Service Manual

Ultra-low Temperature Freezer

MDF-U4186S

SANYO Electric Co., Ltd.
Biomedical Business Division

RoHS

This product does not contain any hazardous substances prohibited by the RoHS Directive.
(You will find 'RSF' mark near the rating plate on the RoHS compliant product.)

WARNING

* You are requested to use RoHS compliant parts for maintenance or repair.
* You are requested to use lead-free solder.

SM9910125

Effective models

This service manual is effective following models.

Model name	Product code	Voltage and Frequency	
MDF-U4186S	823 198 52	220V	50Hz
	823 198 53	220V	60Hz
	823 198 54	230/240V	50Hz
	823 198 55	220V	50Hz

Contents

Specifications

■Structural specifications

Item	MDF-U4186S
External dimensions	W870 x D780 x H1975 (mm)
Internal dimensions	W620 x D515 x H1200 (mm)
Effective capacity	382 L
Exterior	Painted steel
Interior	Painted steel
Outer door	Painted steel
Inner door	2doors, ABS resin panel with stainless frame
Insulation	Rigid-polyurethane foamed-in place
Exterior	Painted steel
Interior	Painted steel
Shelf	3shelves, stainless steel
Caster	4pcs,（2 leveling foot at front）
Access port	ϕ40mm, 1 place (left side)
Net weight	281 kg
Cooling performance	-86℃ at center part of freezing room（AT30℃, no load）
Compressor	H side: 1100W, hermetic type L side: 1100W, hermetic type
Refrigerant	H side: HFC refrigerant(R-407D） L side: HFC refrigerant (R-508）
Refrigerant oil	Ze-NIUS32SA
Evaporator	Tube on sheet
Condenser	H side：Fin and tube L side：Shell and tube
Power supply	Local voltage
Battery	For power failure alarm; Nickel-cadmium battery(5N-270AA), DC6V, 270mAh
Accessories	1 set of keys, 1 scraper, 2 rubber caps
Optional component	Inventory rack (IR-220U), Automatic temperature recorder(MTR-85H), Back-up system (CVK-UB2);LCO2

■**Control specifications**

Item		MDF-U4186S
Temperature controller		Microprocessor controlled system
Temperature sensor		Pt.100Ω
Temperature display		LED digital display（1℃ graduation）
Alarm	High temp. alarm	Selectable with 10℃ or 15℃.(Initial:10℃) ALARM lamp blinks and intermittent buzzer beeps with 12 min. of delay Remote alarm contact: Normal Open, Normal Close Max; 30VDC, 2A Temperature alarm turns on during power failure (not linked with buzzer)
	Door	DOOR lamp is lit when outer door is left opened.
	Filter	Filter check lamp (FILTER) is lit with intermittent buzzer beeps.
	Power failure	ALARM lamp blinks with intermittent buzzer beeps, remote alarm outputs.
	Remote alarm	3P remote alarm terminal: Maximum 30VDC, 2A NC-COM, NO-COM Outputs during temperature alarm and power failure alarm
	Battery life	PV and 'F1' are alternately displayed Accumulating time: Approx. 3 years
	Fan motor life	PV and 'F2' are alternately displayed. Accumulating time: Approx. 6 years
Control panel		Lamp: ALARM, FILTER CHECK, CO2 BACK UP BUZZER: Alarm buzzer stop key ALARM: Alarm test key PV/SV: Temperature setting key ENT: Enter key ＞: Digit shift key Λ: Numerical value shift key
Self diagnosis function		When any failure occurs among the temperature sensor, filter sensor, cascade sensor and AT sensor; ・Error code and internal temp.(PV) are alternately displayed. ・Remote alarm contact turns on and buzzer beeps.
Compressor protection		When the temperature of cascade sensor is -34℃ or lower, L side compressor is turned on. When the temperature of cascade sensor is -12℃ or higher, L side compressor is turned off. When unit detects filter sensor temperature +60℃ or higher, H side compressor is turned off. Overload relay

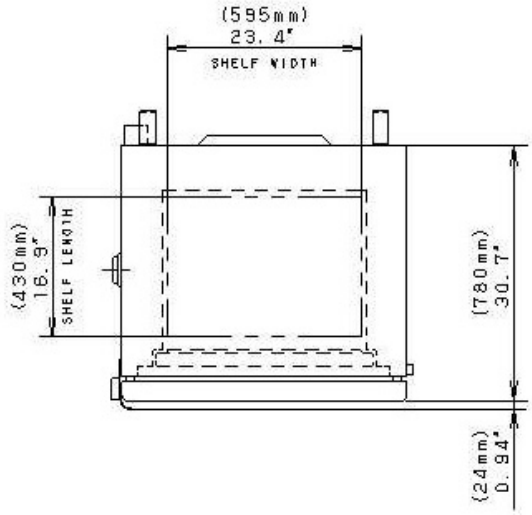
■**Performance specifications**

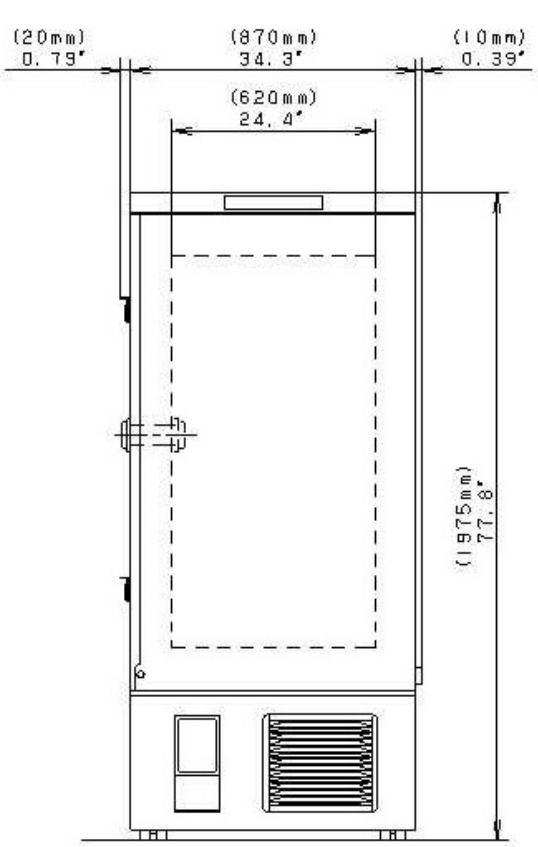
<MDF-U4186S>

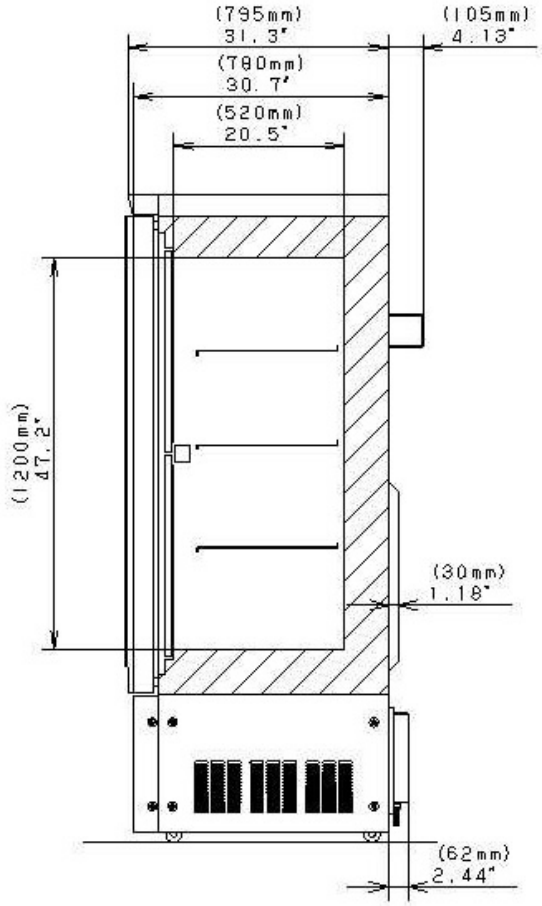
Cooling performance	-86℃ at center part of freezing room (AT 30℃, no load)			
Temperature control range	-20℃ to -86℃ (AT 30℃, no load)			
Power source	220V, 50Hz	220V, 60Hz	230V, 50Hz	240V, 50Hz
Rated power consumption	1010W	1110W	1070W	1110W
Noise level	49 dB [A scale]			
Maximum pressure	2.18 MPa			

* Specifications will be subject to change without notice.

Dimensions


(595mm)
23.4"
SHELF WIDTH
(430mm)
16.9"
SHELF LENGTH
(780mm)
30.7"
(24mm)
0.94"


(20mm)
0.79"
(870mm)
34.3"
(10mm)
0.39"
(620mm)
24.4"
(1975mm)
77.8"

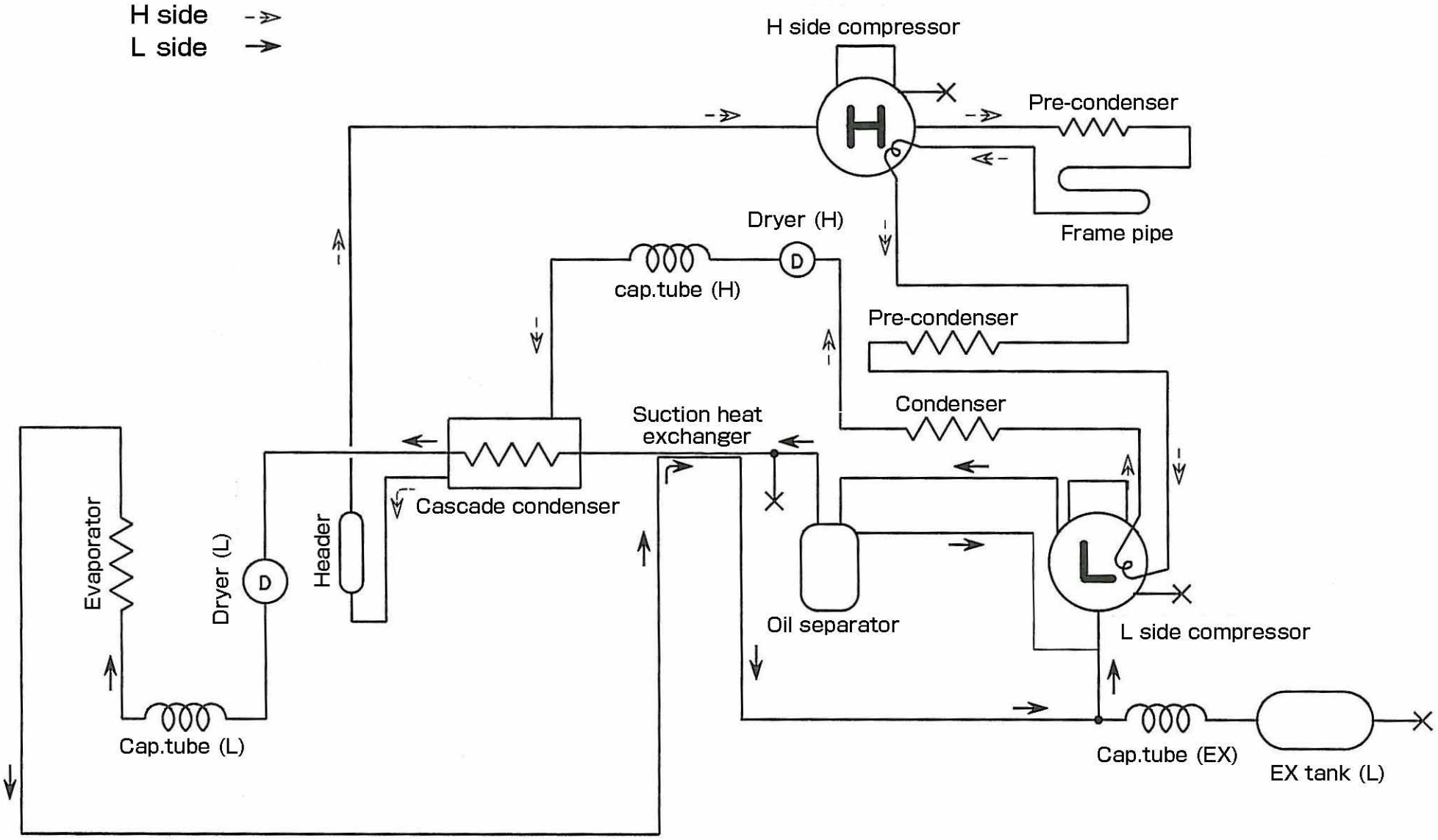

(795mm)
31.3"
(105mm)
4.13"
(780mm)
30.7"
(520mm)
20.5"
(1200mm)
47.2"
(30mm)
1.18"
(62mm)
2.44"

Cooling unit parts

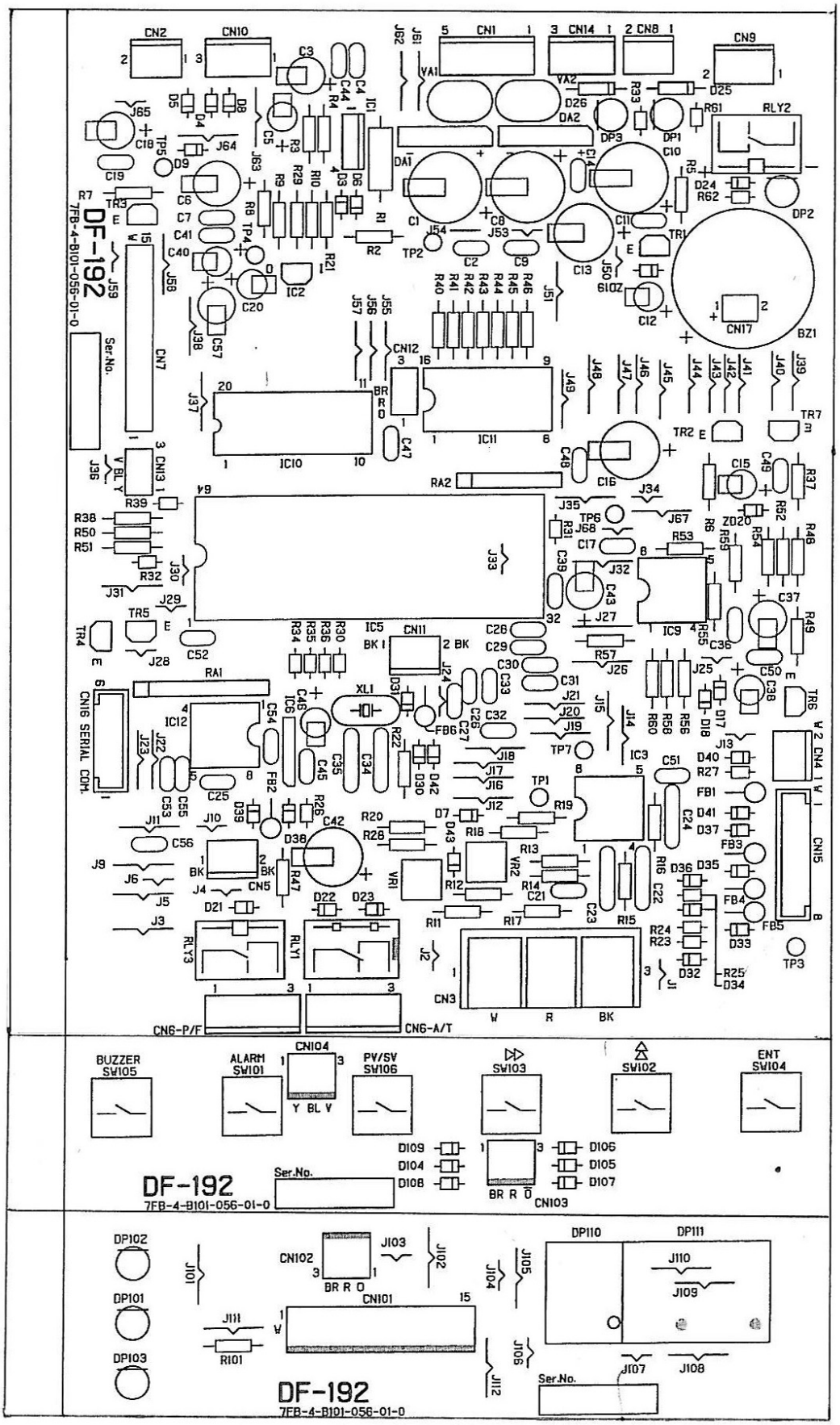
<MDF-U4186S>

Item	Specifications		
	H side	L side	
Compressor			
220V, 60Hz	Compressor code: 7FB-0-M101-001-06	Compressor type: KS370J1NS-7A	
220V, 50Hz	Compressor code: 7FB-0-M101-001-04	Compressor type: KS370J1NS-4A	
230/240V, 50Hz	Compressor code: 7FB-0-M101-001-05	Compressor type: KS370J1NS-4A1	
Refrigerant oil	Ze-NIUS32SA Charged q'ty: 850cc	Ze-NIUS32SA Charged q'ty: 850cc	
Cooling system	Forced air cooling (partially) Oil cooler	Forced air cooling (partially) Oil cooler	
Condenser			
Type	Fin and tube	Cascade condenser	
Condenser	12 columns x 3 lines P4mm Fin 62pcs.	Coil pipe ϕ6.35mm	
Pre-condenser	W 250mm	——	
Frame pipe	ϕ6.35mm	——	
Evaporator Type	Cascade condenser Shell and tube ϕ80mm	Tube on sheet ϕ9.52mm	
Capillary tube			Ex. capillary
Resistance PSI・kg/cm^2	78 PSI/G	5 kgf/cm^2	34 PSI/G
Length	3000mm	2000mm	500mm
Outer diameter	ϕ2.4mm	ϕ1.8mm	ϕ2.4mm
Inner diameter	ϕ1.2mm	(ϕ0.65mm)	ϕ1.2mm
Refrigerant	R-407D Charged q'ty: 391g	R-508 Charged q'ty: 310g	
Oil additive	n-Pentane Charged-q'ty: 24g	n-Pentane Charged q'ty: 44g	
Dryer	4A-XH-9 Charged q'ty: 18g	4A-XH-6 Charged q'ty: 58g	
Condensing fan	ϕ230 mm、4 blades Material: ABS		
Condensing fan motor Type	SE4-E11L5P		
Oil separator	——	SPK-0S02S2 (810-4-2008)	

Refrigeration circuits



Components on PCB



Electrical parts

MDF-U4186S		220V, 50Hz	230/240V, 50Hz	220V, 60Hz
Compressor (H),(L)	Type	KS370J1NS-4A	KS370J1NS-4A1	KS370J1NS-7A
	Compressor code	7FB-0-M101-001-04	7FB-0-M101-001-05	7FB-0-M101-001-06
	Rated voltage	220/230V, 50Hz	230/240V, 50Hz	220V, 60Hz
	Winding resistance (C-S)	2.53Ω	2.53Ω	1.64Ω
	Winding resistance (C-R)	4.8Ω	4.8Ω	3.35Ω
Starting relay (H),(L)	Type	AMVL-300A	AMVL-300A	AMVL-300A
	Pick up voltage	185~217VAC	185~217VAC	215~247VAC
	Drop out voltage	60~120VAC	60~120VAC	69~132VAC
	Parts code	626 100 1503	626 100 1503	
Overload relay (H),(L)	Type	MRA99953-9201	MRA99953-9201	MRA99954-9201
	Action to the temp. (no current) ON	69+/-11℃	69+/-11℃	69+/-11℃
	Action to the temp. (no current) OFF	135+/-5℃	135+/-5℃	135+/-5℃
	Action to the current (AT25℃)	22.5A	22.5A	29.5A
	Operation time	6~16sec	6~16sec	6~16sec
	Parts code	624 226 3166	624 226 3166	624 226 3173
Starting capacitor (H),(L)	Rating	100MF, 250VAC	100MF, 250VAC	160MF, 250VAC
Running capacitor (H),(L)	Rating	25MF, 400VAC	25MF, 400VAC	25MF, 400VAC
Condensing fan motor	Type	SE4-E11L5P	SE4-E11L5P	SE4-E11L5P
	Rating	220-240VAC	220-240VAC	220-240VAC
	Parts code	624 225 6236	624 225 6236	624 225 6236
Cap.tube heater	Rating	12W, 100V	12W, 100V	12W, 100V
	Resistance (25℃)	846Ω	846Ω	846Ω
	Parts code	624 198 7902	624 198 7902	624 198 7902
Door heater	Rating	27.6W, 230V	27.6W, 230V	27.6W, 230V
	Resistance (25℃)	400Ω	400Ω	400Ω
Temp. control relay (H)(L)	Type	G4F-11123T	G4F-11123T	G4F-11123T
	Contact capacity	20A, 12VDC	20A, 12VDC	20A, 12VDC
	Parts code	624 173 2397	624 173 2397	624 173 2397
Temp. sensor	Type	PT-100Ω	PT-100Ω	PT-100Ω
Cascade sensor	Type	502AT	502AT	502AT
	Rating	5kΩ, 25℃	5kΩ, 25℃	5kΩ, 25℃
Filter sensor	Type	502AT	502AT	502AT
	Rating	5kΩ, 25℃	5kΩ, 25℃	5kΩ, 25℃
A.T. sensor	Type	502AT	502AT	502AT
	Rating	5kΩ, 25℃	5kΩ, 25℃	5kΩ, 25℃
Power transformer	Type	ATR-C105	ATR-C105	ATR-C105
	Primary	200/225/240V	200/225/240V	200/225/240V
	Secondary	100V, 50VA	100V, 50VA	100V, 50VA
	Parts code	624 204 5786	624 204 5786	624 204 5786
Power transformer (for PCB)	Type	A-3578	A-3578	A-3578
	Rating	100V, 6.2VA	100V, 6.2VA	100V, 6.2VA
	Parts code	624 224 6381	624 224 6381	624 224 6381
Breaker switch	Type	BAM215131	BAM215131	BAM215131
	Rating	250V, 15A	250V, 15A	250V, 15A
	Parts code	624 215 4235	624 215 4235	624 215 4235
Battery switch	Type	SLE6A2-5	SLE6A2-5	SLE6A2-5
	Rating	250VAC, 4A	250VAC, 4A	250VAC, 4A
	Parts code	624 213 1472	624 213 1472	624 213 1472
Door switch	Type	PS-500-605	PS-500-605	PS-500-605
	Rating	200V, 0.5A	200V, 0.5A	200V, 0.5A
	Parts code	624 171 3228	624 171 3228	624 171 3228
Test switch (for CVK-UB2, option)	Type	8R2021	8R2021	8R2021
	Rating	125VAC, 3A	125VAC, 3A	125VAC, 3A
	Parts code	624 194 3984	624 194 3984	624 194 3984
Back up switch (for CVK-UB2, option)	Type	HLS208N	HLS208N	HLS208N
	Rating	125VAC, 5A	125VAC, 5A	125VAC, 5A
	Parts code	624 169 9690	624 169 9690	624 169 9690
Solenoid valve (for CVK-UB2, option)	Type	X8264D9	X8264D9	X8264D9
	Rating	24VDC	24VDC	24VDC
	Parts code	624 215 2224	624 215 2224	624 215 2224
Power transformer (for CVK-UB2, option)	Type	ATR-K285T	ATR-K285T	ATR-K285T
	Primary	100/115/230V	100/115/230V	100/115/230V
	Secondary	23V, 1.2A	23V, 1.2A	23V, 1.2A
	Parts code	624 203 9624	624 203 9624	624 203 9624

Specifications of sensor

1. Temperatures and resistance values in temperature sensor (Type: 502AT-1)

℃	kΩ	℃	kΩ	℃	kΩ	℃	kΩ
−50	154.5	−36	71.80	−22	35.65	0	13.29
−49	145.9	−35	68.15	−21	33.99	5	10.80
−48	137.8	−34	64.71	−20	32.43	10	8.84
−47	130.2	−33	61.48	−19	30.92	15	7.20
−46	123.1	−32	58.43	−18	29.50	20	6.01
−45	116.5	−31	55.55	−17	28.14	25	5.00
−44	110.2	−30	52.84	−16	26.87	30	4.17
−43	104.4	−29	50.23	−15	25.65	35	3.50
−42	98.87	−28	47.77	−14	24.51	40	2.96
−41	93.70	−27	45.45	−13	23.42	45	2.51
−40	88.85	−26	43.26	−12	22.39	50	2.13
−39	84.18	−25	41.19	−11	21.41	55	1.82
−38	79.80	−24	39.24	−10	20.48	60	1.56
−37	75.67	−23	37.39	−5	16.43	65	1.35

2. Temperatures and resistance values in temp. sensor (Type: Pt100Ω- NEW JIS)

℃	Ω	℃	Ω	℃	Ω	℃	Ω
−170	31.32	−100	60.25	-30	88.22	40	115.54
−160	35.79	−90	64.30	-20	92.16	50	119.40
−150	39.82	−80	68.33	-10	96.09	60	123.24
−140	43.87	−70	72.33	0	100.00	70	127.07
−130	48.00	−60	76.33	10	103.90	80	130.89
−120	52.11	−50	80.31	20	107.80	90	134.70
−110	56.19	−40	84.27	30	116.70	100	138.50

Connections on PCB

The following shows the connections of connectors on the control PCB.

Connector	Connects to	Usage	Voltage
CN1	Power transformer	To supply the power to PCB.	#1-#2; 10.3VAC #3; GND #4-#5; 18.5VAC
CN2	#1 - #2; Battery	To supply the power in power failure	#1; 6VDC #2; GND
CN3	#1 - #3; Temp. sensor	To detect internal temperature	
CN4	#1 - #2; Cascade sensor	To detect cascade temperature	
CN5	#1 - #2; Filter sensor	To detect temperature in condenser outlet pipe.	
CN6	#1 - #5; Remote alarm terminal #1; COM. #3; N.O. #5; N.C.	To output remote alarm	
CN7	Display PCB	To connect each LEDs.	
CN8	#1 - #2; Temp. control relay L	To control internal temperature.	#1-#2; 12VDC
CN9	#1; Cap. tube heater #2; To power supply line	To conduct electricity in cap. tube heater.	
CN13	Control PCB	To connect to each switches.	
CN14	#1 - #3; Temp. control relay H		
CN15	#1 - #2; A.T. sensor	To detect ambient temperature	

Control specification

1. Key and Switch

BUZZER : In alarm condition, buzzer stops sounding with this key pressed. Remote alarm output and alarm message would not be off.

ALARM : With this key pressed to activate alarm test mode to be forcibly step into alarm condition (ALARM lamp blinks and intermittent buzzer sounds).

PV/SV : Press this key once to activate set mode (2nd digit in LED blinks), press the key once more to revert to current internal temperature (PV) display.

▶▶ During set mode, shift between the 1st digit and the 2nd digit. In PV display, press the key over 5 seconds to display filter sensor temperature for 3 seconds. (digit of decimal point is not displayed)
In PV display, press the key 5 times during 5 seconds to turn capillary heater on for the period set in normal operation.

▲ During set mode, count the blinking digit up. In PV display, press the key over 5 seconds to enter the function mode. (“F00” is displayed)
In PV display, press the key for 5 times in 5 seconds to display the value of decimal point for 3 seconds. (Ex. -80.3℃ → 803)

ENTER : During set mode, press the key to store the displayed temperature as set value (SV).
In PV display, press the key 5 times during 5 seconds to display cascade sensor temperature for 3 seconds.

2. Temperature control

Setting range : -20℃～-95℃

Display range : -170℃～50℃

Setting procedure : Press PV/SV key and set the required value with ▲ key and ▶▶ key. Press ENTER key to memorize the set value.

Unacceptable value : If you input value out of setting range and press ENTER key, the buzzer beeps for 1 second to inform the value unacceptable.
If you input value out of setting range and press PV/SV key, automatically revert to PV display to notify the value is unacceptable.

3. High temperature alarm

Setting range : Selectable 10℃ or 15℃

Setting procedure : Keep pressing ▲ key over 5 seconds to enter function mode (F00). Press again to count the value up. “F01” displayed to input the value of high temperature alarm. (the 1st digit blinks)
(Ex. If you want to set at 15℃ (initial 10℃), change the value to “001” and press ENTER key to store the value in non-volatile memory.

4. Function mode

Setting range : 00~32

Display range : 00~39

00, 02, 04, 05, 08, 12~14, 18, 19, 23, 26~30 and 33~39 are unused.

Setting procedure : In PV display, keep pressing ⏫ key over 5 seconds to enter function mode (F00 is displayed). Change the blinking 1st digit to desired function code with ⏫ key and ⏩ key. Press ENTER key to be function code available.

If you input above unused function code and press ENTER key, automatically revert to PV display.

Unacceptable value : Even If you input value out of setting range (F33~39) and press ENTER key, automatically revert to PV display to notify the value is unacceptable.

Note) If you press PV/SV key with any function mode displayed, automatically revert to PV display to ignore the displayed function mode.

5. Warning function

Door alarm : With outer door is left opened, ALARM lamp (red) is lit. the buzzer beeps intermittently with 30 minutes of delay and ALARM lamp blinks.
Remote alarm terminal does not output.
Buzzer beeps again with 30 minutes of delay after you pressed BUZZER key to stop buzzer beeping.
Buzzer stops beeping and ALARM lamp is gone off when you shut the door.

High temp. alarm : When PV is reached to SV+SV_H (high temp. alarm SV) +1 or, ALARM lamp and LED display blinks, intermittent buzzer beeps with approx. 12 minutes of delay and remote alarm output turns on.
When PV is reached to SV+ SV_H or lower, ALARM lamp and LED display go off, buzzer stops beeping and remote alarm output turns off.
If you press BUZZER key, the buzzer stops beeping instead remote alarm output does not turn off.
You can set SV_H at 10℃ in F01.

Filter alarm : When the filter sensor temperature is reached to 45℃ or higher, FILTER lamp is flash and the buzzer beeps intermittently.
When the filter sensor temperature is reached to 41℃ or lower, FILTER lamp goes off and buzzer stops beeping.

6. Other function

Cascade control : When the cascade temperature is reached to -34℃ or lower during pull-down, Compressor L would be turned ON.
When the cascade temperature is reached to -12℃ or higher during pull-up, Compressor H would be turned OFF.

Auto return : If there is not any key operation for 90 seconds in SV set mode and function code set mode, automatically reverts to PV mode.
Note) Auto return is not worked in F09 and F10.

7. Function mode

F00 Automatically revert to PV display
F01 SV_H (high temp. alarm SV) setting
F03 Indication of battery accumulation time
F02, F04, F05 Automatically revert to PV display
F06 Service code input (code: 384)
F07 Temperature Zero Adjustment
F08 Automatically revert to PV display
F09 (Factory test mode …… Unused)

F10	(Factory test mode …… Unused)
F11	(Cascade temperature Zero Adjustment …… Unused)
F12~F14	Automatically revert to PV display
F15	Indication of temperature in AT sensor
F16	(Timer speed-up mode …… Unused)
F17	Model code setting (non-volatile memory initialization …… Unused)
F18, F19	Automatically revert to PV display
F20	Capillary heater is forcibly turned off
F21	(Communication ID setting …… Unused)
F22	(Communication mode setting ……Unused)
F23	Automatically revert to PV display
F24	PV display (decimal point is displayed)
F25	Setting of alarm resume time
F26~F30	Automatically revert to PV display
F31	Buzzer setting during filter alarm
F32	Indication of fan motor accumulation time
F33~F39	Automatically revert to PV display

Setting procedure: In PV display, keep pressing ▲▲ key over 5seconds to display "F00".
Input the desired function code with ▲▲ key and ▶▶ key.
Press ENTER key to be function mode available.
Note) You should input service code in F06 prior to use F07, F09~11, F15~17, F20~22, F24 and F31.
To cancel service code, input "000" in F06 or turn the power off.

F00: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in "F00" displayed to revert to PV display..

F01: <Purpose> SV_H (high temp. alarm SV) setting
<Operation> Input F01 and press ENTER key to display "000" (initial value).
Set selectable "000" or "001" with ▲▲ key. Press ENTER key to store the value and revert to PV display.

F02: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in "F02" displayed to revert to PV display.

F03: <Purpose> To indicate battery accumulation time. The battery is used for lamp and buzzer operation during power failure.
<Operation> Input F03 and press PV/SV key to display battery accumulation time and "F03" alternately.
<Cancel> Input PV/SV key again to revert to PV display.

F04,05: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in "F04" (F05) displayed to revert to PV display.

F06: <Purpose> Dividing F-code for customer used from service
<Operation> Input F06 and press ENTER key to display "000" (initial value).
Set to "384" with ▲▲ key and ▶▶ key. Press ENTER key to store the value and revert to PV display.
<Cancel> Input F06 and press ENTER key to display "384".
Change to "000" with ▲▲ key and ▶▶ key. Press ENTER key to store the value and revert to PV display.
Turn the power off then on to revert to "000". (not stored in non-volatile memory)
Note) "384" is stored in non-volatile memory during battery back-up. (battery SW is ON)

<How to reset battery (fan motor) accumulation time>
Input F06 and press ENTER key. Input '409' ('419' for fan motor) and press ENTER key again to reset battery (fan motor) accumulation time to show '000' in F03 (F32).

F07: <Purpose> To match controlled temperature of temp. sensor with 1/2air temp.
<Operation> Input F07 and press ENTER key to display "000" (initial value).
Change to the desired value (-99~099) with ▲▲ key and ▶▶ key.
Press ENTER key to store the value and revert to PV display.
Input service code in F06 prior to use this mode.

F08: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F08 displayed to revert to PV display.

F12~14: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F12~14 displayed to revert to PV display.

F15: <Purpose> To indicate temperature in AT sensor
<Operation> Input F15 and press PV/SV key to display F15 and 'XXX' (present AT sensor temperature) alternately.
<Cancel> Press PV/SV key to revert to PV display.

F18~19: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F18~F19 displayed to revert to PV display.

F20: <Purpose> To turn capillary tube heater forcibly off
<Operation> In F20 display, press ENTER key to display "000" (initial value). Change the value to "001" and press ENTER key again to turn capillary tube heater forcibly off. Unit reverts to PV display automatically.
Service code should be input in F06 prior to use this mode.

F21~23: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F21~F23 displayed to revert to PV display.

F24: <Purpose> PV is displayed in 3 digits (digit of decimal point is displayed)
<Operation> In F24 displayed, press ENTER key to display "000" (initial value)
Change the value to "001" with ▲▲ key and press ENTER key.
Ex.) -85.1℃ → 851
Service code should be input in F06 prior to use this mode.

F25: <Purpose> Setting of alarm resume time
<Operation> Input F25 and press ENTER key to display "100" (initial value).
Change the value with ▲▲ key and ▶▶ key.
Press ENTER key to store the value and revert to PV display.
Settable range is between 10 and 60 min. with 1 min. increment.

If you set selectable following code with BUZZER key pressed, both buzzer and remote alarm relay are turned OFF;
000: Buzzer and remote alarm don't resume
010: Buzzer and remote alarm resume with 10min. later
020: Buzzer and remote alarm resume with 20min. later
030: Buzzer and remote alarm resume with 30min. later (initial set)
040: Buzzer and remote alarm resume with 40min. later
050: Buzzer and remote alarm resume with 50min. later
060: Buzzer and remote alarm resume with 60min. later

if you set selectable following code with BUZZER key pressed, only buzzer is turned OFF;
100: Buzzer doesn't resume
110: Buzzer resumes with 10min. later
120: Buzzer resumes with 20min. later
130: Buzzer resumes with 30min. later
140: Buzzer resumes with 40min. later
150: Buzzer resumes with 50min. later
160: Buzzer resumes with 60min. later

F26~30: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F26~F30 displayed to revert to PV display.

F31: <Purpose> Buzzer setting during filter alarm
<Operation> In F31 displayed, press ENTER key to display "001" (initial value). Change to "000" with ⏫ key and press ENTER key to be FILTER lamp lit during filter alarm. Service code should be input in F06 prior to use this mode.
001: Alarm lamp flashes and the buzzer beeps intermittently
000: Alarm lamp is lit

F32: <Purpose> To indicate accumulation time of condensing fan motor
<Operation> Input F32 and press PV/SV key. F32 and accumulation time (Ex."000") are alternately displayed. If you press ENTER key, the unit reverts to PV display.
<Cancel> Press PV/SV key to revert to PV display.

F33~39: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENTER key in F33~F39 displayed to revert to PV display.

8. Differential (The point in which compressor turns ON and OFF)

COMP ON: SV +0.5℃
COMP OFF: SV -0.8℃

9. Temperature offset

The difference between the temperature in temp. sensor and center temperature of the chamber should be adjusted by temperature offset.
Offset value; PV + 2.0℃

10. Remote alarm

(1) High temp. alarm (RLY 1)
In normal condition: Remote alarm contact is N.O. N.C.
↓ ↓
In alarm condition: Remote alarm contact is N.C. N.O.

(2) Power failure alarm (RLY 3)
In normal condition: Remote alarm contact is N.O. N.C.
↓ ↓
In power failure: Remote alarm contact is N.C. N.O.

11. Sensor failure

(1) Temp. sensor

Open circuit: E01 and 50℃ are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Compressor would be allowed to turn on.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E02 and -170 ℃ are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Compressor would be allowed to turn on.
Press BUZZER key to stop the buzzer beeping.

(2) Cascade sensor

Open circuit: E03 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs. The resistance value would be limitless that makes the temperature -34℃ or lower. At the time L side compressor is not forcibly turned off.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E04 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs. The resistance value would be “0” that makes the temperature -18℃ or higher to detect an error.
L side compressor is forcibly turned off.
Press BUZZER key to stop buzzer beeping.

(3) Filter sensor

Open circuit: E05 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E06 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

(4) AT sensor

Open circuit: E07 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.
Press BUZZER key to stop the buzzer beeping.

Short circuit: E08 and PV are displayed alternately, the buzzer beeps intermittently and remote alarm contact outputs.

(5) Error code priority

No.1: Temp. sensor failure (E01 or E02)
No.2: Cascade sensor failure (E03 or E04)
No.3: Filter sensor failure (E05 or E06)
No.4: AT sensor failure (E07 or E08)
No.5: Condenser abnormal temperature (E10) … H side compressor locks

(4) Error diagnosis

E01: When PT sensor detects 50.0℃ or higher , it regards as open circuit.
E02 : When PT sensor detects -170℃ or lower, it regards as short circuit.
E03 : When cascade sensor detects -64℃ or lower, it regards as open circuit.
E04: When cascade sensor detects 70℃ or higher, it regards as short circuit.
E05 : When filter sensor detects -50℃ or lower, it regards as open circuit.
E06 : When filter sensor detects 70℃ or higher, it regards as short circuit.
E07: When AT sensor detects -50℃ or lower, it regards as open circuit.
E08: When AT sensor detects 70℃ or higher, it regards as short circuit.
E10: When filter sensor detects 60℃ or higher, it regards as open circuit.
When filter sensor detects equal or lower than AT sensor temperature +10℃, E10 is cancelled to display.

12. Operation of capillary tube heater

Cycle : Once every 17 hours
Operation period : 8 minutes
Timing to activate: Capillary tube heater activates with regardless of L side compressor. At the time L side compressor is turned off.

13. Compressor operation when the power is supplied (battery unattached)

H side compressor: Once the power is supplied, H side compressor is forcibly turned on with regardless of PV.
When filter sensor detects 60℃ or higher, H side compressor is forcibly turned off. This function is ineffective when E05 or E06 is displayed.

L side compressor: When PV is higher than SV+0.5℃ and cascade sensor detects -34℃ or lower, L side compressor turns on with 2minutes (initial value) of delay after the power was supplied.
When PV is higher than SV+0.5℃ and cascade sensor detects -34℃ or higher, L side compressor turns on with 2minutes (initial value) of delay after the power was supplied.

Setting data: The setting data initialized in F17 is retrieved in non-volatile memory.

14. Lamp and buzzer

(1) Control PCB

DP1: Green lamp
Goes off when L side compressor is OFF. (normal status)
Lit when L side compressor is ON.

DP2: Red lamp
Goes off when the capillary tube heater is OFF. (normal status)
Lit when the capillary tube heater is ON.

DP3: Yellow lamp
Lit continuously
Lit when H side compressor is ON. (normal status)
Goes off when H side compressor is OFF.

(2) Display PCB

DP102: Red lamp
Goes off when unit has no alarms.
Blinks when unit has high temp. alarm (without delay), or sensor failure, or power failure, or door open.

DP101: Red lamp
Goes off when unit does not have filter alarm.
Blinks or lit when unit has filter alarm.

DP103: Green lamp
Goes off when BACK UP switch is off poison.
Lit when BACK UP switch is on position.

(3) Buzzer

High temp. alarm :	Intermittent tone with 12minutes of delay
Sensor error/ Condenser abnormal temperature:	Intermittent tone when EXX (XX=01~08, 10) is displayed
Power failure:	Intermittent tone
Key quick:	Short tone if key quick is available
Unacceptable value:	1second continuous tone when you input value out of range

15. Notice of timing for replacing battery/fan motor (F1: Battery F2: Fan motor)

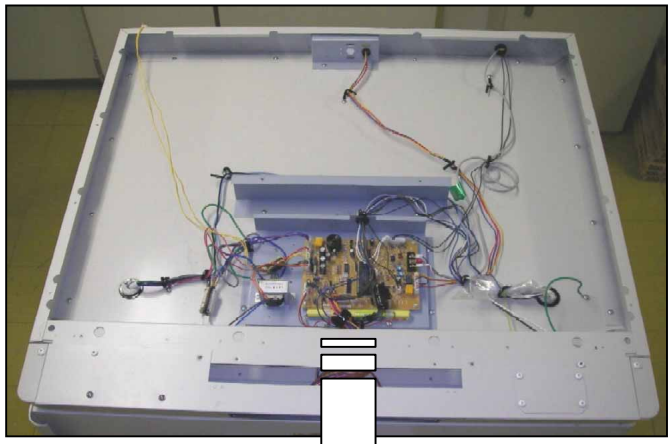
(1) In F03 mode, “F1” and PV are alternately displayed when the battery accumulation time is “028” (2.8 years) or higher.

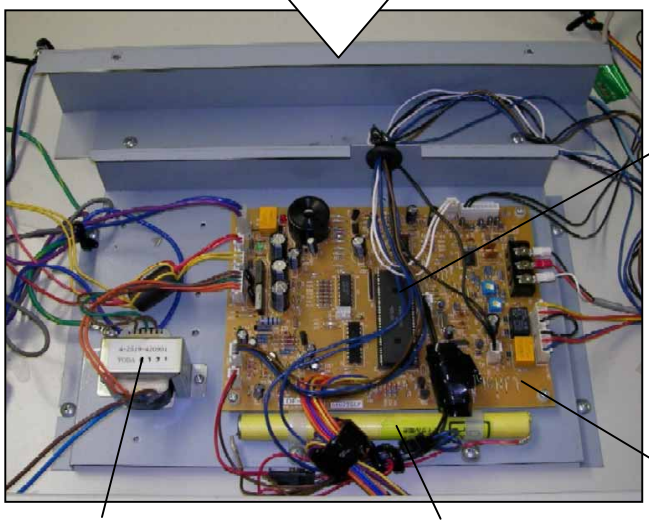
(2) In F32 mode, “F2” and PV are alternately displayed when the fan motor accumulation time is “056” (5.6 years) or higher.

Note: You must reset battery (fan motor) accumulation time in F06 after you replace them.
See page 14 how to reset.

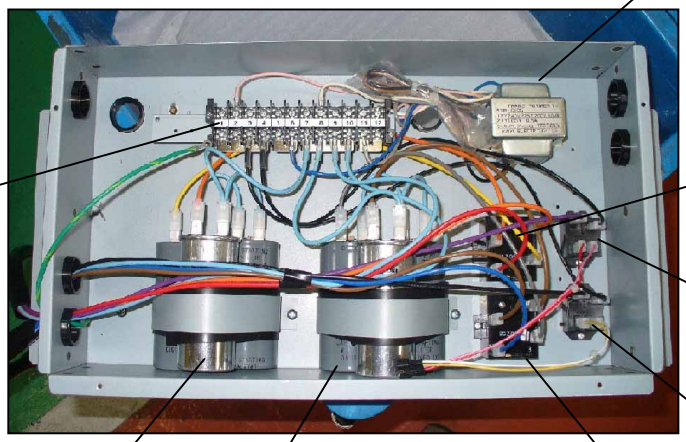
Parts layout

<PCB BOX – Ceiling>

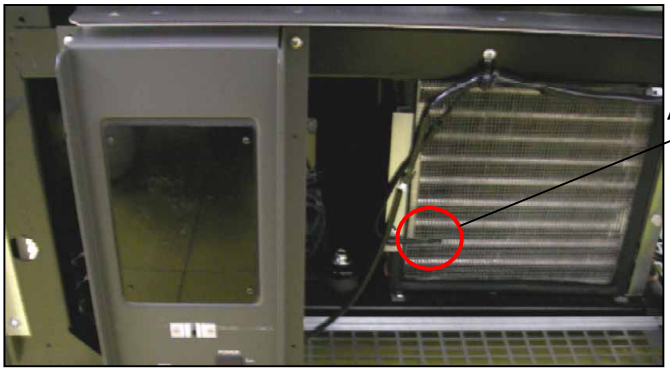




<Electric BOX-bottom,rear>



<Lower part – Rear>

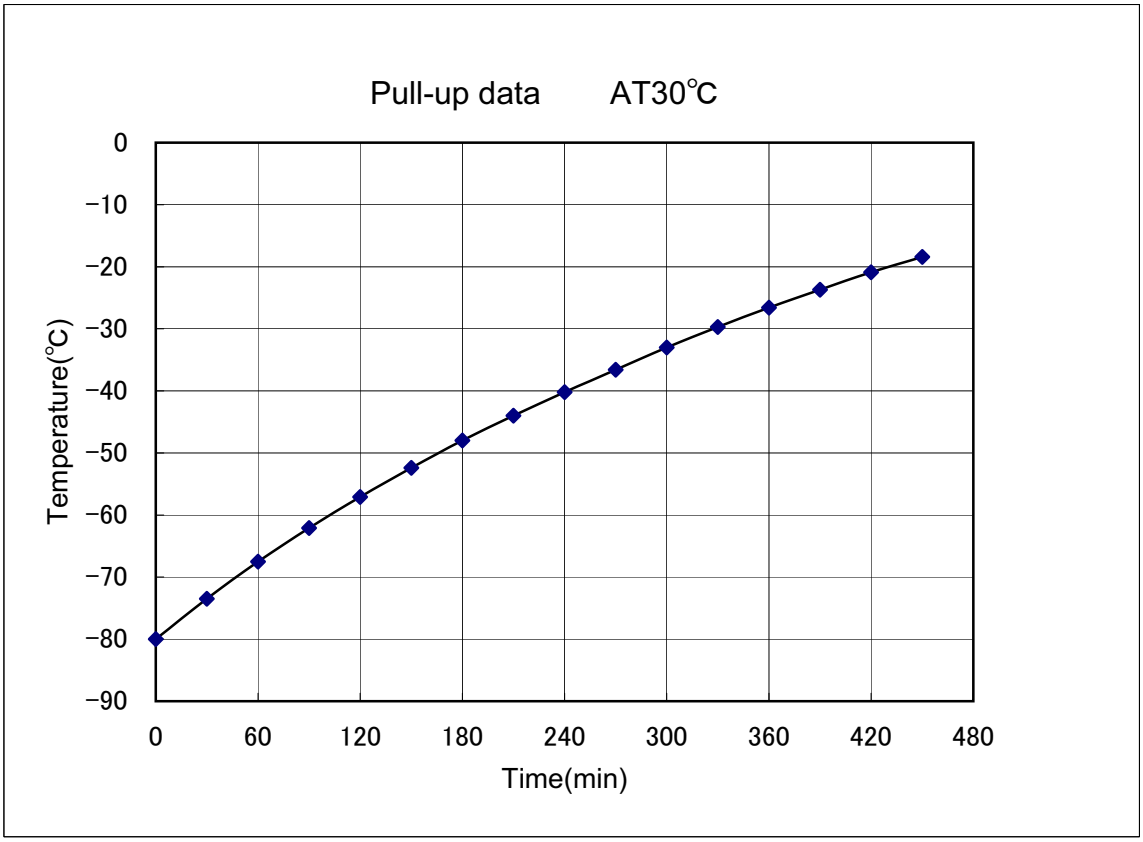


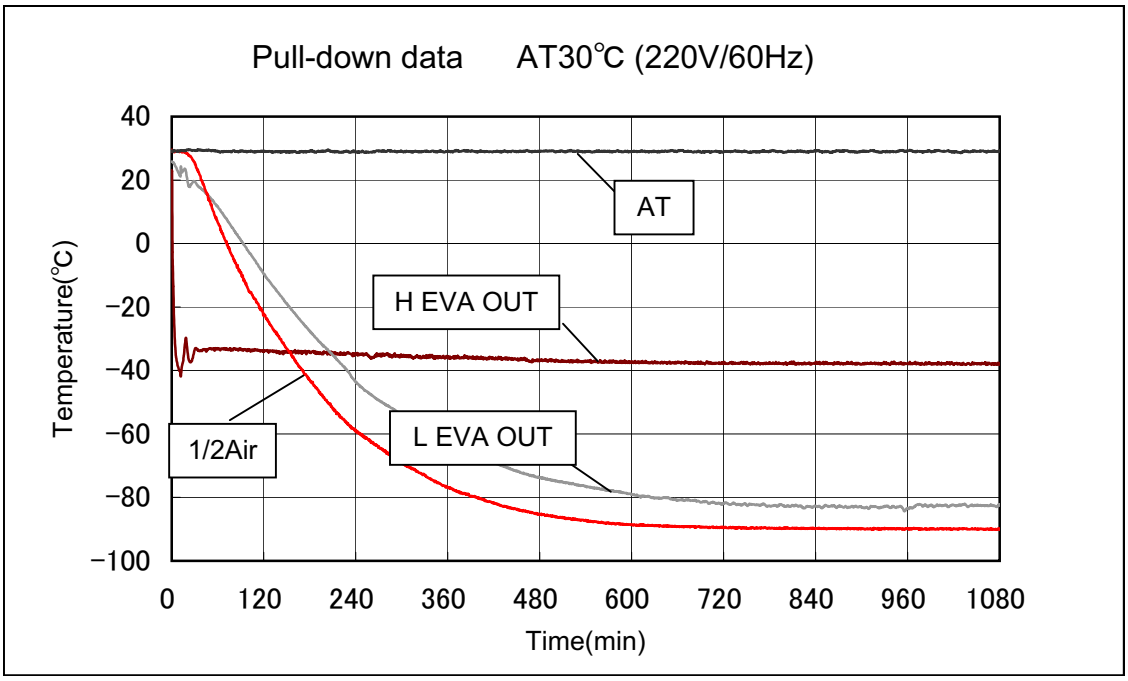
<Lower part – Side>

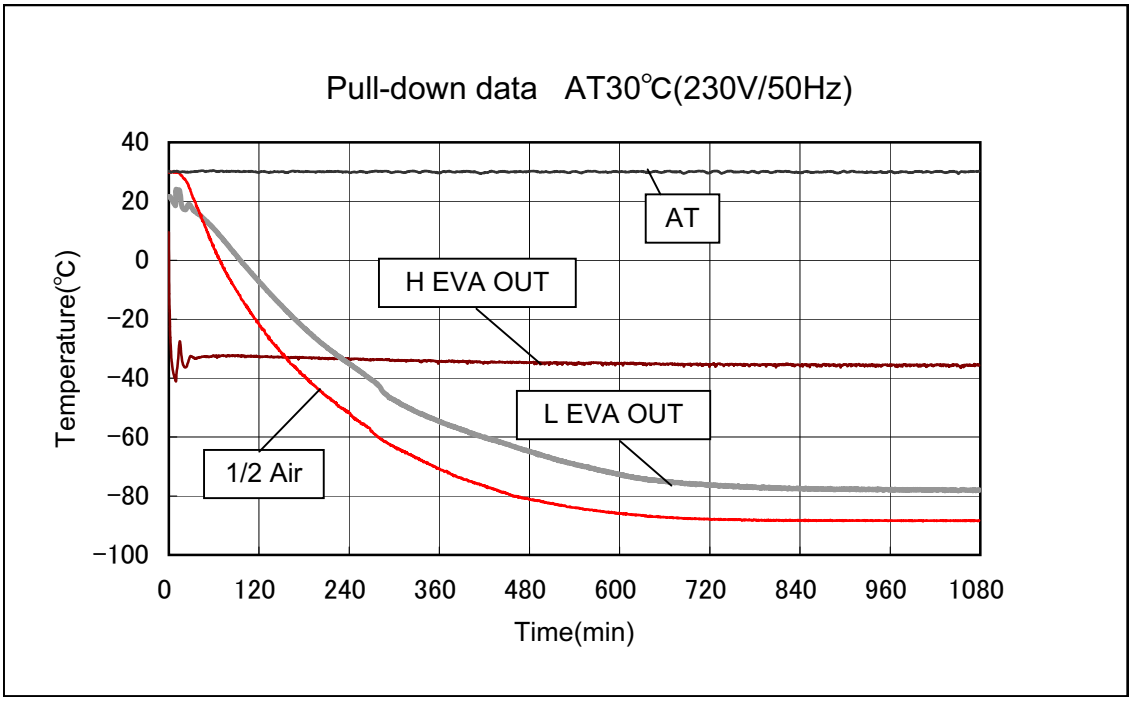
<Right part – Rear>

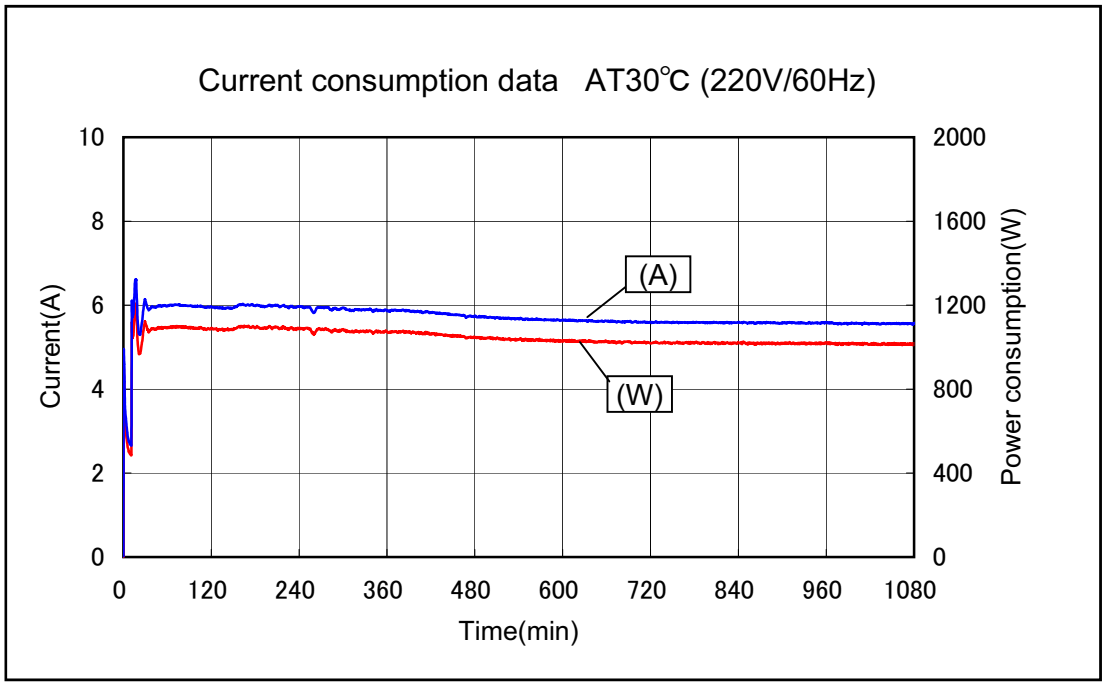
Test data

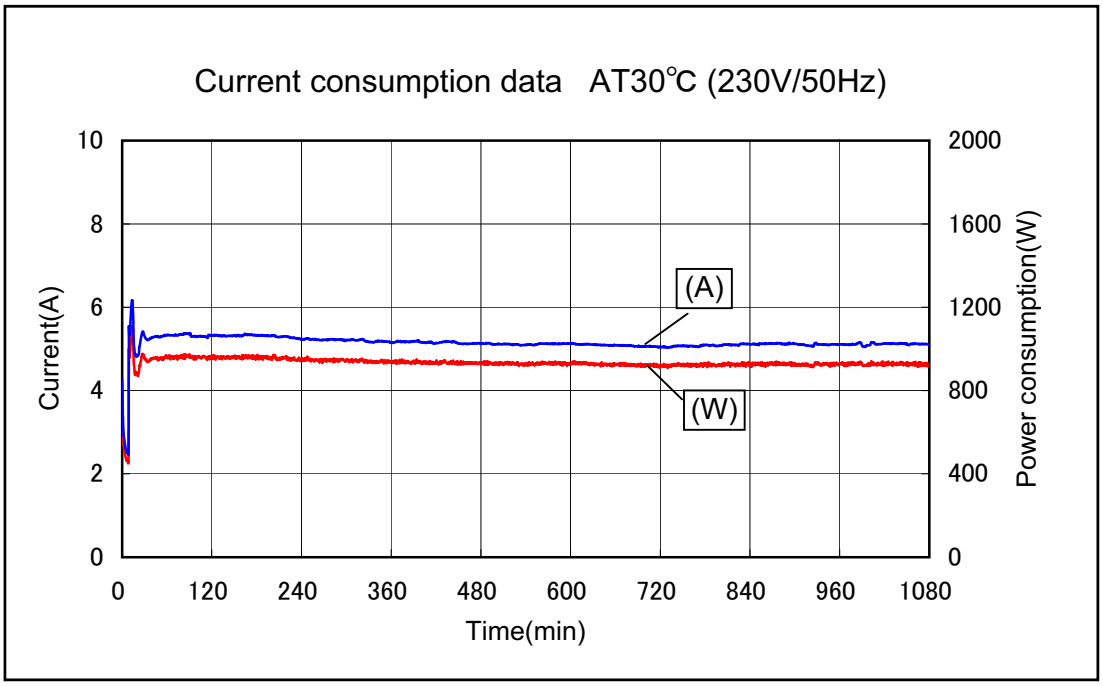
※Following data are the reference only.

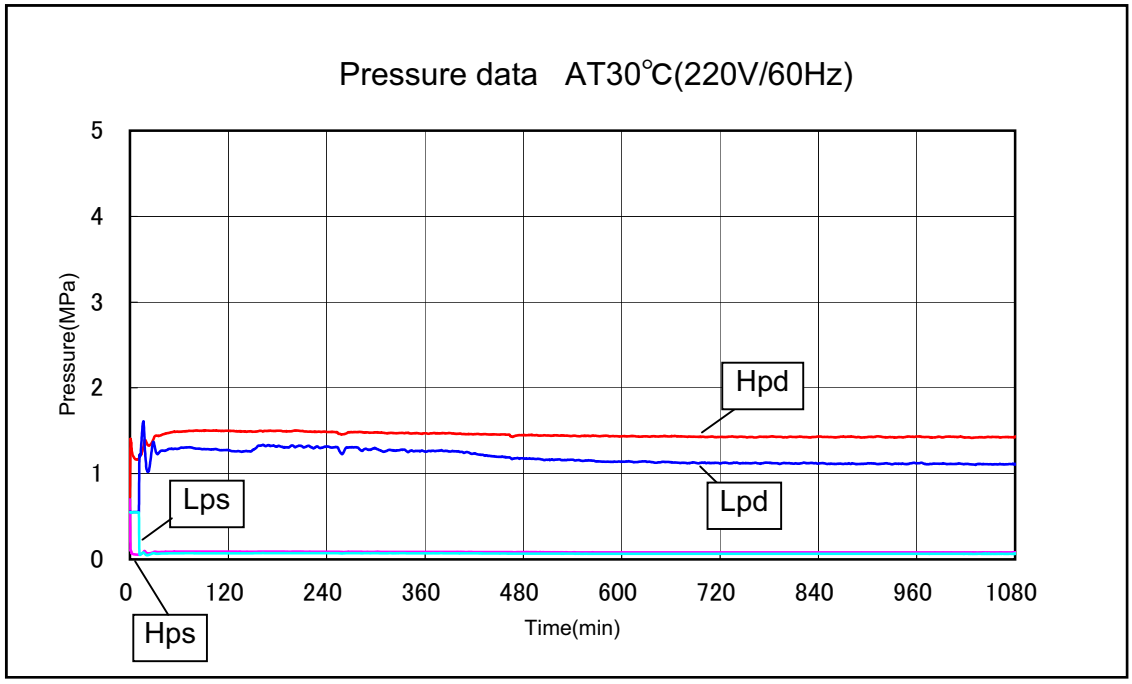


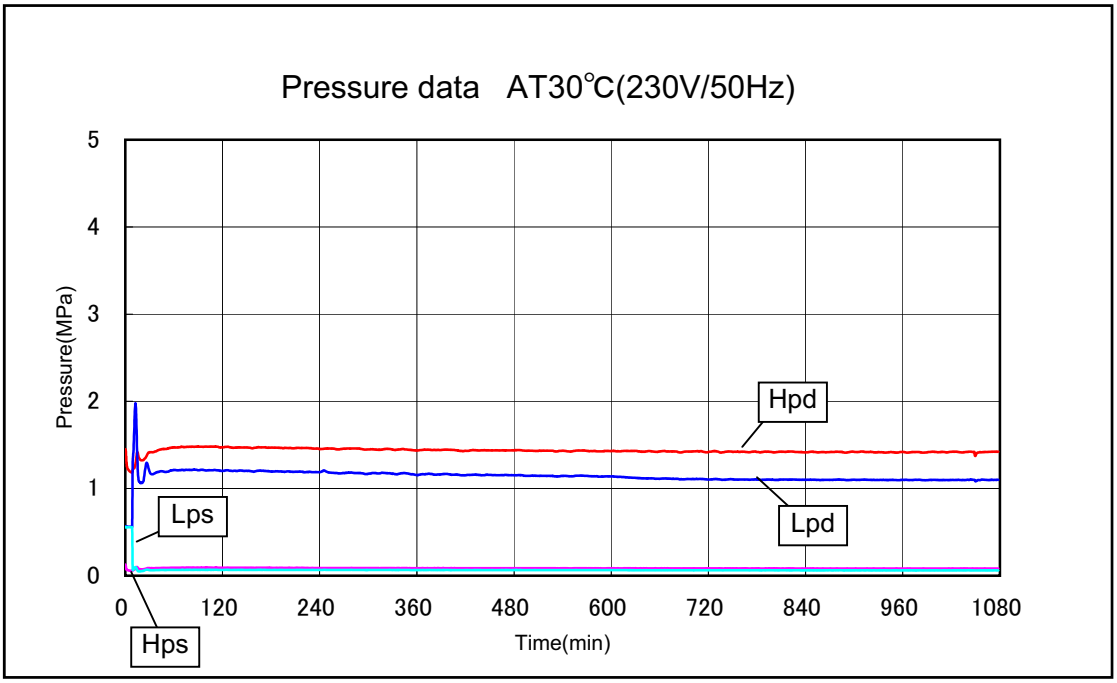

Pull-down data AT30℃ (220V/60Hz)
Temperature(℃)
40
20
0
−20
−40
−60
−80
−100
0
120
240
360
480
600
720
840
960
1080
Time(min)
AT
H EVA OUT
L EVA OUT
1/2Air


Pull-down data AT30℃(230V/50Hz)
Temperature(℃)
40
20
0
−20
−40
−60
−80
−100
0
120
240
360
480
600
720
840
960
1080
Time(min)
AT
H EVA OUT
L EVA OUT
1/2 Air


Current consumption data AT30℃ (220V/60Hz)
Current(A)
Power consumption(W)
Time(min)
(A)
(W)
0
2
4
6
8
10
0
400
800
1200
1600
2000
0
120
240
360
480
600
720
840
960
1080

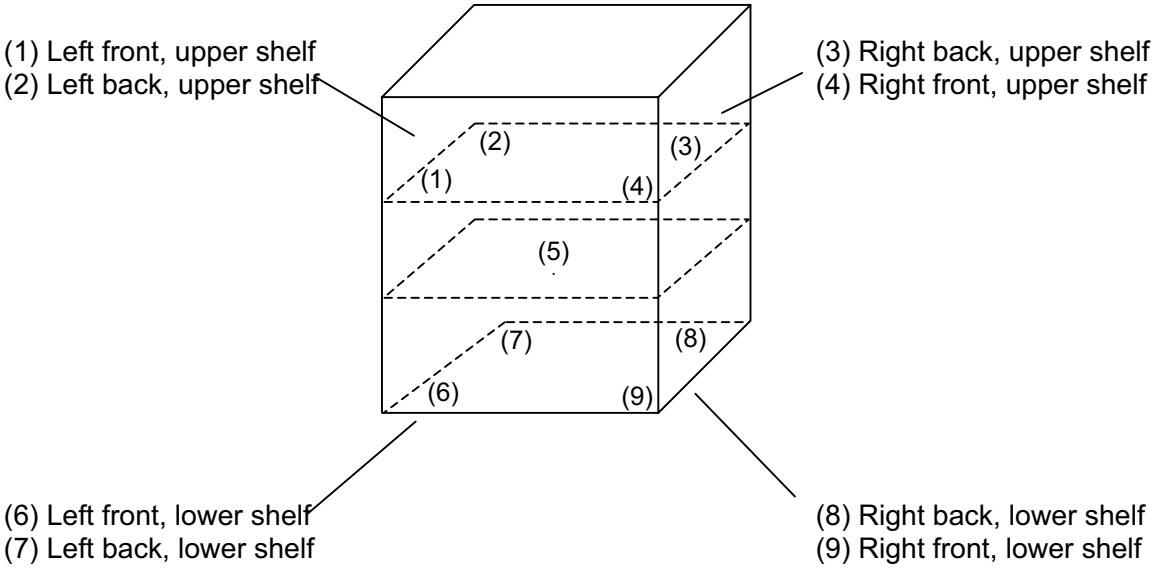

Current consumption data AT30℃ (230V/50Hz)
Current(A)
Power consumption(W)
Time(min)
(A)
(W)
0
2
4
6
8
10
0
400
800
1200
1600
2000
0
120
240
360
480
600
720
840
960
1080


Pressure data AT30℃(220V/60Hz)
Pressure(MPa)
5
4
3
2
1
0
0
120
240
360
480
600
720
840
960
1080
Time(min)
Hpd
Lps
Lpd
Hps


Pressure data AT30℃(230V/50Hz)
Pressure(MPa)
5
4
3
2
1
0
0
120
240
360
480
600
720
840
960
1080
Time(min)
Hpd
Lps
Lpd
Hps

Temperature uniformity data

Condition: SV -80℃, each measuring points are 1/6 width and depth



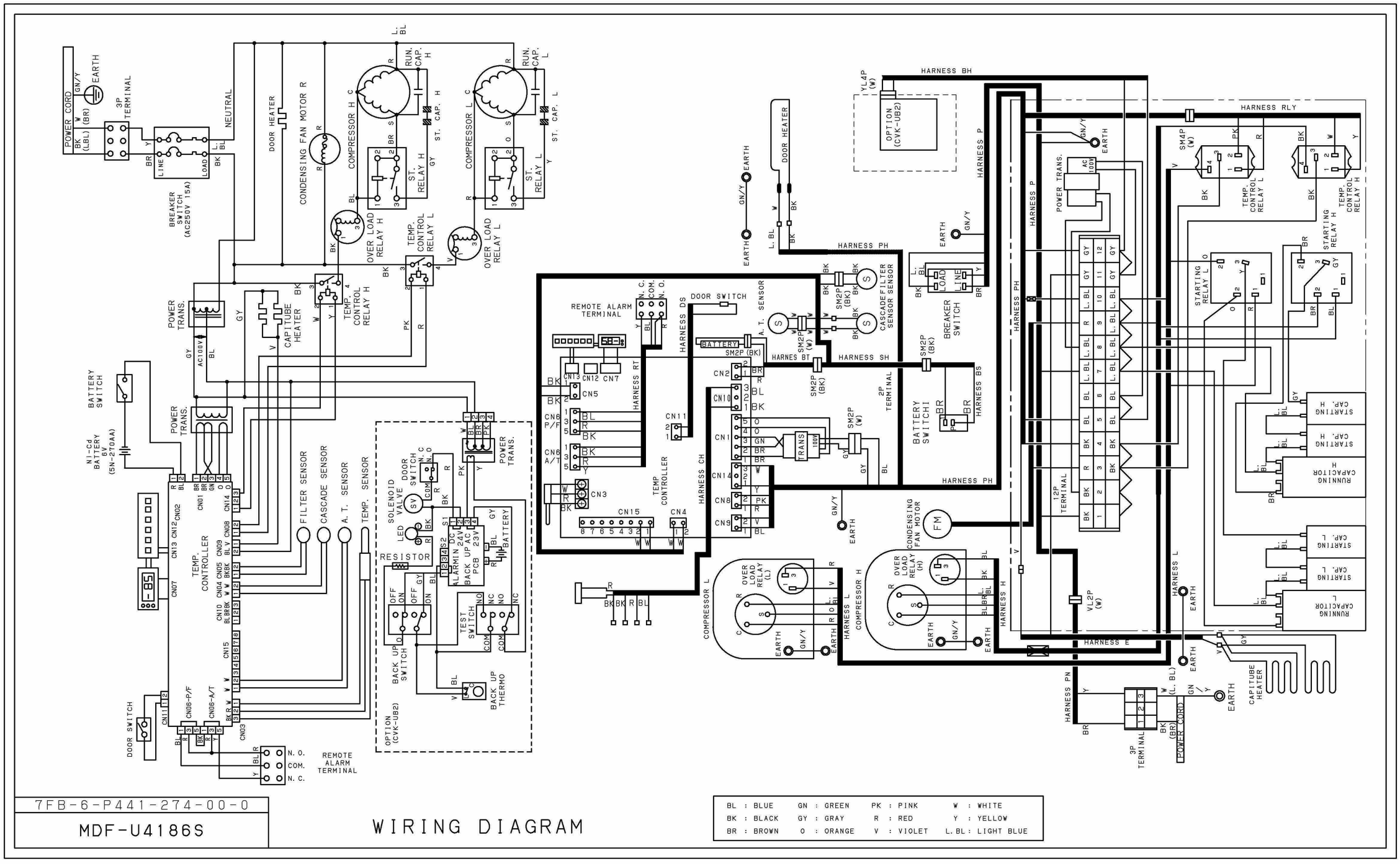
* Point (5)
When you measure 1/2 chamber air temperature, set probe at the point 10 ~ 20 mm beyond the shelf to get temperature correctly.
If you set probe below the shelf, it was resulted in approx. 2℃ higher.

Unit; ℃

Point	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MAX	-74.8	-74.8	-75.1	-74.8	-78.2	-75.2	-75.2	-75.9	-75.6
MIN	-78.7	-79.3	-79.6	-78.8	-79.8	-77.5	-77.5	-77.7	-77.6
Difference	±2.0	±2.3	±2.3	±2.0	±0.8	±1.2	±1.2	±0.9	±1.0
Average	-76.8	-77.1	-77.4	-76.8	-79.0	-76.4	-76.4	-76.8	-76.6

<Note> Above data is the reference only.

Wiring Diagram



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MDF-U4186S

WIRING DIAGRAM

Circuit Diagram