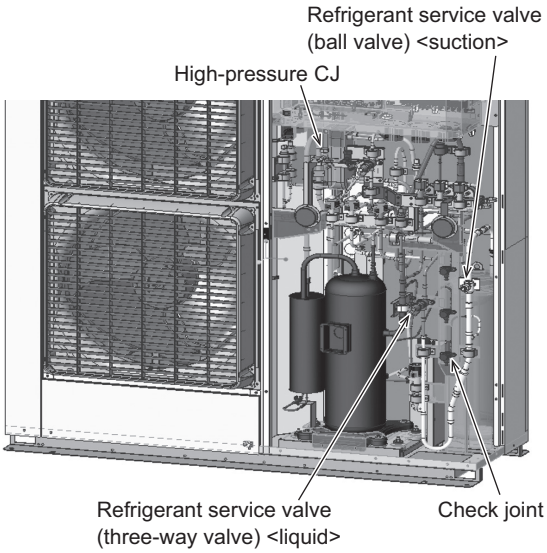
Test procedure



9-1-3. Air tightness test procedure

Procedures

1. The air tightness test is performed by pressurizing the refrigerant pipes up to the unit's design pressure with nitrogen gas. Connect the devices to the check joint upstream of the refrigerant service valve (ball valve) <suction> and the high-pressure check joint. See the figure on the right for connections.
The check joints are all designed to be connected with Swagelok fittings.
Air tightness test inside the condensing unit is not necessary.



2. Fully open the refrigerant service valve (three-way valve) <liquid> and open the refrigerant service valve (ball valve) <suction>. For usage of the refrigerant service valves, refer to sections 9-2. 9-2-6. (page 42).

3. Do not pressurize the system up to the design pressure at once. Increase the pressure in small increments. Pressurize the system to 0.5 MPa, stop increasing the pressure for at least 5 minutes, and check that the pressure does not drop.

4. Pressurize the system to 1.5 MPa, stop increasing the pressure for at least 5 minutes, and check that the pressure does not drop.

5. Write down the outside air temperature and pressure after pressurizing the system to the design pressure.

6. Apply a foaming agent. If no bubbles occur, there are no leaks.
Leave the system in the defined value for 24 hours. If the pressure is maintained, there are no leaks.
When the outside air temperature changes by 1°C, the pressure changes by approximately 0.01 MPa. Adjust the test conditions as necessary.
If the pipe is pressurized before cooled down after welding, the pressure drops after the pipe cools down.
The pressure changes (up/down) depending on the outside air temperature.
(Gas in the container (scale-invariant) is in proportion to absolute temperature.)

Absolute pressure during measurement = absolute pressure during pressurization × (273°C + temperature during measurement) / (273°C + temperature during pressurization)

Absolute pressure = gauge pressure + 0.10133 (MPa)
(Gauge pressure indicates the gauge manifold-specified value.)
A pressure drop indicates a refrigerant leakage in the system. Find the refrigerant leaking area, and fix it.
If a leakage is found, inspect the welded part using soap water.
Nitrogen purge must be done before welding.

9-1-4. Refrigerant leakage detection

Special care for refrigerant leakage is important. Use a refrigerant leak detector for R744.

9-2. Vacuum drying

9-2-1. Purpose of vacuum drying

Completely evaporate any moisture that has entered the evaporator from the refrigerant pipes using vacuum in order to release it outside the system.

9-2-2. Vacuum drying procedure

(1) Level standard of a vacuum pump

Use a vacuum pump capable of attaining a vacuum pressure of 66 Pa at a point of 5 minutes from the startup of operation.

(2) Vacuum drying time

1) Perform vacuum drying for one hour after the vacuum level reaches 266 Pa on the vacuum gauge.
(Thorough vacuum drying eliminates moisture in the pipes.)
2) Check that the vacuum pressure does not drop one hour after the vacuum drying is completed.

(3) Vacuum drying procedure

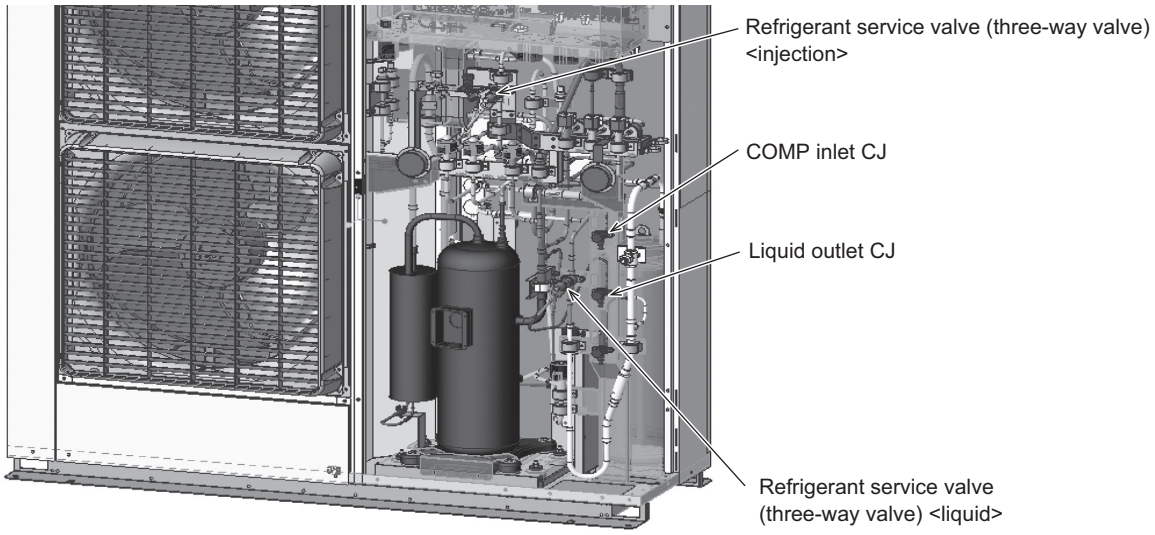
Be sure to use a vacuum pump for vacuum drying of the system. Vacuum drying must be performed by a specialist.
The low-pressure is digitally displayed on the Main board. **Unless the unit is energized during the vacuum drying, the low-pressure is not displayed on the Main board. Check the low-pressure by using a gauge manifold and a vacuum gauge.**

Procedures

1. Connect to the vacuum pump.
For information on the vacuum pump connection, refer to the relevant page. (page 41)

2. Evacuate the air from the check joint connected to the refrigerant service valve (three-way valve) <liquid> in the high-pressure circuit.
Because a check valve is used in the low-pressure circuit, perform vacuum drying with the high-pressure circuit first (the capacity will be larger).

3. Evacuate the air from the check joint at the compressor inlet in the low-pressure circuit.
When performing vacuum drying, open the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection> half way, and the ball valve <suction> all the way.
For how to open the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection> half way, refer to section 9-2-6. (page 42).
(The condensing unit is filled with nitrogen. Attempting vacuum drying without opening the valves as described above will not eliminate air out of the condensing unit.)



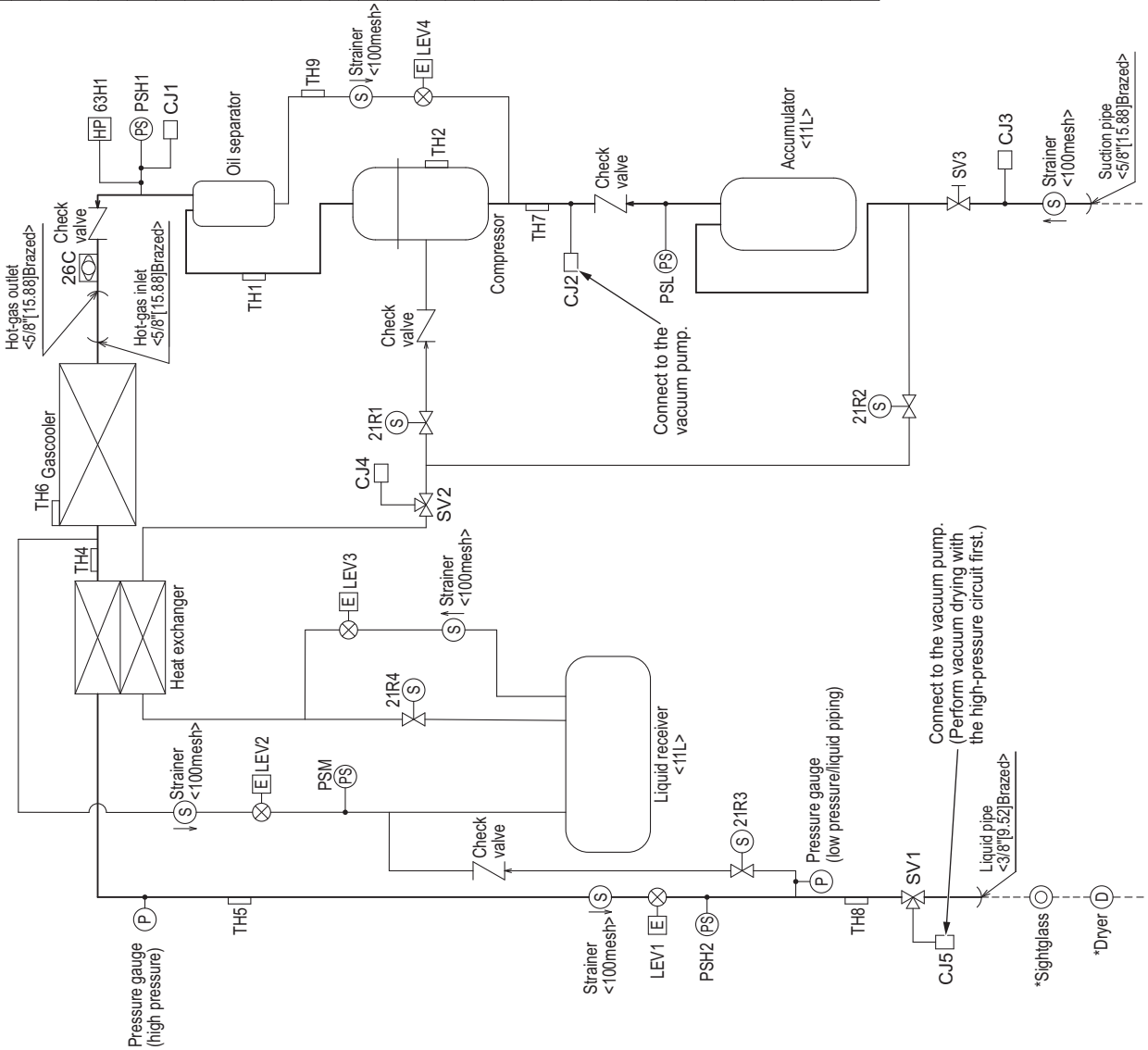
4. When the vacuum drying is completed, close the check joint and remove the vacuum pump.

9-2-3. Connection of the vacuum pump

(1) ECOV-X37VA, ECOV-X55VA

Symbol	Component	Trigger threshold
CJ1	Check joint	
CJ2	Check joint	
CJ3	Check joint	
CJ4	Check joint	
CJ5	Check joint	
LEV1	Electronic expansion valve	
LEV2	Electronic expansion valve	
LEV3	Electronic expansion valve	
LEV4	Electronic expansion valve	
PSH1	Pressure sensor <high pressure>	
PSH2	Pressure sensor <low pressure>	
PSM	Pressure sensor <low pressure>	
PSL	Pressure sensor <low pressure>	
SV1	Stop valve	
SV2	Stop valve	
SV3	Stop valve	
TH1	Thermistor <discharge pipe temperature>	
TH2	Thermistor <compressor oil temperature>	
TH4	Thermistor <gascooler outlet pipe temperature>	
TH5	Thermistor <heat exchanger outlet pipe temperature>	
TH6	Thermistor <outside air temperature>	
TH7	Thermistor <suction pipe temperature>	
TH8	Thermistor <liguid pipe temperature>	
TH9	Thermistor <oil pipe temperature>	
21R1	Solenoid valve	Open while energized
21R2	Solenoid valve	Open while energized
21R3	Solenoid valve	Open while energized
21R4	Solenoid valve	Open while energized
26C	Thermostat <discharge>	135°C OFF,115°C ON
63H1	Pressure switch <first high pressure>	12MPa OFF,8.5MPa ON

Note1.Those items marked with an asterisk are field-supplied.



9-2-4. Procedures for stopping the vacuum pump

To prevent the backflow of vacuum pump oil to the unit, open the relief valve on the vacuum pump, or draw in air by loosening the charging hose. Then stop operating the vacuum pump.
Use the same procedures when stopping a vacuum pump with a check valve.

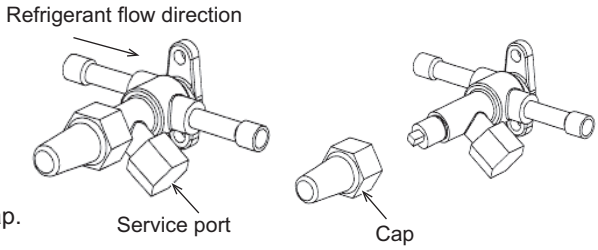
9-2-5. Required precision of vacuum gauge

(1) Use a vacuum gauge that can measure the vacuum pressure of 266 Pa and measure at 1 Torr (130 Pa) increments.
(2) A general gauge manifold cannot measure the vacuum pressure of 266 Pa.

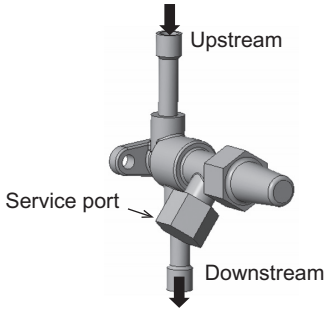
9-2-6. Operating the valve check joint

(1) Procedure to operate the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection>

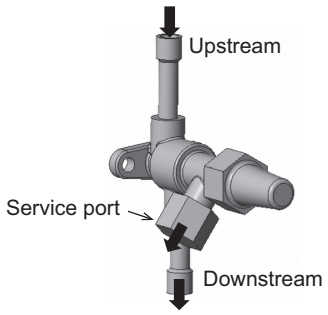
- Remove the cap, and turn the valve rod with pliers. Turn the valve rod counterclockwise to open the valve, and clockwise to close it.
- Tighten the cap to a torque of 25 to 35 N·m at the completion of valve operation.
  Failure to replace the cap will lead to refrigerant leakage.
  Do not damage the refrigerant sealing inside the cap.



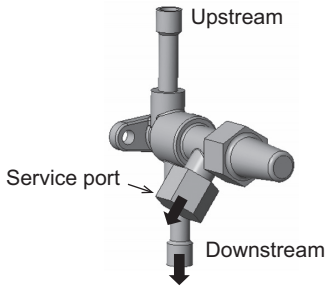
•Fully open
Both the upstream and downstream pass refrigerant.
Service port does not.



•Half open
The upstream, downstream, and service port all pass refrigerant.

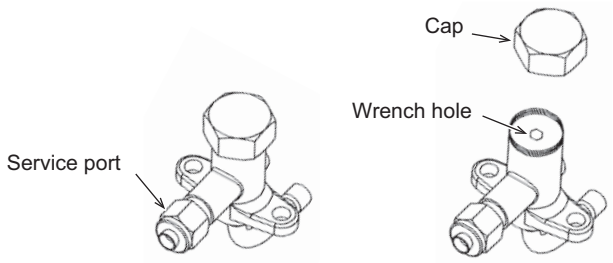


•Fully closed
The downstream and service port pass refrigerant.
Upstream does not.



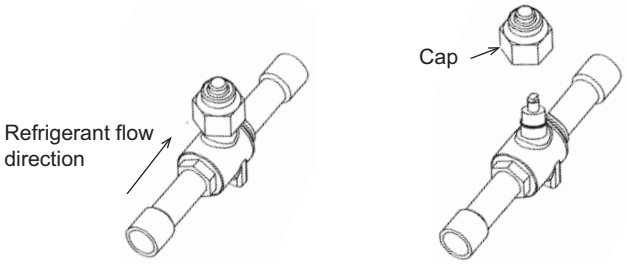
(2) Procedure to operate the check joint

- Remove the cap, and turn the valve rod with a 4-mm Allen wrench. Turn the valve rod counterclockwise to open the valve, and clockwise to close it.
- Tighten the cap to a torque of 15 N·m at the completion of valve rod operation.
  Failure to replace the cap will lead to refrigerant leakage.
  Do not damage the refrigerant sealing inside the cap.
- Securely tighten the cap on the charge port to a torque of 6 N·m.
  Failure to tighten the cap will lead to refrigerant leakage.
- The type of screw used for the check joint in the condensing unit is 7/16-20 UNF.

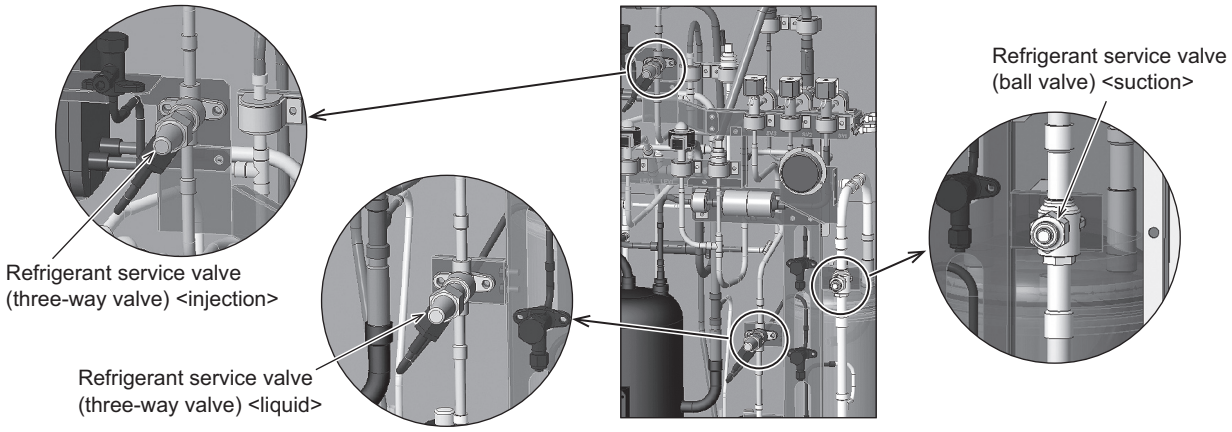


(3) Procedure to operate the refrigerant service valve (ball valve) <suction>

- Remove the cap, and turn the valve rod with pliers. Turn the valve rod counterclockwise to open the valve, and clockwise to close it.
- Tighten the cap to a torque of 13.5 to 20 N·m at the completion of valve operation.
  Failure to replace the cap will lead to refrigerant leakage.
  Do not damage the refrigerant sealing inside the cap.



9-2-7. Parts names



10-1. Refrigerant charging procedure

Charge the system with refrigerant from the high-pressure side first.
Charging the system from the low-pressure side first may damage the compressor.

Follow the instructions below to charge refrigerant.

Procedures

1. Complete vacuum drying.
2. Weigh the refrigerant cylinder. <Before charging>
3. Pressurize the system with refrigerant through the check joint on the discharge line of the compressor first. Then, charge the system with liquid refrigerant through the check joint connected to the refrigerant service valve (three-way valve) <liquid>.

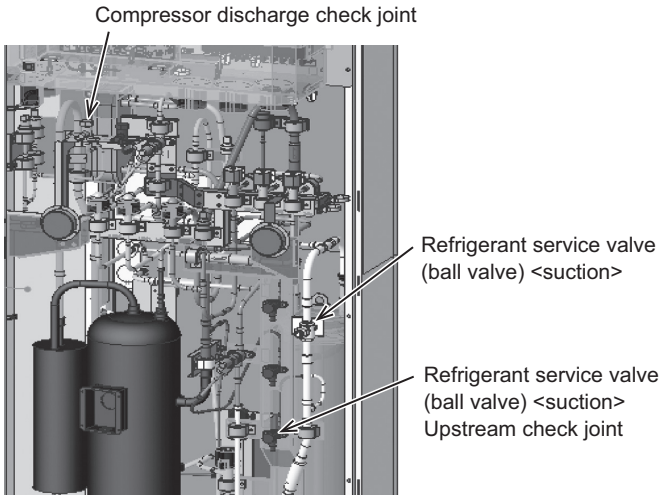
Note

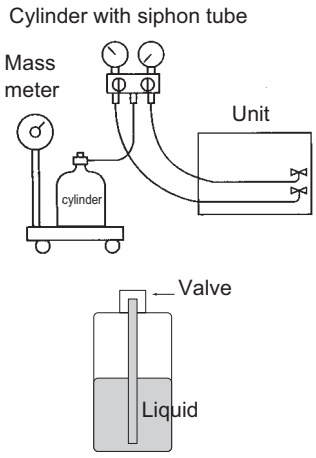
- Charge the high-pressure side with liquid refrigerant.
  Gradually add R744 in gas form to the refrigerant system until the internal pressure reaches 0.52 MPa.
  If R744 is charged in liquid form when the internal pressure is below 0.52 MPa, dry ice may form inside the system.
- Open the refrigerant service valve (three-way valve) <liquid> half-way to charge refrigerant.
- Do not charge liquid refrigerant from low-pressure side first.
  Charging liquid refrigerant from low-pressure side first may cause damage to the compressor.
  The compressor may suffer damage if the pressure on the compressor suction side is higher than the compressor discharge side (counter pressure).

4. Weigh the refrigerant cylinder.
5. Check that proper amount of refrigerant has been charged.

The amount of refrigerant to be charged = Cylinder weight before charging - Cylinder weight after charging

6. After the refrigerant has been charged, fully open the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection>.
   Then open the check joint to remove the refrigerant accumulated inside the pipe between the check joint and the three-way valve. Close the check joint cap. Do this with both the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection>. Open the refrigerant service valve (ball valve) <suction>.
7. After test run, check the operating conditions of the system, and then add an allowable amount of refrigerant if necessary. When adding refrigerant, charge additional refrigerant from the check joint upstream of the refrigerant service valve (ball valve) <suction> while operating the unit.





Note

- While the unit is stopped, the liquid pipe pressure must not exceed 8 MPa.
  If the liquid pipe pressure exceeds 8 MPa, remove the refrigerant.
  The liquid pipe pressure can be measured with a pressure gauge.
- After the refrigerant is charged, fully open the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection>, open the check joint, remove the refrigerant accumulated inside the pipe between the check joint and the three-way valves, and close the check joint cap. Do this with both the refrigerant service valve (three-way valve) <liquid> and the refrigerant service valve (three-way valve) <injection>.
- Remove the refrigerant according to the applicable laws and regulations.

10-2. Allowable amount of refrigerant to be charged

Charge the refrigerant according to the table below.
(Install an additional accumulator if the amount of refrigerant exceeds the allowable amount shown in the table.)

(kg)

	Pipe length (m)	Medium temperature (ET -5~-20°C)					Low temperature (ET -20~-35°C)				
		Evaporator internal volume (L)					Evaporator internal volume (L)				
		2	4	6	8	10	2	4	6	8	10
Standard refrigerant charge	10	6.3	6.6	7.0	7.4	7.7	6.0	6.3	6.7	7.1	7.4
	20	6.7	7.0	7.4	7.7	8.1	6.3	6.7	7.0	7.4	7.7
	30	7.0	7.4	7.8	8.1	8.5	6.6	7.0	7.3	7.7	8.1
	40	7.4	7.8	8.1	8.5	8.9	6.9	7.3	7.7	8.0	8.4
	50	7.8	8.2	8.5	8.9	9.2	7.3	7.6	8.0	8.3	8.7

	Pipe length (m)	Medium temperature (ET -5~-20°C)					Low temperature (ET -20~-35°C)				
		Evaporator internal volume (L)					Evaporator internal volume (L)				
		2	4	6	8	10	2	4	6	8	10
Maximum refrigerant charge	10	8.2	8.6	9.1	9.6	10.0	7.8	8.3	8.7	9.2	9.7
	20	8.7	9.1	9.6	10.1	10.5	8.2	8.7	9.1	9.6	10.1
	30	9.1	9.6	10.1	10.5	11.0	8.6	9.1	9.6	10.0	10.5
	40	9.6	10.1	10.6	11.0	11.5	9.0	9.5	10.0	10.4	10.9
	50	10.1	10.6	11.1	11.5	12.0	9.4	9.9	10.4	10.8	11.3

- The internal volume of the condensing unit is 30.4 L.
- When using an 8HP model unit with a pipe length of 30 meters or longer, use ø12.7 liquid pipes to ensure subcooling.
- Add 0.5 kg of refrigerant per 10 m (medium temperature) or 0.4 kg (low temperature) when using ø12.7 liquid pipes.
- If the value is not found in the table, calculate the amount of refrigerant to be charged by interpolation.
- Do not overcharge refrigerant more than the maximum amount.
- For information on evaporator internal volume, contact the manufacture of the indoor unit.
- After charging the refrigerant, check that no flash gas (bubbles) is seen through the sight glass while the unit is in operation.
  If the flash gas (bubbles) does not disappear, check the following:

  1)Check for refrigerant leakage.
  2)Check for liquid flood-back.
- Procure a sight glass locally.

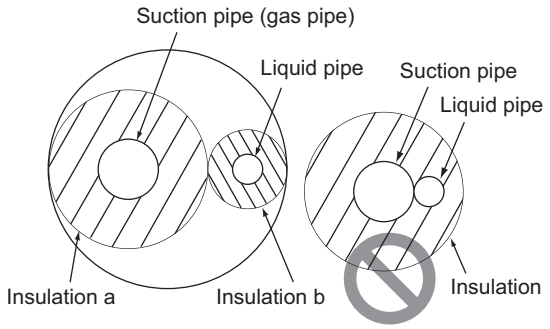
10-3. Insulating

- Insulating must be done after air tightness test.
- The liquid pipe and suction pipe must be insulated. Refer to the table below.
  Use foamed polyurethane and styrol with no hygroscopicity for insulation.

(Unit: mm)

Pipe	Insulation	Medium temperature		Low temperature	
		Thickness of insulation (recommended)		Thickness of insulation (recommended)	
Suction pipe	a	Pit piping	25 or more	Pit piping	50 or more
		Ceiling piping	50 or more	Pit piping	75 or more
Liquid pipe	b	20 or more			

* Calculate the thickness of the insulation with 0°C as the refrigerant temperature (for medium temperature) and -30°C as the refrigerant temperature (for low temperature), and 0°C for liquid pipe.

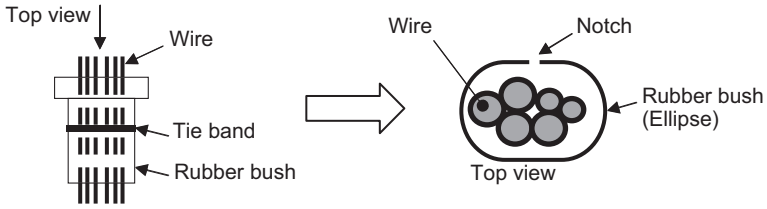


Prohibition of heat exchange between the suction pipe and the liquid pipe

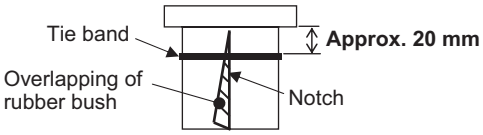
- Do not exchange heat between the suction pipe and the liquid pipe.
- Hot gas pipe is always high temperature. Insulate pipes if they are installed in a place accessible to people. Use insulation that is rated for temperatures of at least 150°C, such as insulation tubes or glass wool insulation.

11-1. Notes on wiring

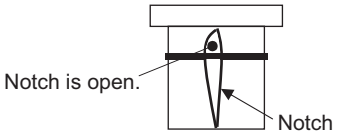
- Install an earth leakage breaker.
  Installation must be according to the applicable laws and regulations.
  (Earth leakage breaker is required for all refrigerating appliances including show cases.)
- Do not wire at any place where dew may drop from suction parts.
- Ensure that no electric wires come into contact with high-temperature parts (compressor, gas cooler, discharge pipe) or the edges of the unit.
- Wear protective gloves to prevent injury on wiring the unit.
- Do not route wires through insulation, such as pipes, to prevent overheat.
- Pass the electric wires through the rubber bush of the wiring through-hole of the control box and bind them over the rubber bush.



- When fixing the rubber bush with a tie band, ensure that the notch on the back side of the rubber bush overlaps as shown in <Good example> and no gap is present. Leaving a gap may allow rain, snow, and/or small animals to enter the unit, causing malfunction.

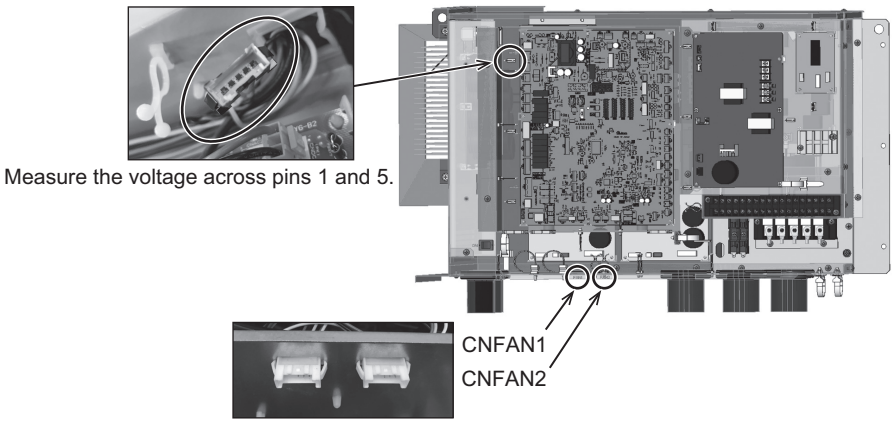


<Back side of the rubber bush (Good example)>



<Back side of the rubber bush (Bad example)>

- Install the transmission cable at least 5 cm away from the power cable to avoid electrical noise interference.
  (Do not place them in the same conduit.)
- Before inspecting inside the control box, turn off the main power of the unit, wait at least 10 minutes, and check that the voltage of the electrolytic capacitor (main inverter circuit) is no greater than 20 VDC. The voltage check position is between pins 1 and 5 of the RYPN connector.
  (See the pictures below for the voltage check position and location of the connectors.)



- Before starting servicing, disconnect the outdoor fan connectors (CNFAN1 and CNFAN2).
  When connecting and disconnecting connectors, make sure that the outdoor fan is not running and that the voltage of the main circuit capacitor is no greater than 20 VDC.
  If the outdoor fan rotates due to strong wind, the main circuit capacitor will be charged and pose a risk of electric shock. Refer to the wiring nameplate for details.
  When finishing servicing, connect the outdoor fan connectors (CNFAN1 and CNFAN2) as they were.
- When the ON/OFF switch (SW1) is ON, the components may still be carrying current even when the compressor is stopped.
  Do not touch the charging part of the power supply wiring. When performing a test run, if there is the possibility that refrigerant may be left inside the compressor after a long stoppage period or flood-back error stop, disconnect the power supply wiring from the terminal block of the compressor after power shutoff, and measure the insulation resistance of the compressor to check that the compressor is not ground-faulted.
- If the insulation resistance is 1 MΩ or below, energize the belt heater for 12 hours or more. Energize the unit and keep the ON/OFF switch (SW1) OFF for at least 12 hours.
  (When the compressor is energized to evaporate the liquid refrigerant inside, the insulation resistance rises.)

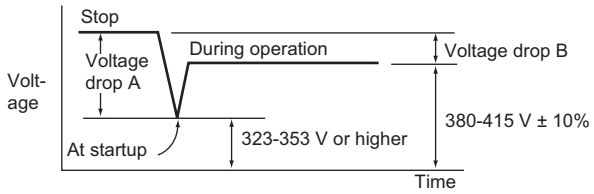
Note

- If the power supply cord is damaged, it must be replaced by the manufacturer, its service agent, or qualified personnel in order to avoid hazards.

11-2. Wire capacity

Maximum allowable voltage for this unit is shown in the figure.

Wire capacity must be according to the applicable laws and regulations. The range of allowable voltage is listed in the next section "Electrical characteristics".
The wire size is the minimum value for the metal conduit wiring. If the voltage drops, use a wire that is one size thicker in diameter.



Note
Starting voltage cannot be measured with a tester, but starting voltage drop (Voltage drop A) is about 5 times the voltage difference (Voltage drop B) between stoppage voltage and operation voltage. The amount of starting voltage can be estimated by subtracting operation voltage from voltage with the unit stopped.

(Voltage drop A) ≈ 5 × (Voltage drop B)

Starting voltage drop A can be disregarded because this unit starts with inverter.

This unit complies with IEC 61000-3-12 provided that the short-circuit power Ssc is greater than or equal to Ssc[*1] at the interface point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, by consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power Ssc greater than or equal to Ssc[*1].

*1 Ssc

Model	Ssc (MVA)
ECOV-X37VA ECOV-X55VA	1.66

11-3. Electrical characteristics

Model				ECOV-X37VA	ECOV-X55VA
Power source				3-phase 4-wire, 380 to 415 V, 50 Hz	3-phase 4-wire, 380 to 415 V, 50 Hz
Electrical characteris-tics	Electric power consumption <Note 1>		kW	6.25	10.0
	Running current (380V/400V/415V) <Note 1>		A	10.8/10.3/9.9	17.3/16.5/15.9
	Starting current		A	8	8
	Maximum current		A	20	20
Compressor	Rotation per minute (RPM)		min^{-1}	61	95
	Electric heater <oil>		W	45	45
Condenser	Fan	Motor output	W	74 × 2	74 × 2
Electrical wiring	Electric wire size	<Note 2>	mm^2	5.5 or larger	5.5 or larger
	Overcurrent protector	Local switch	A	25	25
		Branch switch	A	25	25
	Switch capacity	Local switch	A	25	25
		Branch switch	A	25	25
	Control circuit wire size		mm^2	1.6 or larger	1.6 or larger
	Grounding wire diameter		mm^2	3.5 or larger	3.5 or larger
	Phase advance capacitor	Capacity	μF	N/A	N/A
	(Compressor)		kVA	N/A	N/A
	<Note 3>	Wire size	mm^2	N/A	N/A

Note 1 Measurement conditions are as follows.

Ambient temperature: 32°C, evaporation temperature: -10°C, suction superheat: 10 K

Compressor operating frequency: 66 Hz (ECOV-X37VA), 95 Hz (ECOV-X55VA)

Note 2 The figures in the angle brackets in the "Electric wire size" row indicate the maximum wire length where the voltage drop is 2 V or less.

Note 3 Specific wiring requirements should adhere to the wiring regulations of the region.

Note 4 Power supply cords of appliances shall not be lighter than polychloroprene sheathed flexible cord (design 60245 IEC57).

Note 5 An earth leakage breaker with at least 3 mm contact separation in each pole shall be provided by the installer.

Note 6 Do not use a phase-advancing capacitor with inverter compressor.

• Install an earth leakage breaker.

Leaked current varies depending on wire length, wire routing, and/or presence of devices that emit high frequency.

Select high-harmonic-type earth leakage breakers.

If MODBUS® is used, follow the instructions below.

- Do not connect a power supply to the terminal block for transmission lines. If connected, the electronic parts will burn out.
- Use shielded cables for transmission wiring.
  Wiring using a multi-core cable with different types of transmission wires compromises correct transmission of signals and results in a malfunction.
- When splicing transmission wires, make sure to splice the shielded cables as well.

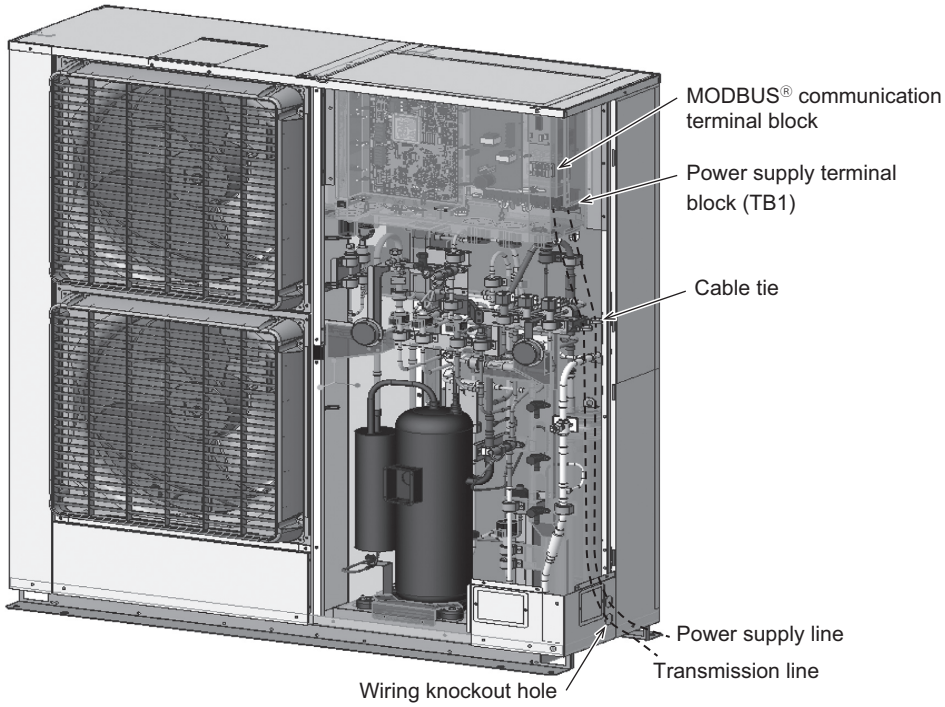
11-4. Connecting wires

Procedures

1. Connect the power supply line to the power supply terminal block (TB1).
2. If necessary, connect the control line (220 to 240 V). (See 11-5.)
3. If necessary, connect the transmission line (MODBUS®).

Model	Wire type	Connected to	Notes
ECOV-X37, 55VA	Power supply line	Power supply terminal block inside the unit control box (TB1)	-
	Control line (220 to 240 V)	Auxiliary terminal block (1 to 32)	-
	Transmission line (MODBUS®)	Terminal block for transmission lines (+, -, SG)	-

Connection locations



Note

- Do not bundle the power supply line and the transmission line together. Keep them away from each other.

For details on the MODBUS® set-up, refer to the MODBUS® Interface Manual.
Please contact the local distributor for the MODBUS® Interface Manual.

11-5. Output signal to external devices

Operation signals can be output from the terminal block on the control box.

(1) Alarm signal

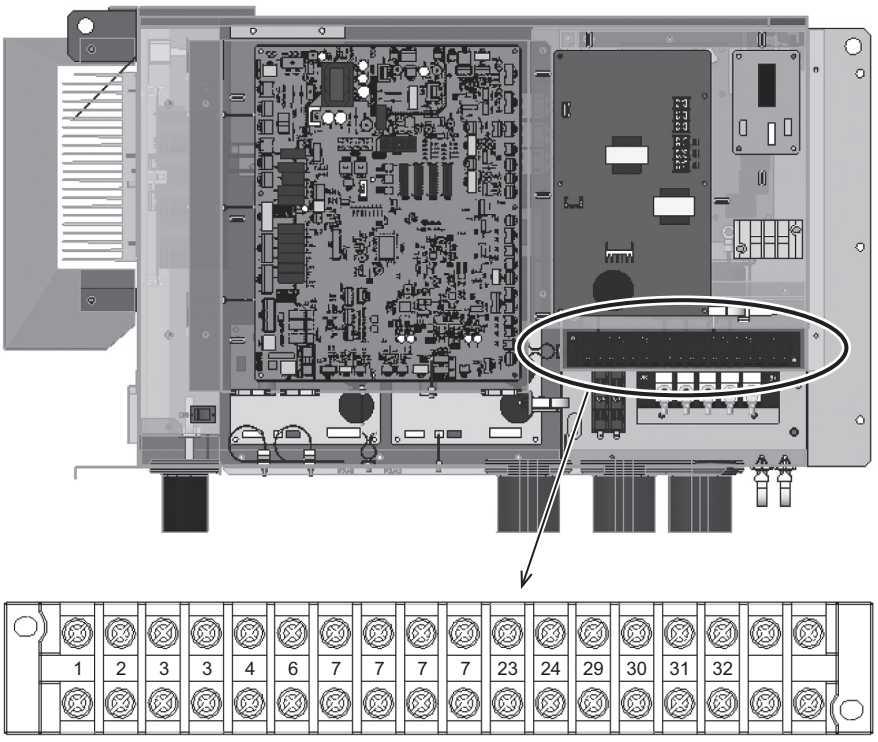
Alarm signals can be output from terminal blocks 7 and 23.
The output signal voltage of terminal blocks 7 and 23 are 220 to 240 VAC. <Use a current of 0.01 to 0.3 A.>
Alarm signal will be output if the refrigerator has come to an abnormal stop.

(2) Compressor operation signal

Compressor operation signals can be output from terminal blocks 6 and 7.
The output signal voltage of terminal blocks 6 and 7 are 220 to 240 VAC. <Use a current of 0.01 to 0.3 A.>
Signals will be output when the compressor is in operation. Signals will not be output when the compressor is not in operation.

(3) Condensing unit operation signal

Condensing unit operation signals can be output from terminal blocks 4 and 7.
The output signal voltage of terminal blocks 4 and 7 are 220 to 240 VAC. <Use a current of 0.01 to 0.3 A.>
Signals will be output when the condensing unit is operating normally (including the times when the compressor is stopped to prevent an excessive drop in low pressure).
Signals will not be output if the condensing unit has come to an abnormal stop.



(4) Precautions for screwing

When replacing electrical parts inside the control box, use the following recommended tightening torques for screwing.

Recommended tightening torque

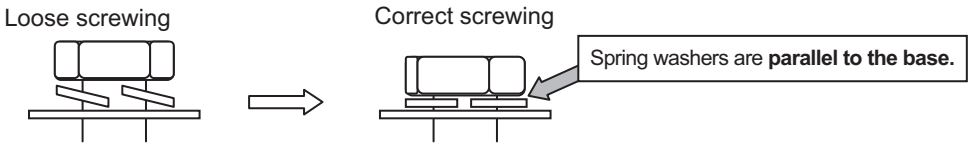
	Screw	Recommended tightening torque (N·m)
Power supply terminal block (TB1)	M6	**4 to 5.4**
Auxiliary terminal block (control lines 1 to 32)	M3.5	**0.82 to 1.0**
Auxiliary terminal block (transmission lines +, -, SG)	M4	**1.0 to 1.3**

Follow the procedure below to check that the screws are properly tightened.

Procedures

1. Check that the spring washers are parallel to the base.

If a screw is not tightened straight, tightening the screw with the specified torque is not sufficient to ensure correct screwing.

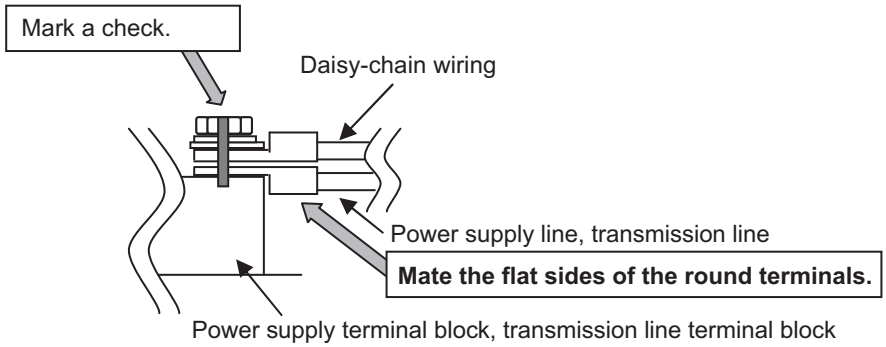


2. If wires are connected, make sure that they are not loose on the screw terminals.

3. Tighten the screws straight so as to **prevent the screw's threads from being damaged.**
To prevent screws from being tightened diagonally, **mate the flat sides of the round terminals** when attaching.

4. After tightening the screws, mark the screw head, washer, and terminal with a check using a marker.

(Example)



12-1. To ensure proper test run

Check if the wiring work has been done properly.
After the piping work, be sure to measure the insulation resistance between the cable run and ground, and that between each wire with a high voltage insulation megger tester to check that the resistance is 1 MΩ or more. (Do not measure the insulation resistance of the controller to prevent damage to the electronic circuit boards.)
After checking that the installation work has been done properly, power ON the main switch (earth leakage breakers etc.).
Check the phase order of the power supply and the interphase voltage. If the voltage is out of the ±10% range, or if the voltage imbalance is more than 2%, discuss the countermeasure with the customer.

The crankcase heater that is used for preventing the foaming of lubricating oil is powered only when the compressor is stopped. Before starting up the unit after leaving it alone more than half a day with its main switch OFF, energize the unit at least 3 hours to heat the lubricating oil.
Fully open the refrigerant service valve.
Make sure that the compressor or fan is generating no abnormal noise or vibration. When there is any abnormality, immediately stop and inspect the unit.
After the operation becomes stable, check that the operation pressure and the temperature of each device are in the proper range. Refer to "Checking the unit condition". (Page 61)

12-2. Setting the pressure switch <high pressure>

(1) The unit is equipped with a pressure switch <high pressure> in the refrigerant circuit as a safety device. The default values of the switch are fixed and unchangeable.
(2) Do not change the settings or do not replace the switch.
(3) The default values of the pressure switch <compressor discharge pressure> are as follows.

Safety device	Default setting value (MPa)	
	OFF	ON
Pressure switch <compressor discharge pressure>: 63H	12.0	8.5

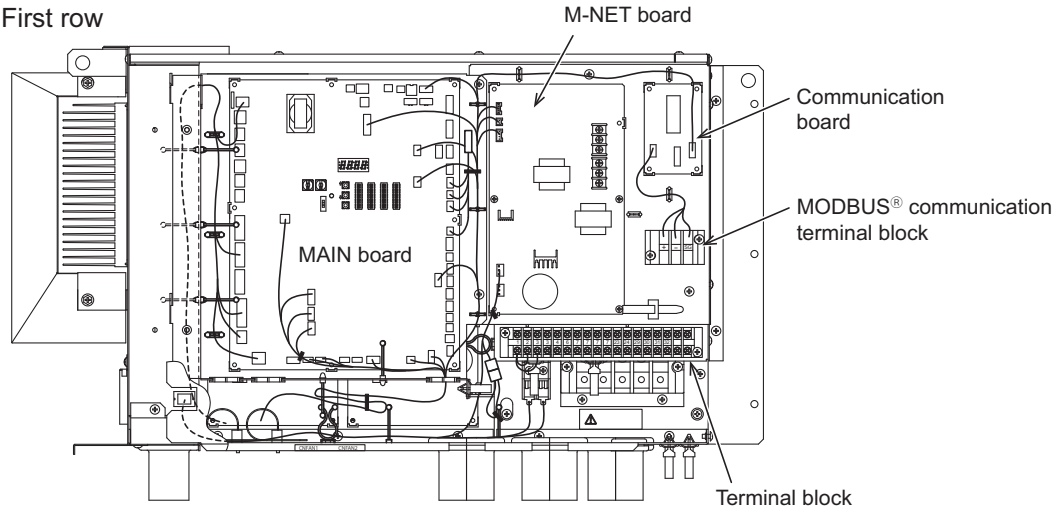
12-3. Unit components of control devices

■ **Unit components**

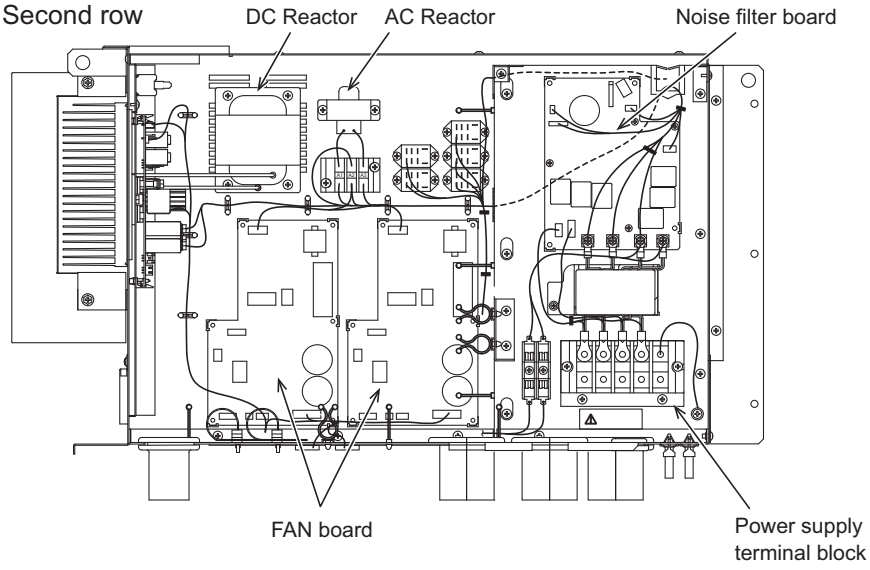
Note

- Do not measure the insulation resistance of the controller because doing so will damage its electrical circuit.

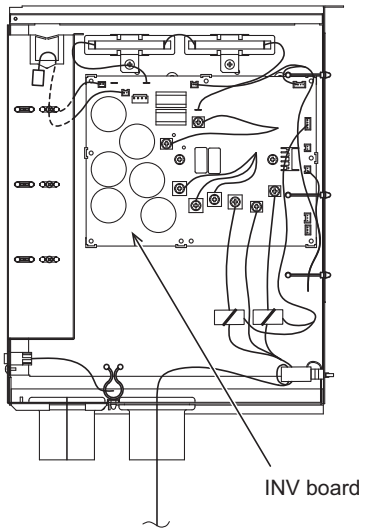
First row



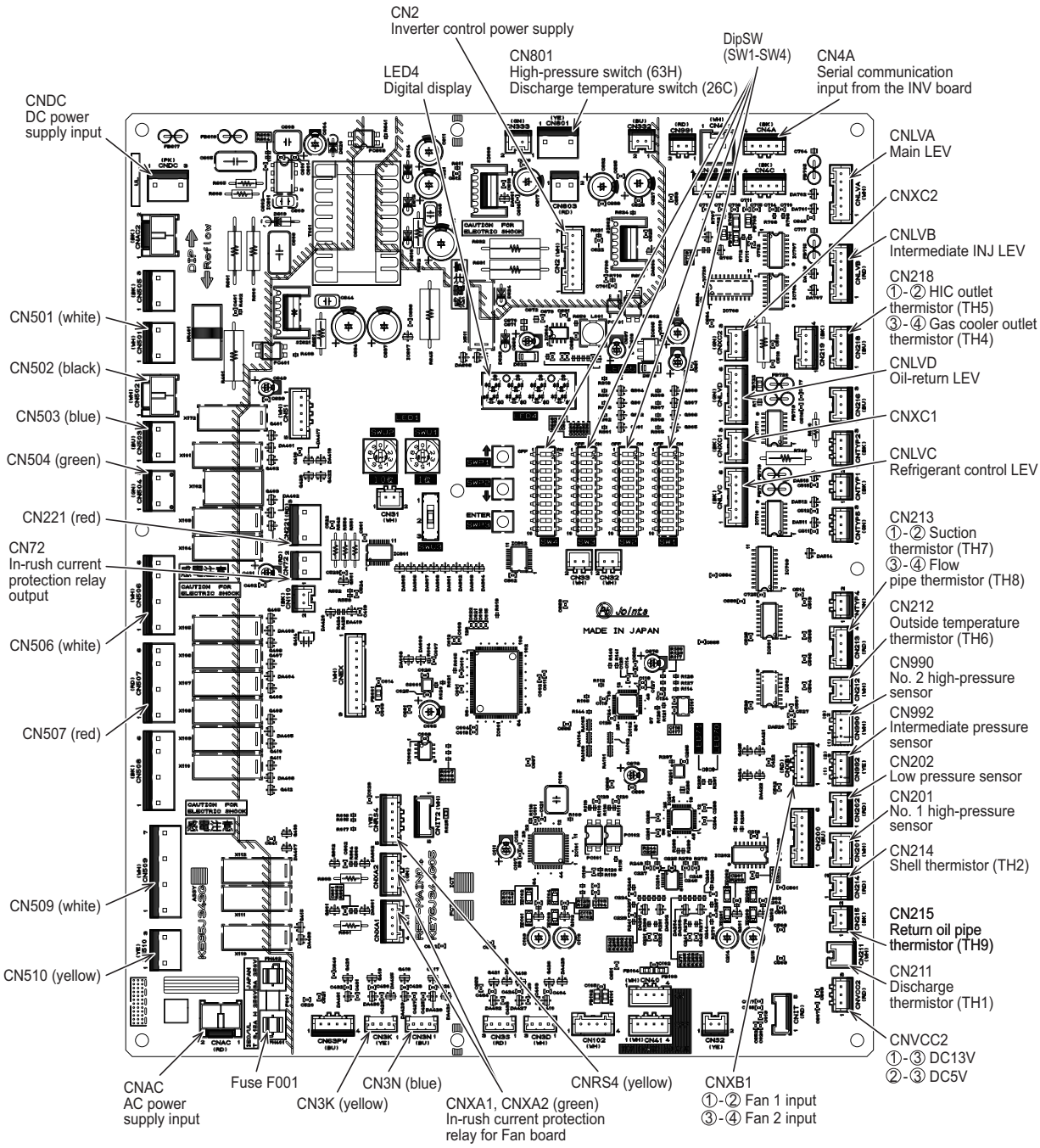
Second row



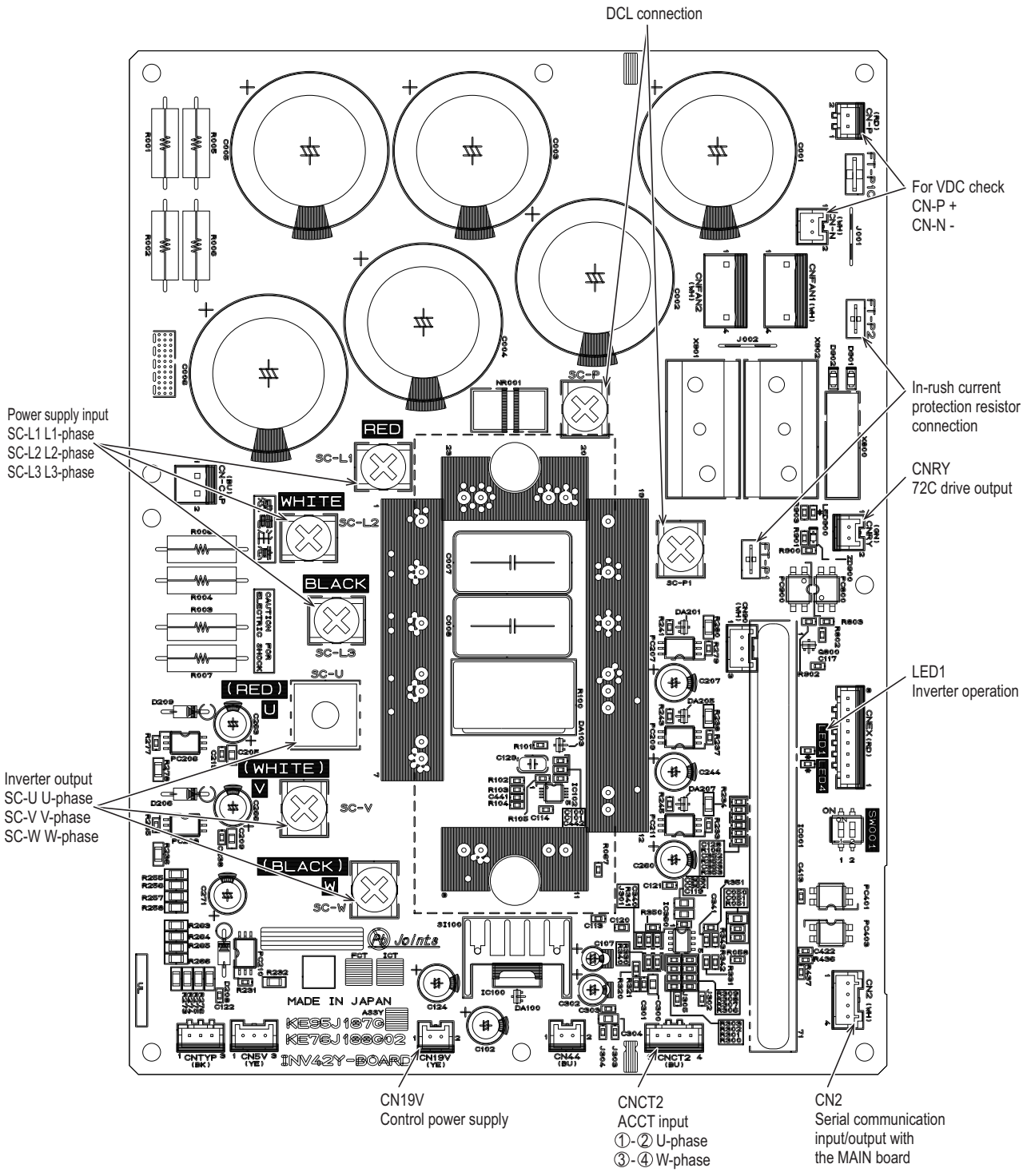
Side



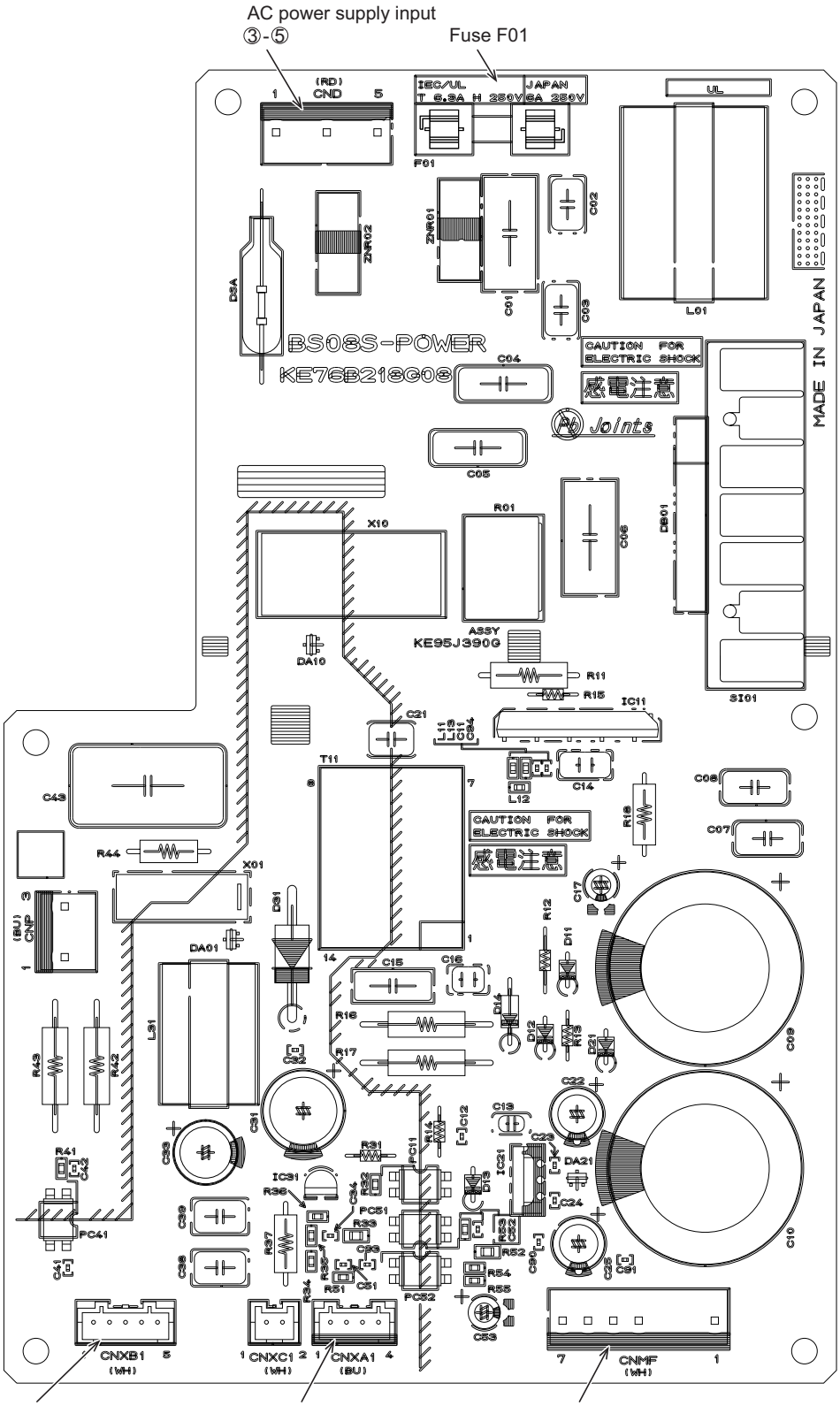
■ **MAIN board**


CN2
Inverter control power supply
LED4
Digital display
CN801
High-pressure switch (63H)
Discharge temperature switch (26C)
DipSW
(SW1-SW4)
CN4A
Serial communication
input from the INV board
CNDC
DC power
supply input
CNLVA
Main LEV
CNXC2
CNLVB
Intermediate INJ LEV
CN218
①-② HIC outlet
thermistor (TH5)
③-④ Gas cooler outlet
thermistor (TH4)
CNLVD
Oil-return LEV
CNXC1
CNLVC
Refrigerant control LEV
CN213
①-② Suction
thermistor (TH7)
③-④ Flow
pipe thermistor (TH8)
CN212
Outside temperature
thermistor (TH6)
CN990
No. 2 high-pressure
sensor
CN992
Intermediate pressure
sensor
CN202
Low pressure sensor
CN201
No. 1 high-pressure
sensor
CN214
Shell thermistor (TH2)
CN215
Return oil pipe
thermistor (TH9)
CN211
Discharge
thermistor (TH1)
CNVCC2
①-③ DC13V
②-③ DC5V
CN501 (white)
CN502 (black)
CN503 (blue)
CN504 (green)
CN221 (red)
CN72
In-rush current
protection relay
output
CN506 (white)
CN507 (red)
CN509 (white)
CN510 (yellow)
CNAC
AC power
supply input
Fuse F001
CN3K (yellow)
CN3N (blue)
CNXA1, CNXA2 (green)
In-rush current protection
relay for Fan board
CNRS4 (yellow)
CNXB1
①-② Fan 1 input
③-④ Fan 2 input

■ **INV board**


DCL connection
For VDC check
CN-P +
CN-N -
In-rush current
protection resistor
connection
CNRY
72C drive output
LED1
Inverter operation
Power supply input
SC-L1 L1-phase
SC-L2 L2-phase
SC-L3 L3-phase
Inverter output
SC-U U-phase
SC-V V-phase
SC-W W-phase
RED
WHITE
BLACK
(RED)
(WHITE)
(BLACK)
U
V
W
SC-L1
SC-L2
SC-L3
SC-U
SC-V
SC-W
SC-P
SC-P1
MADE IN JAPAN
INV42Y-BOARD
CN19V
Control power supply
CNCT2
ACCT input
①-② U-phase
③-④ W-phase
CN2
Serial communication
input/output with
the MAIN board

■ **FAN board**



CNXB1
In-rush current drive voltage input
④-⑤

CNXA1
Input/output signal for the fan
① Vcc (5 VDC)
② Command voltage input
③ RPM output
④ GND

CNMF
Inverter output
① Vcc (339 VDC)
④ GND
⑤ Vcc (15 VDC)
⑥ RPM command
⑦ RPM input

12-4. Setting the target evaporation temperature

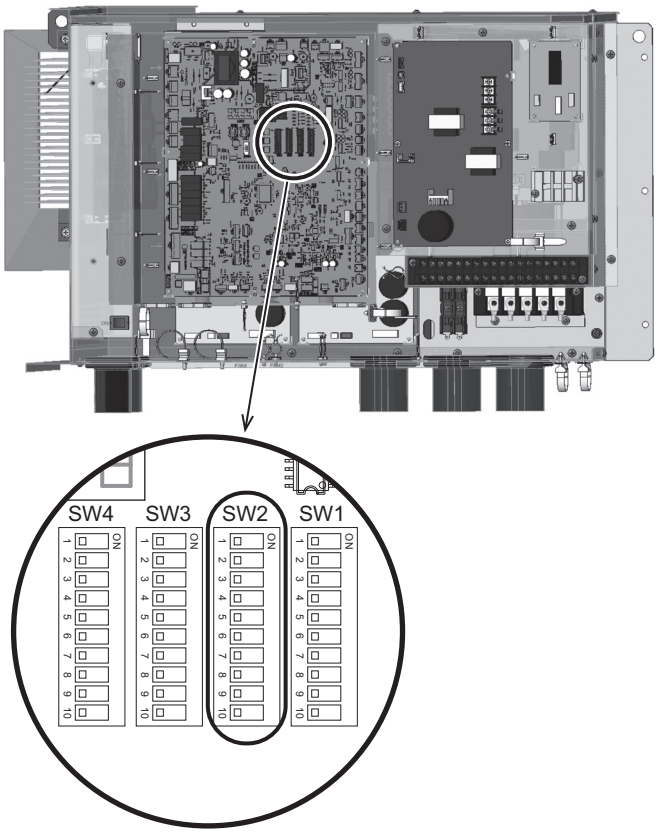
Set the dip switch (SW2) according to the following table to set the target evaporation temperature.

Note

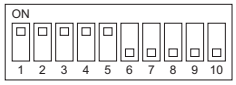
- Always turn off the power of the unit before setting the dip switch (SW2).

1: ON 0: OFF

Dip switch (SW2)						Target evaporation temperature
1	2	3	4	5	6	
0	1	0	0	1	0	-5
1	1	0	0	1	0	-6
0	0	1	0	1	0	-7
1	0	1	0	1	0	-8
0	1	1	0	1	0	-9
1	1	1	0	1	0	-10
0	0	0	1	1	0	-11
1	0	0	1	1	0	-12
0	1	0	1	1	0	-13
1	1	0	1	1	0	-14
0	0	1	1	1	0	-15
1	0	1	1	1	0	-16
0	1	1	1	1	0	-17
1	1	1	1	1	0	-18
0	0	0	0	0	1	-19
1	0	0	0	0	1	-20
0	1	0	0	0	1	-21
1	1	0	0	0	1	-22
0	0	1	0	0	1	-23
1	0	1	0	0	1	-24
0	1	1	0	0	1	-25
1	1	1	0	0	1	-26
0	0	0	1	0	1	-27
1	0	0	1	0	1	-28
0	1	0	1	0	1	-29
1	1	0	1	0	1	-30
0	0	1	1	0	1	-31
1	0	1	1	0	1	-32
0	1	1	1	0	1	-33
1	1	1	1	0	1	-34
0	0	0	0	1	1	-35



- Before operating the unit, set the target evaporation temperature using the dip switch (SW2).
  If the target evaporation temperature is not set, operation starts with the target evaporation temperature tentatively set to -10°C.
- Even when using MODBUS® to set the target evaporation temperature, always use the dip switch (SW2) to set the target evaporation temperature before operating the unit.
  When the power to the unit is shut off due to a power outage, the unit starts up with the target evaporation temperature that has been set with the dip switch (SW2) upon recovery of the power.
  Until the target evaporation temperature is set again using MODBUS®, the target evaporation temperature that has been set with the dip switch (SW2) is effective.
- For instructions on how to set the target evaporation temperature using MODBUS®, refer to the MODBUS® Interface Manual.
- Please contact the local distributor for the MODBUS® Interface Manual.

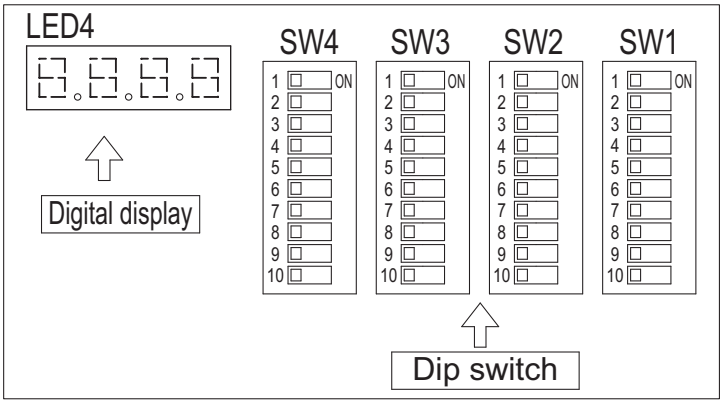


Switches 1 to 5 are ON, and switches 6 to 10 are OFF in the figure on the left.

12-4-1. Component names and display of the MAIN board (inside the control box)

[A] Digital display on the MAIN board: LED4
[B] Dip switch: SW1 - SW4

Display of the MAIN board (inside the control box)



Operation status display on LED4

Symbol	Operation status
oFF	Compressor stoppage (by using operation switch)
run	Compressor in operation
LPoF	Low-pressure cutoff function is stopped.
0H	Compressor stoppage (by using capacity control)
00H	Compressor preliminary stoppage (during the 3-minute restart delay mode)
000H	Compressor error stoppage
oIL1	Oil return operation

Note 1: If the low pressure has not reached “the low-pressure cutoff ON-threshold” even after the lapse of the low pressure cutoff restart delay time, the LED repeatedly shows “LPoF,” “0H,” and “low pressure” in order.

12-4-2. Evaporation temperature setting according to the usage

Target evaporation temperature needs to be set or changed according to the usage or depending on the cooling load.
This unit is controlled that it detects the low pressure and keeps the evaporation temperature at certain degree.
Set or change the target evaporation temperature according to the cooling load or usage.

(1) Target evaporation temperature setting

Target evaporation temperature can be set by using the DIP switches.
Refer to “12-4. Setting the target evaporation temperature” for procedures.

Target evaporation temperature

Refrigerator internal temperature range	Space temperature	Target evaporation temperature *1
−3ºC ~ +10ºC Fruit and vegetables/chilled grocery/ processed meat/ fresh dish/ dairy products	0ºC above	−10ºC ~ −5ºC
	−2ºC	−12ºC
−30 ºC ~ −5 ºC	−10ºC or below	−20ºC or below
Chill-stored pre-frozen food	-18ºC	−30ºC
Ice cream	-23ºC	−35ºC

*1. Take into consideration the pressure loss that occurs in a system with long refrigerant line, and adjust the target evaporating temperature as necessary.

- Even when using MODBUS® to set the target evaporation temperature, always use the dip switch (SW2) to set the target evaporation temperature before operating the unit.
  When the power to the unit is shut off due to a power outage, the unit starts up with the target evaporation temperature that has been set with the dip switch (SW2) upon recovery of the power.
  Until the target evaporation temperature is set again using MODBUS®, the target evaporation temperature that has been set with the dip switch (SW2) is effective.
- For instructions on how to set the target evaporation temperature using MODBUS®, refer to the MODBUS® Interface Manual.
- Please contact the local distributor for the MODBUS® Interface Manual.

Extra information

Target evaporation temperatures and corresponding control value (automatically calculated)

Target evaporation temperature	ºC	-35	-30	-20	-10	-5
Target low pressure	MPa	1.11	1.32	1.86	2.54	2.94
Low-pressure cutoff compressor OFF-threshold	MPa	0.90	0.90	1.32	1.86	2.18
Low-pressure cutoff compressor ON-threshold	MPa	1.10	1.18	1.58	2.19	2.54

12-5. Test run procedure

12-5-1. Initial processing

It will take approximately two minutes (max. five minutes) for the low pressure to be displayed on the digital display on the MAIN board after the unit is turned on.
If the low pressure does not appear on the digital display after a while, check for wiring errors.

(1) What to expect during the initial processing
During the initial setting of the LEV, the LEV will make clicking noises, but this is not a malfunction.
During the initial setting of the circuit board, a value will appear on the digital display for a few seconds.

12-5-2. Operation

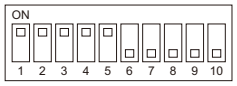
(1) Operate the unit operation. (Capacity control)

1) Check that dip switch SW3-5 is OFF.
Capacity control operation is performed using the inverter.
2) Set the ON/OFF switch (SW1) to ON.
The unit starts operating.
Low pressure will be displayed on the digital display on the MAIN board.

12-5-3. Stop the unit. (Pump down stop)

(1) Stop the unit.

Set the ON/OFF switch (SW1) to OFF.
The unit stops operating.



Switches 1 to 5 are ON, and switches 6 to 10 are OFF in the figure on the left.

Note

- To prevent refrigerant flood-back upon resuming operation, turn off the switch (SW1) after low-pressure cutoff from pump down operation.

(2) Stop the unit after pump down. (Pump-down mode)

Use the pump-down mode when closing the solenoid valve on the liquid line, recovering the refrigerant to the liquid receiver, and providing maintenance for the load-side equipment.

1) Set the ON/OFF switch (SW1) to OFF to stop the operation.
2) Set the unit power to OFF.
3) Set dip switch SW3-5 to ON to start the fixed frequency mode. Set dip switch SW3-1 on the unit to ON to start the pump-down mode.
4) Set the unit power to ON and the ON/OFF switch (SW1) to ON to start the operation.
The unit operates at the low-pressure cutoff OFF-threshold of 0.9 MPa and the ON-threshold of 1.1 MPa.
After completing the pump down process, set the ON/OFF switch (SW1) to OFF to stop the operation, and set dip switches SW3-5 and 3-1 to OFF with the unit power set to OFF.
* Do not operate the unit in the above settings except to perform maintenance.
* Even after pump down stop, approximately 1 MPa of refrigerant will remain on the low-pressure side. Refrigerant may spew out during servicing.

- If the system is overcharged with refrigerant, performing a pump-down operation through the liquid service valve in high ambient temperature (30°C or above) may result in high-pressure cut off.
- If a pumpdown is performed on a system with refrigerant overcharge and is then stopped for a long time, the pressure may rise. Do not perform a pumpdown, and instead stop the unit by turning off the operation switch.

12-6. Checking the unit condition

12-6-1. Regular operation check

Check that the discharge pressure is not abnormally high.

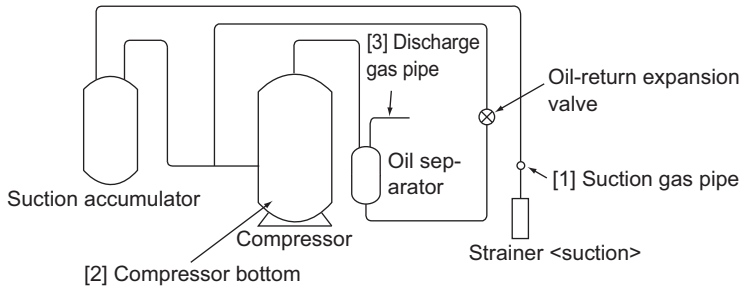
Ambient temperature	0	5	10	15	20	25	30	35	40
Discharge pressure	5.5	5.5	5.7	6.0	6.5	7.0	8.0	9.0	9.5

Check that the unit's suction gas temperature does not exceed 20°C.

Check if the compressor is not flooding. If the compressor is flooding, adjust the opening of the expansion valve on the load side.

The solenoid valve may open or close while the compressor is stopping. This is not a malfunction.

•The table below shows the temperature of each part when the unit is properly adjusted.



Evaporation temperature (°C)	-10	-35
[1] Unit suction gas temperature (°C)	0 to 10	-15 to -5
[2] Compressor bottom (°C)	40 to 65	50 to 75
[3] Discharge gas temperature (°C)	90 to 110	90 to 110

- Power supply: 3-phase 4-wire, 380 to 415 V, 50 Hz
- Ambient temperature: 32°C
- Operation at 40 Hz

12-6-2. Preventing short-cycling operation

(1) Checking if the operation is in short-cycling or not

Check the cycle of operation/stop time. If it is within 15 minutes, the operation is in short-cycling.

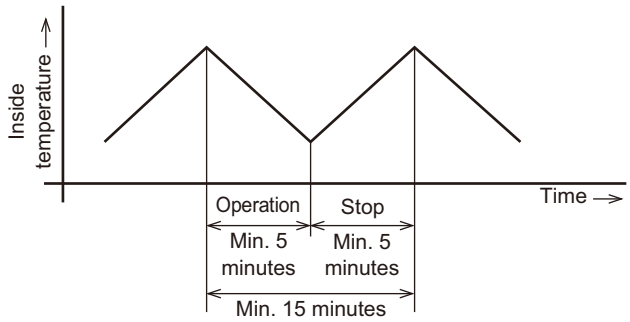
Eliminate the cause of the short-cycling.
The unit is equipped with a delay timer (at a maximum 200 seconds) to prevent frequent short-cycling operations.

(2) Preventing short-cycling operation (frequent repeat of operation/stop)

As an essential measure to prevent short-cycling operation, the operation pattern needs to be set as shown in the figure.

ion pattern needs to be set as shown in the figure.

- Short-cycling operation may cause a lack of lubricating oil because of a large oil trip at the startup.
- A large amount of current flows to the built-in motor when the unit starts, which may cause the motor to be overheated, resulting in burn-damage to the coil.



(3) Major cause of short-cycling

Followings are possible major causes of short-cycling.

- Setting failure of low pressure control
  For example, the low pressure differential is set to 0.2 MPa or below.
- Clogged strainer <suction>
- Leakage in the injection circuit or in solenoid valve <liquid> on the evaporator side caused by device fault or foreign substances.
- Refrigerant undercharge
- Condensing unit selection error (Unit capacity is too large.)
- Frosted evaporator

12-6-3. Troubleshooting

(1) How to check the error history

If the following code and value are shown on the digital display of the MAIN board, perform troubleshooting according to "Error codes and messages for troubleshooting" (page 72).

- 4-digit code → Detailed code → 000H → Low pressure (Alternating blinking display)

Note

- After the test run, check for leakage.

12-6-4. Error code

(1) Error code list

The table below shows a list of Error code that are shown on the digital display.
Refer to "Error codes and messages for troubleshooting " for details.
The following codes blinks on the digital display in order.
• 4-digit code → Detailed code → 000H → Low pressure (Alternating blinking display)
Alarm (control board) output "Default" in the table indicates the following settings.
on: Alarm is output when an error occurs.; off: Alarm is not output when an error occurs.

Error code	Detail code	Preliminary code	Detail code	Error type	Alarm (X112) output
					Default
4102	001	-	-	Open phase	ON
4106	-	-	-	Self-power-supply OFF error (power supply detection error)	OFF
1102	001	1202	001	Discharge temperature rise protection function trip	ON
1301	-	1401	-	Pressure sensor (PSL) fault	ON
5101	-	1202	-	Thermistor <discharge pipe temperature (TH1)> fault	ON
5104	003	-	-	Thermistor <gas cooler outlet temperature (TH4)> fault	OFF
5105	002	-	-	Thermistor <heat exchanger outlet temperature (TH5)> fault	OFF
5112	-	1243	-	Thermistor <compressor shell oil temperature (TH2)> fault	OFF
1500	001	-	-	Refrigerant floodback protection 1	ON
1500	002	-	-	Refrigerant floodback protection 2	ON
1143	-	-	-	High oil temperature fault	ON
1302	001	1402	001	High pressure (HPS1) fault	ON
1302	006	1402	006	High pressure (HPS2) fault	ON
1304	-	1404	-	High pressure (MPS) fault	ON
1559	-	-	-	Oil-return pipe clogging	ON
5201	-	1402	-	Pressure sensor <PSH1> fault	ON
5201	004	1402	004	Pressure sensor <PSH2> fault	ON
5204	001	1404	001	Pressure sensor <PSM> fault	ON
5106	-	-	-	Thermistor <ambient temperature (TH6)> fault	OFF
5110	001	1214	001	Inverter heatsink temperature drop/thermistor circuit fault	OFF
4250	101	4350	101	IGBT fault	ON
4250	104	4350	104	IGBT short-circuit/ground fault	ON
4250	105	4350	105	Inverter overload short-circuit	ON
4250	106	4350	106	Overcurrent cutoff <instantaneous inverter value S/W> fault	ON
4250	107	4350	107	Overcurrent cutoff <effective inverter value S/W> fault	ON
4220	108	4320	108	Inverter BUS voltage drop protection	ON
4220	109	4320	109	Inverter BUS voltage rise protection	ON
4220	111	4320	111	Logic error	ON
4220	129	4320	129	Control power supply fault	ON
4230	-	4330	-	Inverter heatsink overheat protection	ON
4240	-	4340	-	INV overload protection	ON
5301	115	4300	115	Current sensor <inverter AC current> fault	ON
5301	117	4300	117	Current sensor circuit <inverter AC current> fault	ON
5301	119	4300	119	IGBT open-phase/inverter AC current sensor disconnection detection error	ON
5301	120	4300	120	Inverter AC current sensor mis-wiring detection error	ON
0403	001	4300	001	Serial communication <MAIN board> error	ON
5108	-	-	-	Thermistor <liquid pipe temperature (TH8)> fault	OFF
5109	002	-	-	Thermistor <return-oil pipe temperature (TH9)> fault	OFF
4220	131	4320	131	Inverter BUS voltage drop protection	ON
1302	002	-	-	Mechanical protective device <pressure switch/thermal switch> trip	ON
5107	-	-	-	Thermistor <suction pipe temperature (TH7)> fault	OFF
4116	001	4166	001	Fan rotation speed error (connector CNFAN1)	ON
4116	002	4166	002	Fan rotation speed error (connector CNFAN2)	ON
-	-	7000	050	IGBT system error (inverter reset)	-

Error code	Detail code	Preliminary code	Detail code	Error type	Alarm (X112) output
					Default
Function setting error					
7113	014	-	-	TYPE4 error	ON
7113	015	-	-	TYPE5 error	ON
7113	016	-	-	TYPE6 error	ON
7113	012	-	-	TYPE2 error	ON
7113	001	-	-	Unmatched unit model setting error	ON
Function setting error (unset)					
7117	014	-	-	TYPE4 open error	ON
7117	015	-	-	TYPE5 open error	ON
7117	016	-	-	TYPE6 open error	ON
7117	012	-	-	TYPE2 open error	ON

♦ Thermistor fault indicates that a shorted or open thermistor is detected.

Other codes	Code explanation
Lo	It is suggested that the low pressure is -0.100MPa or below.
H2	Operation with the inverter compressor operating frequency being fixed at a certain level.
OIL1	Oil return operation in progress

12-7. Miscellaneous functions

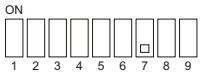
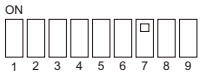
12-7-1. To correspond the low outside air temperature

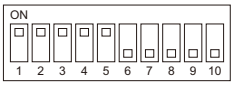
(1) When outside air temperature is below internal unit temperature

When outside air temperature is below internal unit temperature, operation failure may be caused to prevent the low pressure from its recovery after a compressor pumpdown stop. Also, a pipe flooding protection control may be detected in this condition. Follow the instructions below for troubleshooting.

a) Raise high pressure.
Take appropriate measures on site, such as narrowing the suction space of condenser.

b) Use the Low outside air temperature mode.
Changing the dip switch SW2 setting will switch the mode into the low outside air temperature mode which enables the unit to operate under low outside air temperature. When the outside air temperature is less than 0°C and the low-pressure cutoff OFF-threshold is reached, the compressor will stop and restart after three minutes in the Low outside air temperature mode.

Operation mode	Dipswitch SW2	Notes
Normal mode (Factory setting)		A pump down operation is performed according to the low-pressure cutoff OFF and ON thresholds depending on the target evaporation temperature setting.
Low outside air temperature mode		When the outside air temperature is less than 0°C and the low-pressure cutoff OFF-threshold is reached, the compressor will stop and restart after three minutes even if the low-pressure is still below the ON-threshold. (The compressor will stop and be held when the low-pressure reaches the OFF-threshold after startup.)



Switches 1 to 5 are ON, and switches 6 to 10 are OFF in the figure on the left.

c) Decrease the target evaporation temperature.
If the low pressure does not recover after a pump down stop, change the setting of the dip switch (SW2) to decrease the target evaporation temperature.
For how to set the dip switch, refer to section 12-4. Setting the target evaporation temperature (page 57).

13-1. The list of control item

Control type	Function	Content
Control at Startup	Frequency control	The inverter compressor will operate at or below 35 Hz for three minutes after startup.
Control at stoppage	High-pressure startup prevention control	When the high pressure is high, the unit will operate in the fan mode without starting up the compressor.
Normal operation control	Frequency control	Controls the compressor operating frequency and fan rotation speed for the high/low pressure to meet the target pressure.
	Fan control	
	Oil recovery control	When the cumulative operation time of the inverter compressor under the specified conditions reaches one hour, the compressor will stop and remain stopped for three minutes to allow the oil to migrate back to the compressor.
	Low-pressure cutoff control	Low-pressure cutoff threshold will automatically be calculated according to the target evaporation temperature setting.
	(Short-cycling operation)	Once stopped, the unit will not restart for three minutes to prevent short-cycling.
	Discharge temperature control	Control the linear expansion valve (LEV2) to reach the discharge pipe temperature to 100°C or below.
Backup control	Low compression ratio protection (LED4: bP01)	Increases the compressor operation frequency when the compressor operation frequency is low and the compression ratio is small.
	Fan motor hunting prevention (LED4: bP02)	Decreases the fan output when the fan output is large and the rotation speed of the fan is unstable.
	Discharge pressure suppression 1 (LED4: bP03)	Decreases the compressor operation frequency and opens LEV2 when the discharge pressure is high.
	Discharge temperature suppression (LED4: bP04)	Decreases the compressor operation frequency when the discharge temperature is high.
	Low-pressure suppression (LED4: bP05)	Decreases the compressor operation frequency when the low pressure approaches the cut-off value.
	Discharge temperature overrise protection (LED4: bP06)	Decreases the compressor operation frequency and opens LEV3 when the discharge temperature is high.
	Discharge temperature overrise protection (LED4: bP28)	Opens LEV2 and LEV3 when the discharge temperature is high.
	Discharge pressure overrise protection (LED4: bP07)	Operates the fan at full speed when the discharge pressure is high.
	Low-pressure retraction speed protection (LED4: bP09)	Decreases the compressor operation frequency when the low-pressure retraction speed is fast.
	Compressor shell bottom temperature protection 1 (LED4: bP13)	Opens solenoid valve 21R2 when the compressor shell-bottom temperature is high.
	Compressor shell bottom temperature protection 2 (LED4: bP14)	Increases the compressor operation frequency when the compressor shell-bottom temperature is high and the compressor operation frequency is low.
	Refrigerant flood-back protection 1 (LED4: bP15)	Increases the compressor operation frequency when the temperature condition for triggering the refrigerant flood-back protection is met and the compressor operation frequency is low.
	Refrigerant flood-back protection 2 (LED4: bP17)	Decreases the compressor operation frequency when the temperature condition for triggering the refrigerant flood-back protection is met and the compressor operation frequency is high.
	Heatsink temperature overrise suppression (LED4: bP18)	Operates the fan at full speed when the heatsink temperature is high.
	Liquid pipe pressure overrise suppression (LED4: bP25)	Closes LEV1 when the liquid pipe pressure is high.
	Discharge pressure suppression 2 (LED4: bP27)	Decreases the compressor operation frequency and closes LEV3 when the discharge pressure is high.
	Liquid reservoir pressure overrise protection (LED4: bP29)	Closes LEV2 when the liquid reservoir pressure is high.
	High compression ratio protection (LED4: bP30)	Decreases the compressor operation frequency when the compression ratio of the compressor is large.
Abnormal stop control	Refer to the "Error codes and messages for troubleshooting" for the details of abnormal stop control.	
Service functions	Backup operation (During low-pressure sensor fault)	When an inverter compressor operation is available, the operating frequency will be fixed.

♦The inverter compressor of this unit cannot be operated with commercial power supply.
Refer to the clause "Troubleshooting the principal components" for any problems with the unit.

13-1-1. Initial processing

It will take approximately two minutes (max. five minutes) for the low pressure to be displayed on the digital display on the MAIN board after the unit is turned on.
If the low pressure does not appear on the digital display after a while, check for wiring errors.

(1) What to expect during the initial processing
During the initial setting of the LEV, the LEV will make clicking noises, but this is not a malfunction.
During the initial setting of the circuit board, a value will appear on the digital display for a few seconds.

13-1-2. Low-pressure cutoff (normal operation)

a) Low-pressure cutoff threshold will automatically be calculated according to the target evaporation temperature setting.
b) Once stopped, the unit will not restart for three minutes to prevent short-cycling.

13-1-3. Oil recovery control

Procedures

1) Oil recovery operation will start when the operating frequency of the inverter compressor meets the conditions as defined in the table below.
2) Oil recovery operation will be terminated when the operating frequency of the inverter compressor meets the conditions as defined in the table below.

Unit model	Oil recovery control		
	Operation start conditions	Operation end conditions	Control frequency
ECOV-X37VA ECOV-X55VA	Cumulative operation at or below the specified operating frequency has not exceeded 1 hour.	Compressor has been operating at 58 Hz or above for five minutes or longer.	58 Hz or above

See page 69 for how to set SET1 and SET2.

(1) Oil recovery operation

Procedures

1) All compressors will remain stopped for three minutes.
2) Operate the compressor at the specified frequency. (See the table above "Control frequency" for the frequency during oil-return operation.)
If the low pressure reaches the OFF-threshold, all compressors will stop for three minutes.
3) Oil-return operation will automatically end when the cumulative operation time of 2) has reached five minutes, and the unit will resume normal operation.

13-1-4. High pressure suppression control

(1) Control related to discharge pressure
If the discharge pressure reaches 10.3 MPa or above, inverter compressor operating frequency will be reduced.
• Solenoid valve 21R3 will open if the discharge pressure is 9.8 MPa or above. (Solenoid valve 21R3 may not open under certain conditions.)

(2) Control related to liquid pipe pressure
• Solenoid valve 21R3 will open if the liquid pipe pressure is 7.6 MPa or above. (Solenoid valve 21R3 may not open under certain conditions.)

13-1-5. Compressor flooding prevention

Refrigerant flood-back control will be performed when the following conditions are continuously met for 30 minutes while the compressor is in operation.

- Compressor shell oil temperature < current low-pressure saturation (gas) temperature + 10°C (low-pressure saturation (gas) temperature > -10°C), or compressor shell oil temperature ≤ 0°C (low pressure saturation (gas) temperature ≤ -10°C)
- Discharge superheat (discharge pipe temperature - current high pressure saturation (gas) temperature) ≤ 20K (when HPS1 ≤ 7.2 MPa)
- Discharge pipe temperature ≤ 80°C (when HPS1 > 7.2 MPa)

(1) Control method

1) When the conditions for the refrigerant flood-back protection are met, the compressor will stop, and the alarm output (220-240 VAC between terminal block numbers 7 and 23) will be turned on.
2) [4-digit code → Detailed code → 000H → Low pressure] will appear on the digital display LED4 in order.
3) When the compressor shell oil temperature reaches 0°C or above (when low pressure saturation (gas) temperature is at or below -10°C) or the current low pressure saturation (gas) temperature + 10°C or above (when low pressure saturation (gas) temperature exceeds -10°C), or the suction superheat reaches 5K or above, the compressor will restart, and the unit will go back to normal control.
   At this time, [4-digit code → Detailed code → 000H → Low pressure] still appears on the digital display LED4.
   The display will go back to the normal low pressure display mode when the problem has been solved and the operation switch (ON/OFF) SW1 is turned off and then turned back on.

(2) Refrigerant flood-back alarm output display

1) When the following conditions are continuously met for 1 hour while the compressor is in operation, the alarm output (220-240 VAC between terminal block numbers 7 and 23) will be turned on, and [4-digit code → Detailed code → 000H → Low pressure] will appear on the digital display LED4 in order. (The compressor will not stop.)
   - Compressor shell oil temperature < -15°C
2) When the following conditions are met for continuous 3 hours when the compressor is in operation or stopped, the alarm output (200 V between terminal block numbers 7 and 23) will be turned on, and [4-digit code → Detailed code → 000H → Low pressure] will appear on the digital display LED4 in order. (The compressor will not stop.)
   - Compressor shell oil temperature < -5°C and compressor shell oil temperature < current low pressure saturation (gas) temperature + 10°C (low-pressure saturation (gas) temperature > - 10°C)
     Or compressor shell oil temperature < -5°C and compressor shell oil temperature ≤ 0°C (low pressure saturation (gas) temperature ≤ -10°C)
   - Discharge superheat (discharge pipe temperature - current high pressure saturation temperature) ≤ 20K (when HPS1 ≤ 7.2 MPa)
   - Discharge pipe temperature ≤ 80°C (when HPS1 > 7.2 MPa)
   - Cumulative compressor operation in a given 3 hour is 10 minutes or longer.

Note

- When the shell bottom thermistor (TH2) or pressure sensor (PSL) error is occurring, this control will not be performed.

13-1-6. Other

- On this unit, solenoid valve 21R1 opens during operation. (Solenoid valves 21R2 and 21R3 are closed.) When the low pressure is high during operation, however, solenoid valve 21R1 may stay closed and solenoid valve 21R2 may open. (Solenoid valve 21R3 remains closed.)
- When the low pressure is low during operation, the minimum frequency may rise under certain conditions.

13-2. Switch settings

13-2-1. Dip switch settings

Note

- Before setting the dip switch, turn off the main power of the unit.

(1) Dip switch settings

SW		Item	OFF	ON	Note
1	1–6	M-NET address setting	See the table below for combinations.		
2	1–6	Target evaporation temperature setting	See the separate table for combination.		See the specified page. (page 57)
	7	Low outside air temperature mode	Low-pressure cutoff ON-threshold effective (normal operation)	The compressor resumes operation 3 minutes after it was stopped by the low-pressure cutoff function.	Effective when outside temperature is 0ºC or below (page 65)
	8	Use of oil-recovery operation (oil return)	SET2	SET1	Factory default setting: SET 2
	9	Compressor INV no-load operation mode	Disable	Enable	See the specified page. (page 88) (Set to OFF normally.)
3	1	Pump-down mode	Normal	Pump-down mode	Effective only when the compressor operating frequency is fixed: The low-pressure cutoff OFF-threshold will be 0 MPa.
	4	Use of emergency operation during a low-pressure sensor error	No	Yes	Effective only when the compressor operating frequency is fixed: When the low-pressure sensor fails, the pressure switch (locally procured) will perform low-pressure cutoff control.
	5	Operation mode switching	Normal	Fixed frequency operation	The compressor operating frequency is fixed in the fixed frequency mode.

Note

- Do not change the settings of the items that are not contained in the table above. (For the factory default settings, see the nameplate on the product.)

13-2-2. Dip switch settings 1-1 to 1-6 (M-NET address settings)

No.	SW[1]*1						address
	1	2	3	4	5	6	
0	0	0	0	0	0	0	151
1	1	0	0	0	0	0	151
2	0	1	0	0	0	0	152
3	1	1	0	0	0	0	153
4	0	0	1	0	0	0	154
5	1	0	1	0	0	0	155
6	0	1	1	0	0	0	156
7	1	1	1	0	0	0	157
8	0	0	0	1	0	0	158
9	1	0	0	1	0	0	159
10	0	1	0	1	0	0	160
11	1	1	0	1	0	0	161
12	0	0	1	1	0	0	162
13	1	0	1	1	0	0	163
14	0	1	1	1	0	0	164
15	1	1	1	1	0	0	165
16	0	0	0	0	1	0	166

No.	SW[1]*1						address
	1	2	3	4	5	6	
17	1	0	0	0	1	0	167
18	0	1	0	0	1	0	168
19	1	1	0	0	1	0	169
20	0	0	1	0	1	0	170
21	1	0	1	0	1	0	171
22	0	1	1	0	1	0	172
23	1	1	1	0	1	0	173
24	0	0	0	1	1	0	174
25	1	0	0	1	1	0	175
26	0	1	0	1	1	0	176
27	1	1	0	1	1	0	177
28	0	0	1	1	1	0	178
29	1	0	1	1	1	0	179
30	0	1	1	1	1	0	180
31	1	1	1	1	1	0	181
32	*	*	*	*	*	1	182

*1 The values in the table above mean the following: 1=ON, 0=OFF, *=Either ON or OFF

13-3. Control methods for the control items

Discharge-temperature based control (TH1•26C)

°C

135 — Abnormal stop (mechanical)

120 — Abnormal stop (sensor)

115 — Compressor operating frequency decreased

111 — LEV opening increased (up to maximum opening) and compressor operating frequency decreased
(The compressor does not decelerate under certain conditions.)

Discharge superheat ≤ 2°C
- •Injection solenoid valve closes.
- •Compressor flooding protection range

(The AND conditions of suction superheat and oil temperature superheat.)

Oil temperature control (TH2)

° C

80 — Compressor stops if this temperature lasts for 5 seconds or longer.

75 — Solenoid valve 21R2 opens.

74 — When the compressor operating frequency is low, the compressor accelerates.
(The frequency does not exceed the upper limit.)

Compressor shell temperature superheat ≤ -8°C
- • Operating frequency control (at or above 30 Hz, at or below 37 Hz)
- • Compressor flooding protection range (The AND conditions of suction superheat and oil temperature superheat)

Discharge-pressure control (HPS1, 63H)

MPa

12.0 — Abnormal stop (mechanical)

11.0 — Abnormal stop (sensor)

10.6 — Compressor operating frequency decreased minimum and LEV3 opening decreased

10.3 — Compressor operating frequency decreased and LEV2 opening increased

9.8 — Fan operates at maximum speed

Compression ratio < 1.67 — Compressor operating frequency increased

Compression ratio < 1.55 — Compressor operating frequency increased

Compression ratio < 1.33 — Compressor operating frequency increased

Liquid pipe pressure-based control (HPS2)

8.0 — Abnormal stop (sensor)

7.6 — Solenoid valve 21R3 opens. (Solenoid valve 21R3 does not open under certain conditions.)

7.4 — LEV1 opening decreases.

Liquid trap pressure-based control (MPS)

8.5 — Abnormal stop (sensor)

Use one of the following to troubleshoot problems with the condensing unit.
(1) If the digital display on the MAIN board is lit, see the section "c) Error codes and messages for troubleshooting".
(2) If the digital display on the MAIN board is unlit, use the flowchart "Checking the electrical circuit."
(3) If the compressor does not start, no error code appears on the display, and the inter-phase voltage is low (approx. 100V), check for open phase.

14-1. Troubleshooting

a) Checking tips for each error code
Troubleshooting can be done by using the digital display (the slide and rotary switches).
When the LED4 is alternately blinking
Perform troubleshooting according to the section "Error codes and messages for troubleshooting."
When the LED4 displays only low pressure
If the condensing units are not operating normally, check for a blown fuse, check that the target evaporation temperature setting, target condensation temperature setting, and dip switch settings for maintenance are set correctly, and that the refrigerant circuit (pressure/temperature), electrical circuits, and power supplies (voltage/frequency) are trouble-free.

b) Remedy
When an error occurs, follow the procedures below for checkup.

Procedures

1) When errors are detected, LED4 displays error codes, and compressor stops.
2) Remove the cause of the error, and press the error reset switch (SW3) (field-supplied).
3) Turn the ON/OFF switch (SW1) in the control box on the unit to OFF, and turn it back ON.
The error code keeps blinking even after re-starting the unit by the field-supplied switch <error reset>: SW3.
The error code will light off.
If the unit is restarted with the error reset switch (SW3) (field-supplied), the error code will remain lit.

c) Error codes and messages for troubleshooting

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause	Check method and remedy
Error code	Detail code	Preliminary code	Detail code					
4102	001	–	–	Open phase		(1) An open phase in the power supply (L1 and N phases) was detected.	(i) Power supply fault Open phase in the power supply Power supply voltage drop	Check the input voltage (L1-N) at power supply terminal block TB1.
							(ii) Noise filter board fault Coil (L1, N) fault	Check the coil for proper connection. Check the coil for breakage. Check that the voltage at connector CN4 ≥ 280 V.
							(iii) Wiring connection fault	Check that the voltage at connector CNAC on the MAIN board ≥ 195 V. If below 195 V, check the wiring connection between CN4 on the noise filter board and CNAC on the control board.
							(iv) Blown fuse	Check to see if fuse F001 on the MAIN board is not blown. → If the fuse is blown, check the actuator for short-circuit and ground fault.
4106	–	–	–	Self-power-supply OFF error (power supply detection error)		(1) Transmission line power supply fault	(i) Wiring fault	Check all units in a given refrigerant system for the following. a) Turn off the power supply, disconnect the wires from TB3 and TB7, turn the power supply back on, and check if a voltage of 25 V is output from each unit after 120 seconds. If the power supply connector is connected to CN41 on the MAIN board, no voltage will be output to TB7. When no voltage is output in step "a)," check the following. b) Check CN102, CNS2, CNIT, which connect the MAIN board and the transmission power-supply board, for proper connection. If no voltage is output in step "a)" or "b)," there is a problem with the MAIN board or the transmission power-supply board. If a voltage is output in step "a)" or "b)," check the following. c) Check the indoor-outdoor transmission line and the transmission line for centralized control for shorting. d) Check the transmission line for centralized control and the indoor-outdoor transmission line are not mixed up. e) Check that only one unit is supplying power to the transmission line for centralized control. (There should only be one unit whose power-supply connector is connected to CN40 or a power-supply device.) Check that no other power-supply devices or units are supplying power to the indoor-outdoor transmission line. (Look for units whose LED1 on the transmission power-supply board is lit.)
							(ii) Transmission line power supply overcurrent was detected, and voltage cannot be output.	
							(iii) Transmission line power supply is malfunctioning, and voltage cannot be output.	
							(iv) Transmission line detection circuit fault	
						(2) Transmission line power supply reception fault	One unit stopped supplying power, and no other units start supplying power.	

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause		Check method and remedy
Error code	Detail code	Preliminary code	Detail code						
1102	001	1202	001	Discharge temperature rise protection function trip		(1) If the thermistor <discharge pipe temperature> registers 120ºC during operation, the unit will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If a temperature of 120ºC or higher is detected twice within 30 minutes of the stoppage of the units, the units will make an abnormal stop, and an error code will be displayed. The error code will be written to the memory at this time. (3) If a temperature of 120ºC or higher is detected after 30 minutes have elapsed after the stoppage of the units, it is regarded as the first detection, and the sequence as described in section (1) above will be followed.	(i)	Refrigerant gas leakage, refrigerant gas undercharge	Check the refrigerant amount through the sight glass. Add refrigerant.
							(ii)	Overload operation	Check the operation data. Check the suction gas temperature.
							(iii)	Expansion valve actuation fault	Check the LEV for proper operation. Check the temperature at the LEV inlet/outlet. (Use the fixed LEV opening mode.)
							(iv)	Temporary refrigerant shortage due to refrigerant floodback	Check the operation status, such as incorrect opening angle of the expansion valve, solenoid valve <liquid> fault, fan motor fault, heat exchanger clogging, and the start-delay time of the fan.
							(v)	Refrigerant service valve operation fault	Check that the refrigerant service valves are fully open.
							(vi)	Fan motor fault Fan control board fault	Refer to 14-3-4. (7) Quick check of the DC fan motor (fan motor/control board).
							(vii)	Thermistor <discharge pipe temperature> fault	Check the thermistor intake temperature. Check the thermistor resistance value.
							(viii)	MAIN board thermistor <discharge pipe temperature) input circuit fault	Same as above
1301	–	1401	–	Pressure sensor (PSL) fault		(1) If an open- or short-circuited pressure sensor <PSL> is detected (first detection), the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If an open- or short-circuit is detected twice within 30 minutes of the stoppage of the units, the units will make an abnormal stop. The error code will be written to the memory at this time.	(i)	Pressure sensor <PSL> fault	Refer to page 82.
							(ii)	Broken sensor wire sheath	Check the sensor wire sheath for tear.
							(iii)	Missing connector pins	Check the connector for missing pins.
							(iv)	Sensor wire breakage	Check the sensor wire for breakage.
							(v)	MAIN board low-pressure input circuit fault	Check the sensor intake pressure.
							(vi)	Pressure drop due to refrigerant gas leakage.	Check the pressure with a gauge manifold.
5101	–	1202	–	Thermistor <discharge pipe temperature (TH1)> fault		(1) A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. The operation will automatically be continued if other sensors can be substituted for.	(i)	Thermistor fault	Check the thermistor resistance.
							(ii)	Pinched lead wire	Check the lead wire for pinching.
5112	–	1243	–	Thermistor <compressor shell oil temperature (TH2)> fault			(iii)	Torn wire sheath	Check the wire sheath for tear.
							(iv)	Missing connector pins, contact failure	Check the connector for missing pins.
							(v)	Broken wire	Check the wire for breakage.
							(vi)	Circuit board thermistor input circuit fault	Check the sensor intake temperature.
5104	003	–	–	Thermistor <gas cooler outlet temperature (TH4)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. Abnormal thermistor will be ignored, and the operation will be continued.	(i)	Thermistor fault	Check the thermistor resistance.
							(ii)	Pinched lead wire	Check the lead wire for pinching.
							(iii)	Torn wire sheath	Check the wire sheath for tear.
							(iv)	Missing connector pins, contact failure	Check the connector for missing pins.
							(v)	Broken wire	Check the wire for breakage.
							(vi)	Circuit board thermistor input circuit fault	Check the sensor intake temperature.
5105	002	–	–	Thermistor <heat exchanger outlet temperature (TH5)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. Abnormal thermistor will be ignored, and the operation will be continued.	(i)	Thermistor fault	Check the thermistor resistance.
							(ii)	Pinched lead wire	Check the lead wire for pinching.
							(iii)	Torn wire sheath	Check the wire sheath for tear.
							(iv)	Missing connector pins, contact failure	Check the connector for missing pins.
							(v)	Broken wire	Check the wire for breakage.
							(vi)	Circuit board thermistor input circuit fault	Check the sensor intake temperature.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause		Check method and remedy
Error code	Detail code	Preliminary code	Detail code						
1500	001	–	–	Refrigerant floodback protection 1		(1) If a discharge superheat of 20 K or below (HPS1 ≤ 7.2 MPa or TH1 ≤ 80ºC (HPS1 > 7.2 MPa), and the compressor shell bottom superheat of below 10 K, and a suction superheat below 5 K are registered for continuous 30 minutes, the units will make an abnormal stop. The error code will be written to the memory at this time. (2) If the compressor shell oil temperature reaches 10ºC or above, the operation will be resumed. (3) If the compressor shell oil temperature of -15ºC or below has been registered for an hour, an error code will be displayed. (The compressor will not stop operating.) The error code will be written to the memory at this time. (4) If the compressor shell oil temperature reaches 10ºC or above, the error code will be cancelled.	(i)	load-side fault	Check the operation status, such as incorrect opening angle of the expansion valve, solenoid valve <liquid> fault, fan motor fault, heat exchanger clogging, and the start-delay time of the fan.
							(ii)	Expansion valve actuation fault	Check the LEV for proper operation. Check the temperature at the LEV inlet/outlet. (Use the fixed LEV opening mode.)
1500	002	–	–	Refrigerant floodback protection 2			(iii)	Thermistor fault (TH1, TH2, PSH1, PSL)	Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							(iv)	Thermistor installation problem (TH1, TH2, PSH1, PSL)	Check that the thermistor and the pressure sensor are installed in the correct places.
							(v)	MAIN board thermistor input circuit fault (TH1, TH2, PSH1, PSL)	Check the sensor intake temperature and pressure.
1143	–	–	–	High oil temperature fault		(1) If a thermistor <compressor shell oil temperature> of 80ºC or higher is registered for continuous five seconds during operation, the compressor will stop, go into the three-minute restart-delay mode, and an error code will be displayed. The error code will be written to the memory at this time. (2) If the thermistor <compressor shell oil temperature> reading reaches 70ºC or below after three or more minutes have elapsed since the stoppage of the unit, the operation will be resumed.	(i)	Refrigerant gas leakage, refrigerant gas undercharge	Check the low pressure and the sight glass. Add refrigerant.
							(ii)	Overload operation	Check the operation data. Check the suction gas temperature.
							(iii)	Stop valve operation fault	Check that the stop valves are fully open.
							(iv)	Excessive oil in the compressor	Check the amount of oil in the compressor.
							(v)	Thermistor <compressor shell oil temperature> fault	Check the sensor intake temperature. Check the thermistor resistance value.
							(vi)	MAIN board thermistor <compressor shell oil temperature> input circuit fault	Same as above
1302	001	1402	001	High pressure (HPS1) fault		(1) If the pressure sensor <PSH1> detects a pressure of 11.0 MPa or higher during operation (first detection), the compressor stops, goes into the three-minute restart-delay mode, and restarts after three minutes. The error code will be written to the memory at this time. (2) If a pressure of 11.0 MPa or higher is detected twice within 30 minutes of the stoppage of the unit, the unit will make an abnormal stop, and an error code will be displayed. The error code will be written to the memory at this time. (3) If a pressure of 11.0 MPa or higher is detected after 30 minutes have elapsed after the stoppage of the unit, it is regarded as the first detection, and the sequence as described in section (1) above will be followed.	(i)	Stop valve operation fault	Check that the stop valves are fully open.
							(ii)	Short-cycling operation	Check the suction air temperature.
							(iii)	Dirty heat exchanger	Check the heat exchanger for soiling.
							(iv)	Fan motor fault	Refer to page 94.
							(v)	Loose fan motor connector	Check the fan motor connector for proper insertion.
							(vi)	Pressure sensor <PSH1> fault	Refer to page 82.
							(vii)	MAIN board pressure sensor <PSH1> input circuit fault	Check the sensor intake pressure.
							(viii)	Pressure switch <high pressure> connector disconnection	Check the pressure switch <high pressure> connector for proper insertion. Wiring fault between the pressure switch <high pressure> and the MAIN board.
							(ix)	Refrigerant overcharge	Check the high pressure during operation.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause		Check method and remedy
Error code	Detail code	Preliminary code	Detail code						
1302	006	1402	006	High pressure (HPS2) fault		(1) If a pressure of 8.0 MPa or higher is detected (first detection) by the pressure sensor <PSH2> during operation, the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If a pressure of 8.0 MPa or higher is detected twice within 30 minutes of the stoppage of the unit, the unit will make an abnormal stop, and an error code will appear. The error code will be written to the memory at this time. (3) If a pressure of 8.0 MPa or higher is detected after 30 minutes have elapsed after the stoppage of the unit, it is regarded as the first detection, and the sequence as described in section (1) above will be followed.	(i)	Stop valve operation fault	Check that the stop valves are fully open.
							(ii)	Short-cycling operation	Check the suction air temperature.
							(iii)	Dirty heat exchanger	Check the heat exchanger for soiling.
							(iv)	Fan motor fault	Refer to page 94.
							(v)	Loose fan motor connector	Check the fan motor connector for proper insertion.
							(vi)	Pressure sensor <PSH2> fault	Refer to page 82.
							(vii)	MAIN board pressure sensor <PSH2> input circuit fault	Check the sensor intake pressure.
							(viii)	Refrigerant overcharge	Check the high pressure during operation.
1304	–	1404	–	High pressure (MPS) fault		(1) If a pressure of 8.5 MPa or higher is detected (first detection) by the pressure sensor <PSM> during operation, the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If a pressure of 8.0 MPa or higher is detected twice within 30 minutes of the stoppage of the unit, the unit will make an abnormal stop, and an error code will appear. The error code will be written to the memory at this time. (3) If a pressure of 8.0 MPa or higher is detected after 30 minutes have elapsed after the stoppage of the unit, it is regarded as the first detection, and the sequence as described in section (1) above will be followed.	(i)	Stop valve operation fault	Check that the stop valves are fully open.
							(ii)	Short-cycling operation	Check the suction air temperature.
							(iii)	Dirty heat exchanger	Check the heat exchanger for soiling.
							(iv)	Fan motor fault	Refer to page 94.
							(v)	Loose fan motor connector	Check the fan motor connector for proper insertion.
							(vi)	Pressure sensor <PSM> fault	Refer to page 82.
							(vii)	MAIN board pressure sensor <PSM> input circuit fault	Check the sensor intake pressure.
							(viii)	Refrigerant overcharge	Check the high pressure during operation.
1559	–	–	–	Oil-return pipe clogging		If the return-oil pipe temperature <TH9> relative to the discharge pipe temperature <TH1> remains below the specified temperature for 30 continuous minutes, the opening of the expansion valve (return oil) will be increased. If no improvements are seen when LEV4 is fully open, the compressor frequency will be brought to 45 Hz, and the error code will be displayed.	(i)	Clogged strainer	Check the temperature before and after the strainer.
							(ii)	Expansion valve (return-oil pipe) clogging, actuation fault	Check the LEV for proper operation. Check the temperature at the LEV inlet/outlet. (Use the fixed LEV opening mode.)
							(iii)	Thermistor <return-oil pipe temperature> fault	Check the sensor intake temperature. Check the thermistor resistance value.
							(iv)	MAIN board thermistor <discharge pipe temperature> input circuit fault	Same as above
5201	–	1402	–	Pressure sensor <PSH1> fault		(1) If an open- or short-circuited pressure sensor is detected (first detection), the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If an open- or short-circuit is detected twice within 30 minutes of the stoppage of the unit, an error code will be displayed. The error code will be written to the memory at this time.	(i)	Pressure sensor <PSH1> fault	Refer to page 82.
							(ii)	Torn sensor wire sheath	Check the sensor wire sheath for tear.
							(iii)	Missing connector pins	Check the connector for missing pins.
							(iv)	Sensor wire breakage	Check the sensor wire for breakage.
							(v)	MAIN board low-pressure input circuit fault	Check the sensor intake pressure.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause		Check method and remedy
Error code	Detail code	Preliminary code	Detail code						
5201	004	1402	004	Pressure sensor <PSH2> fault		(1) If an open- or short-circuited pressure sensor is detected (first detection), the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If an open- or short-circuit is detected twice within 30 minutes of the stoppage of the unit, an error code will be displayed. The error code will be written to the memory at this time.	(i)	Pressure sensor <PSH2> fault	Refer to page 82.
							(ii)	Torn sensor wire sheath	Check the sensor wire sheath for tear.
							(iii)	Missing connector pins	Check the connector for missing pins.
							(iv)	Sensor wire breakage	Check the sensor wire for breakage.
							(v)	MAIN board low-pressure input circuit fault	Check the sensor intake pressure.
5204	001	1404	001	Pressure sensor <PSM> fault		(1) If an open- or short-circuited pressure sensor is detected (first detection), the compressor will stop, go into the three-minute restart-delay mode, and restart after three minutes. The error code will be written to the memory at this time. (2) If an open- or short-circuit is detected twice within 30 minutes of the stoppage of the unit, an error code will be displayed. The error code will be written to the memory at this time.	(i)	Pressure sensor <PSM> fault	Refer to page 82.
							(ii)	Torn sensor wire sheath	Check the sensor wire sheath for tear.
							(iii)	Missing connector pins	Check the connector for missing pins.
							(iv)	Sensor wire breakage	Check the sensor wire for breakage.
							(v)	MAIN board low-pressure input circuit fault	Check the sensor intake pressure.
5106	–	–	–	Thermistor <ambient temperature (TH6)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. The operation will automatically be continued if other sensors can be substituted for.	(i)	Thermistor fault	Check the thermistor resistance.
5110	001	1214	001	Inverter heatsink temperature drop/ thermistor circuit fault	Comp		(ii)	Pinched lead wire	Check the lead wire for pinching.
							(iii)	Torn wire sheath	Check the wire sheath for tear.
							(iv)	Missing connector pins, contact failure	Check the connector for missing pins.
							(v)	Broken wire	Check the wire for breakage.
							(vi)	Circuit board thermistor input circuit fault	Check the sensor intake temperature.
							(vii)	Inverter board fault	If the problem persists after restarting operation, replace the inverter board.
4250	101	4350	101	IGBT fault	Comp	When an IGBT error signal is detected	(i)	Inverter output related fault	Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
4250	104	4350	104	IGBT short-circuit/ground fault	Comp	When a short-circuit of the IGBT or a ground fault of the compressor is detected immediately before the inverter starts up	(i)	Compressor ground fault	Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							(ii)	Inverter output related fault	
4250	105	4350	105	Inverter overload short-circuit	Comp	When a short-circuiting of the compressor is detected immediately before the inverter starts up	(i)	Compressor short-circuit	Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							(ii)	Output wiring fault	Check the wire for compressor
4250	106	4350	106	Overcurrent cutoff <instantaneous inverter value S/W> fault	Comp	When the current sensor registers a current above the specified value Refer to "Value table" (page 80) for details.	(i)	Inverter output related fault	Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
4250	107	4350	107	Overcurrent cutoff <effective inverter value S/W> fault	Comp		(ii)	Compressor flooding	Check the compressor refrigerant flooding.
							(iii)	The suction temperature of the gas cooler is above the operating range.	Check the suction temperature of the gas cooler.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause	Check method and remedy
Error code	Detail code	Preliminary code	Detail code					
4220	108	4320	108	Inverter BUS voltage drop protection	Comp	When Vdc ≤ 350 V is detected during inverter operation (software detection)	(i) Power supply environment	Check to see if a momentary power failure or a power failure occurred when an error was detected. Check that the inter-phase voltage (L1-L2, L2-L3, L3-L1) ≥ 350 V.
							(ii) Detection voltage drop	Check the voltage across pins 1-5 of the connector RYPN for checking the BUS voltage while the inverter is stopped.
							→Check the following if 350 V or above.	
							a)	Check that BUS voltage > 350 V Replace the inverter board if 350 V or below.
							b)	Check the voltage at CN72 of the MAIN board. → Go to (iii).
							c)	Check the coils (L1, L2, and L3) for proper connection. Check the coils for breakage.
							d)	Check the IGBT module resistance. Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							e)	Check the wiring connections between the noise filter board and the inverter board. If no problems are found, replace the noise filter board.
							→Check the following if 350 V or above.	
							a)	Check the wiring between SC-P and SC-P1 of the inverter board for proper connection.
							b)	Check the wiring connections between the noise filter board and the inverter board. If no problems are found, replace the noise filter board.
							c)	Check the IGBT module resistance. Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							d)	Check the resistance of the inrush current protector. Refer to 14-3-4. (4) Simple check on the main inverter circuit components.
							e)	Replace the noise filter board.
							(iii) MAIN board fault	Check that a voltage of 12 VDC is applied to CN72 of the MAIN board during inverter operation. →If not, check fuse F001 on the MAIN board, and if no problems are found with the fuse, replace the MAIN board.
4220	109	4320	109	Inverter BUS voltage rise protection	Comp	When Vdc ≥ 830 V is detected during inverter operation	(i) Non-standard voltage	Check the power-supply voltage at the power-supply terminal block. If no problems are found with the power-supply, replace the inverter board.
							(ii) Inverter board fault	
4220	111	4320	111	Logic error	Comp	When only the H/W error logic circuit operates	(i) External noise	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(ii) Inverter board fault	
4220	129	4320	129	Control power supply fault		Insufficient drive voltage for the inverter board relay	(i) Wiring fault	Check the wiring connection between the MAIN board connector (CN72) and the inverter board connector (CN19V).
							(ii) MAIN board fault	Check that a voltage of 12 VDC is applied to CN72 of the MAIN board during inverter operation.
							(iii) Inverter board fault	Replace the inverter board if no problems are found with (ii).
4230	–	4330	–	Inverter heatsink overheat protection	Comp	When the inverter heatsink temperature sensor THHS registers a temperature above the specified value Refer to "Value table" (page 80) for details.	(i) Air passage blockage	Check the cooling air passage of the heatsink of the control box for blockage.
							(ii) Wiring fault	Check the fan wire.
							(iii) THHS fault	Check the IGBT of the inverter board for proper mounting. (Check the heatsink of the IGBT for proper mounting.) Check the THHS sensor intake value. → Replace the inverter board if an abnormal value is shown.
							(iv) Inverter board fault	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(v) Fan fault	Refer to 14-3-4. (7) Quick check of the DC fan motor (fan motor/control board).

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause	Check method and remedy
Error code	Detail code	Preliminary code	Detail code					
4240	–	4340	–	INV overload protection	Comp	When the compressor current > Imax (Arms) or THHS > TOL (ºC) is registered for 10 continuous minutes Refer to "Value table" (page 80) for details.	(i) Short-cycling of air	Check the discharge air from the unit for short-cycling, and check for fan motor fault.
							(ii) Air passage blockage	Check the cooling air passage of the heatsink for blockage.
							(iii) Power supply	Is the power supply voltage ≥ 342 V?
							(iv) Wiring fault	Check the fan wire.
							(v) THHS fault	Check the THHS thermistor intake temperature. → Replace the inverter board if an abnormal value is shown.
							(vi) Current sensor (CT1, CT2) fault	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(vii) Inverter circuit fault	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(viii) Compressor failure	Isn't the compressor abnormally heated during operation? →Check the refrigerant circuit (compressor suction temperature and high pressure, etc.). If no problems are found, the problem is with the compressor.
5301	115	4300	115	Current sensor <inverter AC current> fault	Comp	An output current below the specified value is registered for 10 continuous seconds during inverter operation. Refer to "Value table" (page 80) for details.	(i) Open inverter output phase	Check the output wiring for proper connection.
							(ii) Compressor failure	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(iii) Inverter board fault	If the problem persists after re-starting operation, replace the inverter board.
5301	117	4300	117	Current sensor circuit <inverter AC current> fault	Comp	When the AC current sensor circuit detects an abnormal value immediately before the inverter starts up	(i) Inverter board fault	Refer to page 86.
							(ii) Compressor failure	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
5301	119	4300	119	IGBT open-phase/inverter AC current sensor disconnection detection error	Comp	No current is detected by the self-diagnosis function immediately before the inverter starts up.	(i) Inverter output wiring fault	Check the inverter output wiring for proper connection. Check that the U and W phases output wiring is passed through CT1 and CT2 of the inverter board.
							(ii) Inverter fault	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(iii) Compressor failure	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(iv) Open phase	Check the wiring between IGBT and the compressor for proper connection.
5301	120	4300	120	Inverter AC current sensor mis-wiring detection error	Comp	An intended level of current is not detected by the self-diagnosis function immediately before startup. (Faulty ACCT sensor installation)	(i) Inverter output wiring fault	Check the inverter output wiring for proper connection. Check that the U and W phases output wiring is passed through CT1 and CT2 of the inverter board.
							(ii) Inverter fault	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(iii) Compressor failure	Refer to 14-3-4. (2) Troubleshooting the inverter output-related problems.
							(iv) Inverter board fault	Replace the inverter board if no problems are found.
0403	001	4300	001	Serial communication <MAIN board> error	Comp	When serial communication between the MAIN board and the inverter board is not established	(i) Wiring fault	Check the following wirings for proper connection. Between the MAIN board and the inverter board MAIN board side – Inverter board side CN4A – CN2 CN2 – CN19V CN72 – CNRY
							(ii) Inverter board fault, MAIN board fault	If the problem persists after a power reset, replace the inverter board or the MAIN board.
5108	–	–	–	Thermistor <liquid pipe temperature (TH8)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. Abnormal thermistor will be ignored, and the operation will be continued.	(i) Thermistor fault	Check the thermistor resistance.
							(ii) Pinched lead wire	Check the lead wire for pinching.
							(iii) Torn wire sheath	Check the wire sheath for tear.
							(iv) Missing connector pins, contact failure	Check the connector for missing pins.
							(v) Broken wire	Check the wire for breakage.
							(vi) Circuit board thermistor input circuit fault	Check the sensor intake temperature.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause	Check method and remedy
Error code	Detail code	Preliminary code	Detail code					
5109	002	–	–	Thermistor <return-oil pipe temperature (TH9)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. Abnormal thermistor will be ignored, and the operation will be continued.	(i) Thermistor fault	Check the thermistor resistance.
							(ii) Pinched lead wire	Check the lead wire for pinching.
							(iii) Torn wire sheath	Check the wire sheath for tear.
							(iv) Missing connector pins, contact failure	Check the connector for missing pins.
							(v) Broken wire	Check the wire for breakage.
							(vi) Circuit board thermistor input circuit fault	Check the sensor intake temperature.
4220	131	4320	131	Inverter BUS voltage drop protection	Comp	Same as 4220_108	Same as 4220_108	Same as 4220_108
1302	002	–	–	Mechanical protective device <pressure switch/thermal switch> trip		If the pressure switch of 12.0 MPa or a discharge thermostat trip at 135ºC is detected, the unit will make an abnormal stop, and an error code will be displayed. The error code will be written to the memory at this time.	(i) Stop valve operation fault	Check that the stop valves are fully open.
							(ii) Short-cycling operation	Check the suction air temperature.
							(iii) Dirty heat exchanger	Check the heat exchanger for soiling.
							(iv) Fan motor fault	Check the fan motor.
							(v) Loose fan motor connector	Check the fan motor connector for proper insertion.
							(vi) Pressure switch <high pressure> or discharge thermostat connector disconnection	Check the pressure switch <high pressure> and discharge thermostat connectors for proper connection.
							(vii) Refrigerant overcharge	Check the high pressure during operation.
							(viii) Faulty wiring of the pressure switch <high pressure> or discharge thermostat	Faulty wiring to the pressure switch <high pressure> or to the MAIN board with a faulty discharge thermostat
							(ix) Blown fuse	Check that the fuse (F01) is not blown.
							(x) Refrigerant gas leakage, refrigerant gas undercharge	Check the refrigerant amount through the sight glass. Add refrigerant.
							(xi) Overload operation	Check the operation data. Check the suction gas temperature.
							(xii) Expansion valve actuation fault	Check the LEV for proper operation. Check the temperature at the LEV inlet/outlet. (Use the fixed LEV opening mode.)
							(xiii) Temporary refrigerant shortage due to refrigerant flood-back	Check the operation status, such as incorrect opening angle of the expansion valve, solenoid valve <liquid> fault, fan motor fault, heat exchanger clogging, and the start-delay time of the fan.
5107	–	–	–	Thermistor <suction pipe temperature (TH7)> fault		A short-circuit (high temperature intake) or an open-circuit (low temperature intake) of the thermistor detected during operation will be regarded as a thermistor fault. The error code will be displayed and recorded. The operation will automatically be continued if other sensors can be substituted for.	(i) Thermistor fault	Check the thermistor resistance.
							(ii) Pinched lead wire	Check the lead wire for pinching.
							(iii) Torn wire sheath	Check the wire sheath for tear.
							(iv) Missing connector pins, contact failure	Check the connector for missing pins.
							(v) Broken wire	Check the wire for breakage.
							(vi) Circuit board thermistor input circuit fault	Check the sensor intake temperature.
4116	001	4166	001	Fan rotation speed error (connector CNFAN1)	fan1	Fan motor fault (connector CNFAN1)	(i) Air passage blockage	Check the cooling air passage of the heatsink of the control box for blockage.
							(ii) Fan motor fault	Check the fan motor for proper operation.
							(iii) Wiring fault	Check for connector fault. Refer to 14-3-4. (7) Quick check of the DC fan motor (fan motor/control board).
							(iv) Circuit board fault	
							(v) Fan rotation problem due to strong wind	Install an air protection guide, and check for proper operation.
4116	002	4166	002	Fan rotation speed error (connector CNFAN2)	fan2	Fan motor fault (connector CNFAN2)	(i) Air passage blockage	Check the cooling air passage of the heatsink of the control box for blockage.
							(ii) Fan motor fault	Check the fan motor for proper operation.
							(iii) Wiring fault	Check for connector fault. Refer to 14-3-4. (7) Quick check of the DC fan motor (fan motor/control board).
							(iv) Circuit board fault	
							(v) Fan rotation problem due to strong wind	Install an air protection guide, and check for proper operation.

Error (Maintenance) code/ Preliminary error code				Error type		Error description and detection method	Cause	Check method and remedy
Error code	Detail code	Preliminary code	Detail code					
–	–	7000	050	IGBT system error (inverter reset)		Too frequent circuit board resetting	(i) Thermal switch <discharge>/pressure switch <high pressure> circuit fault	Check for thermal switch <discharge>/pressure switch <high pressure> circuit fault.
							(ii) Circuit board fault	Check the circuit board for problem.
							(iii) Noise	Check the power-supply wire for electrical noise.
7113	014	–	–	Function setting error		Function setting error with the resistor	(i) Wiring fault	Check the connectors CNTYP 1, 2, 4, and 5 on the MAIN board for proper connection.
7113	015	–	–				(ii) Connector disconnection, short-circuit, poor contact	
7113	016	–	–		Comp		(iii) Unmatched MAIN board and inverter board (Replacement with the incorrect board)	Check the replaced circuit for model compatibility, and if it is incompatible, replace it with the correct circuit board.
7113	001	–	–		Comp		(iv) Disconnected transmission line of the condensing unit	
7113	012						(v) Short-circuited transmission line	Check the transmission line of the condensing unit for proper connection.
7117	014	–	–	Function setting error (unset)			(i) Wiring fault	Check the connectors CNTYP 1, 2, 4, and 5 on the MAIN board for proper connection.
7117	015	–	–				(ii) Connector disconnection, short-circuit, poor contact	
7117	016	–	–		Comp			
7117	012	–	–					

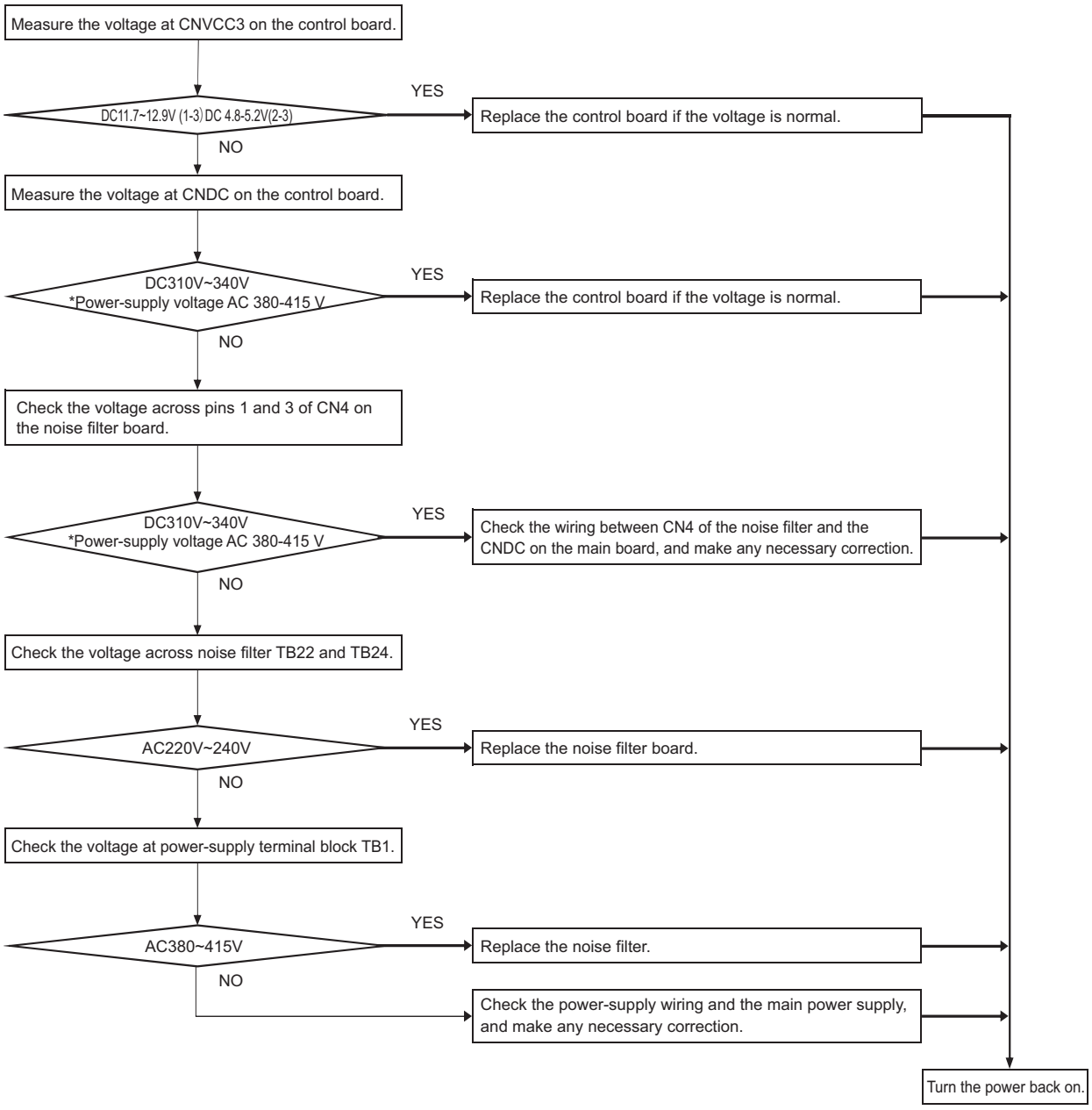
Value table

Inverter compressor

Error description and detection method	Inverter board 42Y
Overcurrent cutoff <instantaneous inverter value S/W> fault (Apeak)	40
Overcurrent cutoff <effective inverter value S/W> fault (Arms)	24
Inverter heatsink overheat protection (°C)	110
Overload protection Imax (Arms)	20
Temperature protection TOL (ºC)	105
Current sensor fault (Arms)	1.8

14-2. Checking the electrical circuit

If no error code is displayed on the control board, use the flowchart to troubleshoot.



14-3. Troubleshooting the principal components

14-3-1. Pressure sensor

(1) Pressure sensor circuit components

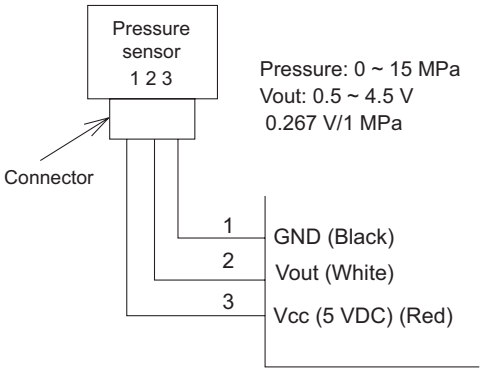
Pressure sensor consists of a circuit as shown in the figure below. When a voltage of 5 VDC is applied across red and black wires, the amount of voltage that corresponds to the pressure is output across white and black wires, and the microcomputer takes in this voltage. Output voltage is 0.4 V per 1 MPa.

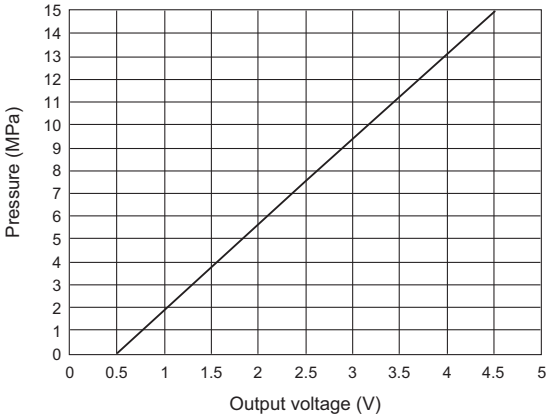
Note

Use a pressure sensor that is directly connected to the connector.
The pin numbers on the pressure sensor and those on the MAIN board do not correspond to each other.

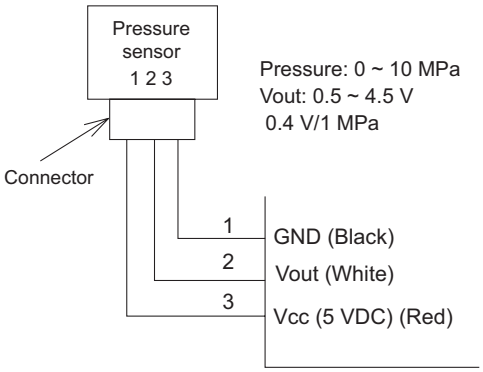
	Main body side	Control board side
Vcc	1 pin	3 pin
Vout	2 pin	2 pin
GND	3 pin	1 pin

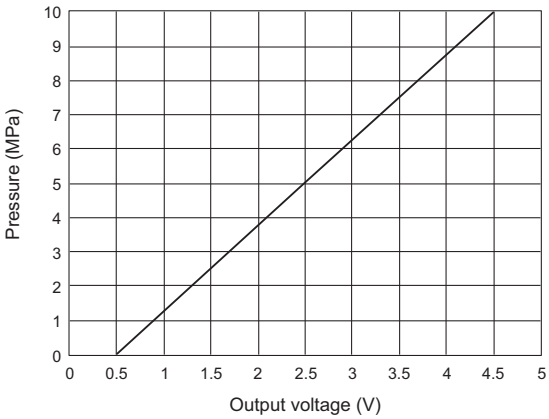
♦ PSH1





♦ PSH2, PSM, PSL

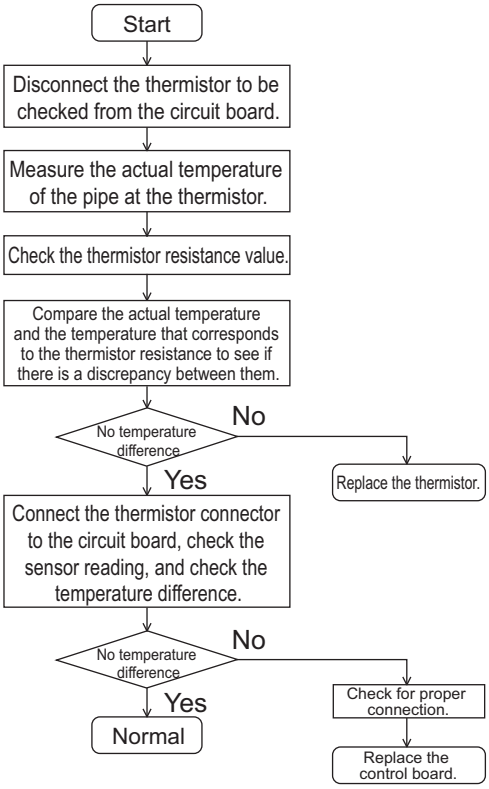




14-3-2. Temperature sensor

Use the flowchart below to troubleshoot the temperature sensor.

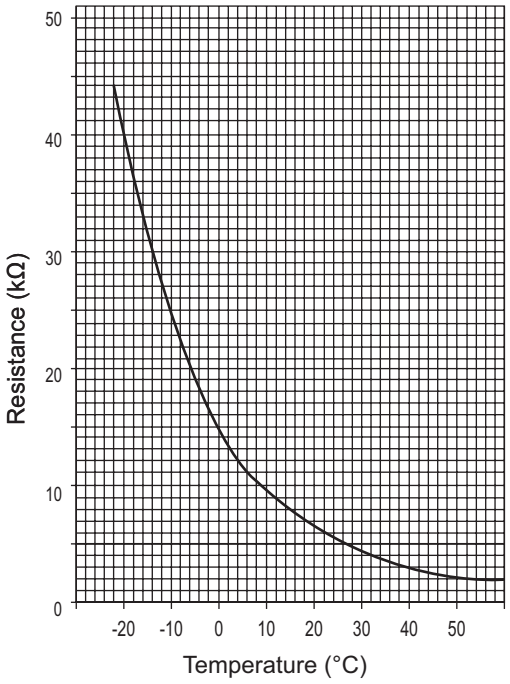
Troubleshooting the thermistor



(1) Low-mid temperature range thermistor : TH2, TH4, TH5, TH6, TH7, TH8

Thermistor $R_0 = 15\ k\Omega \pm 3\%$

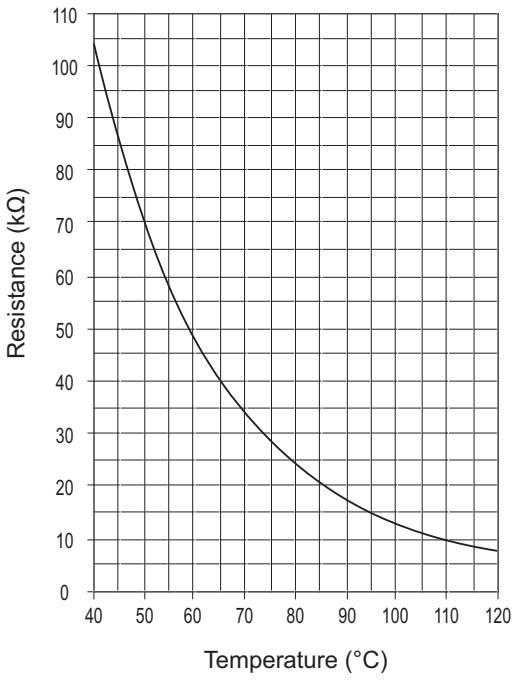
$$R_t = 15 \exp \{3385 \left(\frac{1}{273+t} - \frac{1}{273}\right)\}$$



(2) High-temperature-range thermistor: TH1, TH9

Thermistor $R_{120} = 7.465\ k\Omega \pm 2\%$

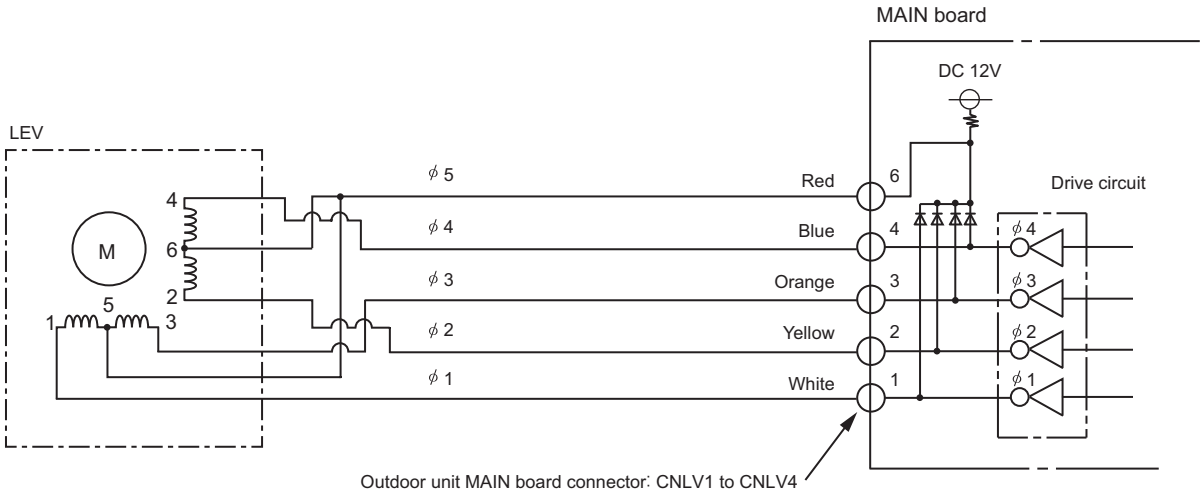
$$R_t = 7.465 \exp \{4057 \left(\frac{1}{273+t} - \frac{1}{393}\right)\}$$



14-3-3. Linear expansion valve

The valve opens and closes according to the pulse signals.

<Wiring between the MAIN board and linear expansion valve (LEV) on the outdoor unit >



Output (phase) number	Output status							
	1	2	3	4	5	6	7	8
ϕ1	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
ϕ2	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
ϕ3	OFF	OFF	OFF	ON	ON	ON	OFF	OFF
ϕ4	OFF	OFF	OFF	OFF	OFF	ON	ON	ON

<Pulse signal output and valve motion>

Output pulses change in the following orders when the

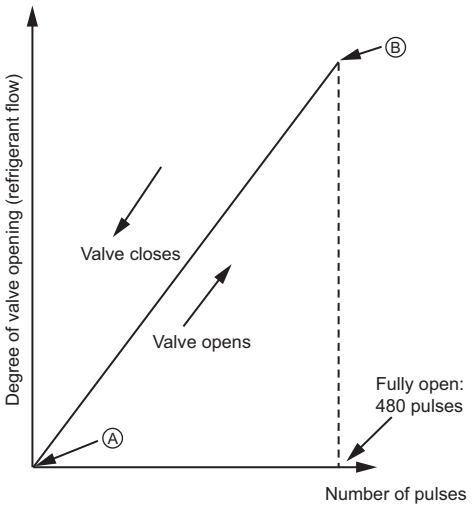
Valve is open; 8→1→2→3→4→5→6→7→8

Valve is closed; 1→8→7→6→5→4→3→2→1

*1. When the Linear expansion valve (LEV) opening angle does not change, all the output phases will be off.

*2. When the output is open phase or remains ON, the motor cannot run smoothly, and rattles and vibrates.

Opening and closing of the LEV



* Upon power on, a 520 pulse signal is sent to the LEV to determine the valve position and always brings the valve to the position indicated by Ⓐ in the diagram. (Pulse signal is output for approximately 17 seconds.)

The LEVs are free of noise and vibration when they are functioning properly. When they become stuck, they make clicking noises.

* Listen for the valve noise by placing a screwdriver on the valve and placing your ear against the handle.

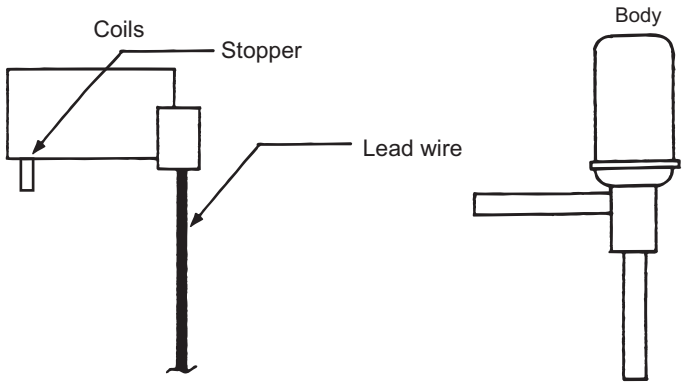
* If liquid refrigerant is inside the valves, it may make the sounds difficult to hear.

(1) Troubleshooting possible problems

Locked LEV	If the LEVs are driven when they are locked, their drive motor runs idle and makes a small clicking sound. If a valve makes noise both when it opens and when it closes, there is a problem with the valve.	Replace the LEV.
Broken or short-circuited motor coil on the LEV	If the resistance between coils (red-white, red-yellow, red-orange, red-blue) that are measured with a tester is in the below range, the LEVs are normal. LEV1, 2, 3: 34.3 Ω ± 10% LEV4: 46 Ω ± 10%	Replace the coil on the LEV.
Faulty wiring or loose connectors	♦Check for loose connectors and terminals, and visually check the lead wire colors. ♦Unplug the connector from the control board, and test for continuity using a tester.	Check for continuity.

(2) LEV coil removal procedure

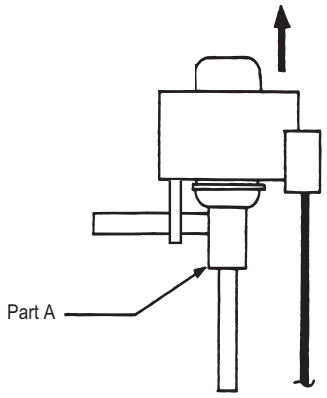
LEVs consist of a coil and a valve body that can be separated from each other.



a) Removing the coil

Securely hold the LEV at the bottom (as indicated by A in the figure), and pull up and out the coil. If the stopper catches the coil, turn the coil to release the stopper from the dent, and then pull it up.

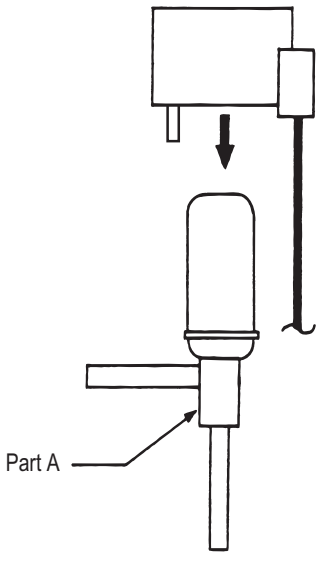
When removing the coil, hold the LEV body securely to prevent undue force from being placed on the pipe and bending the pipe.



b) Installing the coil

Securely hold the bottom of the LEV (part A in the figure), insert the coil from above, and check that the coil stopper is properly placed in the pipe on the LEV body. (Any of the four dents on the valve can be used. Do not stress the lead wire or wrap it around the valve body.)

When removing the coil, hold the LEV body securely to prevent undue force from being placed on the pipe and bending the pipe.



14-3-4. Inverter

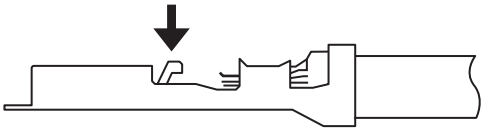
- If there are problems only with the compressor, replace the compressor only.
  Compressor failure will cause an overcurrent to pass through the inverter, but the inverter is protected from damage with the protection function that will stop the inverter when an overcurrent is detected.
- If the inverter fails, replace the failed components on the inverter.
- If both the compressor and inverter fail, replace the compressor and all applicable components on the inverter.

	Error codes and symptoms	Check items
[1]	Inverter-related errors 4220, 4230, 4240, 4250, 5301	See (2) Troubleshooting the inverter output-related problems-[1].
[2]	Main power breaker is tripped.	1) Check the breaker capacity.
		2) Check the electric circuits other than the inverter circuits for short-circuit and ground fault.
		3) If no problems are found with items 1) and 2), see (3) Troubleshooting when the main power breaker trips-[1].
[3]	The main earth leakage breaker is tripped.	1) Check the capacity and the sensitivity current of the earth leakage breaker.
		2) Insulation resistance failure of the electrical components other than the inverter
		3) If no problems are found with items 1) and 2), see (3) Troubleshooting when the main power breaker trips-[1].
[4]	Only the compressor is inoperative.	Check the inverter frequency on the LED and proceed to item [3] under section (2) Troubleshooting the inverter output-related problems.
[5]	The compressor vibrates excessively or makes abnormal sounds.	See (2) Troubleshooting the inverter output-related problems-[3].
[6]	Peripheral devices pick up noise.	1) Check that the power wire to the peripheral devices are not routed adjacent to the power wire to the outdoor unit.
		2) Check that the inverter output wiring is not routed adjacent to the power wire or transmission line.
		3) Insulation resistance failure of the electrical components other than the inverter
		4) Connect the unit to a different power supply circuit.
		5) If the problem appeared suddenly, there is a possibility that the inverter output line had a ground fault. See section (2) Troubleshooting the inverter output-related problems-[3].
		For problems other than the ones listed above, contact a local distributor.

(1) Troubleshooting the inverter-related problems

1) **Inside the inverter is a large capacity electrolytic capacitor, and the residual voltage that remains after the main power is turned off presents a risk of electric shock. Before checking the inverter-related parts, turn off the main power, keep it turned off for at least 10 minutes, and check that the voltage at both ends of the electrolytic capacitor between pin of connectors RYPN 1–5 has dropped to 20V or less.**
2) The IGBT module on the inverter becomes damaged if there are loose screws or connectors. When a problem occurs after replacing components, faulty wiring is often the cause of the problem. Check the wiring, screws, connectors, and Fasten terminals for proper connection.
3) Do not plug or unplug the inverter connectors while the main power is turned on, as this will result in damage to the circuit board. Doing so may result in damage to the circuit board.
4) Electric current sensor will break if a current is passed through the sensor without it being connected to the circuit board. Connect the current sensor to the appropriate connectors on the circuit board before operating the inverter.
5) Faston terminal inrush current prevention resistance has a locking function. Make sure the terminal is securely locked in place after insertion.

Press the tab on the terminal to remove it.



6) When the INV board is replaced, apply a thin layer of heat radiation grease that is supplied evenly to these parts. Wipe off any grease that may get on the wiring terminal to avoid terminal contact failure.
7) Faulty wiring to the compressor damages the compressor. Connect the wiring in the correct phase sequence.

(2) Troubleshooting the inverter output-related problems

	Check items	Symptom	Remedy
[1] Check the compressor INV board error detection circuit.	1) Stop the unit. Remove power supply. 2) Disconnect the inverter output wires from the compressor terminals (U, V, W) *1. 3) Apply power supply 4) Put the outdoor unit into operation	a) Overcurrent error Error code: 4250 Detailed code: No. 101, 104, 105, 106 and 107	Replace the INV board.
		b) Logic error Error code: 4220 Detailed code: No. 101	Replace the INV board.
		c) ACCT sensor circuit failure Error code: 5301 Detailed code: No. 117	Check the resistance of the current sensor ACCT, and replace the sensor if this value is outside the normal range. If the ACCT is normal, replace the compressor INV board.
		d) IGBT module open Error code: 5301 Detailed code: No. 119	Normal → See [2].
[2] Checking the compressor for a ground fault and checking the coil	Disconnect the compressor wiring, and check the insulation resistance and the wirewound resistance of the compressor.	a) Compressor insulation resistance failure Insulation resistance of below 1 MΩ is considered abnormal. ♦With no liquid refrigerant present in the compressor b) Compressor coil resistance failure Coil resistance 0.583Ω ±7%	Replace the compressor. Check that no liquid refrigerant is present in the compressor. If there is no problems are found with the above item, see [3].
[3] Check the inverter for damage. Immediately before or after start-up	Perform the following procedures. **Procedures** 1) Reconnect the connector that was disconnected in step [1]. 2) Disconnect the compressor wiring. 3) Turn SW2-9 on the MAIN board to ON. After the above procedure is completed, put the outdoor unit into operation. Check the inverter output voltage. ♦The use of the voltage tester that is listed in the section "Troubleshooting the IGBT module " is recommended. ♦Measure the voltage when the compressor inverter output frequency is stable. ♦After the above procedure is completed, turn SW2-9 off on the Main board.	a) IGBT module/overcurrent Error code: 4250 Detailed code: No. 101, 104, 105, 106 and 107 b) If there is a inter-wire voltage imbalance of 5% or 5 V (whichever the greater), inverter circuit fault is suspected.	Check the inverter circuit for problems. See [5].
		c) There is no voltage difference between the wires.	See [2]. See item [5] if no problems are found with item [2]. Replace the compressor if no problems are found with item [5].
[4] Check the inverter for damage. When this error occurs during normal operation	Operate the unit. Check the inverter output voltage. ♦The use of the voltage tester that is listed in the section "Troubleshooting the IGBT module is recommended. ♦Measure the voltage when the compressor inverter output frequency is stable.	a) If there is a inter-wire voltage imbalance of 5% or 5 V (whichever the greater), inverter circuit fault is suspected.	Check the inverter circuit for problems. See [5].
		b) There is no voltage difference between the wires.	See [2]. See item [5] if no problems are found with item [2]. Replace the compressor if no problems are found with item [5].

*1 Output voltage is present at the inverter output wiring terminal. To avoid short-circuiting and ground fault, do not let the terminal come in contact with the unit or the compressor, and use caution not to damage the terminal.

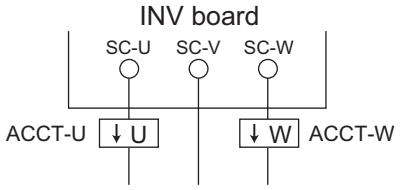
	Check items	Symptom	Remedy
[5] Check the inverter circuit for problems.	Check the IGBT module for loose terminal screws.	a) Terminals screws are loose.	Check all INV board terminal screws, and tighten the loose ones.
	Check the exterior of the IGBT module.	b) Cracked IGBT module due to swelling	Replace the INV board. After replacing the INV board, check for proper operation by following the procedures in sections [3] and [4].
	Measure the resistance between the terminals of the IGBT module. Refer to the section "Troubleshooting the IGBT module."	c) Abnormal resistance between the terminals of the IGBT module	Replace the INV board. After replacing the INV board, check for proper operation by following the procedures in sections [3] and [4].
		d) All items a) - c) above are both normal.	Replace the INV board.

(3) Troubleshooting when the main power breaker trips

	Check items	Symptom	Remedy
[1]	Measure the insulation resistance between the terminals on the power supply terminal block.	0 to several ohms, or insulation resistance failure	Check the components in the main inverter circuit. (e.g., register, insulation resistance) 1) IGBT module Refer to the section "Troubleshooting the IGBT module." 2) Inrush current limiting resistor 3) Electromagnetic contactor 4) DC reactor For items 2) through 4), refer to the section "Simple check on the main inverter circuit components."
[2]	Turn the power back on and check again.	Main power breaker is tripped.	
		LED is blank.	
[3]	Check the unit for normal operation.	The unit operates normally without tripping the main breaker.	1) Look for a possible short-circuit, and if found, repair. 2) If no problems are found with item 1) there may be problems with the compressor.
		Main power breaker is tripped.	It is suspected that the inverter (output side) or compressor had a ground fault. See 2)Troubleshooting the inverter output-related problems-[3].

(4) Simple check on the main inverter circuit components

<table>
<tr><th>Parts</th><th>Evaluation criteria</th></tr>
<tr><td>IGBT module</td><td>Refer to the section "Troubleshooting the IGBT module."</td></tr>
<tr><td>Inrush current limiting resistor R1, R2</td><td>Measure the resistance between terminals: 22Ω ± 10%</td></tr>
<tr><td>Electromagnetic relay
72C</td><td>This electromagnetic relay is rated at DC12V and is driven by a coil.
Check the resistance between terminals
 

<table>
<tr><th></th><th>Check point</th><th>Checking criteria</th></tr>
<tr><td>Coil</td><td>INV board
X901, X902
Across pins 1-2</td><td>160Ω ± 10%</td></tr>
<tr><td>Contact</td><td>INV board
FT-P1 and FT-P2
*Faston terminal removed</td><td>INV board CNRY
Open: ∞
INV board CNRY
At a voltage input of 12 VDC: 0Ω</td></tr>
</table></td></tr>
<tr><td>DC reactor DCL</td><td>Measure the resistance between terminals.: 1 Ω or less (virtually 0 Ω)
Measure the resistance between the terminal and the chassis.: ∞</td></tr>
<tr><td>Current sensor
ACCT</td><td>Disconnect the wiring connector from CNCT2, and measure the inter-teminal resistance: 280Ω±30Ω
Between pins 1 and 2 (U-phase), pins 3 and 4 (W-phase)
 

*Check ACCT wiring for correct phase and direction.</td></tr>
</table>

(5) Troubleshooting the IGBT module

Measure the resistances between each pair of terminals on the IGBT with a tester, and use the results for troubleshooting.
The terminals on the INV board are used for the measurement.

1) Notes on measurement

- Check the polarity before measuring. (On the tester, black normally indicates plus.)
- Check that the resistance is not open (∞ Ω) or not shorted (to 0 Ω).
- The values are for reference, and the margin of errors is allowed.
- The result that is more than double or half of the result that is measured at the same measurement point is not allowed.
- Disconnect all the wiring connected the INV board, and make the measurement.

2) Tester restriction

- Use the tester whose internal electrical power source is 1.5V or greater
- Use the dry-battery-powered tester.

Note

(The accurate diode-specific resistance cannot be measured with the button-battery-powered card tester, as the applied voltage is low.)

♦ Use a low-range tester if possible. A more accurate resistance can be measured.

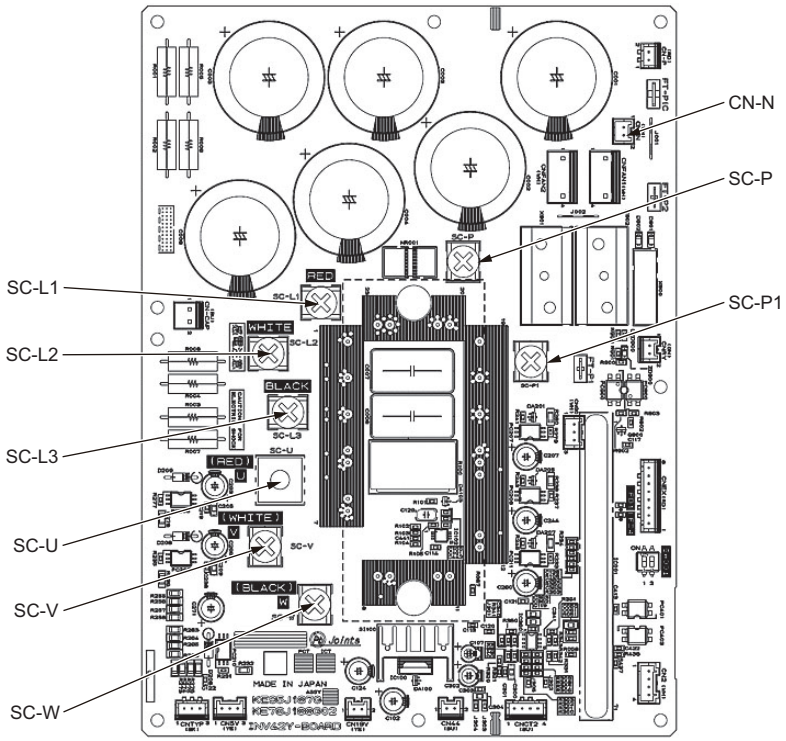
<INV42Y>

Reference resistance value

		Black (+)				
		SC-P	CN-N	SC-L1	SC-L2	SC-L3L
Red (-)	SC-P	-	-	5-200 Ω	5-200 Ω	5-200 Ω
	CN-N	-	-	∞	∞	∞
	SC-L1	∞	5-200 Ω	-	-	-
	SC-L2	∞	5-200 Ω	-	-	-
	SC-L3	∞	5-200 Ω	-	-	-

		Black (+)				
		SC-P1	CN-N	SC-U	SC-V	SC-W
Red (-)	SC-P1	-	-	5-200 Ω	5-200 Ω	5-200 Ω
	CN-N	-	-	∞	∞	∞
	SC-U	∞	5-200 Ω	-	-	-
	SC-V	∞	5-200 Ω	-	-	-
	SC-W	∞	5-200 Ω	-	-	-

INV board outline drawing



(6) Precautions for inverter parts replacement

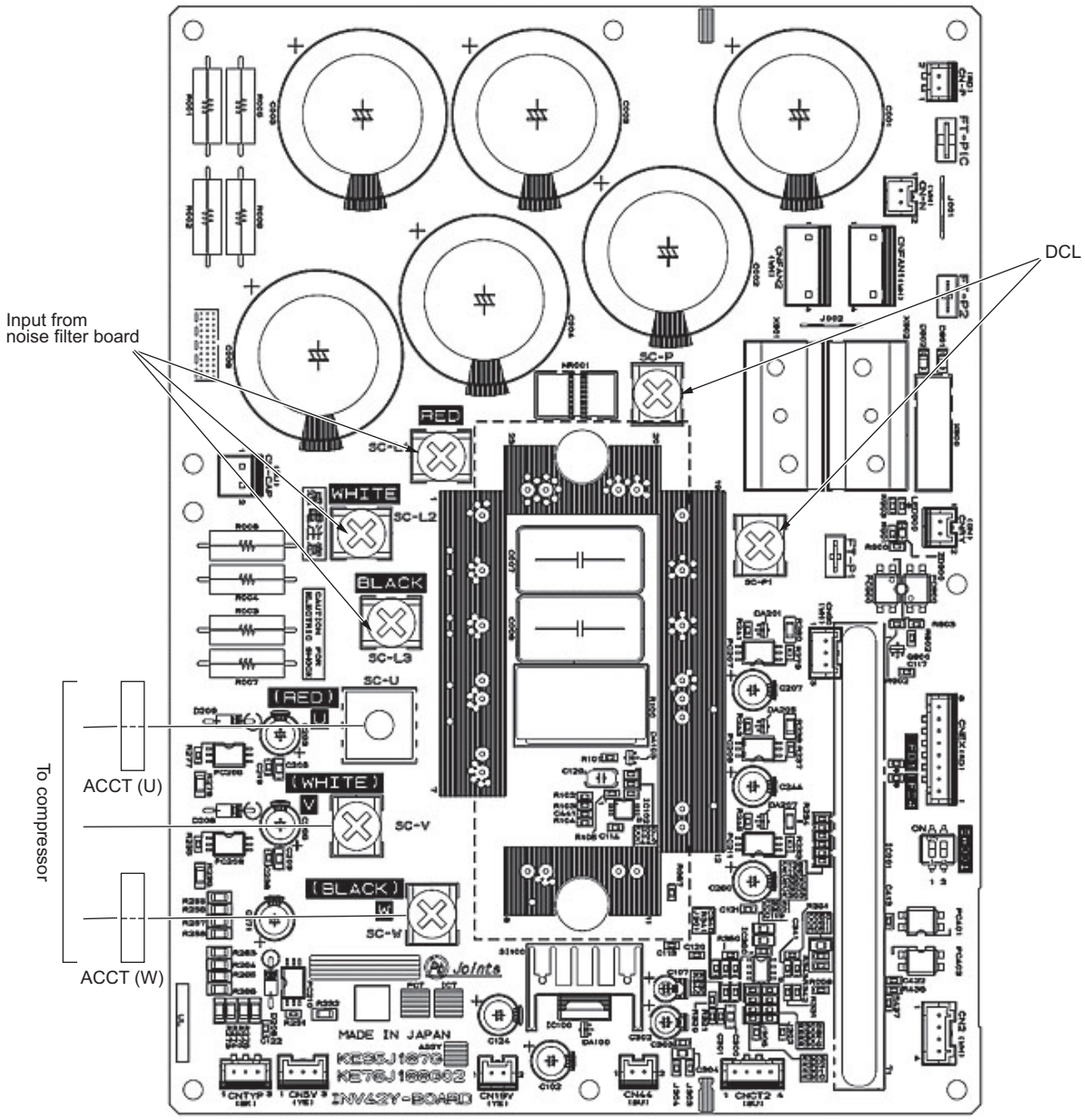
1) Check for faulty or loose wiring.

To avoid damage to the IGBT module, thoroughly check the wiring to the main circuit components in the IGBT module.

Retighten all screws upon completion of all work. If the output wiring from the IGBT module to the compressor is connected incorrectly, compressor damage will result. Refer to the wiring diagram below for wire color-coding.

2) Coat the radiation surface of the IGBT module evenly with the heat radiction grease that is provided with the service parts.

Apply a thin layer of heat radiation grease to the entire surface of the back of the IGBT module, and screw the module securely into place. Wipe off any grease that may get on the wiring terminal to avoid contact failure.



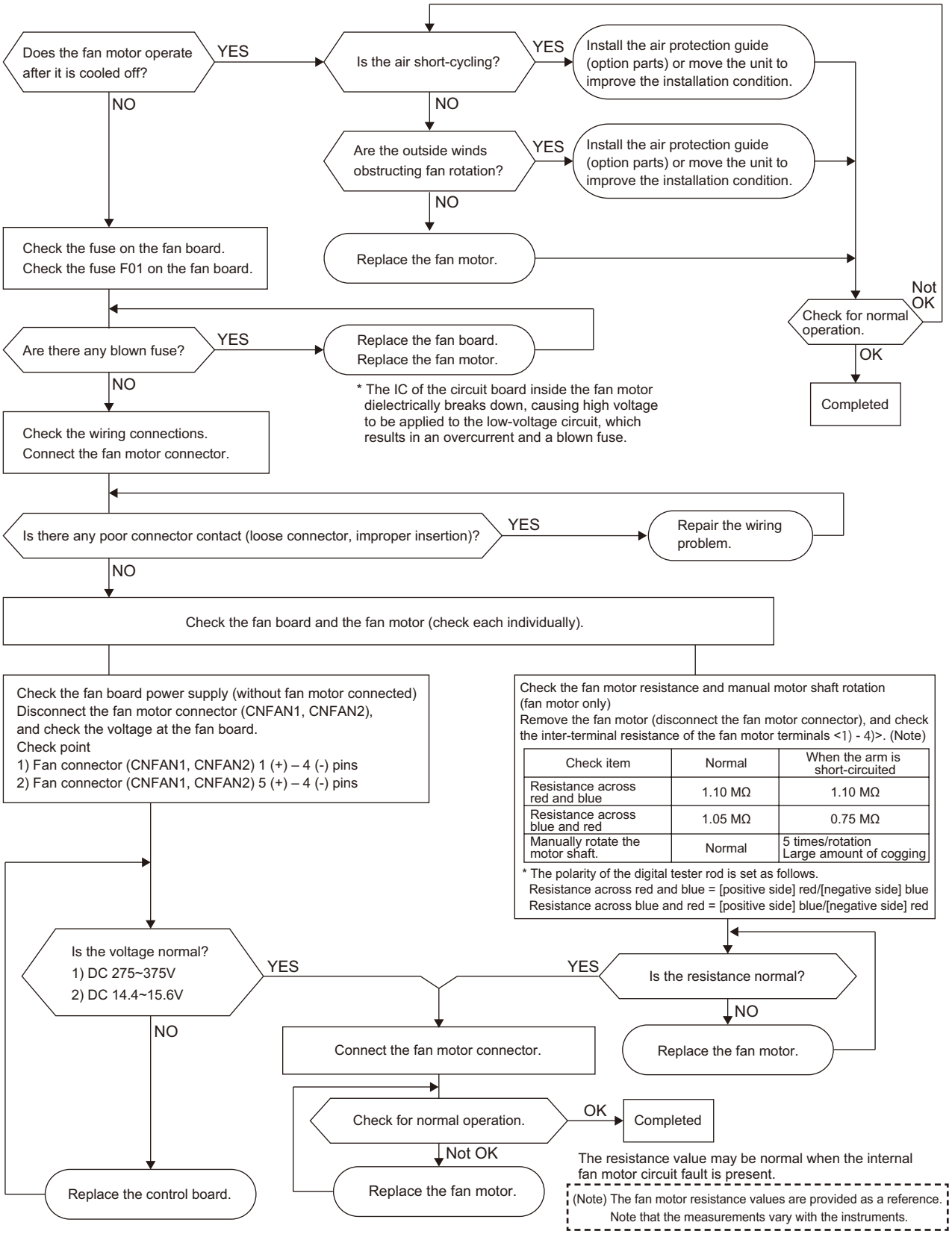
(7) Quick check of the DC fan motor (fan motor/control board)

1) Precautions

- Even when the power is turned off, fan motor connectors (CNFAN1, CNFAN2) may carry high voltage if the fan is rotated by outside winds.
  Use caution not to get an electric shock.
- Do not connect or disconnect the fan motor connectors (CNFAN1, CNFAN2) with the power being turned on. (Doing so can result in circuit board and fan motor malfunction.)

2) Troubleshooting

Symptom: Outdoor unit fan does not turn.



15-1. Important notes

If the unit or its refrigerant circuit components experiences malfunctions, take the following steps to prevent recurrence.

(1) Diagnose the problem and find the cause.
(2) Before repairing gas leakage from the brazed sections on the pipes, remove the refrigerant from the pipes to be repaired. Braze under nitrogen purge to prevent oxidation.
(3) If any component (including the compressor) malfunctions, only replace the parts; it is not necessary to replace the entire unit.
(4) When disposing of the unit, dispose of the refrigerant contained in the unit in accordance with the applicable local laws and regulations.
(5) If the cause of the problem cannot be identified, contact the local distributor and provide the following information: unit model, serial number, and nature of the problem.

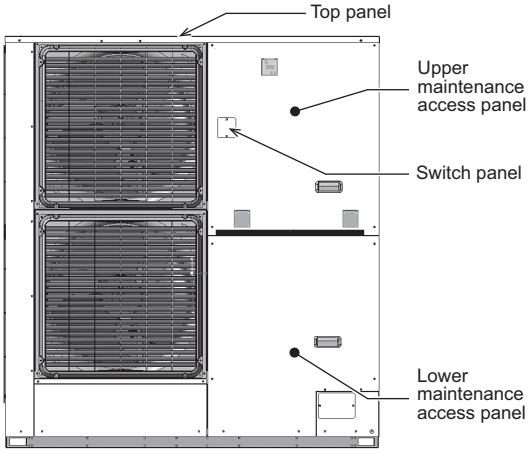
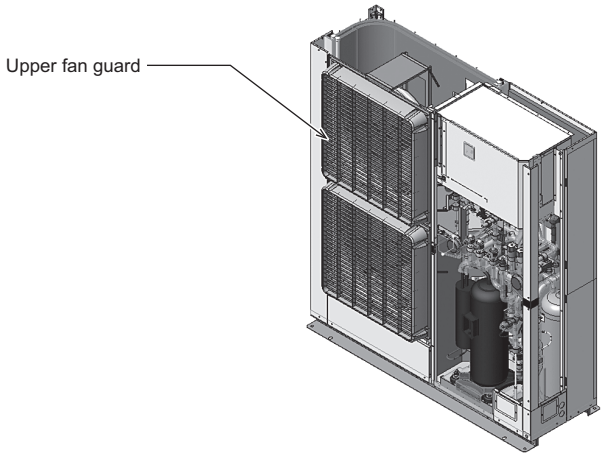
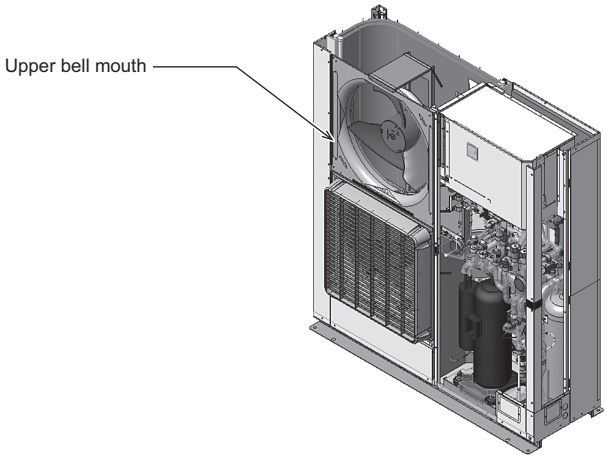
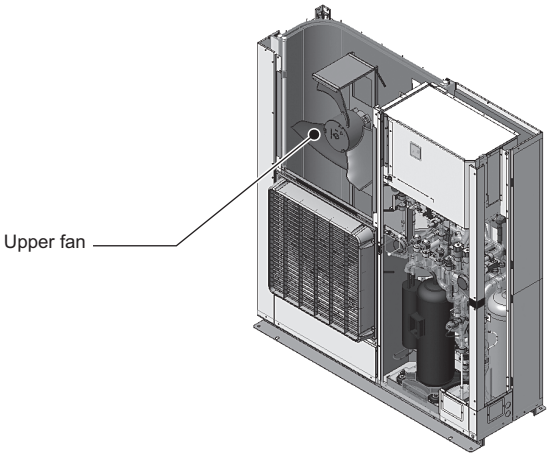
15-2. Replacing the fan

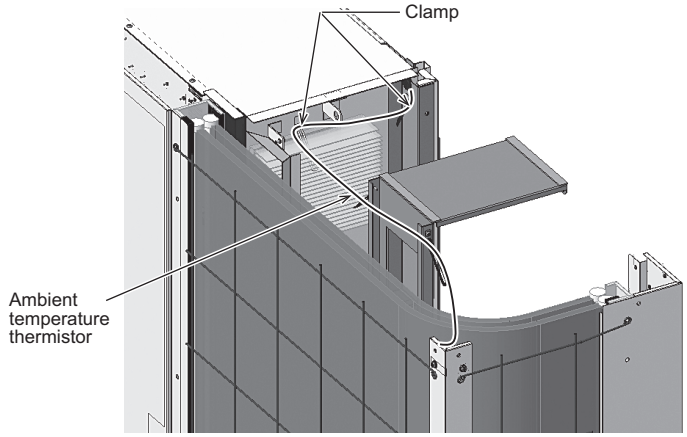
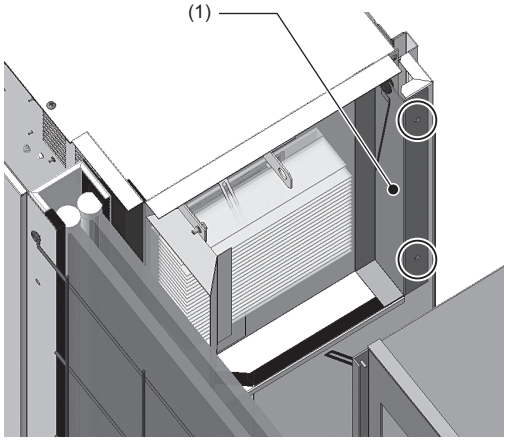
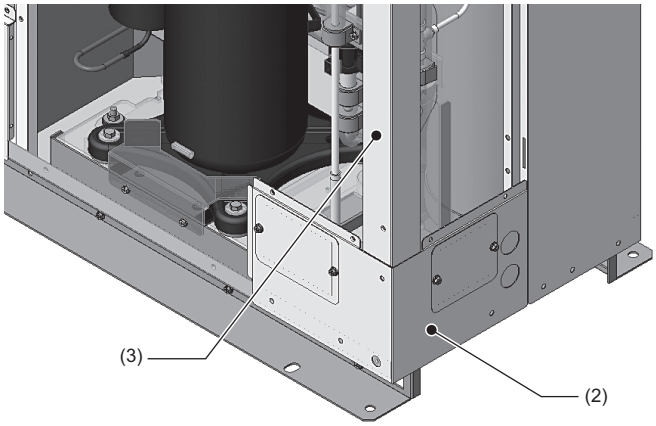
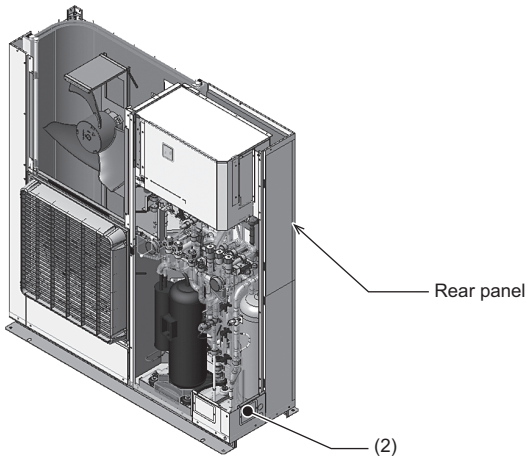
(1) Before replacing the fan, switch off the main power on the condensing unit.
(2) Motor connectors (CNFAN1, CNFAN2) are the bottom of the control box. Remove the service panel, the fan guard and the bell-mouth.
(3) After replacing the fan, route the wires in the same route as the original fan wires, and secure them in place with the clamps.
<Use caution not to come in contact with the surrounding hot pipes.>

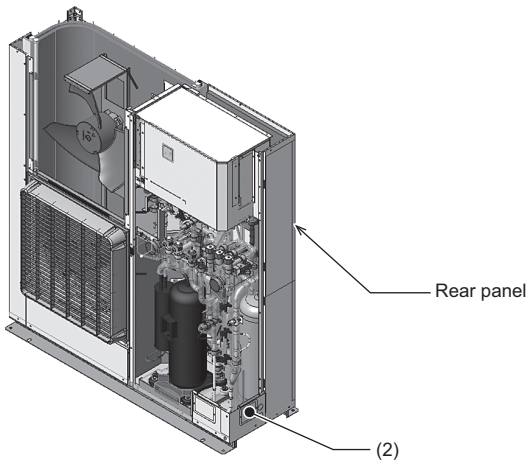
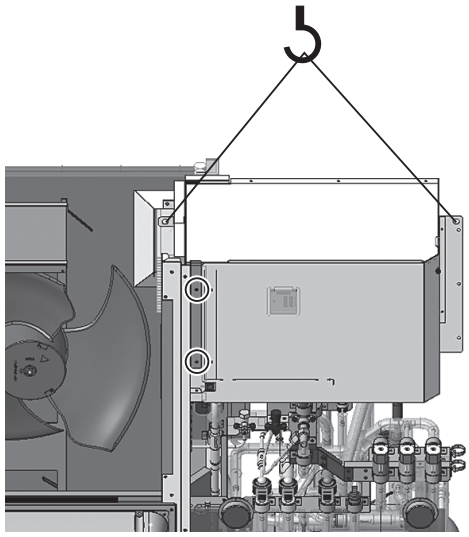
15-3. Replacing the control box

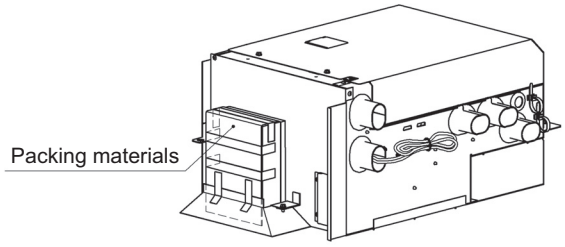
(1) Before inspecting inside the control box, turn off the main power of the unit, wait at least 10 minutes, and check that the voltage of the electrolytic capacitor (main inverter circuit) is no greater than 20 VDC. The voltage check position is between pins 1 and 5 of the RYPN connector.
(2) Before starting servicing, disconnect the outdoor fan connectors (CNFAN1 and CNFAN2).
When connecting and disconnecting connectors, make sure that the outdoor fan is not running and that the voltage of the main circuit capacitor is no greater than 20 VDC.
If the outdoor fan rotates due to strong wind, the main circuit capacitor will be charged and pose a risk of electric shock.
Refer to the wiring nameplate for details.
When finishing servicing, connect the outdoor fan connectors (CNFAN1 and CNFAN2) as they were.

Please refer to the following page for further details.

	Procedure
1 	1. Remove the switch panel, set SW1 to OFF, and turn off the main power supply (breaker). Remove the top panel and the upper and lower maintenance access panels.
2 	2. Remove the upper fan guard.
3 	3. Remove the upper bell mouth.
4 	4. Remove the upper fan. Nut tightening torque: 5.6 ± 0.3 N•m

	Procedure
5 	5. Release the clamp from the ambient temperature thermistor. (2 places)
6 	6. Remove the sheet metal (1). The sheet metal is screwed down with the two screws that are located where circled.
7 	7. Loosen the screws holding the sheet metal (2). The screws may be unscrewed all the way if any pipe or wire is held by the screws. Remove the sheet metal (3).
8 	8. Remove all wiring (except compressor wires) from the control box. Disconnect the compressor wires from the terminal block on the compressor, and replace them along with the control box. Do not leave the rear panel removed because the real panel helps hold the control box in place.

	Procedure
9 	9. Remove the rear panel. Note that the sheet metal (2) hooks on to the rear panel (from top to bottom). The top part needs to be unhooked when removing the panel. Do not leave the rear panel removed because the real panel helps hold the control box in place.
10 	10. When you are ready to remove the control box, unscrew the two screws that are located where circled to remove it. Use the holes shown in the figure when suspending the control box. Re-place all components in the reverse order as they were removed. Be sure to reconnect all wires.

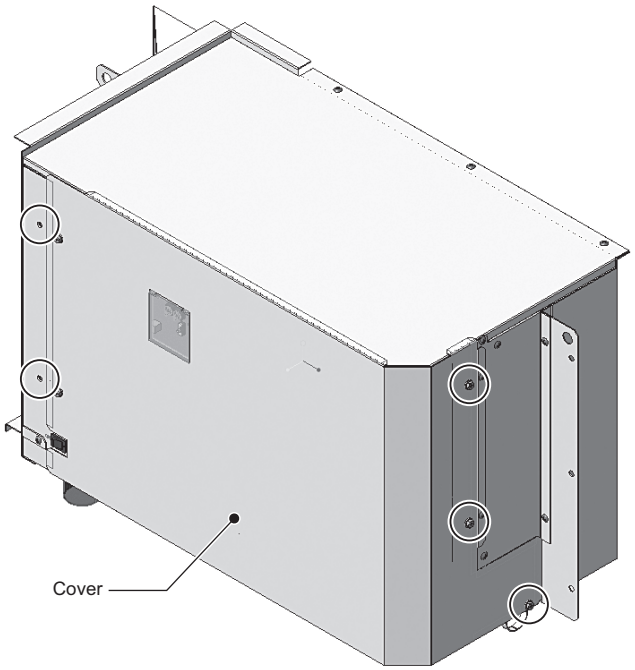
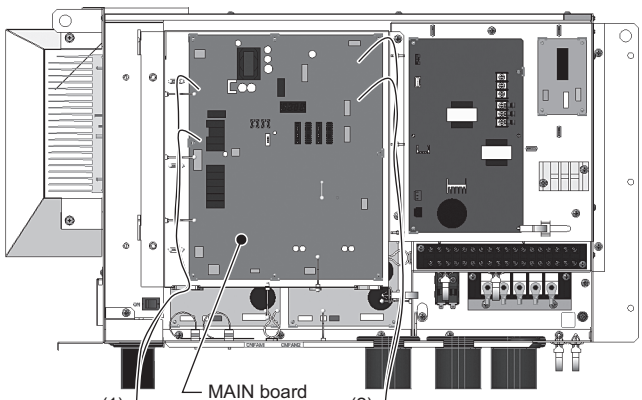
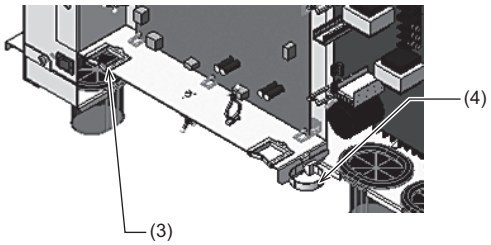


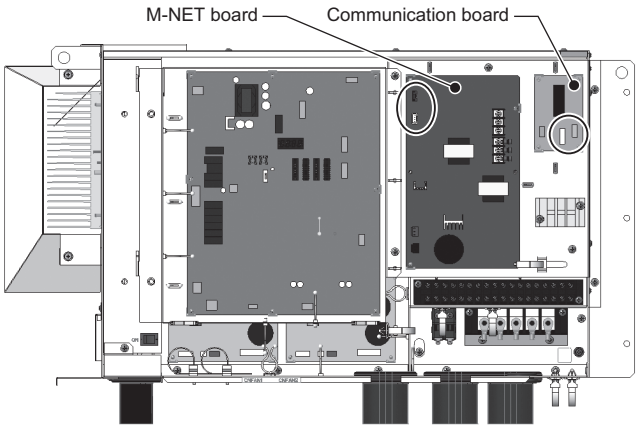
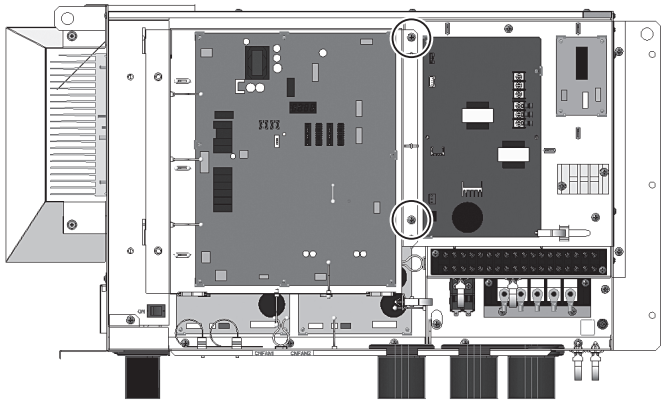
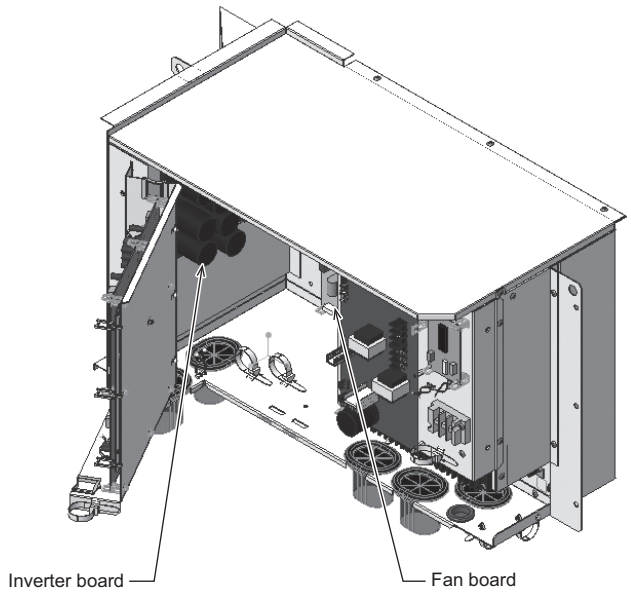
Make sure that remove the packing materials before installing a new control box.

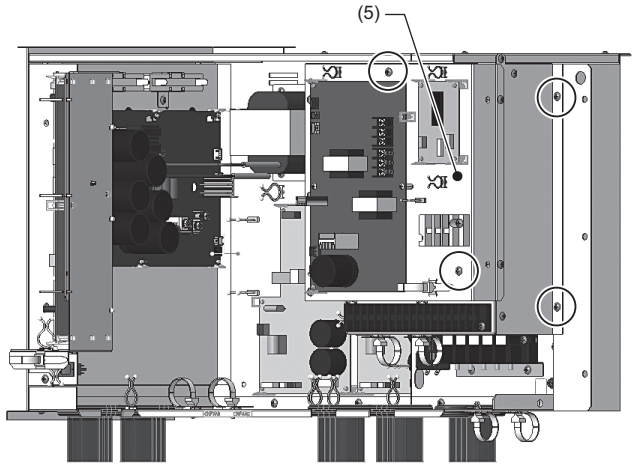
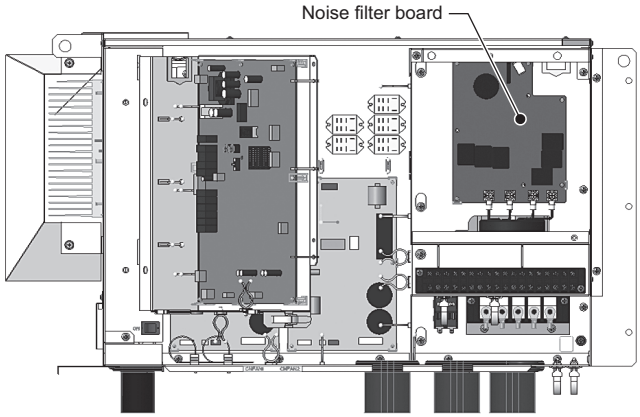
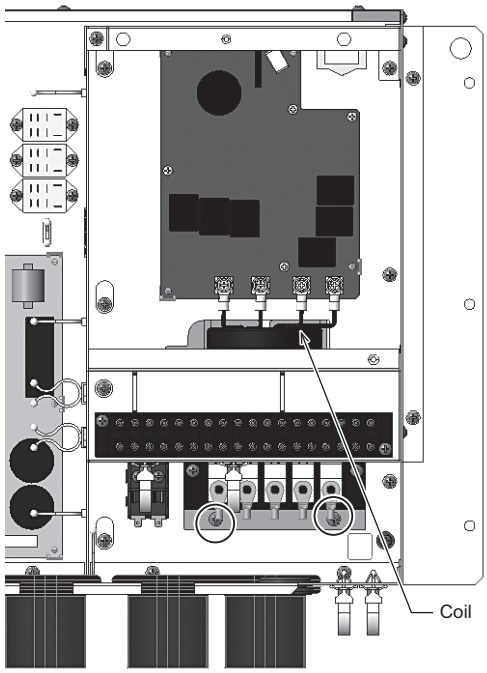
15-4. Replacing the circuit board

(1) Before inspecting inside the control box, turn off the main power of the unit, wait at least 10 minutes, and check that the voltage of the electrolytic capacitor (main inverter circuit) is no greater than 20 VDC. The voltage check position is between pins 1 and 5 of the RYPN connector.

(2) Before starting servicing, disconnect the outdoor fan connectors (CNFAN1 and CNFAN2).
When connecting and disconnecting connectors, make sure that the outdoor fan is not running and that the voltage of the main circuit capacitor is no greater than 20 VDC.
If the outdoor fan rotates due to strong wind, the main circuit capacitor will be charged and pose a risk of electric shock.
Refer to the wiring nameplate for details.
When finishing servicing, connect the outdoor fan connectors (CNFAN1 and CNFAN2) as they were.

Parts	Steps
1 	1. Remove the cover. The cover is screwed down with the five screws that are located where circled.
2  	2. Disconnect the connectors of the wires that are threaded through rubber bushes (1) and (2) from the MAIN board. Release the wires from the cable straps (3) and (4), and let them hang near the rubber bushes.

Parts	Steps
3  	3. Disconnect the connectors listed below and where circled in the figure, and bring the wires to the MAIN board side. M-NET board: CNIT, CNS2, CN102 Communication board: CN1
4 	4. Unscrew the screws that are located where circled. (2 places)
5  	5. Open the sheet metal panel, and replace the circuit board. Re-place all components in the reverse order as they were removed. Go to step 6 if you are replacing the noise filter board.

Parts	Steps
6 Replacing the noise filter board 	6. Remove the sheet metal (5). The sheet metal is screwed down with the four screws that are located where circled.
7 Under the sheet metal 	7. Replacing the noise filter board. Re-place all components in the reverse order as they were removed. Go to step 8 if you are replacing the coil.
8 Replacing the coil 	8. Unscrew the screws holding the Noise filter board and the coil. Then, remove the screws where circled, slide the terminal block down, and unscrew the screws from the terminal block and the coil. Re-place all components in the reverse order as they were removed.

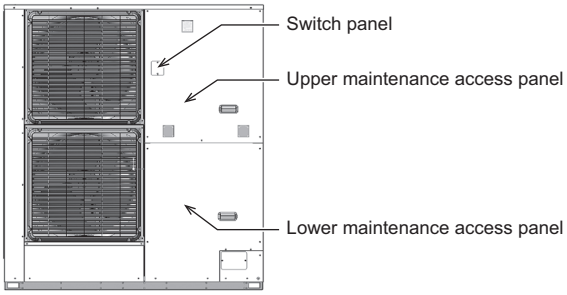
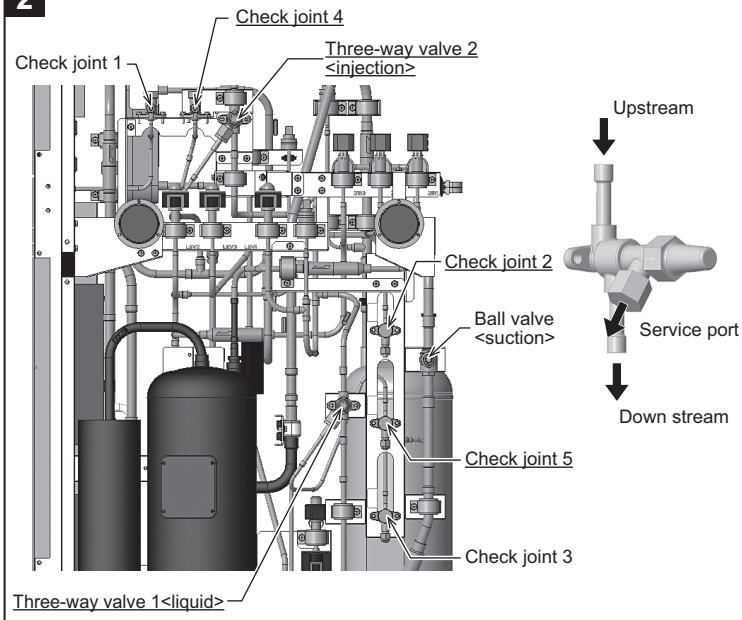
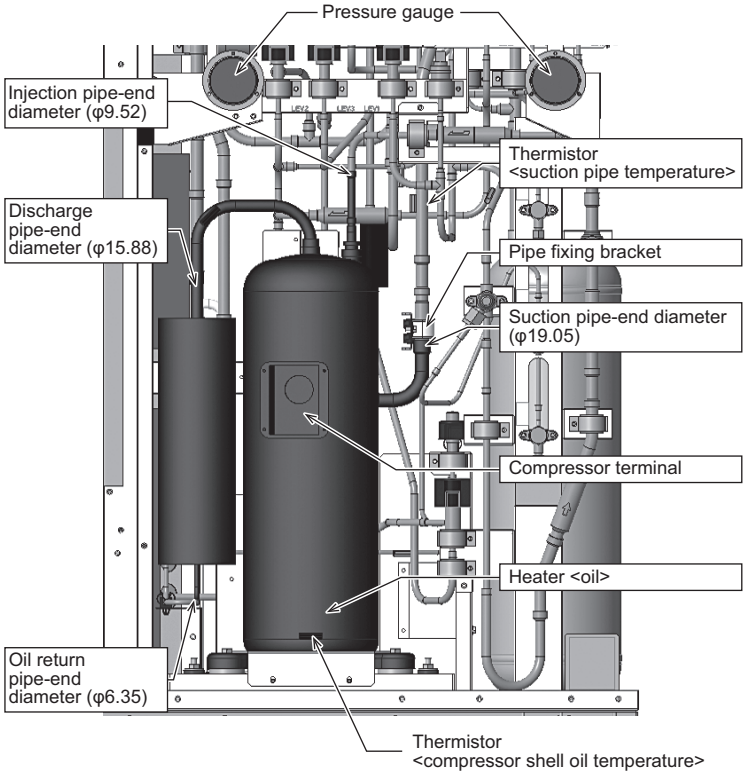
15-5. Replacing the compressor

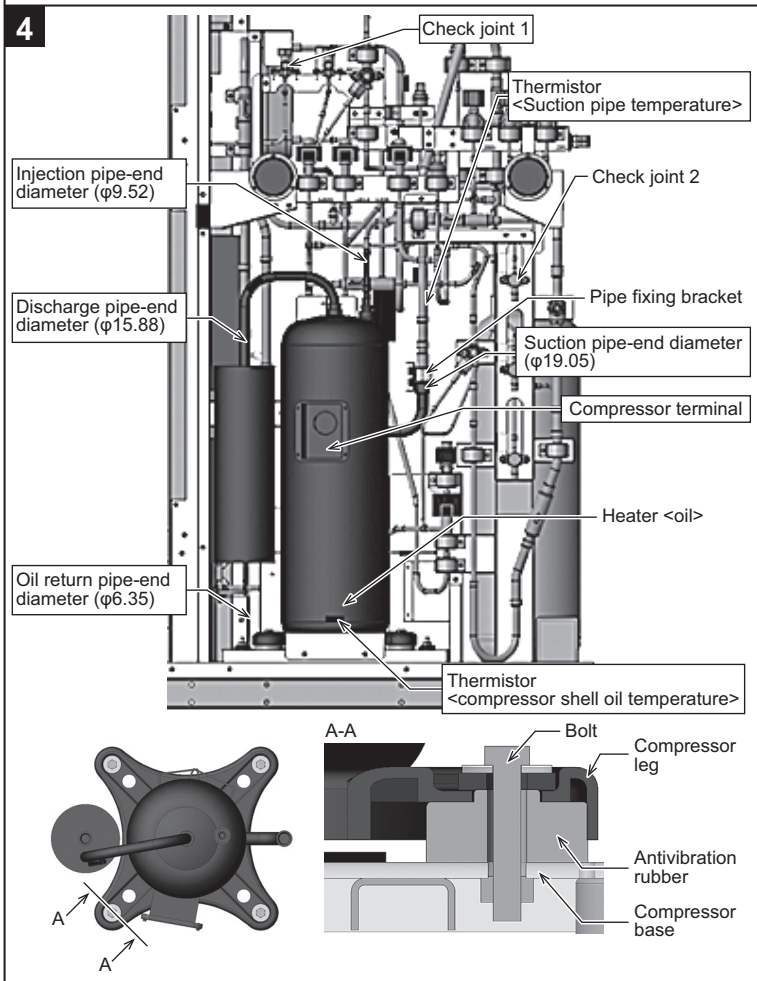
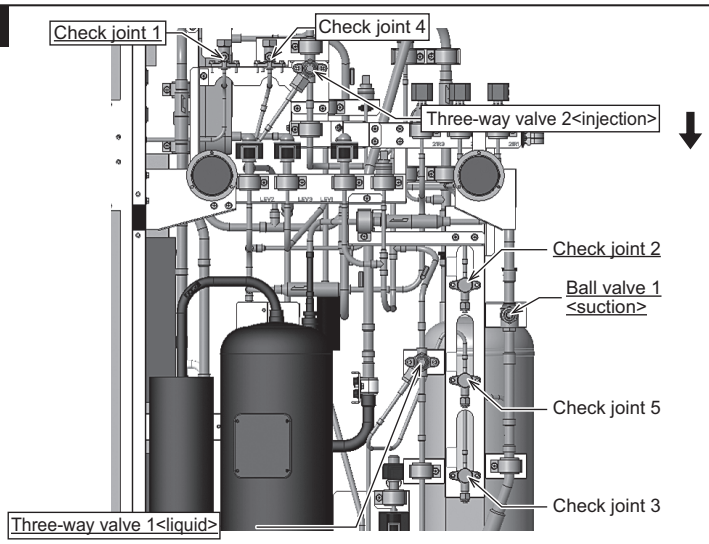
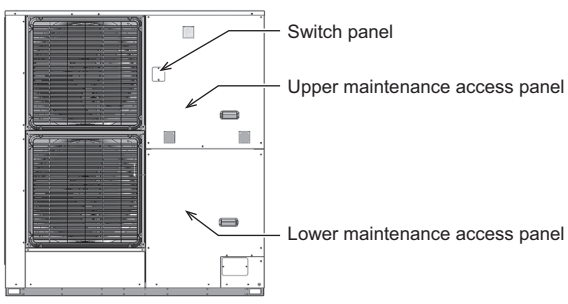
Wear protective gloves.

- Voltage still remains to each part of the circuit board or terminal block even after the switch (ON-OFF) is powered OFF.
  Touching the parts with bare hands poses electric shock hazards.
- Electricity charged to the circuit board remains for a few minutes even after the main switch (power breaker) is powered OFF.
  Touching the parts with bare hands poses electric shock hazards.

(1) Reconnect the suction, discharge, and injection pipes of the compressor to their original positions.
(2) Connect compressor wires in the correct phase (U, V, and W). Connecting them in the wrong phase may damage the compressor.
(3) Reinstall the cables in their original positions, and properly fix the cables in place.
(4) Remember to open the refrigerant service valve at the completion of work.
(5) When removing the compressor, remove the compressor mounting board, too. The compressor mounting board is bolted down with three bolts.

Please refer to the following page for further details.

Parts	Steps
1  	1. Preparation (1) Remove the lower and upper panels from the unit. Remove the switch panel on the upper panel of the unit. (2) Set SW1 <ON/OFF> to OFF, and turn off the main power supply (breaker). *If a pump down operation is performed through the liquid service valve at a high ambient temperature (30°C or higher), the pressure in the circuit may rise.
2  	2. Refrigerant discharge Open three-way valves 1 <liquid> and 2 <injection> halfway, and drain the refrigerant from check joints 2 <compressor suction>, 4 <injection>, and 5 <liquid>. *A high concentration of refrigerant in the atmosphere poses a risk of poisoning and oxygen starvation. Carry a refrigerant detector, and ensure adequate ventilation.
3  	3. Compressor removal (1) Disconnect the wiring from the compressor terminals. (2) Remove the thermistors <discharge pipe temperature>, <compressor shell oil temperature>, and <suction pipe temperature>, and the heater <oil>. *If the main power is not turned off, compressor terminals will remain energized, even if SW1 is turned off. (3) Remove the pipe fixing bracket. Remove the insulation wrapped near the pipe end. (4) Remove the four bolts from the legs of the compressor. (5) Remove the braze from the suction pipe, discharge pipe, injection pipe, and oil-return pipe. *Before starting, check the pressure using a pressure gauge, and make sure that there is no residual pressure. *Cut the suction pipe of the compressor with a pipe cutter, pull out the compressor, and then remove the braze from the suction pipe for easy removal. *Refrigerant oil may have accumulated in the oil separator. Be sure to use a pipe cutter when cutting the oil-return pipe of the compressor. (6) After removing the braze, pull out the compressor and replace it.

Parts	Steps
4 	4. Compressor installation (1) After removing the compressor, install an antivibration rubber on the new compressor, and install the compressor on the compressor base. (2) Attach the bolts to the compressor legs. (9.8 N•m or greater) (3) Connect the suction pipe, discharge pipe, injection pipe, and oil-return pipe by brazing. *The oil-return pipe is skinny. Use caution not to let it become clogged with the brazing filler. If the pipe becomes clogged with brazing filler, oil will not be properly returned to the compressor, resulting in failure. *Direct the brazing torch flame away from wires and insulation. (4) Perform brazing under an inert gas such as dry nitrogen gas to keep oxide scales from forming. Supply dry nitrogen gas through check joint 2 <compressor suction> and let it come out from check joint 1 <discharge>. (When done brazing, continue to keep the dry nitrogen gas flowing until the temperature of the brazed part drops to 200°C or less.) (5) Mount the pipe fixing bracket. Re-place the insulation. Re-place the thermistors and heaters. Connect the wires to the compressor terminals.
5 	5. Airtightness test process (1) After brazing is completed, conduct an airtightness test. Close three-way valve 1 <liquid> and ball valve 1 <suction> to prevent nitrogen from being supplied to the local piping or the load-side devices. Conduct an airtightness test at the design pressure or higher (12.0 - 12.5 MPa). *A pressure of 12.5 MPa can be applied to any parts inside the unit. When pressurizing to the design pressure, first apply pressure through check joint 1 <discharge>, and then apply pressure through check joint 2 <compressor suction>. Extract the nitrogen gas through check joint 2 <compressor suction> first. Make sure the low and the high pressures are not reversed.
6 	6. Refrigerant charging (1) Vacuum dry the pipes, and charge refrigerant in accordance with the instructions provided in Chapters 9 and 10. (2) Check that the service valves that are supposed to be open are open and that the ones that are supposed to be closed are closed. *Make sure that the three-way valve and ball valve are fully open. (3) Turn on the power, and check for proper operation in accordance with the instructions provided in Chapters 11 and 12. (4) Re-place the panels.

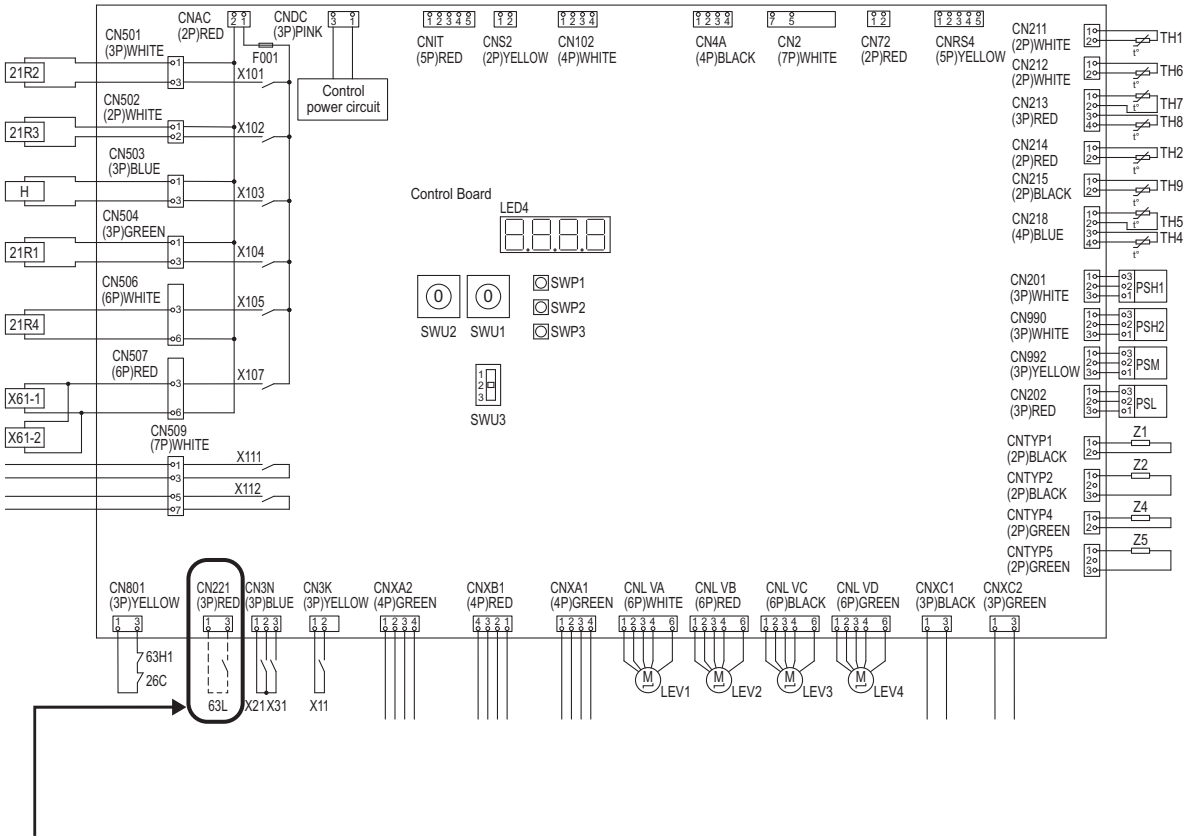
15-6. Backup operation

15-6-1. Low-pressure sensor fault

(1) Pressure switch (field supplied) can be used to operate the system when the low-pressure sensor is not working properly.

Procedures

1) Turn off the main power of the unit.



2) Replace this connector with the supplied connector, and connect a pressure switch (field supplied).

3) Connect the wire from CN211 to the pressure switch (field-supplied) contact.
4) Connect the low-pressure switch to the check joint of the refrigerant service valve (suction line stop valve).
5) Set dipswitches SW3-4 and SW3-5 to ON.
6) Turn on the main power.

Notes
If the connector CN211 is not connected to the pressure switch, and the unit starts operation under shortcircuitcondition, the low-pressure cutoff function will not work and compressor damage will result. Before turning on the main power, be sure to connect the wire from CN211 to the pressure switch contact.

The system can be operated in the emergency operation mode only when the low-pressure sensor is not working properly. It will take approximately six minutes from the time the main power is switched on until the compressor starts up.

16-1. Salt protection specifications

No.	Name	Base material	Standard	Salt damage protection	Surface treatment	Treatment thickness	
						External	Internal
1	Base	Alloyed hot-dip galvanized steel sheet	●	●	Polyester resin	70 µm or more	70 µm or more
2	Base beam	Alloyed hot-dip galvanized steel sheet	●	●	Polyester resin	70 µm or more	70 µm or more
3	Base leg	Alloyed hot-dip galvanized steel sheet	●	●	Polyester resin	70 µm or more	70 µm or more
4	Exterior metal sheet	Alloyed hot-dip galvanized steel sheet	●		Polyester resin	30 µm or more	–
		Alloyed hot-dip galvanized steel sheet		●	Polyester resin	70 µm or more	70 µm or more
5	Interior metal sheet (basic)	Hot-dip galvanized steel sheet	●		–	–	–
		Alloyed hot-dip galvanized steel sheet		●	Polyester resin	70 µm or more	70 µm or more
6	Fan base	Hot-dip galvanized steel sheet	●		–	–	–
		Alloyed hot-dip galvanized steel sheet		●	Polyester resin	70 µm or more	70 µm or more
7	Metal sheet outside the control box	Hot-dip galvanized steel sheet	●		–	–	–
		Aluminum-zinc alloyed plated steel sheet		●	Polyester resin	70 µm or more	–
8	Metal sheet inside the control box	Hot-dip galvanized steel sheet	●		–	–	–
		Aluminum-zinc alloyed plated steel sheet		●	–	–	–
9	Fan guard Bell mouth Fan	Weather-resistant polypropylene resin	●	●	–	–	–
10	Heat exchanger	Aluminum	●	●	–	–	–
11	Oil separator	Carbon steel	●	●	Epoxy resin	25 µm to 35 µm	–
12	Receiver	Carbon steel	●		Epoxy resin	–	–
				●	Polyurethane resin	75 µm or more	–
13	Accumulator	Carbon steel	●		Phenol modified alkyd resin	30 µm or more	–
				●	Polyurethane resin	75 µm or more	–
14	Fin guard	Iron wires	●	●	Polyethylene resin	400 ± 100 µm	400 ± 100 µm
15	Panel fixing screw	Carbon steel	●	●	Zinc-nickel alloy plating + Geomet treatment	5 µm or more	–

Application Guide

	Distance from sea		
Direct sea breeze	300 m	500 m	1 km
Facing inland sea	BS		STD
Facing ocean	BS		
Island location	BS		
Indirect sea breeze			
Facing inland sea	BS		STD
Facing ocean	BS		
Island location	BS		

Caution;
1 Set the outdoor unit to the place with rare direct sea breeze.
2 Don't attach a sunshade. A rain will clean the attached salt.
3 Set the outdoor unit horizontally. The water should not keep in the unit.
4 Please wash the outdoor unit periodically.
5 Repair the scratch on the panel as soon as possible.
6 Inspect periodically. Paint or change parts if necessary.

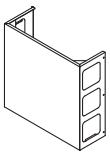
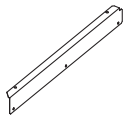
16-2. Detailed specification of high-pressure gas

Model name			ECOV-X37VA	ECOV-X55VA
Refrigerant			R744	R744
Compressor	Model name		HXK17FA-Y	HXK17FA-Y
	Discharge volume	m^3/h	4.1	5.9
Lubricant	Type		MEL220	MEL220
	Refrigerant oil (Compressor)	L	2.7	2.7
	Refrigerant oil (Other)	L	–	–
Design pressure	High pressure	MPa	12.0	12.0
	Low pressure	MPa	8.0	8.0
Design pressure of high-pressure breaker		MPa	12.0	12.0
Compressor	Quantity		1	1
	Withstand voltage test pressure	MPa	–	–
	Air-tightness test pressure	MPa	12.0	12.0
Receiver	Quantity		1	1
	Withstand voltage test pressure	MPa	–	–
	Air-tightness test pressure	MPa	8.5	8.5
	Fusible plug diameter	mm	–	–
	Fusible plug melting temperature	°C	–	–
Gas cooler	Quantity		1	1
	Withstand voltage test pressure	MPa	–	–
	Air-tightness test pressure	MPa	12.0	12.0
	Presence/absence of fusible plug		–	–
Gas-liquid separator (Suction accumulator)	Quantity		1	1
	Withstand voltage test pressure	MPa	–	–
	Air-tightness test pressure	MPa	8.5	8.5
	Presence/absence of fusible plug		–	–

Conduct an air-tightness test for the on-site pipes at the pressure equal to or above the design pressure (air-tightness test pressure).

16-3. Optional parts

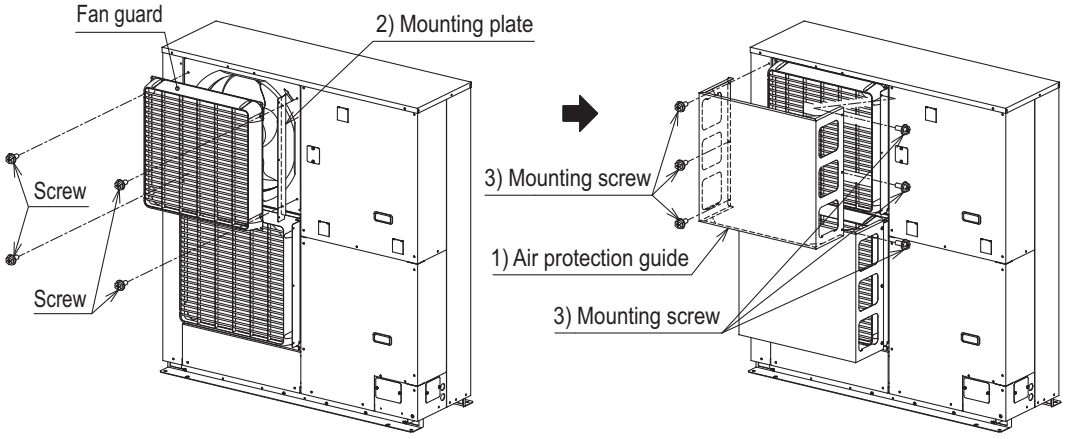
16-3-1. Air protection guide AG-X37A

Item	Air protection guide	Mounting plate	Mounting screw
Quantity	1	1	7 (including 1 spare)
Shape			

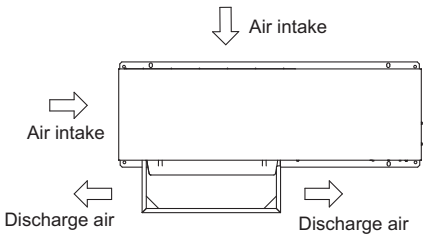
Installation procedure

(1) Remove the crews from the fan guard, and screw 2) mouning plate down together with the fan guard to the unit.

(2) Attach 1) air protection guide to the condensing unit using 3) mounting screws.

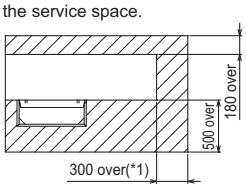


External dimensions



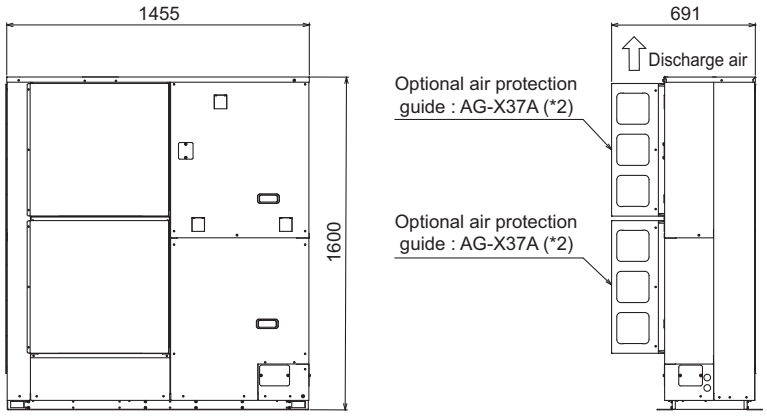
1.Service space

The dimensions of the chart below are necessary in the service space.



*1 When removing the piping and the wiring from the right side, a space of about 300 mm is required on the right side.

*2 Two sets of optional air protection guide (AG-X37A) are required.



16-4. Refrigerant characteristics

♦ R744 refrigerant characteristics chart

Temperature (°C)	Saturated pressure (MPaG)
	Saturated liquid/gas
-45	0.73
-44	0.76
-43	0.80
-42	0.83
-41	0.87
-40	0.90
-39	0.94
-38	0.98
-37	1.02
-36	1.06
-35	1.10
-34	1.14
-33	1.19
-32	1.23
-31	1.28
-30	1.33
-29	1.38
-28	1.42
-27	1.48
-26	1.53
-25	1.58
-24	1.64
-23	1.69
-22	1.75
-21	1.81
-20	1.87
-19	1.93
-18	1.99
-17	2.06
-16	2.12
-15	2.19
-14	2.26
-13	2.33
-12	2.40
-11	2.47
-10	2.55
-9	2.62
-8	2.70
-7	2.78
-6	2.86
-5	2.94
-4	3.03
-3	3.12
-2	3.20
-1	3.29
0	3.38

Temperature (°C)	Saturated pressure (MPaG)
	Saturated liquid/gas
1	3.48
2	3.57
3	3.67
4	3.77
5	3.87
6	3.97
7	4.08
8	4.18
9	4.29
10	4.40
11	4.51
12	4.63
13	4.75
14	4.86
15	4.99
16	5.11
17	5.24
18	5.36
19	5.49
20	5.63
21	5.76
22	5.90
23	6.04
24	6.19
25	6.33
26	6.48
27	6.63
28	6.79
29	6.95
30	7.11

⚠Warning

■ Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
- Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, repair, or at the time of disposal of the unit.
- It may also be in violation of applicable laws.
- MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.

MITSUBISHI ELECTRIC CORPORATION

www.MitsubishiElectric.com

MEES20K045

New publication effective Feb. 2021
Specifications subject to change without notice