Panasonic

Service Manual

Ultra-Low Temperature Freezer

MDF-DU502VH
MDF-DU702VH

Panasonic Healthcare Co., Ltd.
Biomedical Div.

SM0000002-03

Effective model

This service manual is effective for following models.

Model	Voltage	Frequency
MDF-DU502VH-PA	220V	60Hz
MDF-DU502VH-PE	220V/230V/240V	50Hz
MDF-DU702VH-PA	220V	60Hz
MDF-DU702VH-PE	220V/230V/240V	50Hz

Contents

Features

- Energy saving
- Inverter control of compressor
- Improvement of storage efficiency
- Auto air intake port
- Enhancement of safety functions
- New control panel with LCD touch panel

Caution

*Parts replacement and option unit installation must be done by trained service engineer.
*Service engineer must refer to the section “Electric parts” and “Cooling unit parts” about the parts for those operations.

Specifications

Structural specifications

Item	MDF-DU502VH		MDF-DU702VH	
Name	Ultra-Low Temperature Freezer			
Exterior dimensions	W 790 × D 882 × H 1993 mm		W 1030 × D 882 × H 1993 mm	
Interior dimensions	W 630 × D 600 × H 1400 mm		W 870 × D 600 × H 1400 mm	
Effective capacity	528 liters		729 liters	
Exterior	Painted steel			
Interior	Painted steel			
Outer door	Painted steel			
Inner door	2			
Shelf	3			
Outer door latch	1			
Outer door lock	1			
Insulation	Rigid polyurethane foam＋VIP PLUS			
Access port	3 (back x 1, bottom x 2)			
Auto air intake port	Inside of control panel (built-in anti freezing heater)			
Manual air intake port	Product left side lower part			
Compressor	VNEU213U （single-phase 220-240V 50/60Hz ）x 2			
Evaporator	High: Cascade, Low: Tube on sheet			
Condenser	High: Fin and tube, Low: Cascade			
Refrigerant	High Temp. side	Low Temp. side	High Temp. side	Low Temp. side
	R290 135 g ±5 g	R170 70 g ±3 g n-pentane 10 g (16cc) 0+3 g (12.5%wt)	R290 135 g ±5 g	R170 85 g ±3 g n-pentane 12 g (19cc) 0+3 g (12.5%wt)
Refrigerant oil	Ze-NIUSL22SA			
Battery	For power failure alarm, Lead storage battery, DC6 V 7200 mAh, Auto-recharge			
Weight	246 kg		278 kg	
Accessories	1 key, 1 scraper, 1 stick for air intake port cleaning			
Optional components	Temperature recorder: (MTR-85H MTR-G85C), Recorder fixing (MDF-S3085, MTR-85H) Recorder sensor Cover:(MTR-DU700SF) Backup cooling kit:(MDF-UB7);For Liquid CO_2			
	Small inner door (MDF-5ID4, MDF-5ID5)		Small inner door (MDF-7ID4, MDF-7ID5)	
	Drawers (MDF-50R)		-	
	Storage rack (MDF-70SC) Inventory rack (IR-224U, IR-316U) Interface board (MTR-L03)*; For LAN Interface board (MTR-480)*; For RS-232C/RS-485			

* For the data acquisition system MTR-5000 user only.

Control specifications

Item		MDF-DU502VH	MDF-DU702VH
Temperature controller		Microprocessor control system: LCD touch panel input Settable range : -90 ℃～-50 ℃ (unit:1 ℃) Memorized by Non-volatile memory	
Temperature sensor		Platinum resistance (Type: PT 1000 Ω)	
Temperature display		WVGA full color LCD Digital display (Unit: 1 ℃)	
Alarms		SV±5 ℃～±40 ℃, changeable (default:±10 ℃)	
	High / Low temp. alarm	When the chamber temperature exceeds the alarm set temperature, "Alarm" is displayed alternately in normal characters and reverse video in the alarm display field and chamber temperature blinks. After 15 min. (0-15 min. changeable, default: 15℃), "Warning" is displayed in the message display field, buzzer beeps and remote alarm activates and chamber temperature blinks.	
	Door alarm	When the door opens, "Open" is displayed alternately in normal characters and reverse video in the alarm display field. After 2 min. (0-15 min. changeable), buzzer beeps, no remote alarm activates.	
	Fan lock alarm	No detection function.	
	Power failure	"Warning" is displayed alternately in normal characters and reverse video in the alarm display field. And the notification is displayed in the message display field. Buzzer beeps and the remote alarm activates.	
	Filter alarm	Filter alarm indicator is lit when the excessive dust is accumulated on the condenser filter. When this indicator is lit, clean the condenser filter.	
	Remote alarm	Remote alarm terminal 3P; contact capacity DC 30 V, 2 A (Max) Remote alarm activates when temp. alarm or power failure occur.	
Parts replace-ment notificati-on	Battery age	Two type of battery accumulation time display in service mode. At replacement time, it is informed in the message display field.	
	Fan motor age	Fan motor accumulation time display in service mode. Replacement notification is not performed.	
Status	Ambient temperature abnormality	When the sensor is out of the range of 35 ℃ from 0 ℃, the notification display in the message display field.	
	Supply voltage drop	No detection function.	
	High-load operation display	When low side compressor operation rate is over 95 %, the notification display in the message display field.	
Self-diagnosis function		When a sensor is failed, the notification display in the message display field. Buzzer beeps and remote alarm activates.	
Compressor protection		Overload relay (internal) Detected value of filter sensor is 50 ℃ or more. "Warning" is displayed alternately in normal characters and reverse video in the alarm display field and the notification is displayed in the message display field. Buzzer beeps and remote alarm activates.	
Key lock		Selection of ON or OFF by slide in Key Lock mode. OFF: Unlocked ON: Locked	

Performance specifications

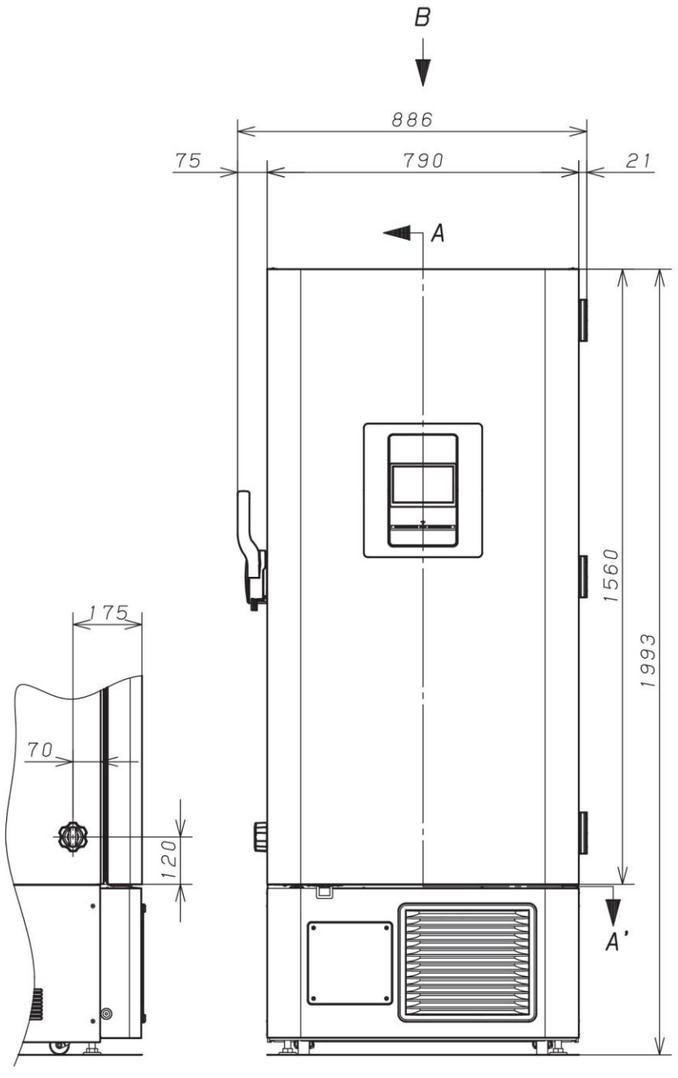
Item	MDF-DU502VH	MDF-DU702VH
Cooling performance	-86 ℃ (AT;30 ℃, no load)	
Temperature control range	-86 ℃～-50 ℃ (ambient temperature; 30 ℃, no load)*	
Rated voltage	AC 220/230/240 V	
Rated frequency	50 Hz (PE) 60 Hz (PA)	
Rated power consumption	430 W (Max. 820 W)(PA) 420 W (Max. 840 W)(PE)	545 W (MAX 930W/ 945 W/ 960 W) (PE) 550 W (MAX 930 W) (PA)
Rated heat radiation	1548 kJ/h (Max. 2952 kJ/h) 1512 kJ/h (Max. 3024 kJ/h)	1962 kJ/h (Max.3348 kJ/h /3402 kJ/h /3456 kJ/h) (PE) 1980 kJ/h (Max. 3348 kJ/h))(PA)
Noise level	52 dB [A] (background noise; 20 dB)	
Maximum pressure	2200 kPa	2200 kPa

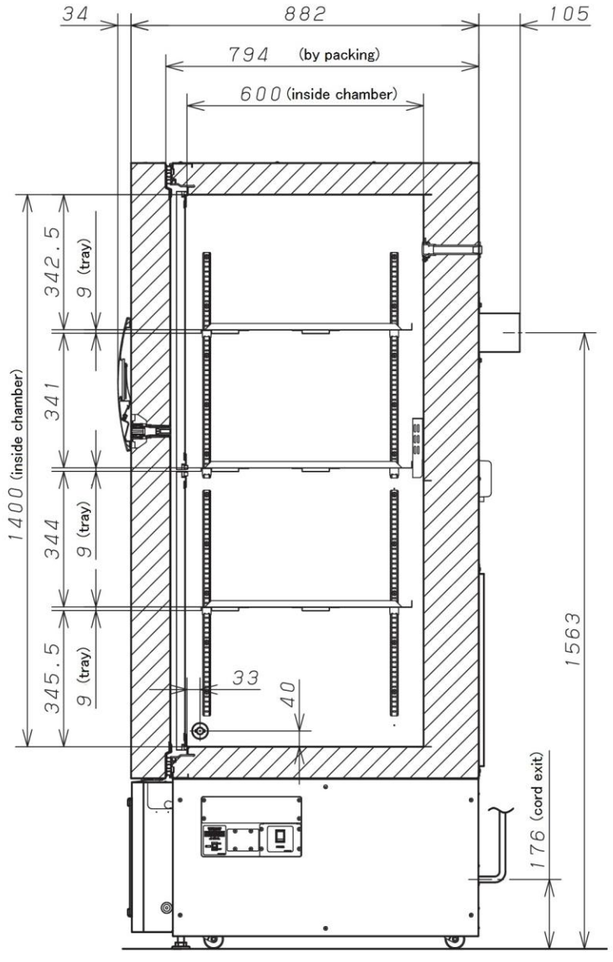
*Maximum cooling performance.

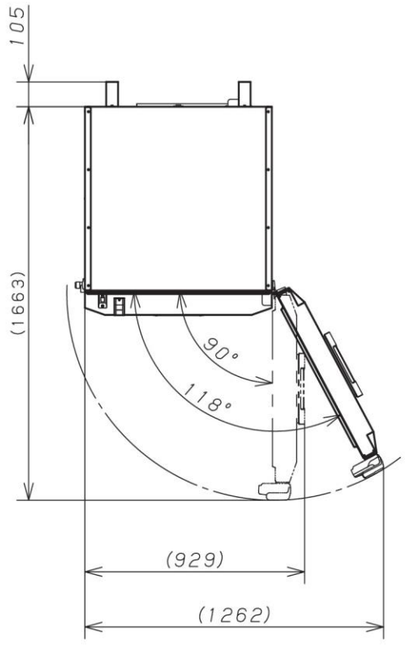
The chamber temperature can be reached at -86 ℃ at ambient temperature 30 ℃ with no load.

Dimension

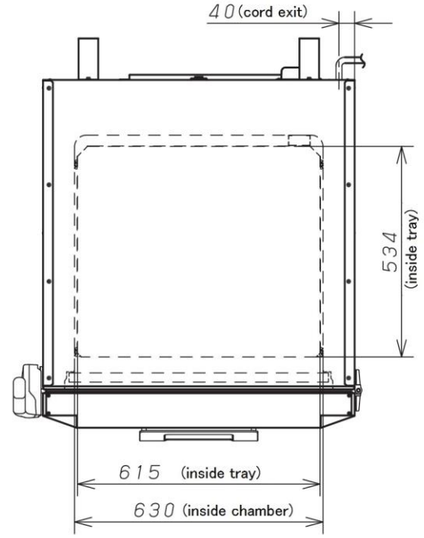
MDF-DU502VH





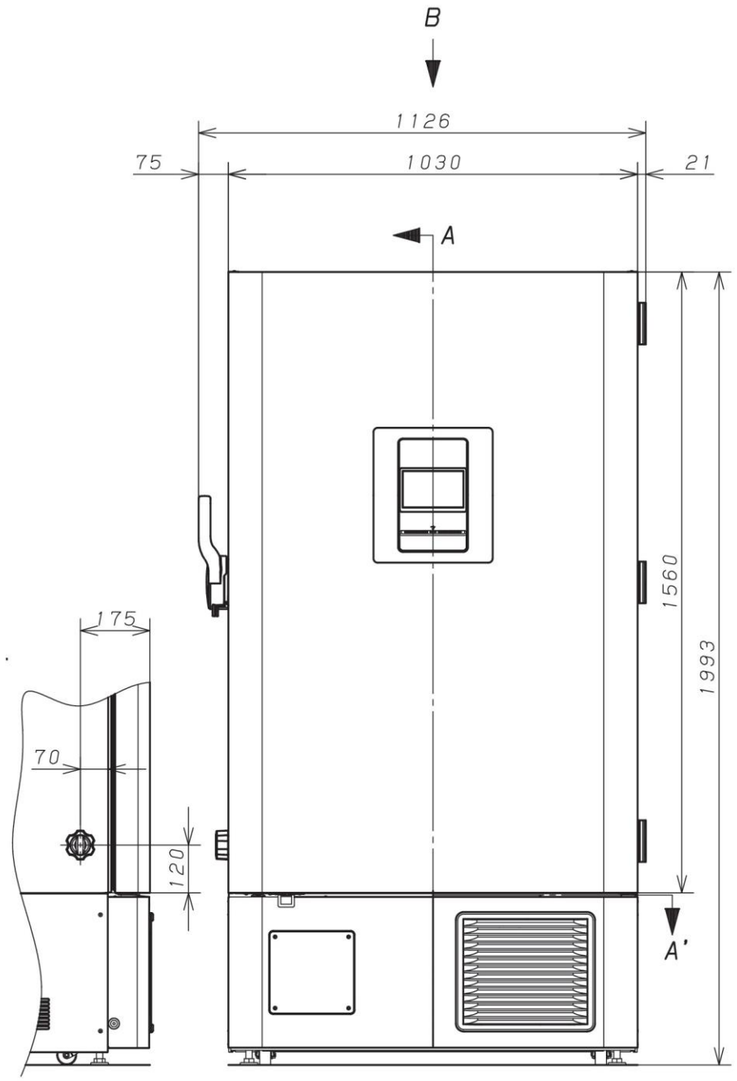


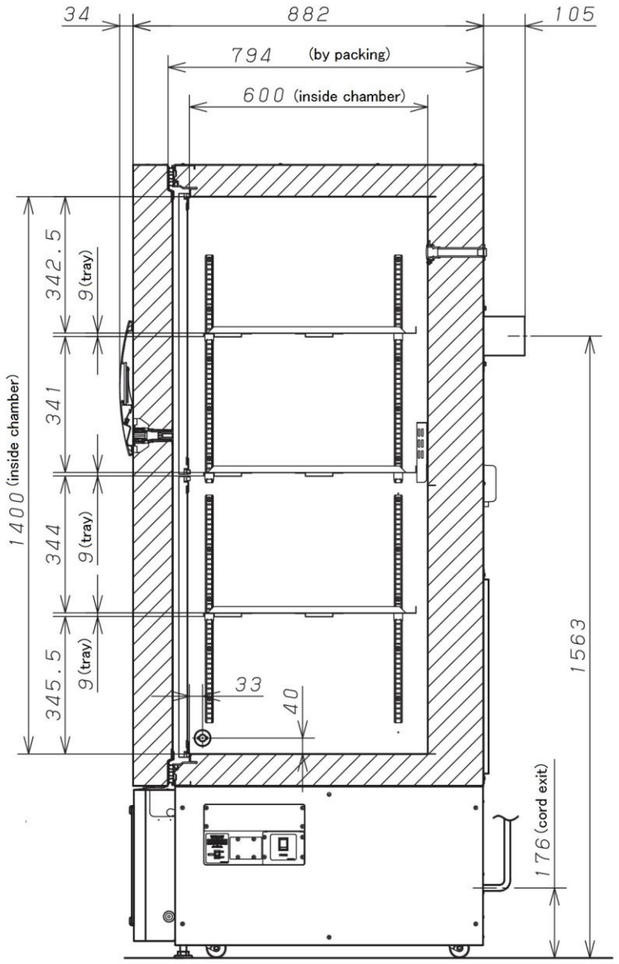
Ref) top view on opening door

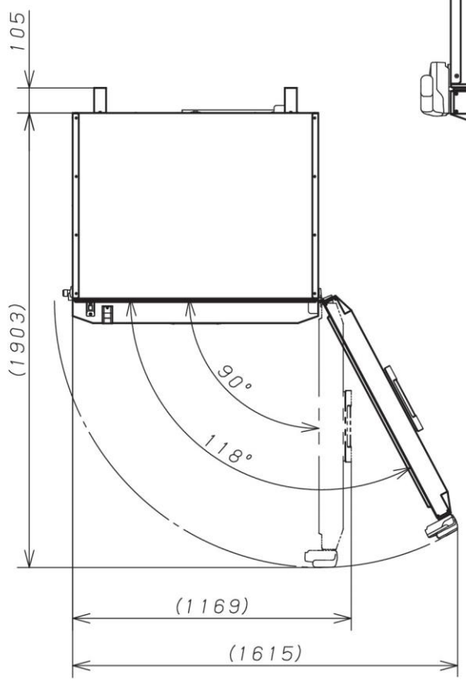


arrow view B (top view)

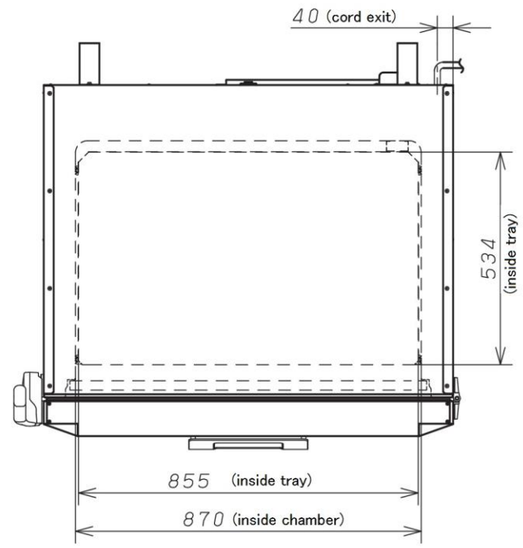
MDF-DU702VH







Ref) top view on opening door



arrow view B (top view)

Cooling unit parts

MDF-DU502VH

1Φ220-240V 50/60Hz

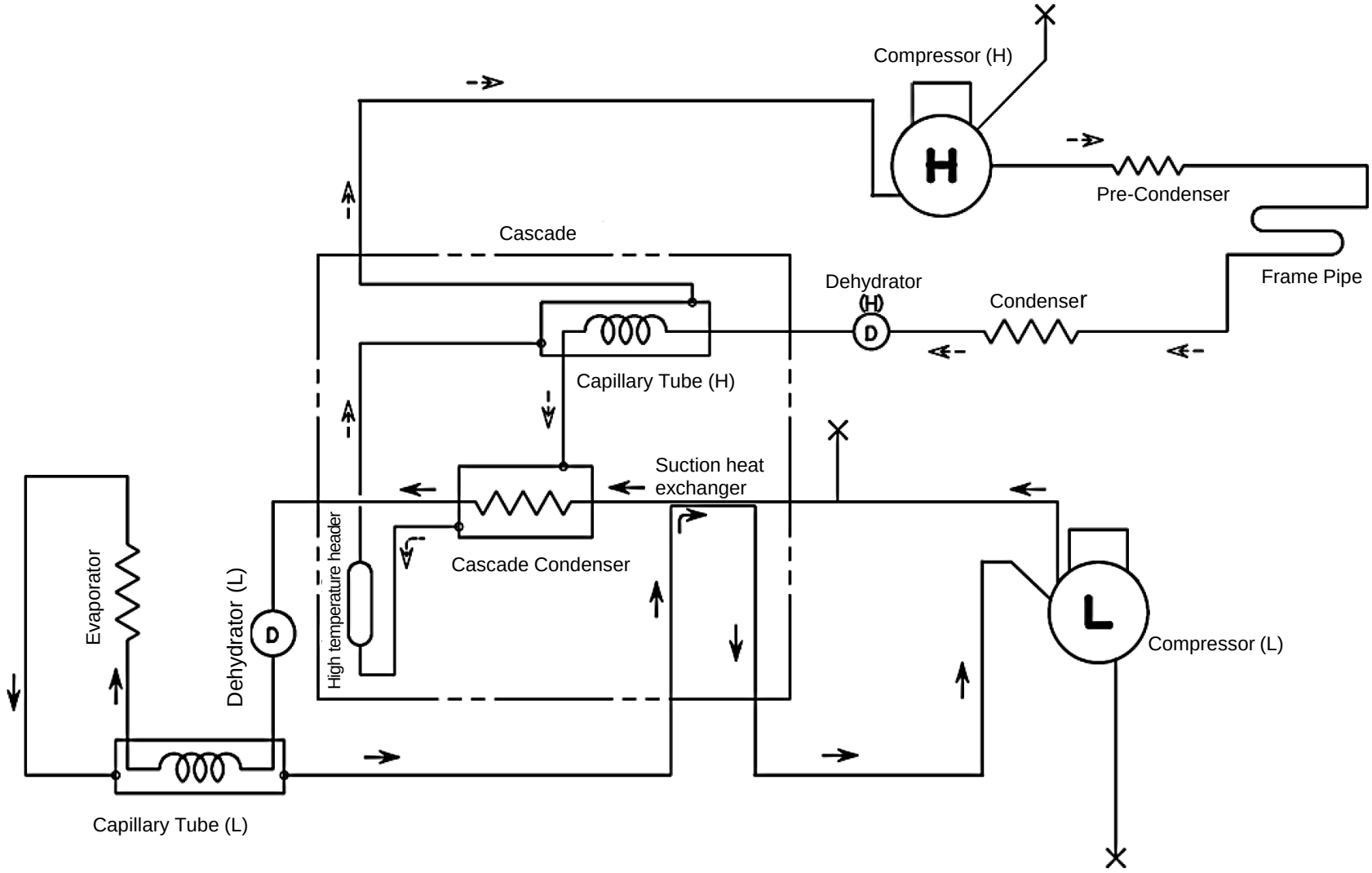
Parts description	Specification	
	Circuit H（Left side at rear view）	Circuit L（Right side at rear view）
Compressor		
Type	VNEU213U	VNEU213U
Compressor cord	LDDG000200	LDDG000200
Rated power supply	Single phase, 220-240 V, 50/60 Hz	Single phase, 220-240 V, 50/60 Hz
Refrigeration oil	Ze-NIUSL22SA Q'ty:500 cc	Ze-NIUSL22SA Q'ty:500 cc
Cooling method	Forcible air circulation（partially）	Forcible air circulation（partially）
Inverter		
Type	VENEU213U	VENEU213U
Inverter code	LDLB041800	LDLB041800
power supply	220-240 V, 50/60 Hz	220-240 V, 50/60 Hz
Condenser		
Type	Finless tube	Finless tube
Condenser	12 columns x 2 lines 5pitch Fin 50spc	Coil pipe Φ6.35 mm
Pre-condenser	W250 mm (within 1column x6lines pre-con)	
Frame pipe	Φ6.35mm	
Evaporator Type Accumulator	Cascade condenser, Shell & Tube Φ80 mm Φ38 mm	Tube on sheet, Φ7.94mm （Sharing with interior）
Accumulator	Φ38mm	
Capillary tube		
Resistance	78 PSI	4.0 kg/cm^2
Length	3000 mm	2000 mm
Outer diameter	Φ2.4 mm	Φ1.8 mm
Inner diameter	Φ1.2 mm	Φ0.9 mm
Refrigerant	TYPE Amount R-290 135g ±5 g	TYPE Amount R-170 70g ±3 g n-pentane 10g（16cc)-0+3g
Dryer	4AXH-9 18 g	4AXH-9 55 g
Condensing fan	Material: ABS Blade: 4 pcs. 230 mm	Material: ABS Blade: 4 pcs. Φ230 mm
Condensing fan motor Type	SV4-11AB5P (440VAC,1.0μF running condenser)	SV4-11AB5P (440VAC,1.0μF running condenser)

MDF-DU702VH
1Φ220-240V 50/60Hz

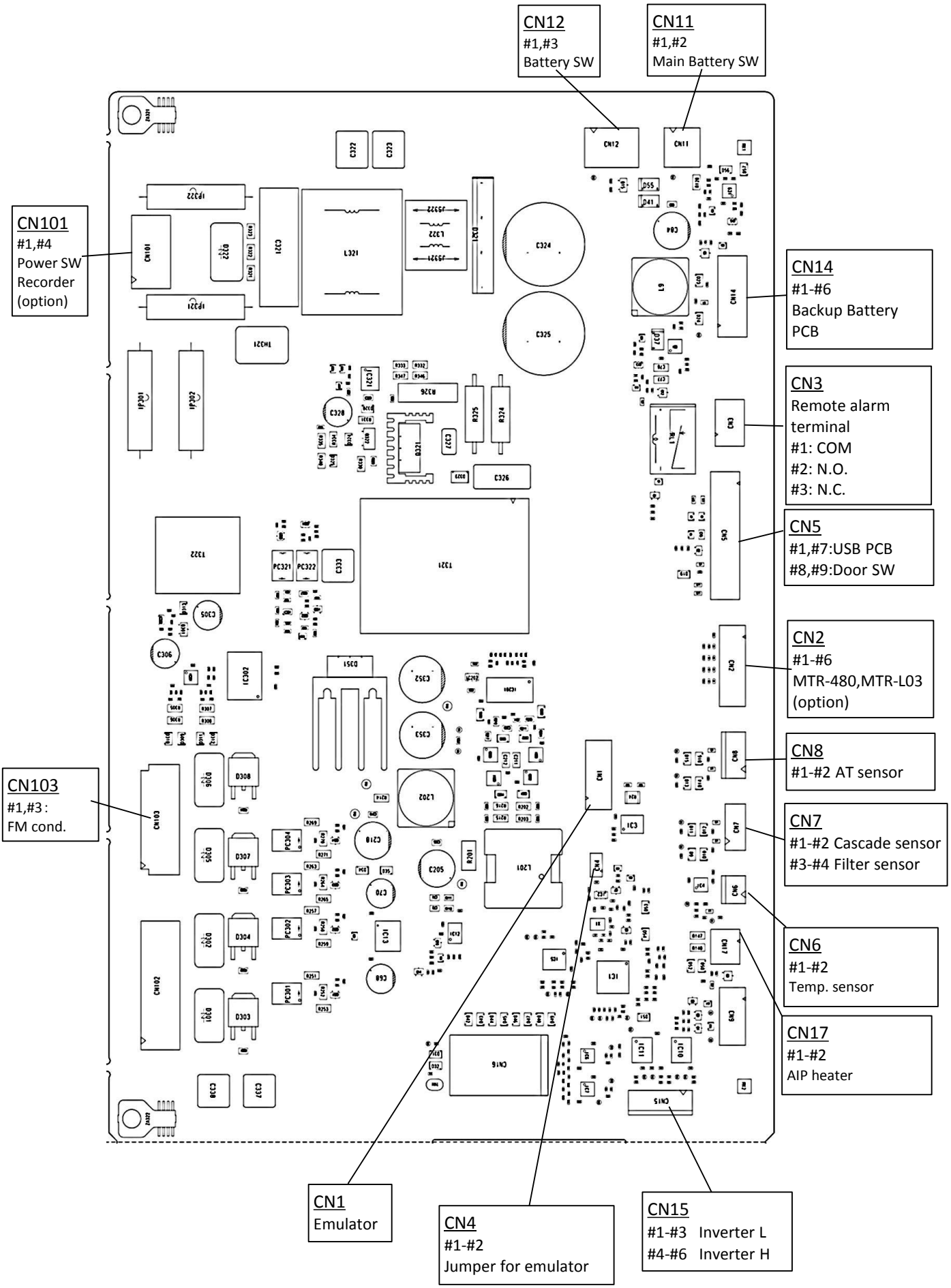
Parts description	Specification	
	Circuit H（Left side at rear view）	Circuit L（Right side at rear view）
Compressor		
Type	VNEU213U	VNEU213U
Compressor cord	LDDG000200	LDDG000200
Rated power supply	Single phase, 220-240 V, 50/60 Hz	Single phase, 220-240 V, 50/60 Hz
Refrigeration oil	Ze-NIUSL22SA Q'ty:500 cc	Ze-NIUSL22SA Q'ty:500 cc
Cooling method	Forcible air circulation（partially）	Forcible air circulation（partially）
Inverter		
Type	VENEU213U	VENEU213U
Inverter code	LDLB041800	LDLB041800
power supply	220-240 V, 50/60 Hz	220-240 V, 50/60 Hz
Condenser		
Type	Finless tube	Finless tube
Condenser	12 columns x 2 lines 5pitch Fin 50spc	Coil pipe Φ6.35mm
Pre-condenser	W250 mm (within 1column x6lines pre-con)	
Frame pipe	Φ6.35mm	
Evaporator Type	Cascade condenser, Shell & Tube Φ80mm	Tube on sheet, Φ7.94mm （Sharing with interior）
Accumulator	Φ38mm	
Capillary tube		
Resistance	78PSI	4.0 kg/cm^2
Length	3000mm	2000mm
Outer diameter	Φ2.4mm	Φ1.8mm
Inner diameter	Φ1.2mm	Φ0.9mm
Refrigerant	TYPE R-290 Amount 135g ±5 g	TYPE R-170 Amount 85g ±3 g n-pentane 12g（19cc)-0+3g
Dryer	4AXH-9 18 g	4AXH-9 55 g
Condensing fan	Material: ABS Blade: 4 pcs. 230mm	Material: ABS Blade: 4 pcs. Φ230mm
Condensing fan motor Type	SV4-11AB5P (440VAC,1.0μF running condenser)	SV4-11AB5P (440VAC,1.0μF running condenser)

Binary refrigerating cuircuit〈cascade system〉 〈MDF－DU502VH/DU702VH)

High temp.
Low temp.



Components on PCB



Connections on PCB

The following shows connections of connector on Main PCB.

Connector	Connects to	Usage
CN1	Emulator	To version up firmware
CN2	#1~#6: MTR-480/MTR-L03 (Option)	To connect with MTR-480/MTR-L03.
CN3	Remote alarm terminal #1: COM #2: N.O. #3: N.C.	Remote alarm contact outputs.
CN4	#1~#2 Jumper	To upgrade firmware version
CN5	#1,#7:USB PCB #8,#9:Door switch	To connect with LCD PCB To detect door open and shut
CN6	#1~#2：Temp. sensor	To control chamber temperature
CN7	#1~#2：Cascade sensor #3~#4：Filter sensor	To detect temperature of cascade To detect temperature of filter
CN8	#1~#2：AT sensor	To detect ambient temperature
CN9	#1~#4:Unused	
CN11	#1,#2:Main battery switch	To supply power during power failure
CN12	#1,#3:Battery switch	To supply power during power failure
CN14	#1~#6:Back-up battery charging PCB	To control battery charging
CN15	#1~#3:Inverter L #3~#6:Inverter H	To control inverter L To control inverter H
CN16	#1~#4:Unused	
CN17	#1,#2: Auto air intake port (AIP) heater	To control AIP heater
CN101	#1,#4:Recorder, Power switch	To supply power to PCB
CN103	#1、#3：Fan motor condenser	To control condensing fan motor

Electric parts

MDF-DU502VH MDF-DU702VH		–PA	–PE
Compressor(A)(B)	Type Rating	VNEU213U 220-240 V, 50/60 Hz	VNEU213U 220-240 V, 50/60 Hz
Inverter	Type Rating	VCCHP2456 220-240 V, 50/60 Hz	VCCHP2456 220-240 V, 50/60 Hz
Condensing fan motor	Type Rating	SV4-11AB5P 230 V,10 W	SV4-11AB5P 230 V,10 W
Capi. Tube Heater(A),(B) MDF-DU702VH S/N:~18010001 only	Rating Resistance(25℃)	230V,12W 4700Ω	230V,12W 4700Ω
Temp. sensoor	Type Rating	Pt (THC-663) 1000Ω	Pt (THC-663) 1000Ω
Cascade sensor	Type Rating	502AT-11 5 kΩ,25 ℃	502AT-11 5 kΩ,25 ℃
Filter sensor	Type Rating	502AT-11 5 kΩ,25 ℃	502AT-11 5 kΩ,25 ℃
Door Switch	Type Rating	SDKNA20700 5 V 5 mA	SDKNA20700 5 V 5 mA
Battery	Type Rating	LC-P067R2J 6 V 7.2 AH	LC-P067R2J 6 V 7.2 AH
Battery Switch	Type Rating	SLE6A2-5 4 A 250 VAC	SLE6A2-5 4 A 250 VAC
Power Switch	Type Rating	JW-L21RRK-P4G 16A, 250VAC	JW-L21RRK-P4G 16A, 250VAC
Power Cord	Plug Length	U3 250VAC 15A 3.8m	K3 250VAC 16A 3.5m

Specifications of sensor

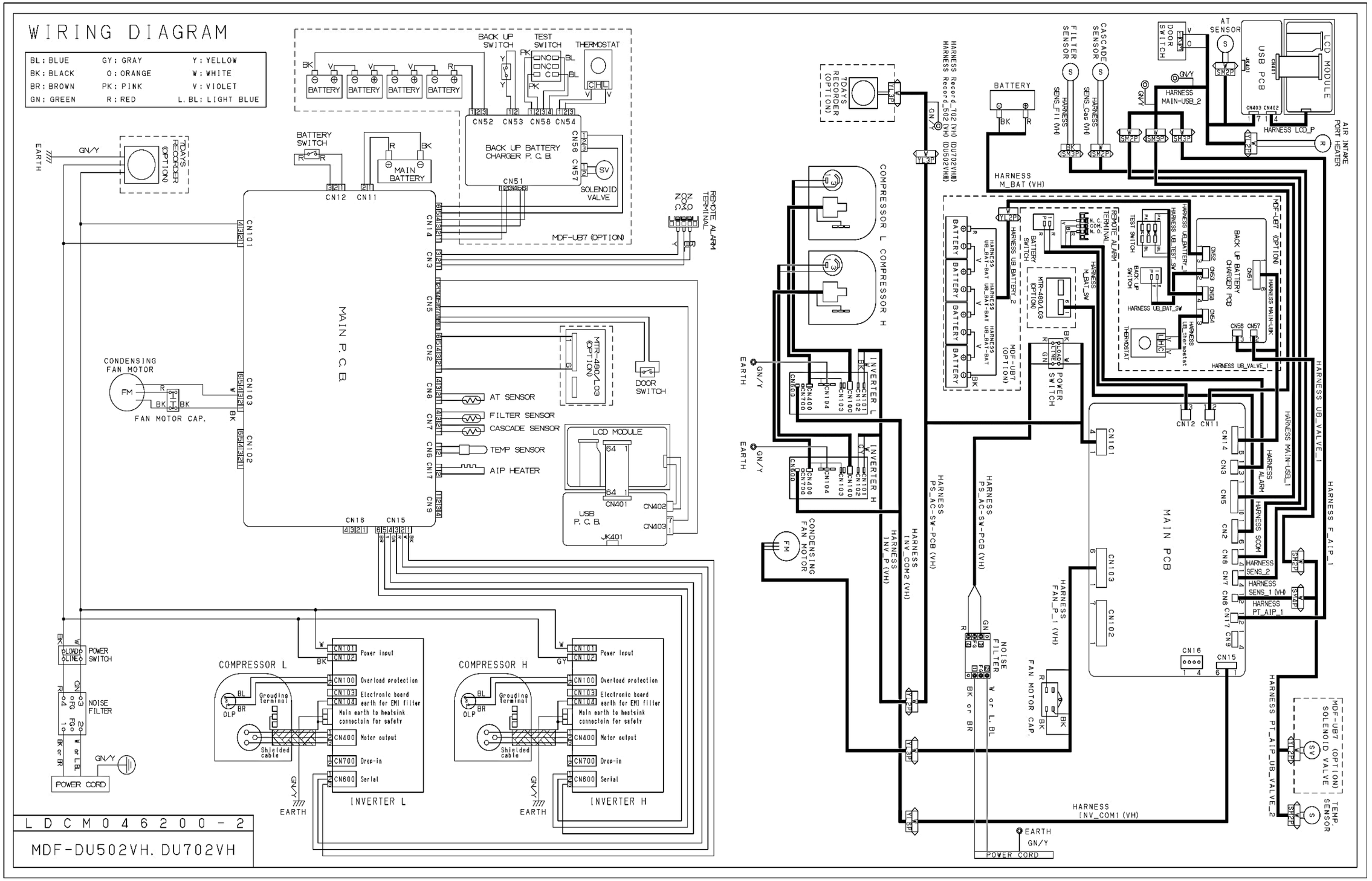
The following shows the temperature in thermal sensor (502AT-11) and its resistance value.

Temp. (℃)	Resistance Value (kΩ)	Temp. (℃)	Resistance Value (kΩ)	Temp. (℃)	Resistance Value (kΩ)
−50	154.6	−7	17.93	12	8.167
−45	116.5	−6	17.16	13	7.853
−40	88.91	−5	16.43	14	7.553
−35	68.19	−4	15.74	15	7.267
−30	52.87	−3	15.08	16	6.993
−25	41.21	−2	14.46	17	6.731
−20	32.44	−1	13.86	18	6.481
−19	30.93	0	13.29	19	6.242
−18	29.51	1	12.74	20	6.013
−17	28.16	2	12.22	25	5.000
−16	26.88	3	11.73	30	4.179
−15	25.66	4	11.25	35	3.508
−14	24.52	5	10.80	40	2.961
−13	23.43	6	10.37	45	2.509
−12	22.39	7	9.960	50	2.137
−11	21.41	8	9.569	55	1.826
−10	20.48	9	9.196	60	1.567
−9	19.59	10	8.840		
−8	18.74	11	8.496		

The following shows the temperature in thermal control sensor (PT1000Ω) and its resistance value.

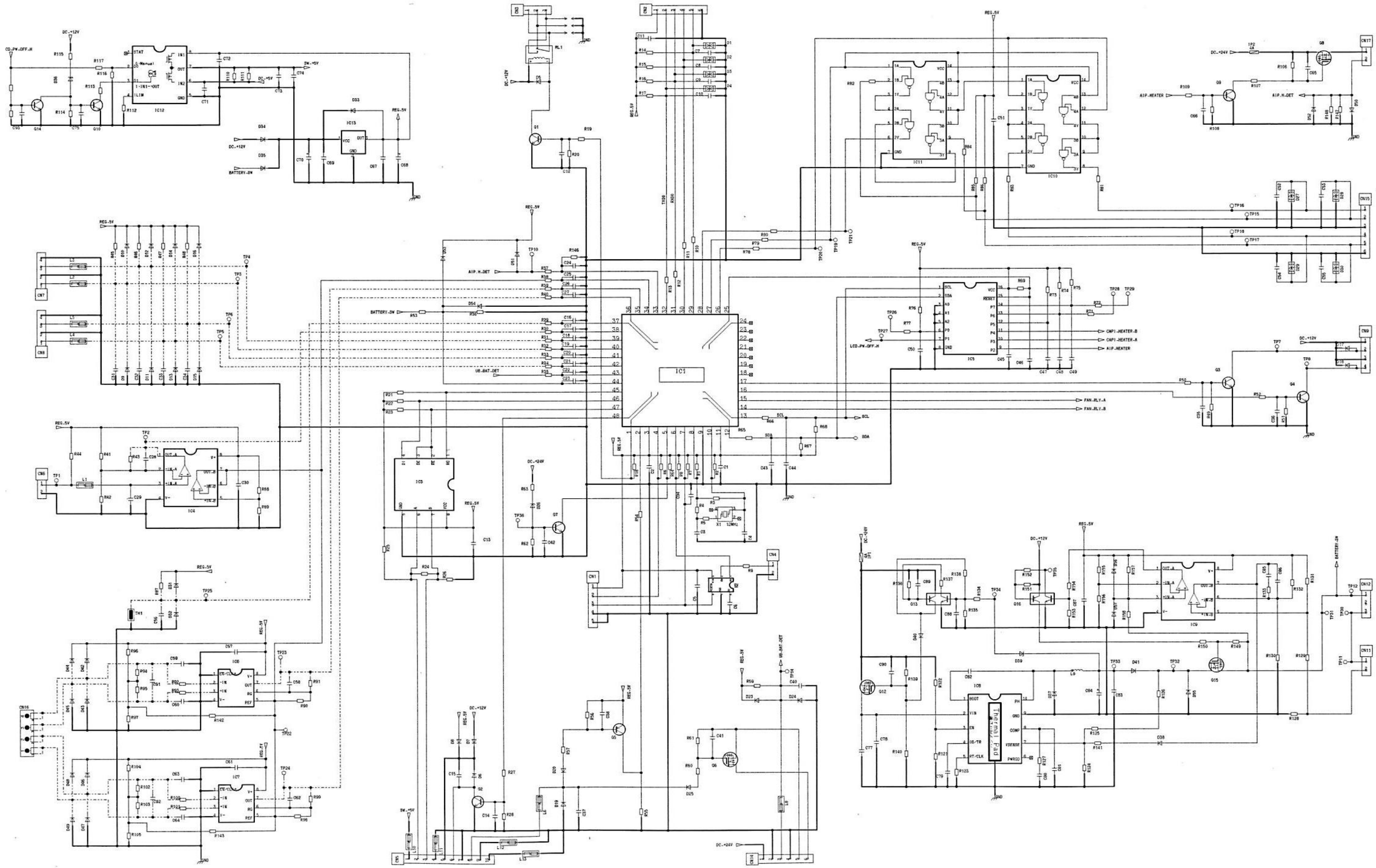
Temp. (℃)	Resistance Value (Ω)	Temp. (℃)	Resistance Value (Ω)	Temp. (℃)	Resistance Value (Ω)
−140	452.8	−70	730.3	0	1000.0
−130	493.0	−60	769.3	10	1038.0
−120	533.1	−50	808.1	20	1076.0
−110	572.9	−40	846.7	30	1113.8
−100	612.6	−30	885.2	40	1151.4
−90	652.0	−20	923.6	50	1189.0
−80	691.3	−10	961.9	60	1226.4

Wiring Diagram

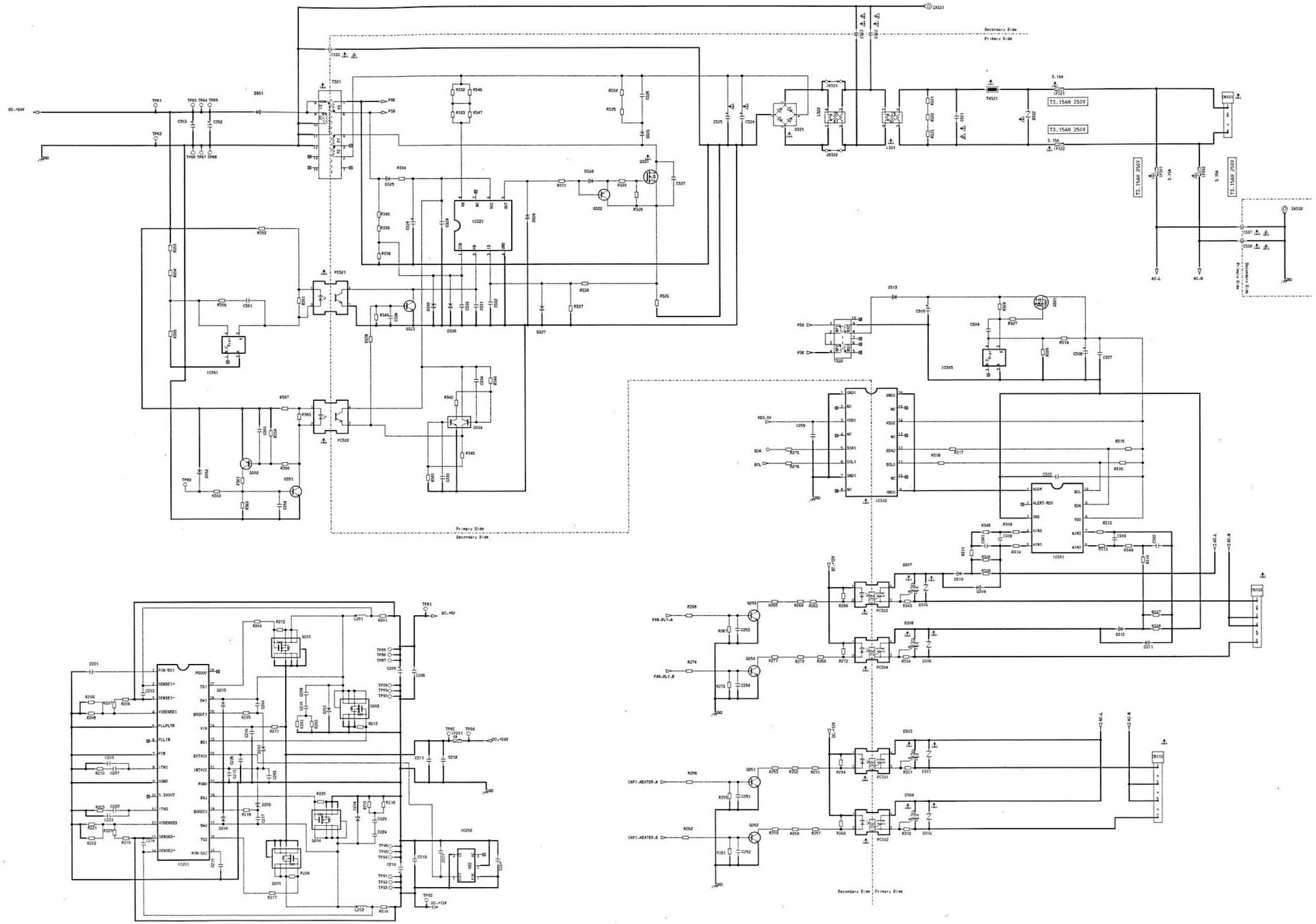


Circuit Diagram

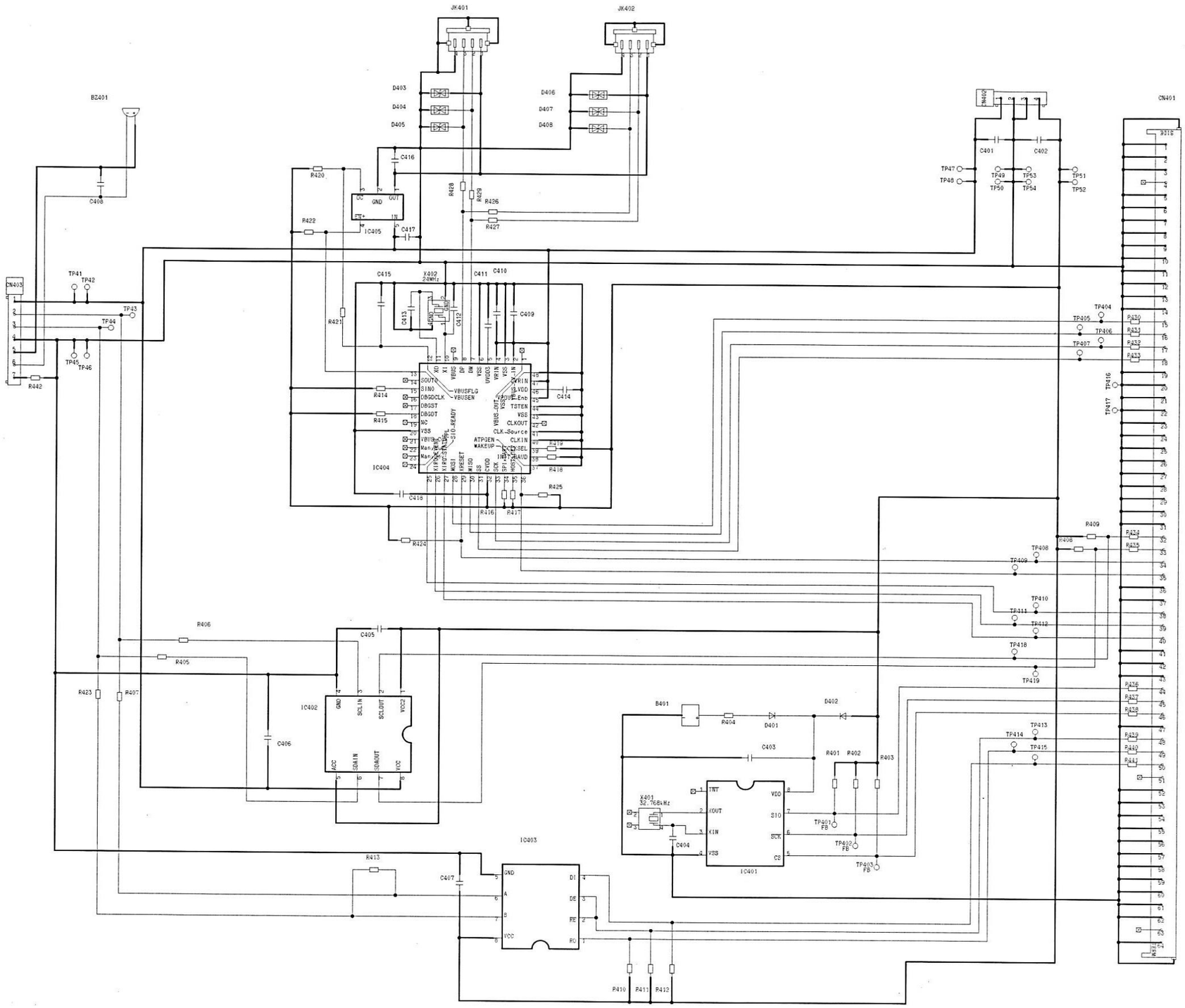
main



power


DC-+24V
GND
T3.15AH 250V
3.15A
AC-L
AC-N
Secondary Side
Primary Side
DC-+5V
DC-+12V
REQ_5V
SDA
SCL
FAN_PLY_A
FAN_PLY_B
CAP1_HEATER_A
CAP1_HEATER_B

USB


JK401
JK402
BZ401
CN401
CN402
CN403
D403
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D406
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D408
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R408
R409
R410
R411
R412
R413
R414
R415
R416
R417
R418
R419
TP401
TP402
TP403
FB
GND
OUT
IN
VCC
SCLIN
SCLOUT
SDAIN
SDAOUT
ACC
INT
XOUT
XIN
VDD
SIO
SCK
CS
VSS

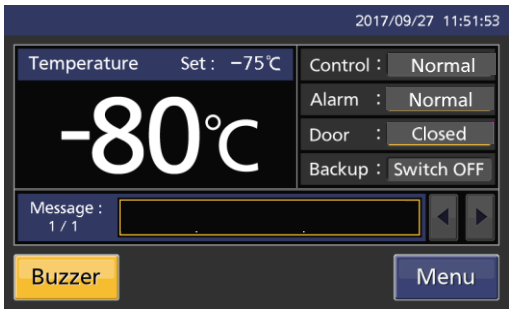
Operation

How to operate Service # 1 and Service # 2 on the service menu is described below. For other operations on the LCD, refer to the instruction manual.

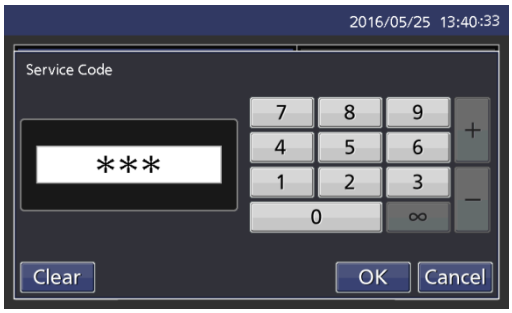
Term	Function
Runtime	Display the accumulate time of Main battery, Backup battery FAN A and FAN B, Reset them.
Version UP	Update the firmware of main board and touch panel.
Temp. Calibration	Chamber adjustment method.
System Configuration #1	Setting Capi. Heater and its timer, compressors, Fan A/B .
Status	Monitoring of chamber temp. , ambient temp, comp. evaporator and fan.
System Configuration #2	Turning On/Off of AIP heater, and Backup. Setting overload alarm delay..
Reset Data	Initialization of data, and flash memory. Setting model code.
Error Log	Output of error log data.
Setup Data	Input and output the data.
Other Setting	Turning On/Off Screen Capture, Demo Mode, Self-diagnosis Function and FAN Alarm.

CAUTION) Firmware update, compressor, FAN, and cap heater settings affect basic performance.
Be careful when operating.

（Runtime,Version Up）



Keep touching MENU KEY (5 sec)



Move to Service Code input display, so input “384” or “335232”

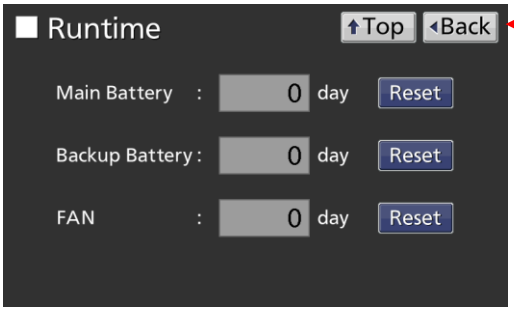
Move to Menu display, touch service #1 key.

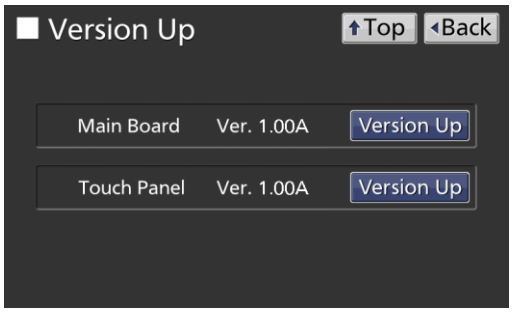
Service code “384”

Move to Service #1 display, touch Runtime or Version Up key

Input “384”, only can check the firmware version.

Service code “335232”





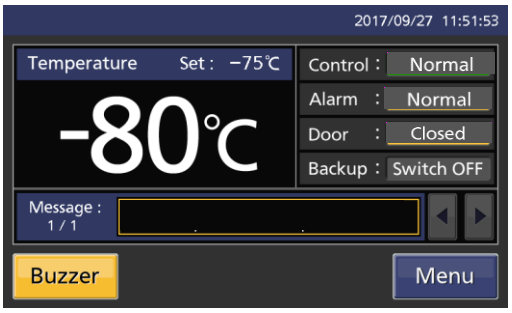
■ Main Battery
Main Battery accumulated time
■ Backup Battery
Backup Battery accumulated time
■ FAN
FAN accumulated time

When each part replace, reset corresponding data.

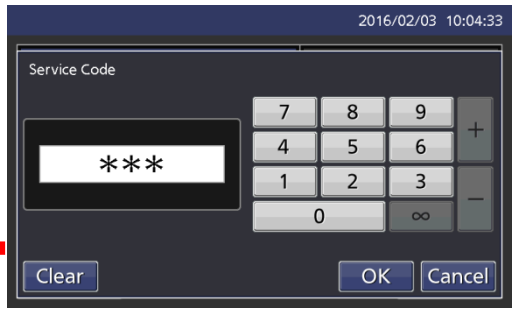
・Confirm the existence of file in predefined folder of USB memory.
・If file is not existence, message “File not found.” is displayed in “Notice” screen and the process end.
・If file is a existence, if it is not compatible model, "Confirm firmware" is displayed and the process is terminated. If it is a compatible model, "Confirm firmware rewrite ・・・" is displayed and when “Yes” is selected, version upgrade of the touch panel embedded software is started, and when “No” is selected, the process is ended.
・During version up, wheel appear in the screen.
・When version upgrade is completed, "Firmware rewrite complete. ..." is displayed.
・If an error (other than Verify check) occurs during version upgrade, "Firmware rewrite failure ... ..." is displayed
・If a Verify error occurs in the Verify check, "Verify check NG. ..." is displayed.

※When some version up files are plurality, the first found file is used for version up
※During appearance “wheel”, all operations are not able to receive.
※“OK” button in “Result” screen is disable, and all operations are not able to receive.（unless user turn off power）
※“OK” button in “Error” screen is disable, and all operations are not able to received.（unless user turn off power）
※During version up , no communication is not carried out and no log.is not output.
※**If you cancel after or during upgrade, restart the main power supply.**

（Temperature calibration procedure：chamber sensor）



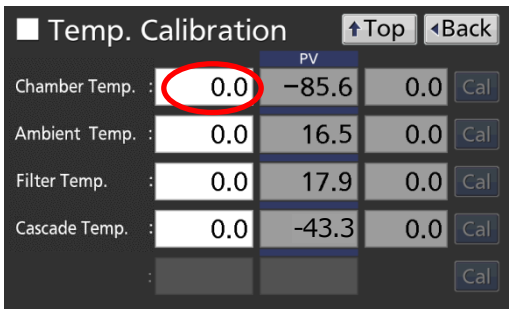
Keep touching MENU KEY (5 sec)



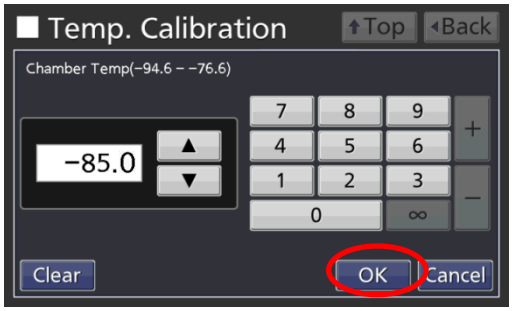
Move to Service Code input display, so input “335232”

Move to Menu display, touch Service #2 key.

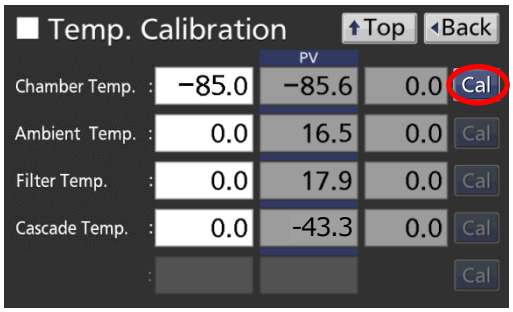
Move to Service display, touch Temp. Calibration key



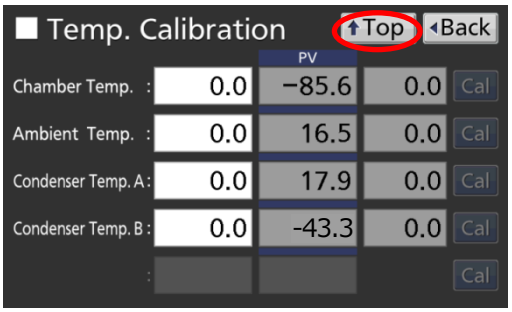
Touch mark area.



Move to input value display.
Input measured value by thermometer



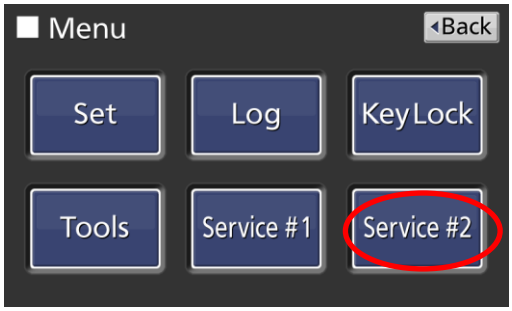
Cal key is vialed within setting range, touch Cal key.



Touch TOP key, so return to Menu display.
Input value area return to zero.

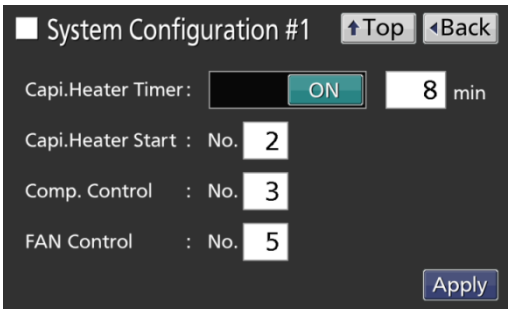
NOTE:: Ambient Temp. sensor and condenser A&B sensor can calibrate in the same procedure.

（Operation System Configuration #1）



Move to Menu display, touch Service #2 key.

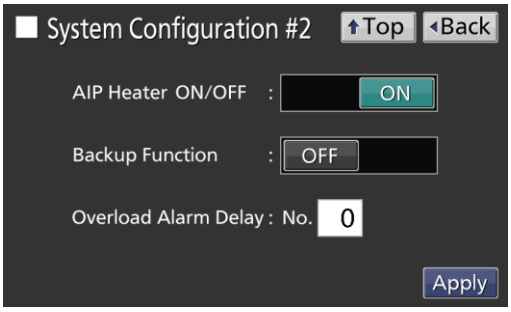
Move to Service display, touch System Configuration #1 key



- Capi. Heater Timer
  Slide key ON（enable）,
  setting time（Default 8 min）.
- Capi. Heater Start
  Capi. heater control setting
  (0) Heater on once in 18 hours
  (1) Force on now
  (2) Force off now(default)
- Comp. Control
  Compressor control setting
  (0)Off
  (1)On
  (2)Auto(default)
  (3)Manual
- FAN control setting
  (0) Off
  (1) On
  (2) Auto(default)

Refer to Control Specification for Capi. Heater Start, Comp. Control, FAN Control.

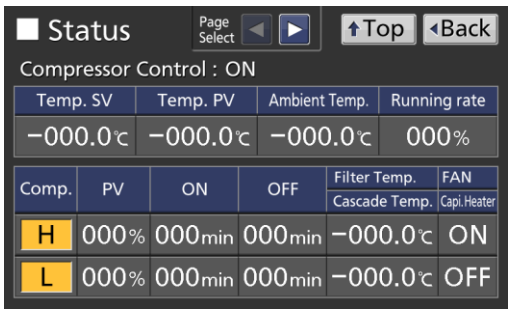
（Operation Configuration #2,Status）



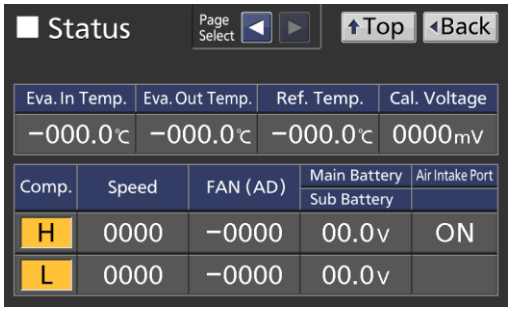
Move to System Configuration #2

- AIP Heater ON/OFF
  AIP Heater set
- Backup Function
  Backup function set. Refer to backup cooling kit
- Overload Alarm Delay
  Set Overload Alarm Delay
  (1)6 hour
  (2)2 day
  (3)5 day（Default）

  Note: Use for validation

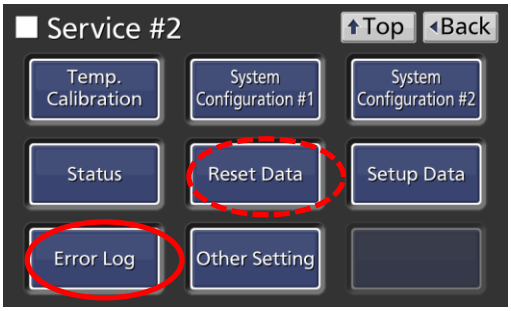


Move to Status display



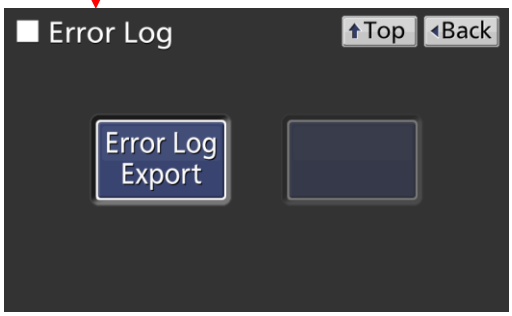
Move to next page.

（Operation Reset Data , Error Log）



Move to Reset Data display

Move to Error Log display



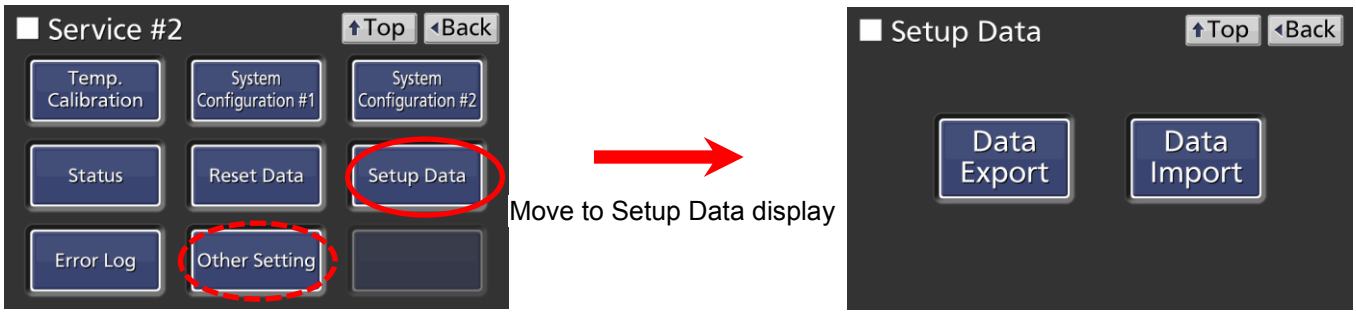
■ Reset data
On（enable）,OFF（disenable）

■ Function Code
925：Flash memory Initialization

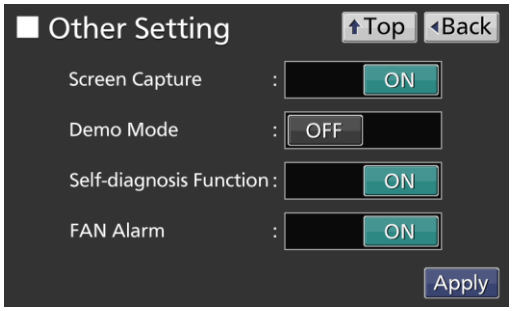
■ Model Code
Set model
(1) MDF-DU502VH
(2) MDF-DU702VH
Use for the version up of the firmware

・Check if USB memory is connected
・If not connected, "USB memory is disconnected." is displayed
・Communicate with ErrorLog command read request (0xA0)
(Suspends communication with Data command read request (0xFF))
・If communication fails, "Communication Failure." is displayed.
・If communication is successful, output error log data (2,048 bytes) to USB memory in binary format (file name: ErrorLog.bin)
・During communication and output , wheel appear in the screen.
・It outputs log information of all seven periods including service (service mode # 2) in the CSV format to the USB memory.
① Actual Temp. (℃)
② Filter Temp. (℃)
③ Cascade Temp. (℃)
④ Ambient Temp. (℃)
⑤ Door Opening
・ Output alarm information of all periods to the USB memory in CSV format.
・ If an error occurs during output, display a warning message depending on the situation and interrupt processing
・ When output is completed, "Export complete." Is displayed in Result box.
※ If settings storage data already exists in USB memory, overwrite it.

（Operation Setup Data , Other Setting）



Move to Version Up display



- ■ Screen Capture
- ■ Demo Mode
- ■ Self-diagnosis Function
- ■ FAN Alarm

USB memory data can be import and export
Import data: setting data
Export data: daily information

■ Data Export

・Confirm the connection of USB memory
・If it is not connected, message; “USB memory is disconnected“ is displayed in “Notice screen”.
・The communication carry out by Setup Data command read request（0x90）.(By Data command read request（0xFF）,the communication is temporary halt.)
・If communication is failure, “Communication Failure” is displayed .
・If communication is success, the saved setting data + LCD control value output to USB memory. by BIN format
・During communication and output, wheel appear in the screen.
・If error occurs during output, depending on any situations, warning message is displayed and the process break.
・When the output complete, “Export complete” is displayed in “Result” box.
※ If the previous saved setting data exit in USB memory, the data is overwritten.

■ Data Import

・Confirm the existence of file in predefined folder of the USB memory.
・If file is not existence or CRC does not match, “File not found.” is displayed in “Notice” screen and the process end.
・If file is existence, “Yes” is displayed in confirm screen A.
And if “Yes” is selected, the communication is carried out by SetupData command wright request （0x91） and saved setting date.is sent.
The setting data is upgraded to saved setting value of LCD control
During communication, wheel appears in the screen.
If the communication is successful, “Complete” is displayed in Result box.
If the communication is failure, “Error” screen is displayed

Control specification

1. Temperature control

(1) Outline

This unit controls two comp.s on the H side and the L side in cooperation, and controls the temp. inside the refrigerator to the set temp. (two-way freezing).
Furthermore, since the two comp.s are of inverter type and the number of revolutions can be changed, PID control is used in the vicinity of the set temp. inside the compartment.

(2) Setting（user）

Item	Set range	Default
Chamber temp.	-90 ℃～ -50 ℃	-80 ℃
Compressor delay	3 min～ 15 min	3 min

(3) Restrict of compressor starting

- Immediately after turning on the power supply or immediately after recovery from power failure, do not start the compressor for the compressor delay time.
- When stopping the compressor, do not start for 3 minutes.

(4) Compressor mode

Name	Action	Condition
NORMAL	Temperature control by NORMAL MODE	During normal operation
ON	Basically it is the same as NORMAL model, and both comp.s are always ON without temp. control. The rotational speed is maintained constant speed operation	During security operation (chamber temp. unknown)
OFF	Both comp.s are always OFF	Demo mode, Power failure Security operation (comp. protection temp. alarm)

(5) Condition and Priority of comp. operation mode

- The condition and the priority of comp. operation mode as following bellow table.
  When the state overlap, the comp. operation mode is determined by the priority.
  For each state、
- For the power failure and demo mode, both are same comp. running operation mode. So, they are coedited as same level.
- Test Program and capirariy heater control are not run within being higher priority condition.
  If higher priority condition starts, these are stopped.

Priority	Condition
High	Power failure, Demo mode
	Security operation（There is also priority in this）
	Test Program
	Capi heater control
Low	Other than those above

Comp.Control in service menu

2. Compressor normal mode

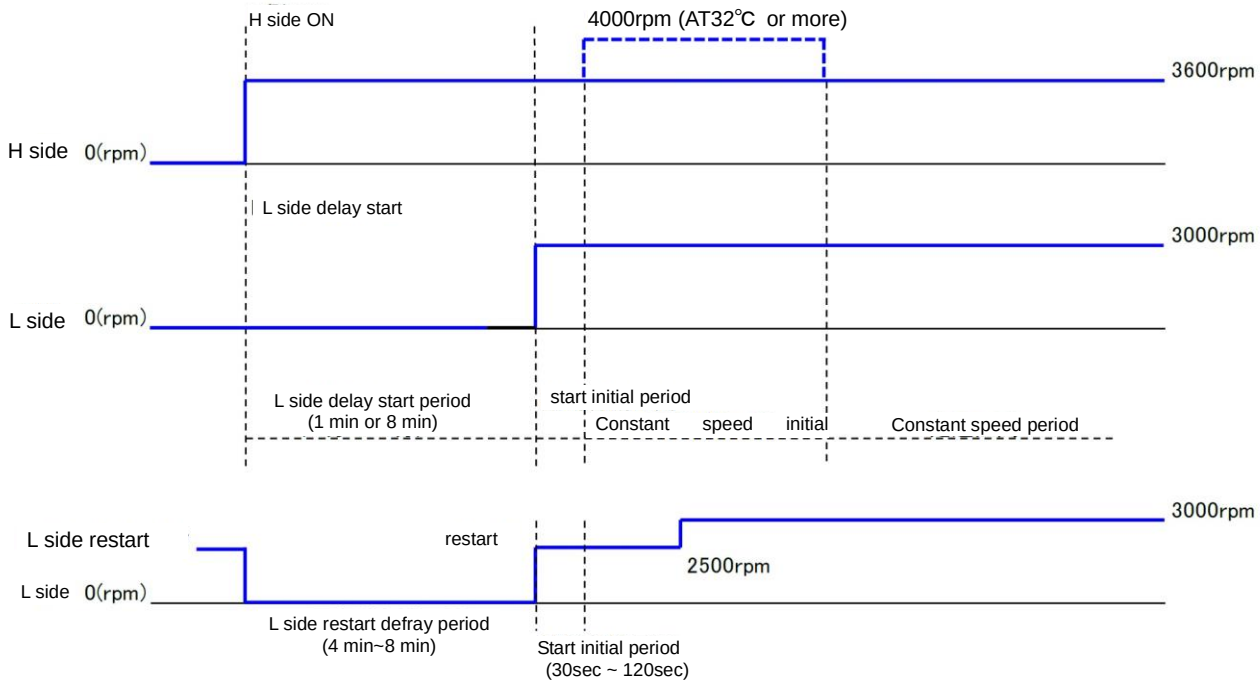
(1) （Speed control）

Three type of comp. operation mode depending the chamber temp.

Chamber temperature	> set temp.(SV) + Proportional band lower limit (EL)	≦set temp.(SV) + Proportional band lower limit (EL)≧ set temp.(SV)- Proportional band upper limit (EH)	< set temp.(SV) - Proportional band upper limit (EH)
Speed control	Constant speed control	PID control	stop

(Constant speed operation)

The control method in the case of starting the comp. from the state where both the comp.s are stopped is shown below



① H side start condition（AND)

・After the H side stopped, the threshold (3 min) elapsed

・（Immediately after H side start failure, 10 sec elapsed ）

・If the chamber temp.is higher than the set temp. plus the threshold (0.5 ° C)

② L side start condition（AND)

・After the L side stopped, the threshold (4 minutes) elapsed

・（Immediately after L side start failure, 10 min elapsed）

・A time longer than the threshold(※1) has elapsed after the H side start.

threshold (※1) condition

short(60 sec) Cascade temp. is below threshold (-20 ° C) and within 2 hours from the L side stop

long (480 sec) Other than those above

＜After security operation＞

・After the L side stop, the threshold(4 min) elapsed.

・After the H side start, 1min elapsed

・The cascade temp. is less than -34 ° C or 15 min elapse from the above

③ H side stop condition（OR)

・the chamber tempreture is lower than set temp.-threshold (0.5℃).

・(security operation)

④ L side stop condition(OR)

・H side stop

・Outside the initial startup period and the cascade temp. is higher than the threshold (-10℃)

⑤ Condition for L side restart（AND)

・After the L side stopped, the threshold (4 min) elapsed

・（Immediately after H side start failure, 10 seconds elapsed）

・The cascade temperature is -34 ° C or less, or even 15 minutes elapse

Number of revolutions at L side restart

First at 2500 rpm,
Return to 3000 rpm with cascade temperature below -20 ° C
⑥ Transition conditions from the initial startup period to the constant-speed initial period (OR)
・Initial startup period has passed 120 sec or more
・Other than the conditions below
Extended for 30 sec when the cascade temp. is higher than the threshold (-10 ° C) and the cascade temp. drop detection.
During the startup period, if the ambient temp. is 32 ° C or more, increase the H rotation to 4000 rpm
⑦ Transition conditions to constant speed initial period or constant speed period
・Detect maximum peak value of the cascade temp. and it is -30 ℃ or less.
【Error handling】
If the following conditions occur, reset the microcomputer once
・Command failure occurred 20 times consecutively

If the above condition occurs even after resetting the microcomputer, it outputs a communication failure warning.
If the communication failure is canceled, the alarm is canceled.

【Addition】
If the following condition (AND) under the constant speed period and the forced-ON mode,
change the L side rotational speed from 3000 to 3150.
・Set temp. is -86 °C or less
・Chamber temp. is -83 °C or less (return to 3000 rpm at -82 °C over)
If the following conditions, change the rotation speed during PID control from 3000 to 3150.
・Set temp. is -83 °C or less

3. Fan control

(1) Control
The fan is operated in the following mode against the compressor operation.
table FAN operation mode

Name	Operation	Condition
A_ON	Fan is always On	When On is set by FAN control※1
A_OFF	Fan is always Off	When Off is set by FAN control※1
AUTO	Change control according to ambient temp.	Normal When Auto is set by FAN control

※1Temporary setting in manufacturing process and service work.

Then, the state transition of AUTO mode is shown in the table below.
・ FAN_OFF : 31℃（Ambient temp. measurement value）
FAN_ON : 32℃（Ambient temp. measurement value）

① AUTO mode
FAN_ON≦T both A and B,ON
FAN_OFF<T<FAN_ON refer to ※2 T≦FAN_OFF Link with comp.

Table AUTO mode

State		Chamber temp.(T)		
No.	FAN	T≦FAN_OFF	FAN_OFF<T<FAN_ON	FAN_ON≦T
C11	Stop	Link with H comp. ※2	※2	ON C12
C12	Run	Link with H comp. ※2	※2	(none) —
	Control policy	Link with H comp. ※2	none	Always ON

※2 If it does not match either state of link with comp. or AB_ON, it is compatible with comp.

4. Capi. heater control

(1)Outline

In order to prevent oil clogging in the capillary, the compressor is periodically stopped, and the heater attached to the capillary is energized. Even if the compressor is in operation, the compressor is forcibly stopped for a certain period depending on the condition.

(2)Set value(service work)

Item	Range	Default
Capi. Heater time	0 min, 6~15 min	8 min
Capi heater mode	0: AUTO / 1 : ON / 2 : OFF	2 : OFF

(3)Control

If AUTO is set, the following operation is performed after 18 hours of product operation start (every 18 hours thereafter). If OFF is set, the same operation as AUTO is performed but only the energization of the capi. heater is canceled.

① Energize the capillary every 18 hours and do not start the compressor during this time.
② If the internal temperature has not reached the OFF1 point, set the compressor to the forced ON state and wait until OFF1 or less.
③ If it does not reach OFF1 or less even after 60 min elapse, forcibly stop the compressor and energize the capillary.

When On is set, the forcible compressor is stopped and the capillary is energized. After that, it switches to AUTO.

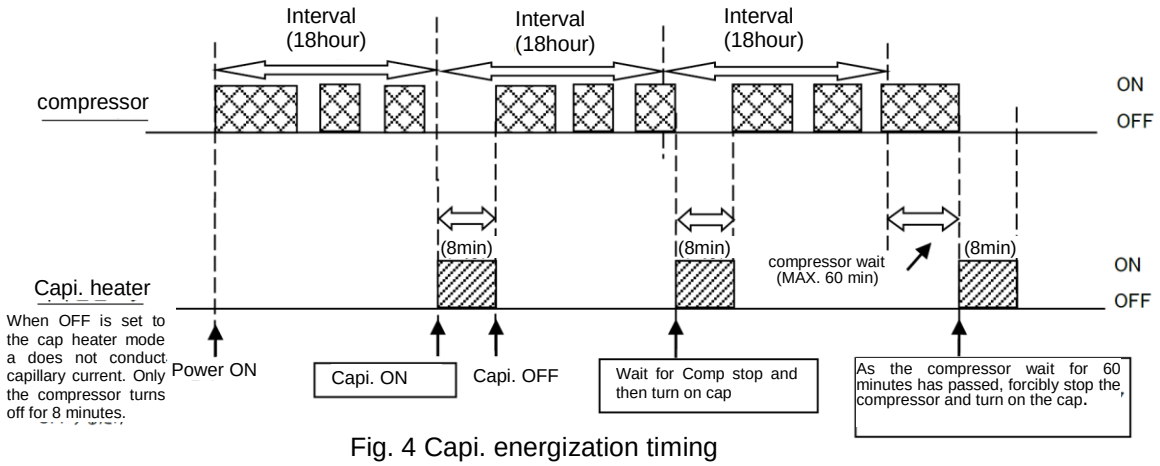


Fig. 4 Capi. energization timing

5. AIP heater control

This heater is always turned ON, but for energy saving or protection of abnormal heating, is turned OFF under the following conditions

Heater OFF condition

- When the chamber temp is more than -39℃, turn off.(when it is less than -40℃, turn ON)
- Opening the door
- On power failure or demo mode

6. Buzzer control

Refer to the following to the types and specifications or buzzer sound and the beep conditions.

Buzzer sound spec.

Spec.(On ms/Off ms/On time)	Type	Condition
(120ms/120ms/twice)	Starting sound	Starting sound(normal)
(780ms/220ms/continue)	Alarm sound(long)	Alarming
(60ms/1600ms/continue)	Alarm sound(short)	Power failure、alarm history, ALARM test

7. Alarm type

Table Alarm type

Code	Name	Class	Judgment condition
W04 A04	High temp. alarm	Temp. alarm	the chamber temp. exceeds the warning temp.
W05 A05	Low temp. alarm	Temp. alarm	The cahmber temp. falls below the warning temp.
W01	Power failure alarm	Power failure alarm	During detecting power failure
—	Door alarm	Door alarm	During opening door
—	Filter alarm	Alarm Notice	Filter sensor temp. is 45 ° C or more Release condition: Filter sensor temp. is 40 ℃ or less, or condenser temp. abnormality occurred
W02	Condenser temp. abnormal	Warning alarm	Filter sensor detected value is 50℃ or more Release condition: filter sensor is AT + 5℃ or less
W09	Chamber temp. control sensor open	Warning alarm	After 5 V voltage conversion, 4950 mV or more
W10	Chamber temp. control sensor short	Warning alarm	After 5 V voltage conversion 25 mV or less
S10	Cascade sensor open	Status alarm	After 5 V voltage conversion, 4950 mV or more
S11	Cascade sensor short	Status alarm	After 5 V voltage conversion, 25 mV or less
S12	Filter sensor open	Status alarm	After 5 V voltage conversion, 4950 mV or more
S13	Filter sensor short	Status alarm	After 5 V voltage conversion, 25 mV or less
S14	AT sensor open	Status alarm	After 5 V voltage conversion, 4950 mV or more
S15	AT sensor short	Status alarm	After 5 V voltage conversion, 25 mV or less
S20	Battery switch	Status alarm	Detected 7.2 V or more
W06	H side inverter communication failure	Warning alarm	Communication failure (more than 20 consecutive occurrences, more than 20 consecutive occurrences after reset), timeout (more than 10 consecutive times), circuit board short
W07	L side inverter communication failure	Warning alarm	Communication failure (more than 20 consecutive occurrences, more than 20 consecutive occurrences after reset), timeout (more than 10 consecutive times), circuit board short
—	Communication abnormal	-	Detected on the touch panel side
S02	Over range of ambient AT	Status notice	The acquired value is 0 ° C or less, 35 ° C or more
S01	Overload running notice	Status notice	It does not reach the set temp. for more than 5 days (120 hours)
S18	Main battery change notice	Status Notice	Tthe number of working days of the product has passed 1022 days (about 2.8 years)
S19	Backup battery change notice	Status Notice	1022 days (about 2.8 years) passed while the Backup function was on
S03	AIP port heater abnormal	Status Notice	Heater control state and acquisition voltage do not match at ON control, less than 0.2 V At OFF control, error judgment is made at 0.1 V or more
S16	Battery re-charge error	Status Notice	Voltage of the main battery is 6 V or less and there is no voltage rise of 0.3 V or more even after 6 hours
S17	Backup battery re-charge error	Status Notice	Voltage of the main battery is 6 V or less and there is no voltage rise of 0.3 V or more even after 6 hours
S21	Main microcomputer flash error	-	Detected on the touch panel side
S22	Communication protocol error	-	Detected on the touch panel side

8. Alarm function

(1) Alarm delay
- Even if the judgment is alarm, buzzer sound and remote alarm is not output within the set time. (after passing set time, the status become alarm.)
- Set range of alarm delay time:※ restrict input by touch panel side.
  Temp. alarm : 0 min (Immediately:no alarm delay)、1min～15min(default:15min)
  Door alarm 0min (Immediately:no alarm delay)、1min～15min(default:2min)

(2) Alarm buzzer output and erase
- The alarm buzzer output on alarm status, and if push "Buzzer" key during output of alarm buzzer, mute the buzzer sound.
- Set range of alarm delay time:※ restrict input by touch panel side.
  Temp. alarm : 0 min (Immediately:no alarm delay)、1min～15min(default:15min)
  Door alarm 0min (Immediately:no alarm delay)、1min～15min(default:2min)

(3) Ring back
- After passing set time from alarm buzzer mute, buzzer sound again.
- Set range of ring back, ※restrict input by touch panel side.
  Ring back function OFF、1min～99min(default:30min)

(4) Remote alarm
- This is linkage with alarm buzzer output. And restrict the output from remote alarm port. (if the alarm buzzer output, the remote alarm output too.)
  However, when the buzzer alarm is no-linkage, even if the alarm is mute status, the remote alarm keep output.
- Remote alarm set
  Buzzer no-linkage(ON)、buzzer linkage(OFF) (default:buzzer no-linkage)

(5) Alarm history
If the judge of alarm from alarm status is released, the status transitions alarm history, and that buzzer has outputted and alarm has occurred are displayed.

(6) Alarm history release
If put the buzzer button within alarm history state, buzzer erase and move to normal state.

Table function vs alarm

Function / Type	(1)Alarm delay	(2)Alarm buzzer output / erase (4)Remote alarm	(3)Ring back	(5)Alarm history (6)History release
Temp. alarm	○	○	○	○
Power failure alarm	—	○	○	○
Door alarm	○	○(Remote alarm —)	—	—
Warning	—	○	○	—
Alarm Status	—	○(Remote alarm —)	—	—
Notice	—	—	—	—

10. Model

(1) Model code
1: MDF-DU502VH
2: MDF-DU702VH

(2) Parameter

		Default		
Module	Term	MDF-DU502VH	MDF-DU702VH	Range
Comp. control	Set temp.	-80℃	-80℃	-50℃ ～ -90℃
	Control mode	Auto	Auto	fix
	Comp. first start delay time	3 min	3 min	3 min～15 min
	Comp. restart delay time	3 min	3 min	fix
	ON point	+0.5℃	+0.5℃	fix
	OFF point	-0.5℃	-0.5℃	fix
	Offset value	+1.0℃	+1.0℃	fix
	Ambient temp.correct	-1.0℃	-1.0℃	fix
	ON/OFF adjustment value	existance	existance	fix
FAN control	Control mode	AUTO	AUTO	Control modes
	ON point	27℃	27℃	-20℃～40℃
	OFF point	26℃	26℃	fix
Capi heater control	Control ON/OFF	ON	ON	ON, OFF
	Control mode	OFF	OFF	ON, OFF, AUTO
	Maximum cooling time	60 min	60 min	fix
	Action interval	Every 18 hour	Every 18 hour	fix
AIP heater control	Control ON/OFF	ON	ON	ON, OFF
	ON point	-40℃	-40℃	-50℃～10℃
	OFF point	ON point+1℃	ON point+1℃	fix

※1 Configurable on service menu

		Default		
Module	Item	MDF-DU502VH	MDF-DU702VH	Range
Alarm	High temp. alarm temp.	+10℃	+10℃	+5℃ ～ +40℃
	Low temp. alarm temp.	-10℃	-10℃	-5℃ ～ -40℃
	Temp. alarm delay time	15 min	15 min	0 min～15 min
	Door alarm delay time	2 min	2 min	0 min ～15min
	Ring back function	ON	ON	ON, OFF
	Ring back time	30 min	30 min	1 min ～99min
	Remote alarm linkage	OFF	OFF	ON, OFF
	Filter alarm temp.	45℃	45℃	※1
	Filter alarm release temp.	Alarm temp. -5℃ or less	Alarm temp. -5℃ or less	fix
	Comp protection alarm temp.	50℃	50℃	※1
	Comp protection release alarm temp.	Ambient temp. +5℃ or less	Ambient temp. +5℃ or less	fix
	Sensors open alarm	4950mV	4950mV	fix
	Sensors short alarm	25mV	25mV	fix
	Battery SW judgment	100mV	100mV	fix
	Port heater voltage judgement	0.2V	0.2V	fix
	Range over of ambient temp.	0～35℃	0～35℃	fix
	Overload running notice	5 day	5 day	6hour,2day,5day※1
	Battery change notice	1022 day	1022 day	fix
	Touch panel communication error	130 sec	130 sec	fix
	Backup battery changing failure	0.3V / 6 hour	0.3V / 6 hour	fix
Calibration value	Chamber temp. sensor PCB calibration value	0℃	0℃	※1
	Chamber temp. sensor calibration value	0℃	0℃	※1
	Ambient temp. sensor calibration	0℃	0℃	※1
	Cascade temp. sensor calibration value	0℃	0℃	※1
	Filter sensor calibration value	0℃	0℃	※1
Security operation	Touch panel OFF	4.45V	4.45V	fix

※1 Variable in service menu

Inverter signal

(1) Outline
In this model, an inverter is used for compressor control. In order to investigate the status of the compressor and the inverter, signal verification of the inverter side is necessary.

(2) The error signal on the inverter side is as follows.

Failure Mode	**LED operation**
Normal operation	1 blink each 15 s
Thermostat failure	2 blinks each 5 s
Inverter failure	3 blinks each 5 s
Compressor failure	4 blinks each 5 s

Parts layout

【Front/Control panel】

【Opposite side of control panel】

LCD panel　　LCD PCB

【Opposite side of front door /auto air intake port】

【Left side】

Door latch support

Air intake port

Handle

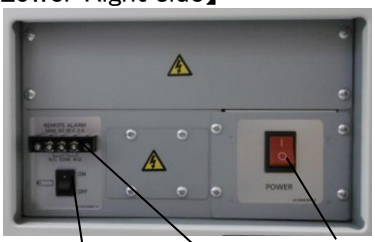
Inner door latch support

Inner door latch

【Chamber】

PT sensor

【Lower Right side】



Battery switch　　Power switch

Remote alarm terminal

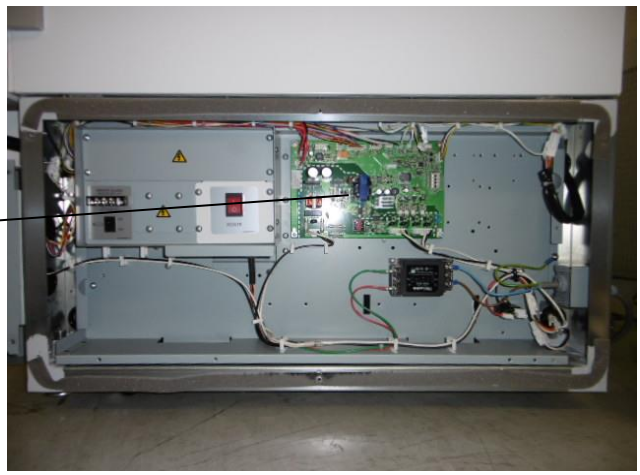
【Rear side】

【Lower front】

Air intake vent(Grill)

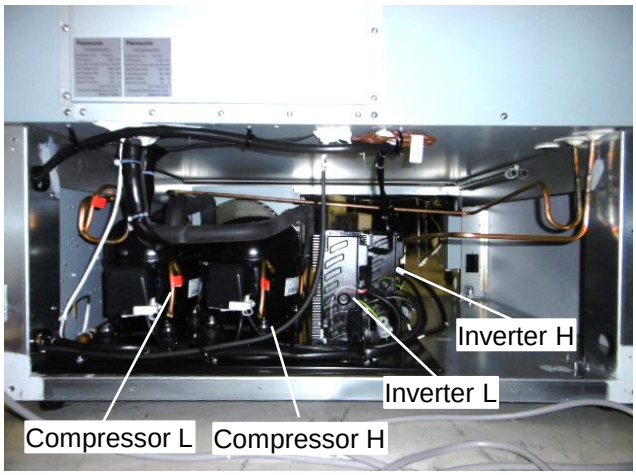
Space for Temperature recorder
(Option)

【Lower right side/Electric Box】



【Lower front/Condenser】

【Rear bottom/Cooling UNIT】



Repairing unit / Gas charge

■Preparations（H/L side common）

- · Refrigerant cylinder (type, amount required to be confirmed), refrigerant cylinder hose
- · Alarm
- · Detector (gas leak tester for HC refrigerant)
- · Dedicated gauge manifold (dedicated GM) (combined with R290 · R170)
- · General purpose gauge manifold (GM)
- · Long hose (10 m or more: length to go outdoors) Field check required in advance
- · Charge hose (4 or more), branching instrument
- · Tools (Driver, pliers, pliers, etc.)
- · Replacement parts (depending on repair contents)
- · Piping
- · Explosion-proof vacuum pump
- · Powerful vacuum pump
- · Piercing tool (2 to 4)
- · Service valve
- · Service port (check valve) * (See work contents in 2.1)
- · Valve driver
- · Scale (electronic weighing scale)
- · Coupler
- · Pinch pliers (2)
- · Nitrogen cylinder, pressure regulator
- · Leak Check Spray (Liquid detergent may be used)
- · Gas welding machine
- · Silver braze, flux, exclusive lighter
- · Plumbing tools (cutter, reamer, bender, flare tool, expander, wrench, mirror, light etc.)
- · Welding cooling tool (water container, waste etc.)
- · Welding protective equipment (leather gloves, goggles, flameproof sheets, steel plates, etc.)
- · Refrigerant protection (leather gloves, goggles)

■Low side only

- · Teflon hose (for pentane)
- · Pentane Charging Cylinder
- · N-Pentane (Containing amount required)
- · Pentane dryer

■Caution

・Use of fire is strictly prohibited during HC gas release and its charge. Especially, pay shut attention for product around and the release port.

・Confirm in advance about the power supply of the work place, weld work availability, carry-in / out route.

・Due to constraints of work environment, welding work may be carried out by moving the product outdoors. In that case, confirm the securing of the power supply at the work place.

・Be careful of burns due to touching the heated part during welding operation.

・Since necessary preparations change depending on the work place and repair content, please check in advance.

・Do not insert the power plug easily without confirming to customer such as emergency outlet.

・Do not use a hose that is cracked or is hard for connector connection, as it may cause gas leakage.

■Common work for high temperature side and low temperature side

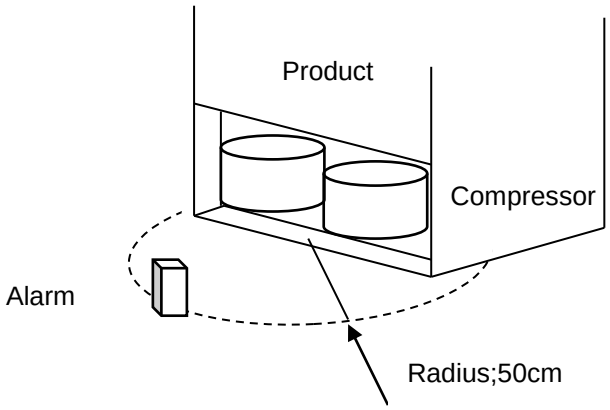
1. Release gas

1.1 Securing work space

Preparations ：Alarm（Note: **Alarm should be operated at all times during work**）

Procedure： Move to the space where you can work the product, open the window / door and set the alarm on the floor within 50 cm radius from the unit.

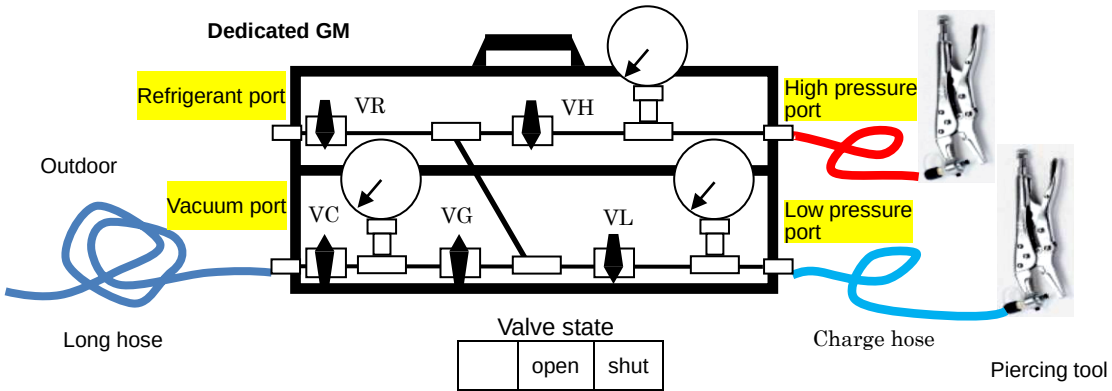
Note：Alarms are generally for one type of gas and there is no mode switching function according to multiple gases. Use a detector for detailed measurements such as exploration of gas leakage location.



1.2 Tool connection

Preparations ：Detector, dedicated GM, piercing tool, long hose, charge hose, branching instruments, tools, leak check spray (liquid detergent can also be substituted)

Procedure ： Connect piercing tool, charge hose, dedicated GM, long hose, as shown below, and lead the long hose tip outdoors.



Valve state

	open	shut
VC		○
VG		○
VL		○
VH		○
VR		○

Note：**Make sure connection is not leaky.**

Although connection to Dedicated GM can be done by hand tightening, confirm that there is no leakage from the connection part when starting gas flow. Make sure there is no break in the middle of the hose (especially long hose).

1.3 Refrigerant release

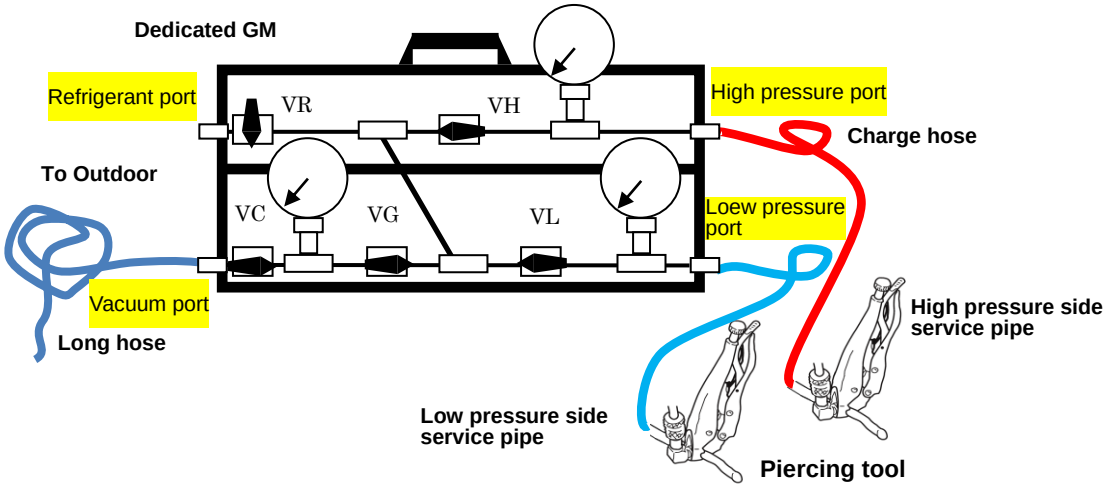
Preparation：Refrigerant protection equipment (leather gloves, goggles), tools

Procedure：※Wearing leather gloves and goggles because it handles refrigerant.

※Confirm whether there are ignitable ones like electric appliances outdoors.

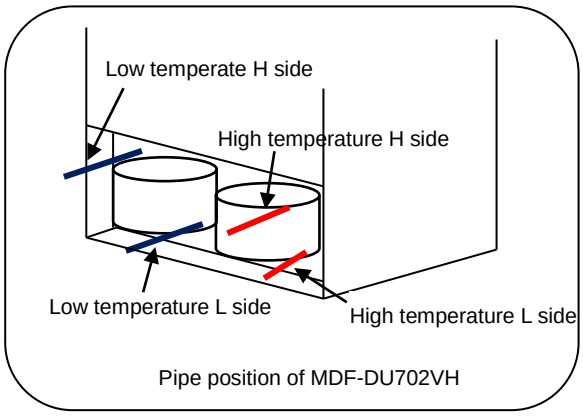
Install a piercing tool in the high / low pressure service pipe of the product, open the valve of the dedicated GM (however, VR is not opened), and release the refrigerant from the long hose to the outdoor.

（Valve open：VC⇒VG⇒VL⇒VH）



	Open	Shut
VC	○	
VG	○	
VL	○	
VH	○	
VR		○

Valve state



Pipe position of MDF-DU702VH

Note：Piercing tool is unnecessary if service valve is attached.

Place the detector near the tip of the outdoor long hose. Be sure to use a detector that can detect HC refrigerant.

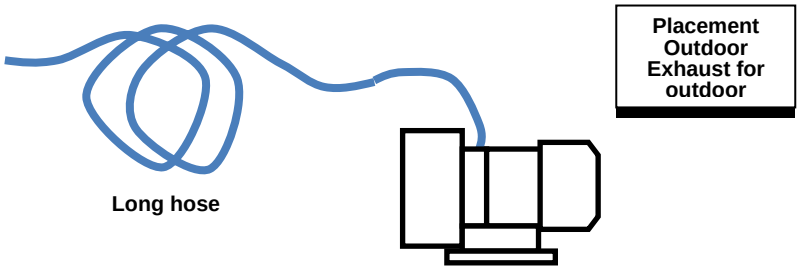
Make sure that the release refrigerant is almost gone by the guidelines and detectors of the dedicated GM.

1.4 Vacuum evacuation of cooling circuits

preparation ：Explosion-proof vacuum pump, detector for HC refrigerant

procedure：Since the refrigerant is dissolved in the compressor oil, connect the explosion-proof vacuum pump to the tip of the long hose led outdoors, and perform vacuum evacuation from the refrigeration circuit for at least 10 minutes. (Place vacuum pump outdoors)

When no gas is detected, shut all the valves and stop the pump.

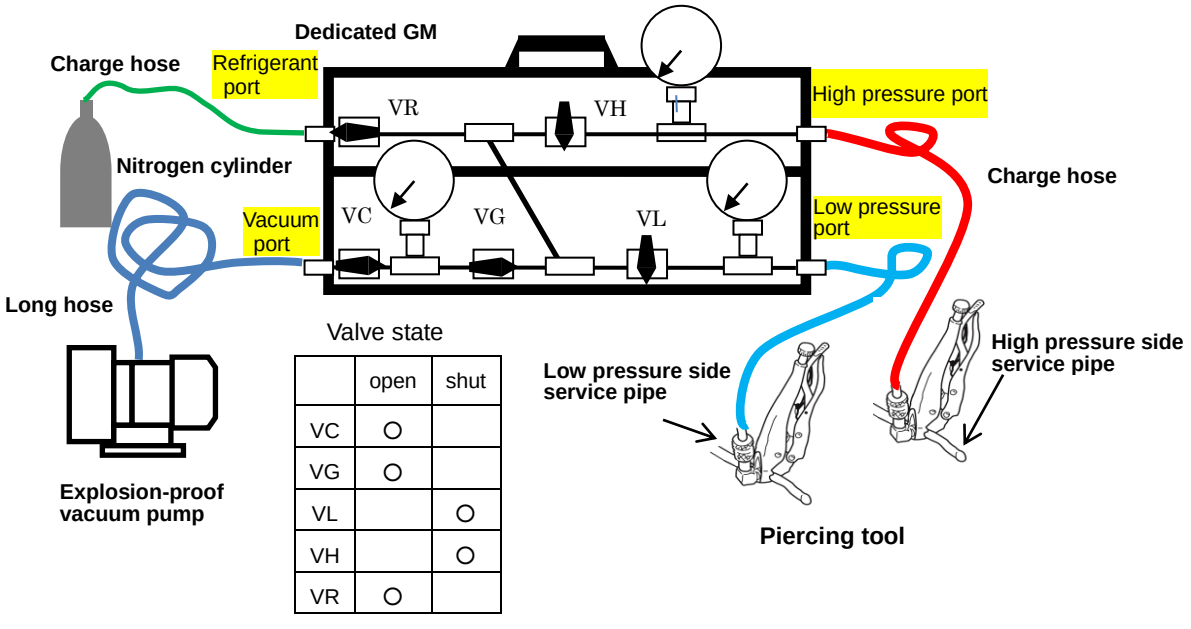


Note： Apply a detector to the exhaust port of the vacuum pump to confirm that the refrigerant has been released.

1.5 Vacuum evacuation before nitrogen blowing

Preparation ：Nitrogen cylinder, pressure regulator, charge hose, branching instruments, tools, leak check spray (liquid detergent can also be substituted)

Procedure：Connect the nitrogen cylinder as shown below and operate the explosion-proof vacuum pump. Open the valves VC, VG, VR and perform vacuum evacuation between the nitrogen cylinder and the dedicated GM.(About 1 minute)



	open	shut
VC	○	
VG	○	
VL		○
VH		○
VR	○	

Note：make sure connection is not leaky.

1.6 Nitrogen charge before nitrogen blowdown

procedure ：After 1.5 , VC, VG are shut, VR, VH, VL are opened and nitrogen is charged (about 30 seconds) (however, the secondary pressure is 0.5-0.7 MPa)

note：In order to prevent air from entering the freezing circuit, fill with nitrogen.

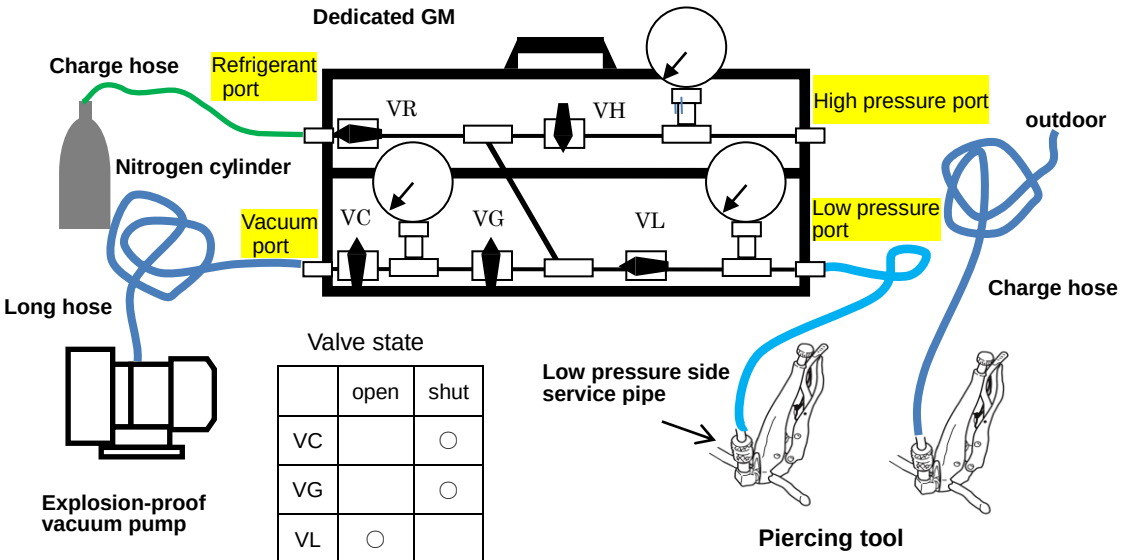
Valve state

	open	shut
VC		○
VG		○
VL	○	
VH	○	
VR	○	

1.7 Nitrogen blow

Procedure：Once all the valves are shut, reconnect as shown below and blow nitrogen for about 30 seconds into the circuit. (Nitrogen replacement: provided that the secondary pressure is 0.5 to 0.7 MPa)

Caution! Since the refrigerant may burn with the flame of the welding machine, always carry out the above procedure.



Valve state

	open	shut
VC		○
VG		○
VL	○	
VH		○
VR	○	

Note：Nitrogen blow is performed to completely release the refrigerant. The flow rate of nitrogen may be small (to the extent that it feels a little with the skin).

2. **Repair**

2.1 Replacement parts

Preparation: Replacement parts, tools, service valves, check valves, piping, piping tools (Cutter, reamer, bender, flare tool, expander, wrench, mirror etc.)

If you do not use a check valve, you need a coupler, piercing tool, pinch off tool, etc.

Procedure: Exchange necessary parts according to repair contents.

In this system, install a service valve on the low pressure side and a check valve on the high pressure side.

When installing the service valve, replace the low-pressure side service pipe. After that, install the service valve on the low pressure side service pipe.

(Instead of installing a check valve, a coupler or a piercing tool may be used, after vacuum evacuation, a pinch-off tool and welding may be used for sealing)

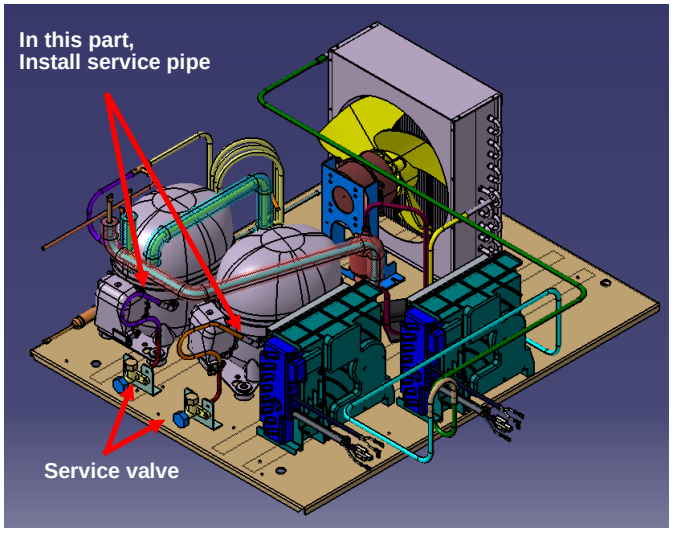
Also, when repairing the refrigeration circuit, be sure to replace the dehydrator.

※ When replacing parts, follow each parts replacement procedure.

※ Place the removed refrigeration circuit parts in a place away from the work place without fire.

In the PA model, the service pipe label (red tag) is attached to the pipe for service valve installation.

Remove the label of the pipe to be welded.



MDF-DU702VH

NOTE : Check valve is also called "access connector".

When the check valve is welded, it will be hot, so remove the valve before doing.

If the check valve cannot be installed on the high pressure side, in the process of "13. Vacuum exhaust ①"

After vacuuming for 2 to 3 hours, once the high pressure side is pinched and welded, Vacuum is carried out for 1 to 2 hours from the low pressure side.

2.2 Preparation for gas welding

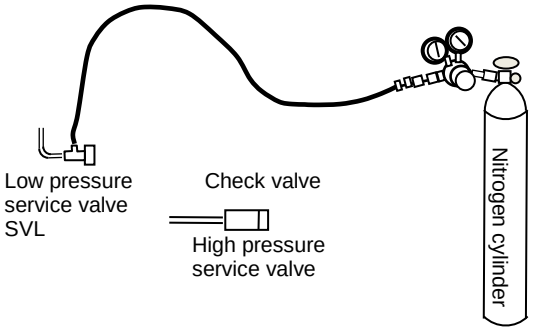
Preparation：Flameproof sheet, tools, nitrogen cylinder, charge hose, branching instrument

Procedure : Pull the welded part as far as possible from the product and cover the periphery with a flameproof sheet as necessary.

In order to prevent oxide film of pipe inside during welding, a nitrogen cylinder is connected to the low pressure side service valve (SVL)

Replace the nitrogen in the piping. (Nitrogen substitution: provided secondary pressure is 0.5 to 0.7 MPa) At this time,

Remove the valve in the check valve. (Outlet of nitrogen)



Valve sate

	open	shut
SVL	○	

Note：Insulation materials are easy to ignite, be sure to cover with fireproof sheets.

The flow rate of nitrogen may be small (to the extent that it feels a little with the skin).

2.3 Piping connection by gas welding

Preparation: gas welding machine, exclusive lighter, silver braze, flux piping tool

(Cutter, reamer, bender, flare tool, expander, wrench, mirror, light etc.)

Welding cooling product (water-filled container, waste etc.),

Weld protective product (leather gloves, goggles, flameproof sheets, steel plates, etc.)

Procedure: Take care not melt the pipe, heat it so that a braze melts around the connection, and then braze to it. Check the brazed state with a mirror, light, etc.

When using silver wax, apply flux to the place where you usually braze.

Note: Forced cooling immediately after brazing heating adversely affects the structure of copper metal. Please leave it for about 2 minutes and then apply wet cloth.

2.4 Refrigeration circuit leak check

Preparations: Leak check spray (liquid detergent can also be substituted)

Procedure: Continue with nitrogen replacement as it is, install a valve in the check valve, and perform a leak check of the entire unit circuit.

(Nitrogen replacement: provided that the secondary pressure is 0.5 to 0.7 MPa)

Note: Use a leak check spray to check the gas leak at the replacement (welding) point.

3. **Evacuation**

3.1 Leak check of connection point

Preparation: Leak check spray (liquid detergent may be used), dedicated GM, general purpose GM *, powerful vacuum pump, Nitrogen cylinder, charge hose, branching equipment, tools

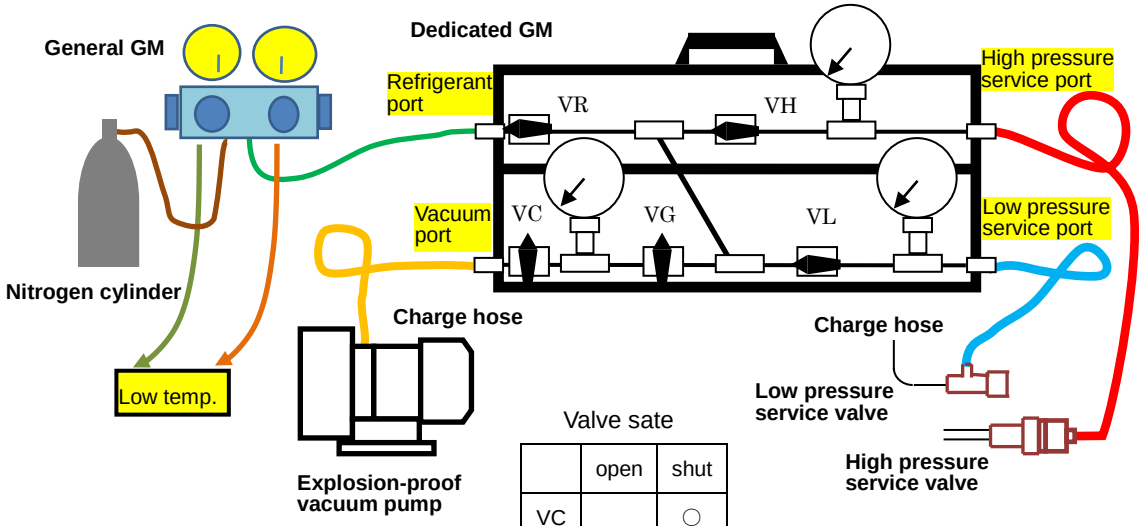
* In case of evacuating simultaneously on the low temperature side and the high temperature side

Procedure: Connect as shown below and prepare for vacuum evacuation. When repairing on the low temperature side was also done, add general purpose GM and connect. ← Vacuum exhaust at the same time at high temperature and low temperature for shortening the time

(In the case of only the high temperature side, connect the hose from the nitrogen cylinder directly to the refrigerant port)

Open the unopened valves of nitrogen cylinders, VR, VL, VH and general purpose GM,

Perform a leak check of the connection point. (Nitrogen replacement: provided that the secondary pressure is 0.5 to 0.7 MPa)



Valve sate

	open	shut
VC		○
VG		○
VL	○	
VH	○	
VR	○	

Note: Use a leak check spray to check the gas leak at the connection point.

Generally, the explosion-proof vacuum pump has a small capacity, so prepare a separate powerful vacuum pump.

(All flammable HC refrigerants are released, so there is no problem even if they are not explosion-proof type)

Connection should be made surely without leakage.

3.2 Evacuation①

Procedure：Remove the hose of the general purpose GM (or coolant port) that was connected from the nitrogen cylinder, open the nitrogen, shut the valve (or VR) of the removed hose, and perform vacuum evacuation to fill the refrigerant. After operating the powerful vacuum pump, open the valve of VC. Vacuuming time: about 4 hours or more with a vacuum pump with a capacity of 300 L / min (When using a vacuum pump with a small capacity value, vacuuming is performed until the degree of vacuum is 3 Torr or less as a guide)

Valve state

	open	shut
VC	○	
VG	○	
VL	○	
VH	○	
VR	○	

（For high temperature side only, VR shut →）

3.3 Complete evacuation

Procedure : Specified time (about 4 hours or more) Shut each valve and stopper temporarily after evacuation and stop the pump.

If vacuum evacuation on the low temperature side is carried out together, disconnect from the refrigerant port.

4. **Gas charge**

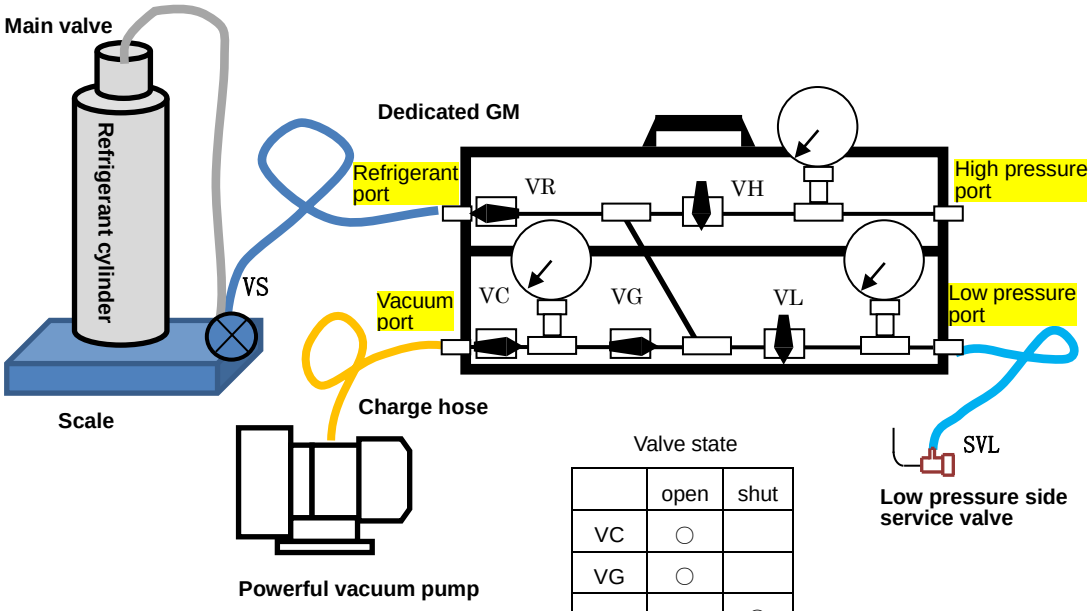
4.1 Evacuation②

Preparations: Dedicated GM, Refrigerant Cylinder, Bottle Cap, Powerful Vacuum Pump, Scale (Electronic Weighing Scale), Charge hose, branching tool, tool

Procedure : After operating the powerful vacuum pump with the refrigerant cylinder on the scale, Open the valve in the following order and evacuate to the refrigerant cylinder.

VS⇒VR⇒VG⇒VC.

Vacuuming time: about 1 minute with a vacuum pump with capacity of 300 L / min (Standard: vacuum degree 3 Torr or less)



Valve state

	open	shut
VC	○	
VG	○	
VL		○
VH		○
VR	○	
VS	○	
Main		○
SVL		○

4.2 Completion of evacuation

Procedure : Specified time (about 1 minute) after evacuating, shut the valve in the following order and stop the pump.

VC⇒VG⇒VR⇒VS

Remove the vacuum pump from the hose.

Valve state

	open	shut
VC		○
VG		○
VL		○
VH		○
VR		○
VS		○
main		○
SVL		○

4.3 Preparation for charge

Preparation: Leak check spray

Procedure: Re-check the type of refrigerant and the amount sealed.

Open the valve slowly in the order of the main valve of the refrigerant cylinder → VS → VR → VL, the indication of scale.

After stabilizing (calm down), reset the display of scale. (0 display)

Perform a leak check to the dedicated GM.

Note : Use a leak check spray (also liquid detergent is acceptable) to check the gas leak at the connection point.

Pay attention to the posture of the refrigerant cylinder when it is enclosed, depending on the structure of the cylinder, because it may be inverted or sideways.

Valve state

	open	shut
VC		○
VG		○
VL	○	
VH		○
VR	○	
VS	○	
main	○	
SVL		○

4.4 Starting gas charge

Procedure: Open SVL slowly and check that the display value of scale slowly decreases. When the specified amount approaches, start slowly closing the SVL, and when reaching the specified amount, shut the SVL. (Please note that there is a time lag between SVL closing operation and display of scale responding to it) Record the final charge amount and shut the main valve of the refrigerant cylinder → VS → VR → VL.

Note: Instead of SVL, VS can be opened and shut to adjust the gas filling amount, but the accuracy of filling quantity is bad. In that case, it is necessary to operate the body compressor and suck in the refrigerant from SVL to VS

valve state

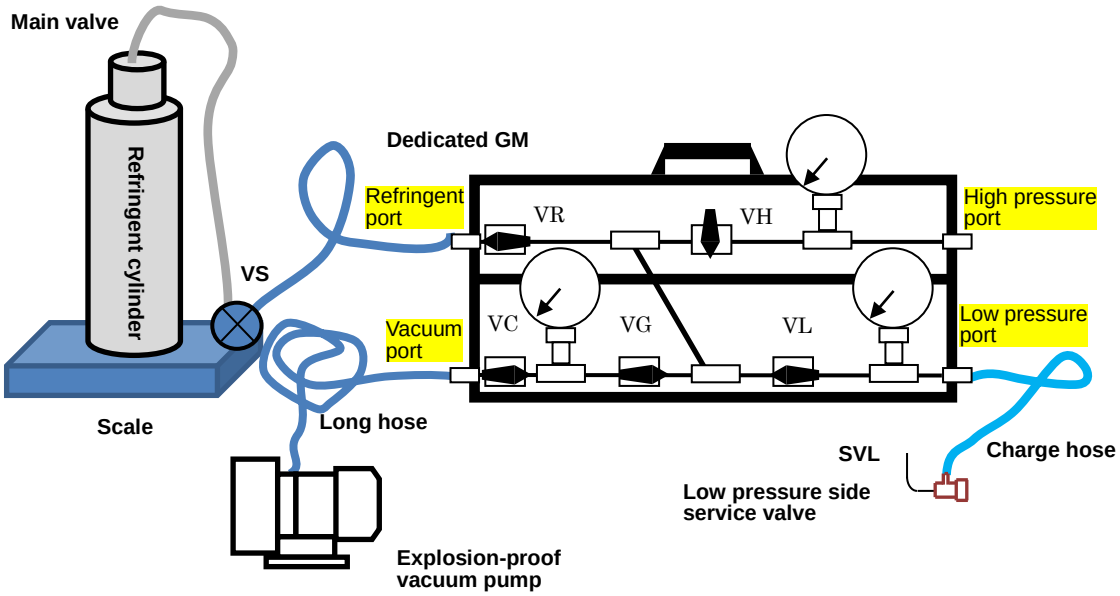
	open	shut
VC		○
VG		○
VL	○	
VH		○
VR	○	
VS	○	
main	○	
SVL	adjustment	

4.5 Stop gas charge

Preparations : Tools, Explosion-proof vacuum pump

Procedure : As shown in the figure below, let the long hose outdoors and connect the explosion-proof vacuum pump. Activate the pump, open the valves (VC, VG, VL, VR, VS) and suck out the remaining refrigerant of the hose / general purpose GM.

When release of the refrigerant is completed, shut all the valves and stop the pump. Remove the hose from the low pressure service valve.

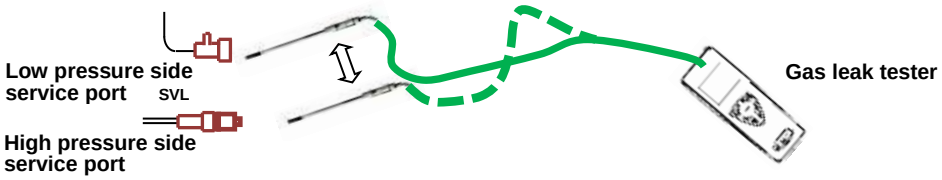


Note : Be sure to use explosion-proof type when using vacuum pump to suck refrigerant.
Do not use the powerful vacuum pump used for evacuation by mistake.

4.6 Gas leak check

Preparation : Detector

Procedure : Leak check low pressure service valve with charge hose removed using detector. Subsequently, the high pressure side service port and the part welded and connected at the time of repair are likewise leak checked. If there is no abnormality, attach the cap to the low-pressure side service valve and the high-pressure side service port



Note : Do not apply excessive force to the welded portion of piping when installing the rear cover after the work (prevent occurrence of cracks).

■L（low temperature）cooling circuit

The work content on the low temperature side is work on the high temperature side 3.3 After completing vacuum evacuation, work to enclose pentane is added. After that, work from the work of vacuum evacuation ② in the same procedure as the high temperature side.

Describe additional pentane inclusion work below.

4.7 Enclosed in pentane

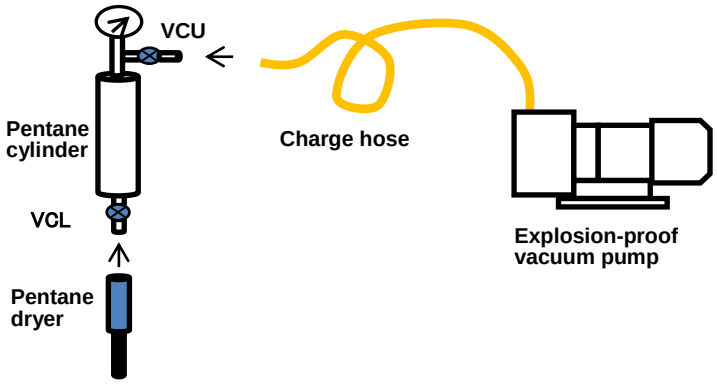
4.7.1 Pentane collection

Preparation : Pentane charging cylinder, n-pentane, pentane dryer, explosion-proof vacuum pump, charge hose, branching instrument, tool

Procedure1 : Prepare the pentane, reconfirm the enclosed amount and convert the "weight ⇒ scale" using the conversion table.

Attach a pentane dryer to the tip of the valve VCL of the pentane cylinder and connect the tip of the valve VCU to the vacuum pump with a charge hose. (At this time, VCU is "open", VCL is "shut" state)

Operate the vacuum pump and evacuate it to a state where pentane solution can be injected. (About 1 minute)



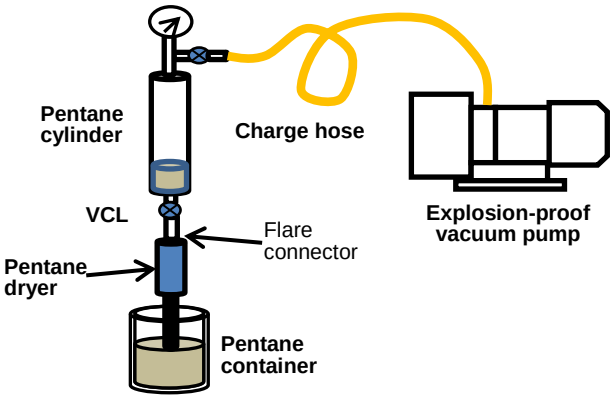
n-pentane

Note1: Because pentane vapor is generated, use an explosion-proof vacuum pump. The pentane dryer has the function of removing the same moisture as the dehydrator.

Procedure2: Dip the tip of the pentane dryer in pentane solution.

With the VCU opened slightly, opening the VCL slowly will cause the pentane to begin to be sucked into the cylinder.

When the specified amount of pentane is sucked into the cylinder, pull out of pentane ends when VCL is "shut". Shut the VCU, shut down the vacuum pump, remove the charge hose from the VCU, and remove the pentane dryer from the VCL.



Note2: When sucking up pentane, in order to prevent over suction, VCL slowly gently opens and shut and adjusts the suction amount.

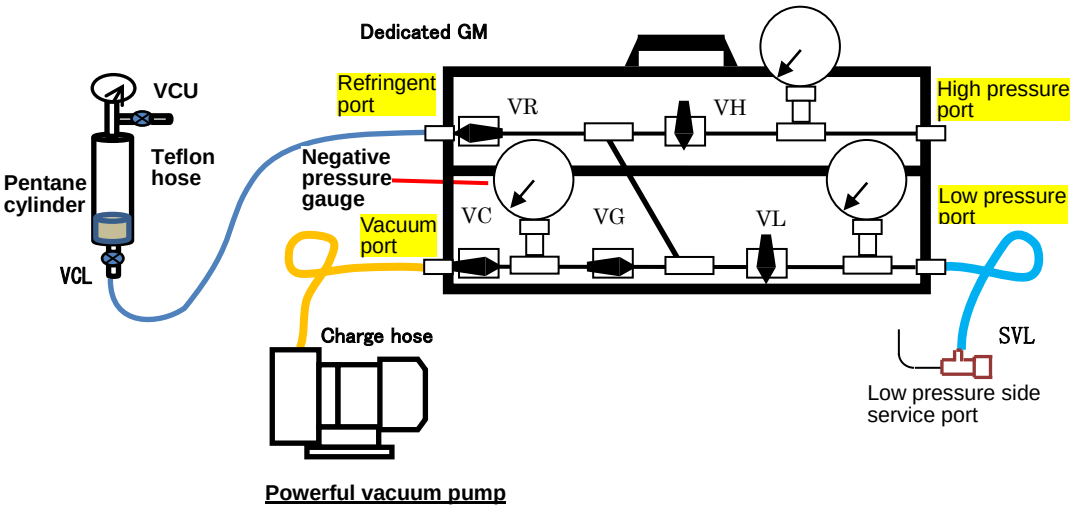
Remove the pentane solution from the tip of the pentane dryer for a while, so remove the pentane dryer from the pentane cylinder and remove it from the pentane container after all the pentane has fallen.

4.7.2 Charge pentane to refrigeration circuit

Preparations : Powerful vacuum pump, Teflon hose (for pentane)

Procedure: With the VR shut, connect the valve VCL of the pentane cylinder with the refrigerant port of the dedicated GM with a Teflon hose.

Operate the vacuum pump, open the valves VC, VG, VR and evacuate the Teflon hose.



Valve Operation

	open	shut
VC	○	
VG	○	
VL		○
VH		○
VR	○	
VCU		○
VCL		○
SVL		○

Note 1: In order to prevent corrosion of hose by pentane and flow into service valve, be sure to use Teflon hose for connection between pentane cylinder and dedicated GM.

Procedure 2: Shut the valves VC and VG, then open the valve VL.

Holding the pentane cylinder vertically, slowly open the VCL and aspirate the pentane into the circuit.

At this time, pull in while watching the guide of the cylinder and stop the VCL when it reaches the specified amount (stop position).

Be sure to stop with the pentane remaining in the cylinder.

Confirm that there is no pentane left in Teflon hose and shut all valves.

Remove the Teflon hose and return the remaining pentane to the container.

Valve Operation

	open	shut
VC		○
VG		○
VL	○	○
VH		○
VR	○	
VCU		○
VCL	adjustment	
SVL	○	

Note2: If the cylinder becomes empty beyond the specified amount, the air will enter the refrigeration circuit, so be sure to stop with the pentane remaining.

4.7.3 After pentane circuit enclosure, just like high temperature side work, 4. Perform gas charge work.

Note 1 : Paste the new service pipe label (red tag) again near the original pasting position.
Leave the service valve without removing it.
This operation is PA only. It is unnecessary for other destinations.

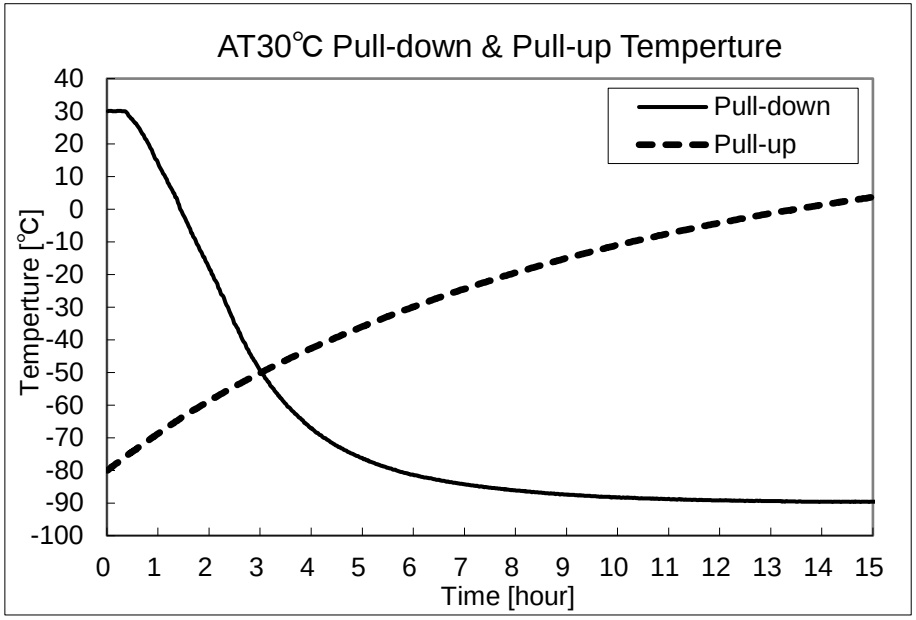
Note 2 : Do not apply excessive force to the welded part of piping (prevention of cracking) when installing the rear cover after the work is finished.

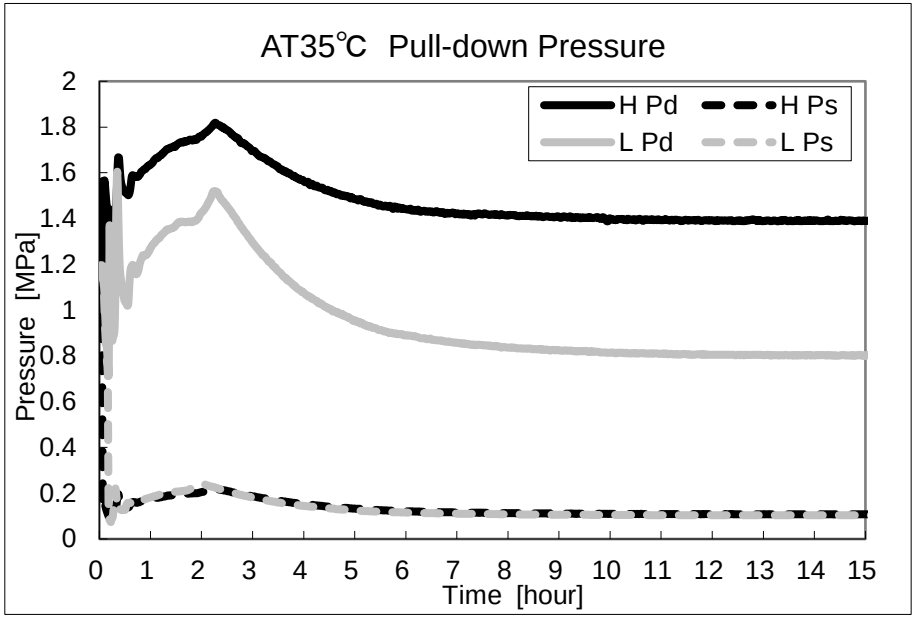
Confirm operation as final confirmation

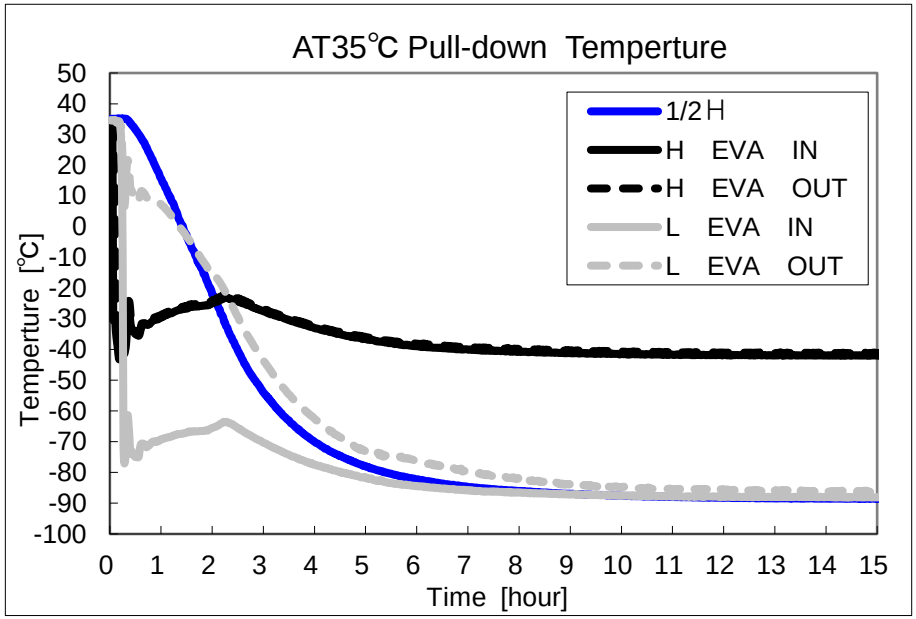
Turn on the freezer and check the operation

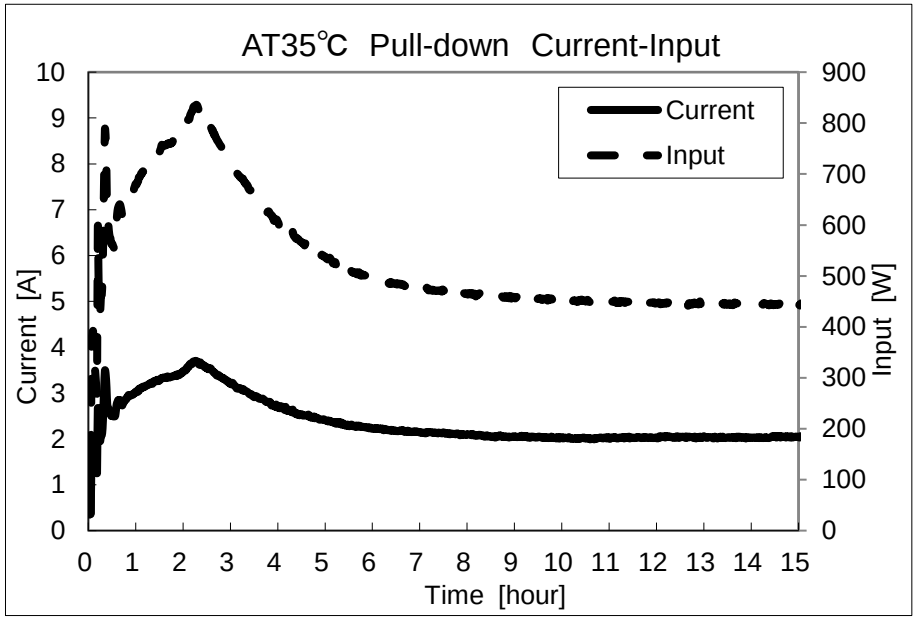
Test Data

MDF-DU502VH（1φ230V 50Hz）

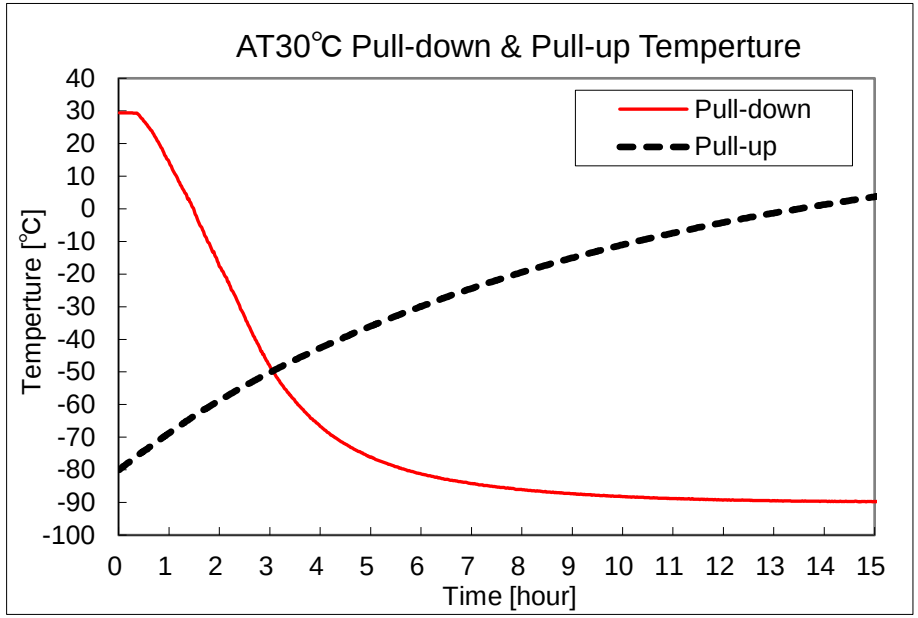


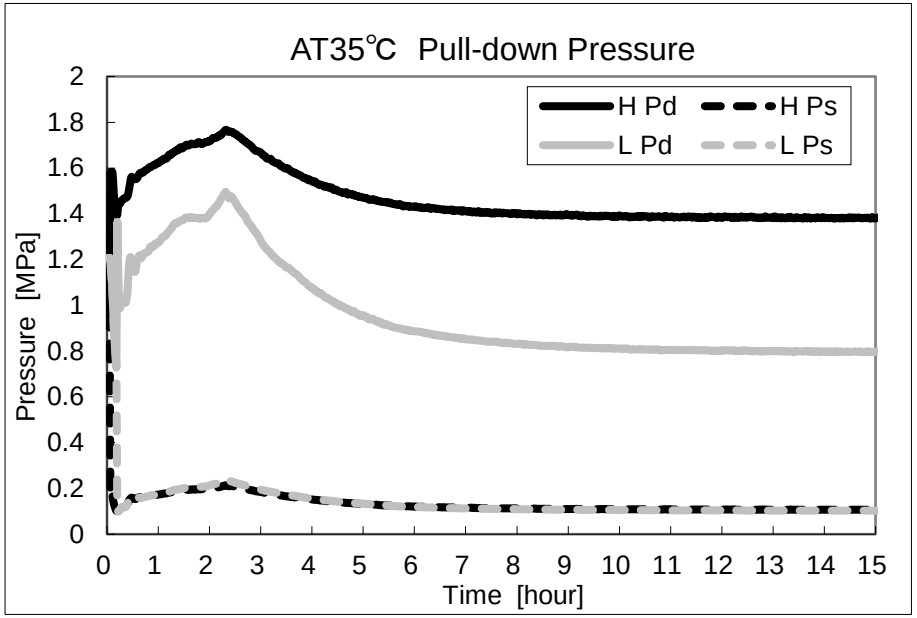


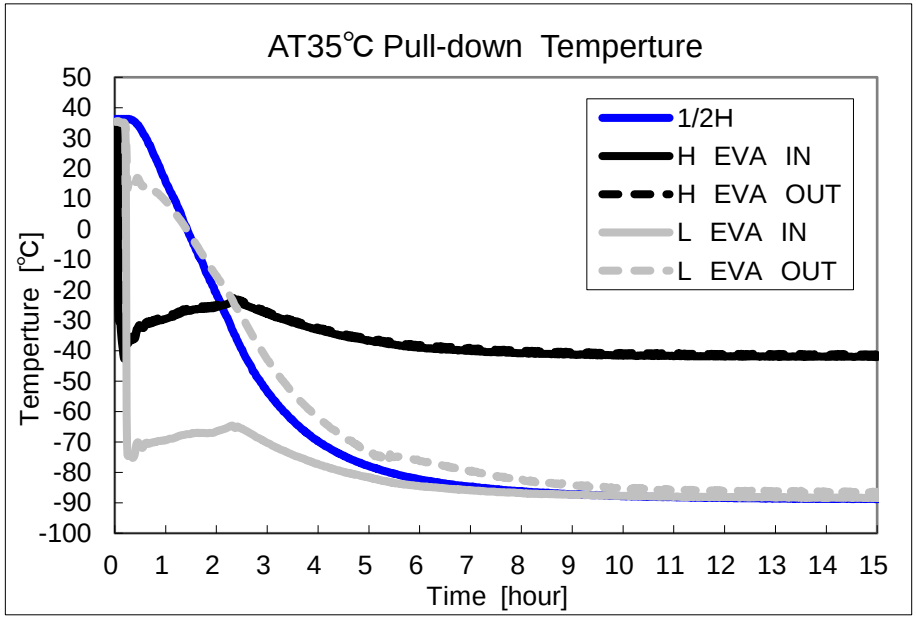


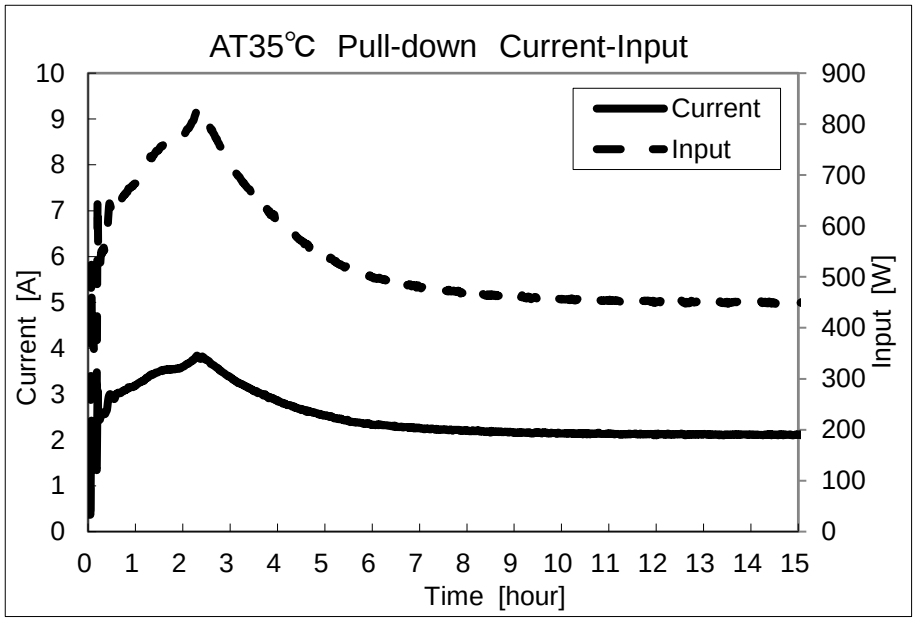


MDF-DU502VH（1φ220V 60Hz）

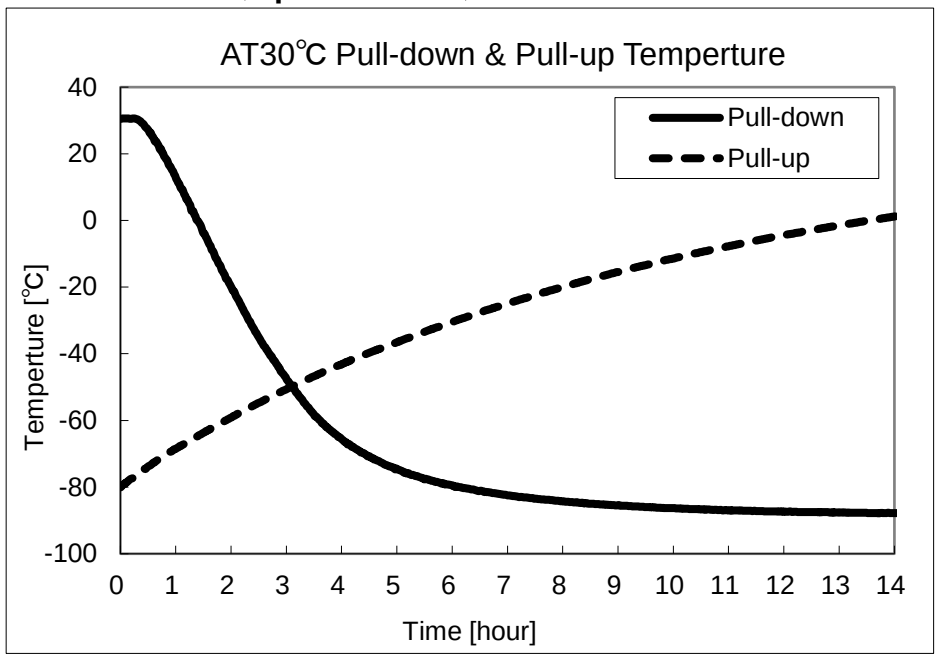


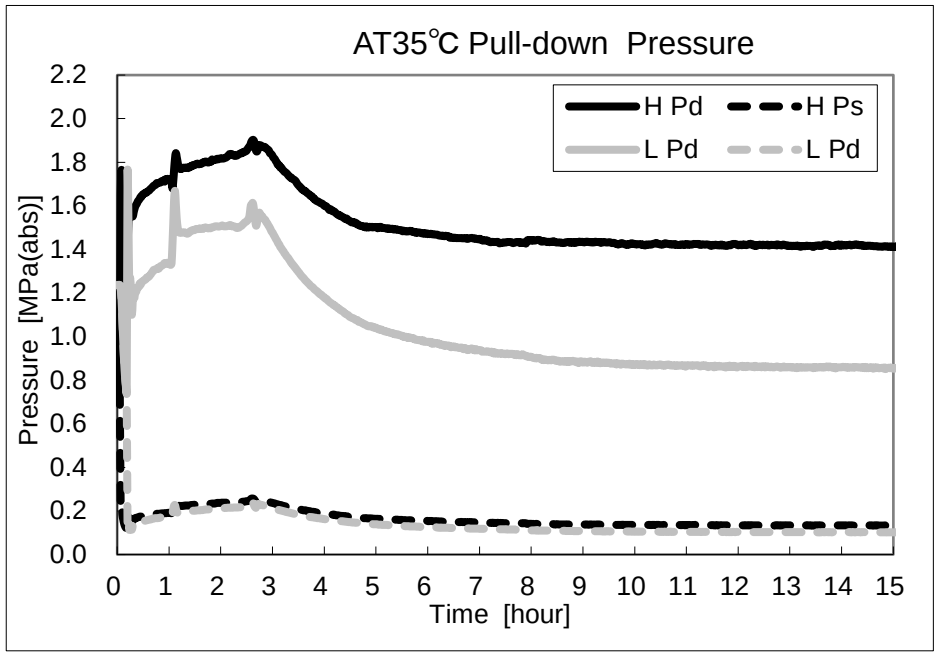


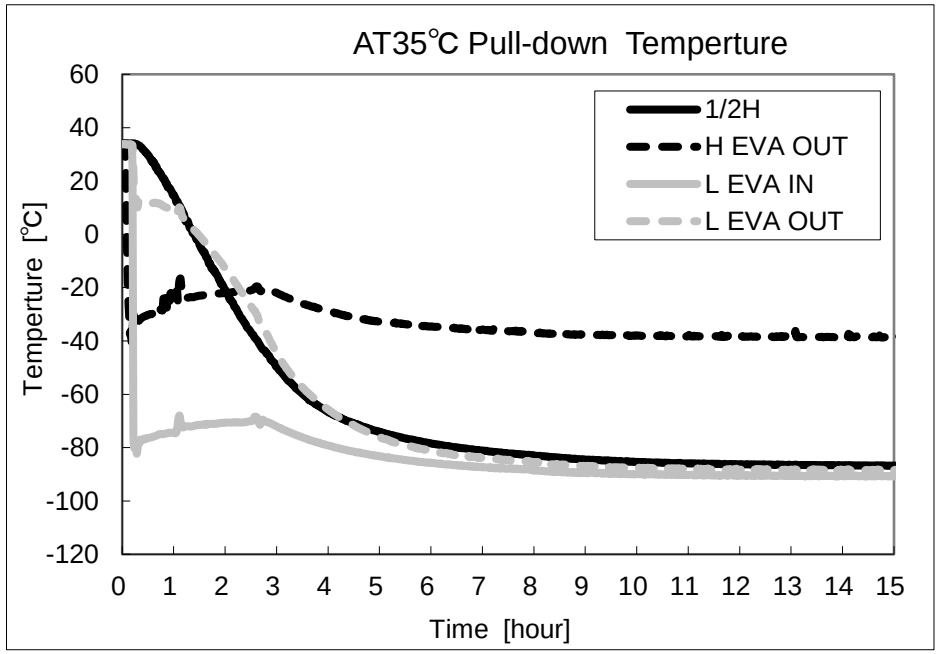


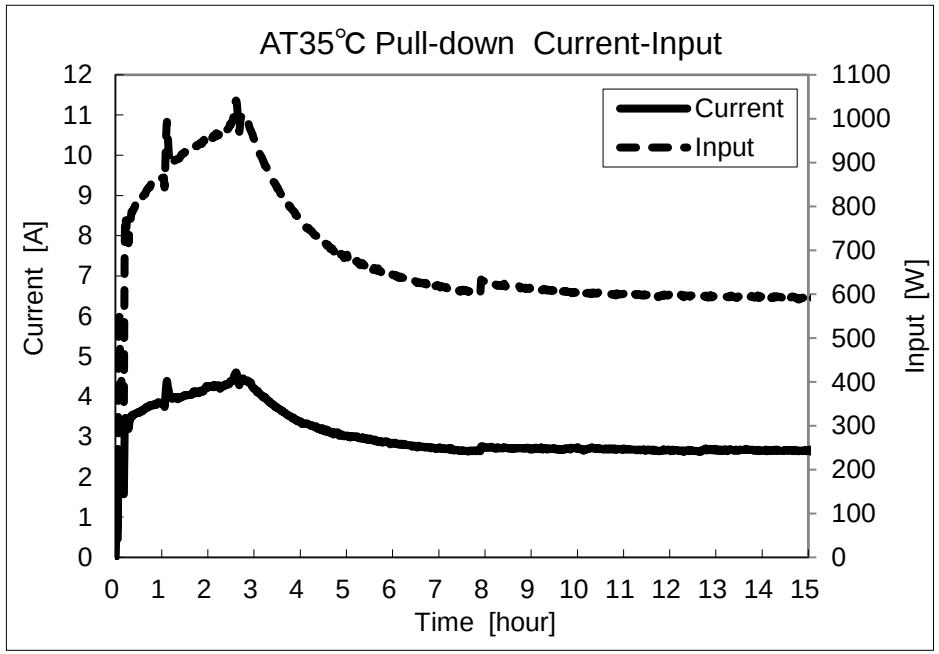


MDF-DU702VH（1φ230V 50Hz）

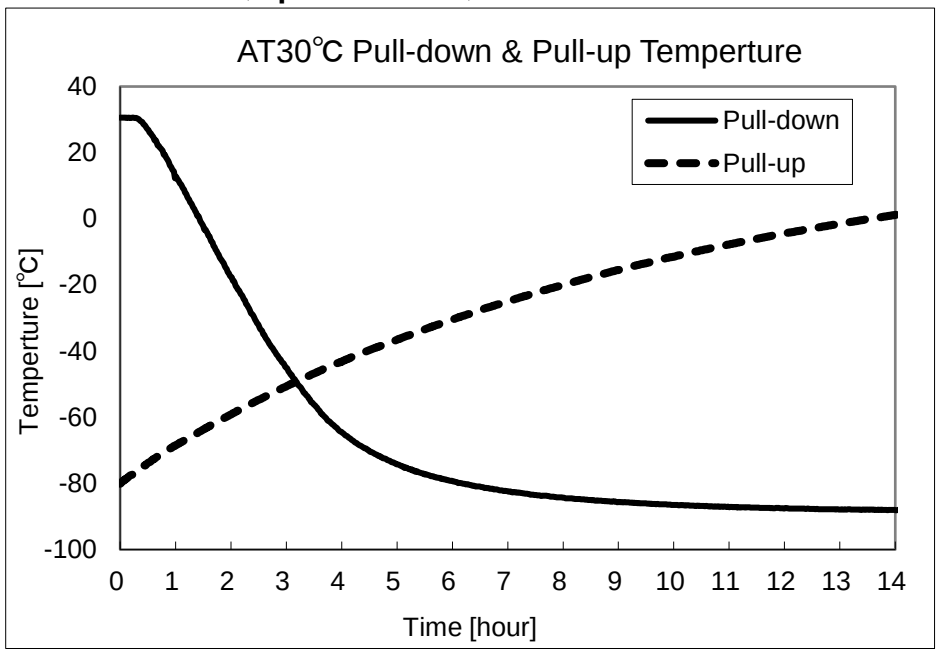


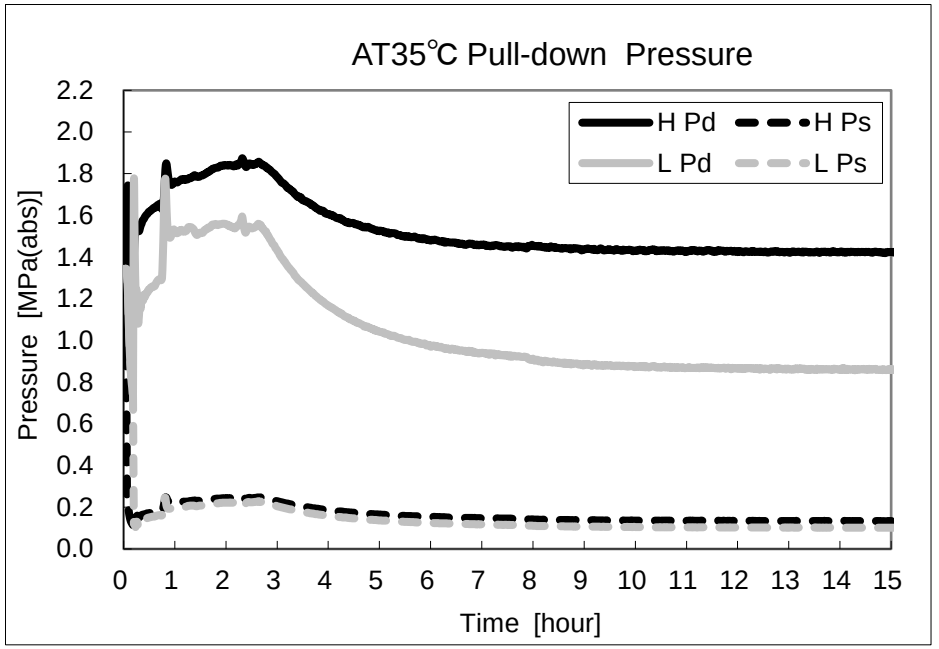


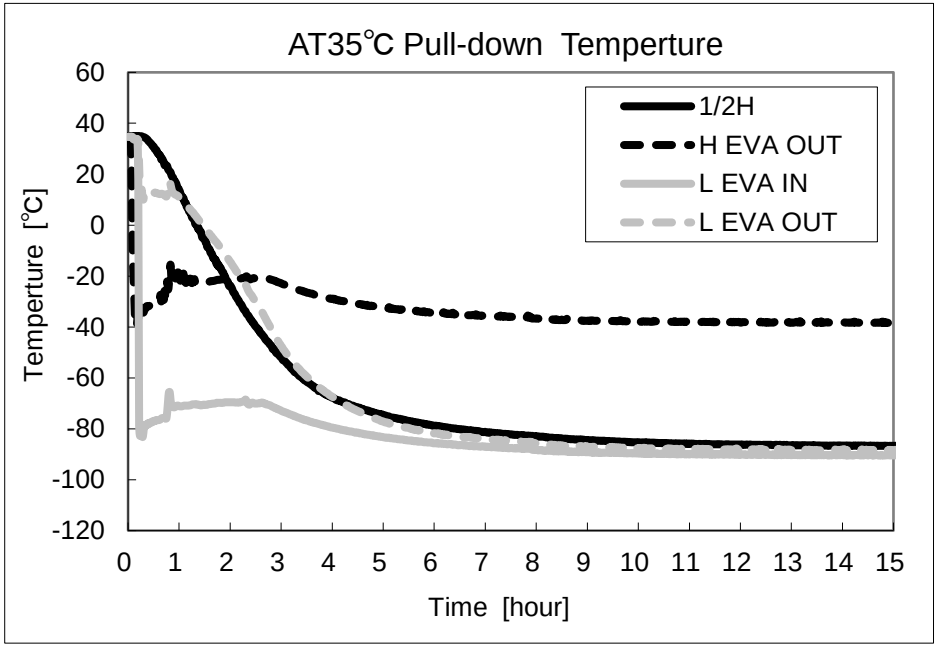


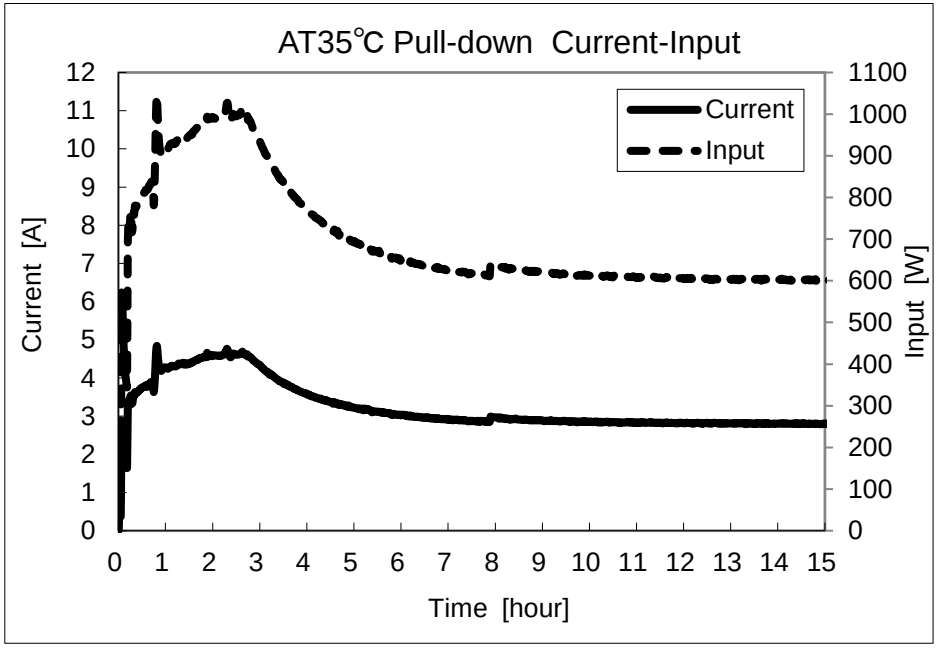


MDF-DU702VH（1φ220V 60Hz）

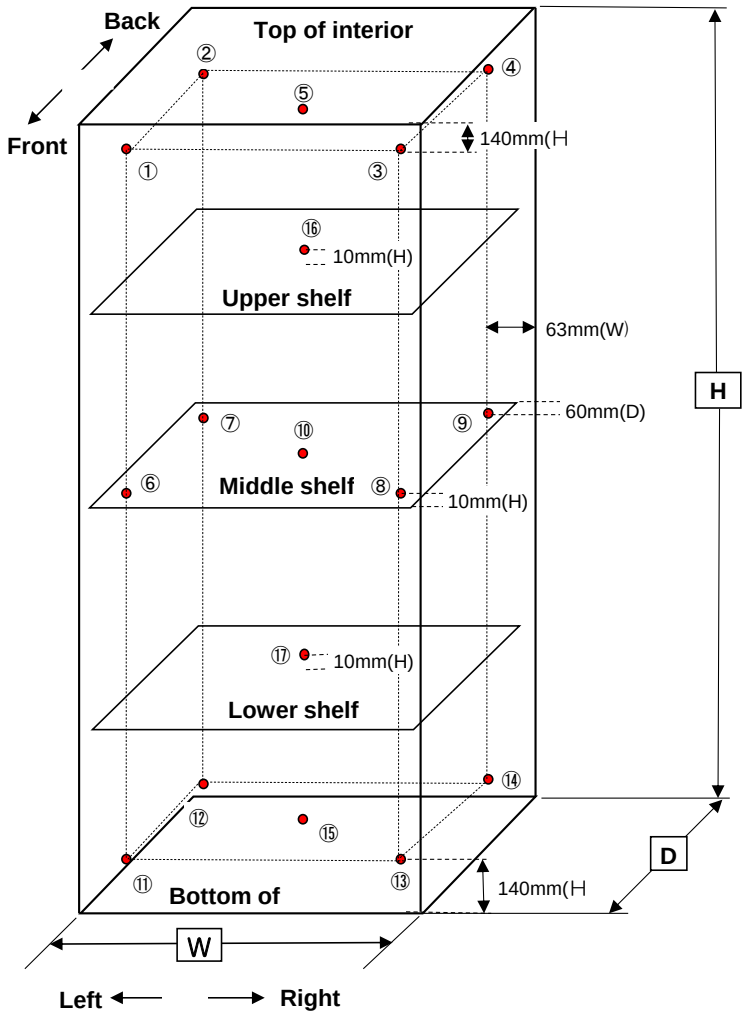








Temperature uniformity - 17points measuring
MDF-DU502VH



Upper area measuring points

①~④: 140mm(H) from the top of interior
60mm(D) and 63mm(W) from each corners of the interior.

⑤: 140mm(H) from the top of interior

⑯: 10mm(H) from the upper shelf

Middle area measuring points

⑥~⑨: 10mm(H), 60mm(D),63mm(W) from each corner of the interior.

⑩: 10mm(H) from the middle shelf

Bottom area measuring points

⑪~⑭: 140mm(H) from the bottom of interior
60mm(D) and 63mm(W) from each corner of the interior.

⑮ 140mm(H) from the bottom of interior

⑰: 10mm(H) from the lower shelf

Internal Temperature Uniformity (Reference Data)
MDF-DU502VH
＜Conditions＞
Ambient temperature: 23/30℃
Load: Unloaded

＜Distribution data＞
Temperature of the cycle in each area（**SV=−80℃**、air temperature）

Unit:℃

			Ambient temperature 23℃							
			230V,50Hz				220V,**60Hz**			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−77.0	−79.6	−78.3	±1.3	−76.9	−79.6	−78.3	±1.4
②		Left back	−77.2	−80.1	−78.7	±1.5	−77.1	−80.0	−78.6	±1.5
③		Right front	−77.4	−80.0	−78.7	±1.3	−77.4	−79.9	−78.7	±1.3
④		Right back	−77.3	−79.9	−78.6	±1.3	−77.2	−79.8	−78.5	±1.3
⑤		Center	−77.2	−79.5	−78.4	±1.2	−77.1	−79.5	−78.3	±1.2
⑥	Middle area	Left front	−79.8	−80.9	−80.4	±0.5	−79.8	−80.8	−80.3	±0.5
⑦		Left back	−80.3	−81.6	−81.0	±0.6	−80.3	−81.6	−81.0	±0.6
⑧		Right front	−79.7	−81.0	−80.4	±0.6	−79.8	−80.8	−80.3	±0.5
⑨		Right back	−80.2	−81.7	−81.0	±0.8	−80.2	−81.5	−80.9	±0.6
⑩		Center	−80.4	−81.1	−80.8	±0.4	−80.4	−81.0	−80.7	±0.3
⑪	Bottom area	Left front	−78.7	−80.6	−79.7	±1.0	−78.7	−80.4	−79.6	±0.9
⑫		Left back	−79.1	−81.2	−80.2	±1.1	−79.1	−81.1	−80.1	±1.0
⑬		Right front	−79.2	−81.2	−80.2	±1.0	−79.2	−81.1	−80.2	±1.0
⑭		Right back	−79.2	−81.5	−80.4	±1.2	−79.3	−81.4	−80.4	±1.1
⑮		Center	−79.1	−81.3	−80.2	±1.1	−79.1	−81.1	−80.1	±1.0
⑯	Center of Upper shelf		−79.3	−80.1	−79.7	±0.4	−79.3	−80.0	−79.7	±0.3
⑰	Center of Lower shelf		−80.5	−81.3	−80.9	±0.4	−80.5	−81.1	−80.8	±0.3
Average			−	−	−79.8	−	−	−	−79.8	−

Unit:℃

			Ambient temperature 30℃							
			230V,50Hz				220V,**60Hz**			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−76.7	−79.4	−78.1	±1.4	−76.8	−79.5	−78.2	±1.3
②		Left back	−76.9	−79.9	−78.4	±1.5	−77.0	−80.0	−78.5	±1.5
③		Right front	−77.2	−79.8	−78.5	±1.3	−77.2	−79.8	−78.5	±1.3
④		Right back	−77.0	−79.7	−78.4	±1.4	−77.1	−79.8	−78.5	±1.4
⑤		Center	−76.9	−79.3	−78.1	±1.2	−77.1	−79.4	−78.3	±1.2
⑥	Middle area	Left front	−79.8	−81.1	−80.5	±0.6	−79.8	−81.1	−80.5	±0.6
⑦		Left back	−80.4	−81.7	−81.1	±0.6	−80.3	−81.8	−81.1	±0.8
⑧		Right front	−79.8	−81.0	−80.4	±0.6	−79.7	−80.9	−80.3	±0.6
⑨		Right back	−80.3	−81.7	−81.0	±0.7	−80.3	−81.7	−81.0	±0.7
⑩		Center	−80.5	−81.2	−80.9	±0.4	−80.5	−81.2	−80.9	±0.4
⑪	Bottom area	Left front	−79.1	−81.2	−80.2	±1.1	−79.2	−81.2	−80.2	±1.0
⑫		Left back	−79.4	−81.5	−80.5	±1.1	−79.5	−81.5	−80.5	±1.0
⑬		Right front	−79.5	−81.4	−80.5	±1.0	−79.6	−81.4	−80.5	±0.9
⑭		Right back	−79.6	−81.8	−80.7	±1.1	−79.6	−81.8	−80.7	±1.1
⑮		Center	−79.5	−81.6	−80.6	±1.1	−79.5	−81.6	−80.6	±1.1
⑯	Center of Upper shelf		−79.3	−80.0	−79.7	±0.3	−79.3	−80.0	−79.7	±0.3
⑰	Center of Lower shelf		−80.7	−81.5	−81.1	±0.4	−80.8	−81.5	−81.2	±0.3
Average			−	−	−79.9	−	−	−	−79.9	−

Note:This data does not represent a guarantee of product performance.

＜Amount of power consumption＞
Amount of power consumption when driving at cycle

(SV=−80℃) Unit:kWh/day

	230V,50Hz	220V,60Hz
AT23℃	6.70	6.80
AT30℃	7.80	7.90

Note:This data does not represent a guarantee of product performance.

＜Distribution data＞
Temperature of the cycle in each area（**SV=−70℃**、air temperature）

Unit:℃

			Ambient temperature 23℃							
			230V,50Hz				220V,**60Hz**			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−67.3	−70.4	−68.9	±1.6	−67.2	−70.5	−68.9	±1.7
②		Left back	−67.5	−71.1	−69.3	±1.8	−67.5	−71.1	−69.3	±1.8
③		Right front	−67.4	−70.6	−69.0	±1.6	−67.5	−70.6	−69.1	±1.6
④		Right back	−67.4	−70.6	−69.0	±1.6	−67.5	−70.6	−69.1	±1.6
⑤		Center	−67.3	−70.6	−69.0	±1.7	−67.3	−70.6	−69.0	±1.7
⑥	Middle area	Left front	−69.3	−71.0	−70.2	±0.9	−69.3	−70.9	−70.1	±0.8
⑦		Left back	−70.0	−71.7	−70.9	±0.9	−69.9	−71.8	−70.9	±0.9
⑧		Right front	−69.2	−70.8	−70.0	±0.8	−69.2	−70.8	−70.0	±0.8
⑨		Right back	−70.0	−71.9	−71.0	±1.0	−69.9	−71.9	−70.9	±1.0
⑩		Center	−70.1	−71.1	−70.6	±0.5	−70.2	−71.1	−70.7	±0.5
⑪	Bottom area	Left front	−67.4	−69.6	−68.5	±1.1	−67.4	−69.5	−68.5	±1.1
⑫		Left back	−68.0	−70.3	−69.2	±1.2	−68.0	−70.2	−69.1	±1.1
⑬		Right front	−67.7	−69.8	−68.8	±1.1	−67.6	−69.6	−68.6	±1.0
⑭		Right back	−68.1	−70.6	−69.4	±1.3	−68.1	−70.5	−69.3	±1.2
⑮		Center	−67.6	−69.8	−68.7	±1.1	−67.6	−69.6	−68.6	±1.0
⑯	Center of Upper shelf		−69.5	−70.6	−70.1	±0.6	−69.5	−70.5	−70.0	±0.5
⑰	Center of Lower shelf		−69.5	−70.5	−70.0	±0.5	−69.5	−70.5	−70.0	±0.5
Average			−	−	−69.5	−	−	−	−69.5	−

Unit:℃

			Ambient temperature 30℃							
			230V,50Hz				220V,**60Hz**			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−67.0	−70.1	−68.6	±1.6	−67.0	−70.1	−68.6	±1.6
②		Left back	−67.3	−70.7	−69.0	±1.7	−67.3	−70.7	−69.0	±1.7
③		Right front	−67.4	−70.4	−68.9	±1.5	−67.3	−70.5	−68.9	±1.6
④		Right back	−67.3	−70.4	−68.9	±1.6	−67.3	−70.4	−68.9	±1.6
⑤		Center	−67.1	−70.3	−68.7	±1.6	−67.1	−70.3	−68.7	±1.6
⑥	Middle area	Left front	−69.4	−71.0	−70.2	±0.8	−69.4	−71.0	−70.2	±0.8
⑦		Left back	−70.1	−71.7	−70.9	±0.8	−70.1	−71.7	−70.9	±0.8
⑧		Right front	−69.4	−70.7	−70.1	±0.6	−69.4	−70.8	−70.1	±0.7
⑨		Right back	−70.0	−71.8	−70.9	±0.9	−70.1	−71.8	−71.0	±0.8
⑩		Center	−70.2	−71.0	−70.6	±0.4	−70.2	−71.0	−70.6	±0.4
⑪	Bottom area	Left front	−67.4	−69.4	−68.4	±1.0	−67.4	−69.4	−68.4	±1.0
⑫		Left back	−68.0	−70.2	−69.1	±1.1	−68.0	−70.2	−69.1	±1.1
⑬		Right front	−67.8	−69.8	−68.8	±1.0	−67.8	−69.8	−68.8	±1.0
⑭		Right back	−68.2	−70.7	−69.5	±1.3	−68.0	−70.7	−69.4	±1.4
⑮		Center	−67.7	−69.9	−68.8	±1.1	−67.7	−69.8	−68.8	±1.1
⑯	Center of Upper shelf		−69.4	−70.4	−69.9	±0.5	−69.4	−70.4	−69.9	±0.5
⑰	Center of Lower shelf		−69.7	−70.7	−70.2	±0.5	−69.7	−70.6	−70.2	±0.5
Average			−	−	−69.5	−	−	−	−69.5	−

Note:This data does not represent a guarantee of product performance.

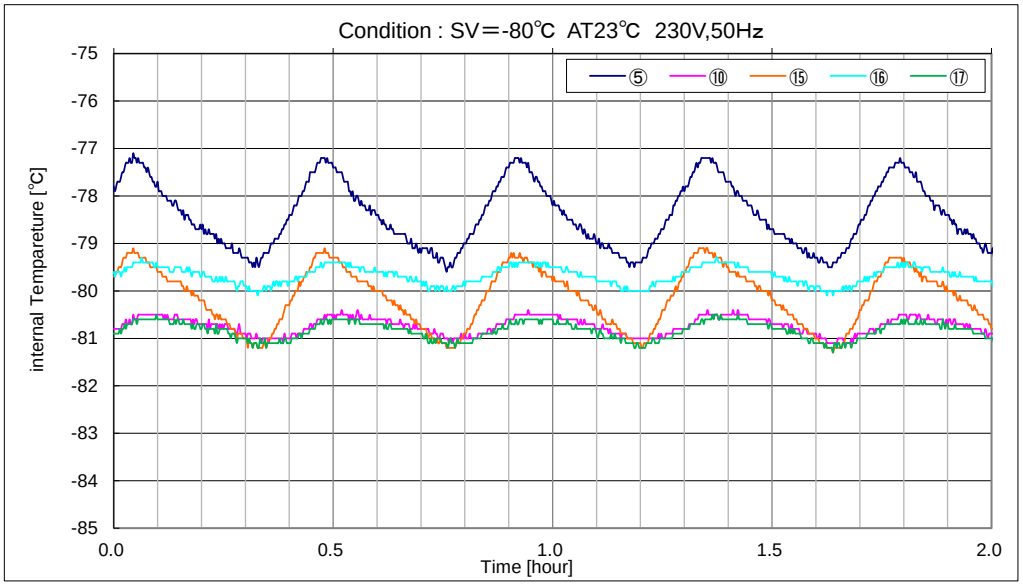
＜Amount of power consumption＞
Amount of power consumption when driving at cycle

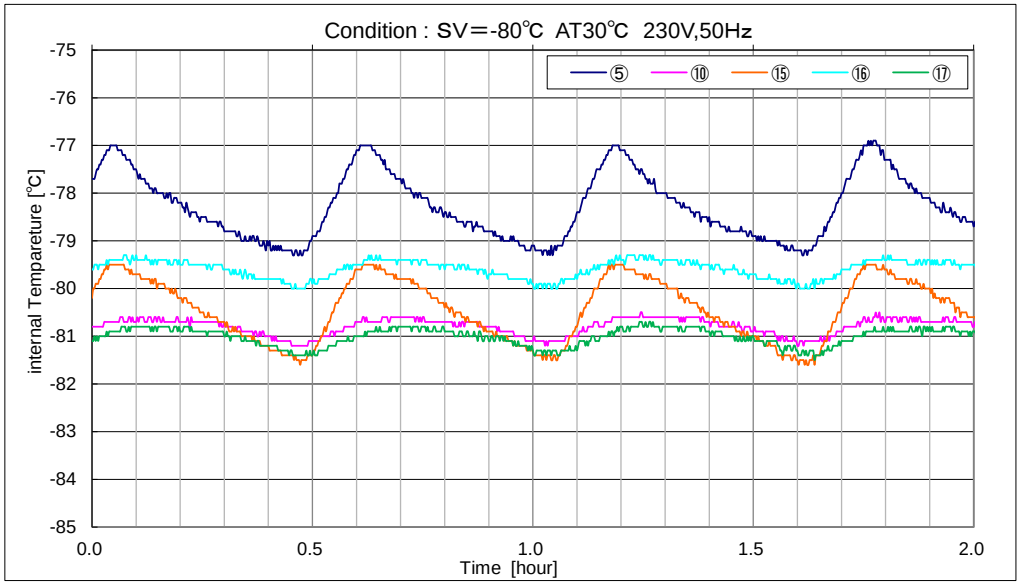
(SV=−70℃) Unit:kWh/day

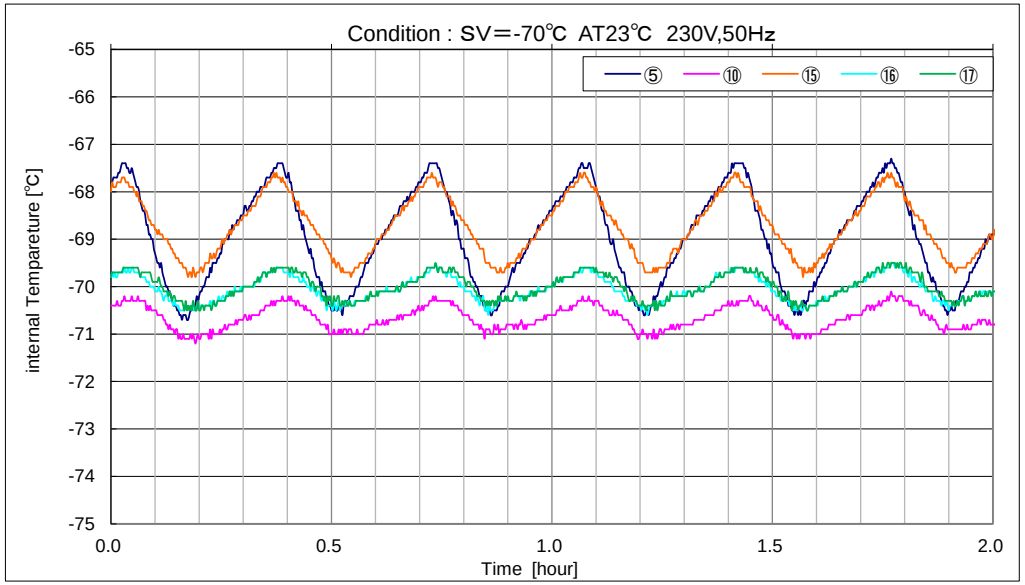
	230V,50Hz	220V,60Hz
AT23℃	5.00	5.10
AT30℃	6.20	6.30

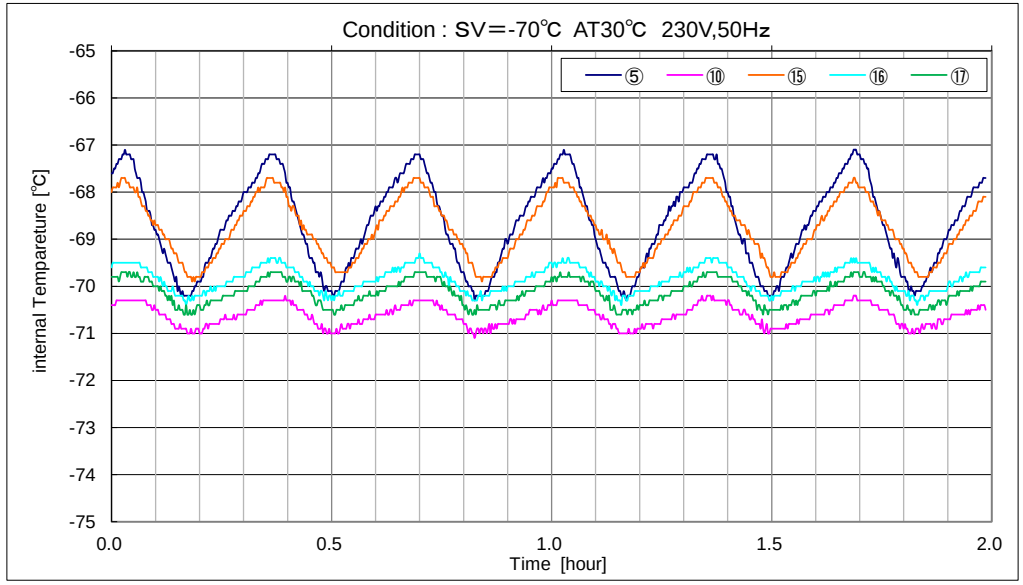
Note:This data does not represent a guarantee of product performance.

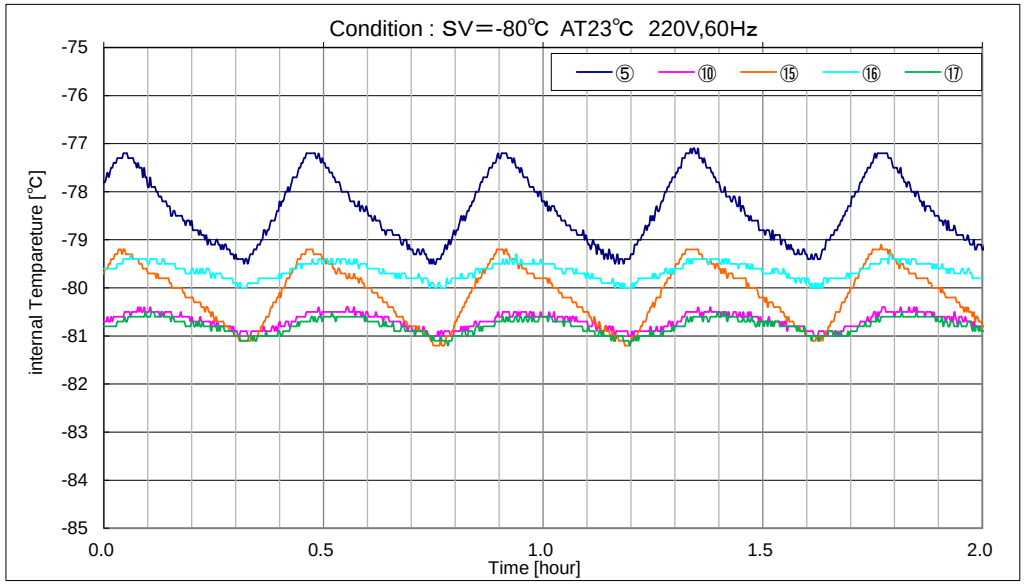
Running Cycle
MDF-DU502VH

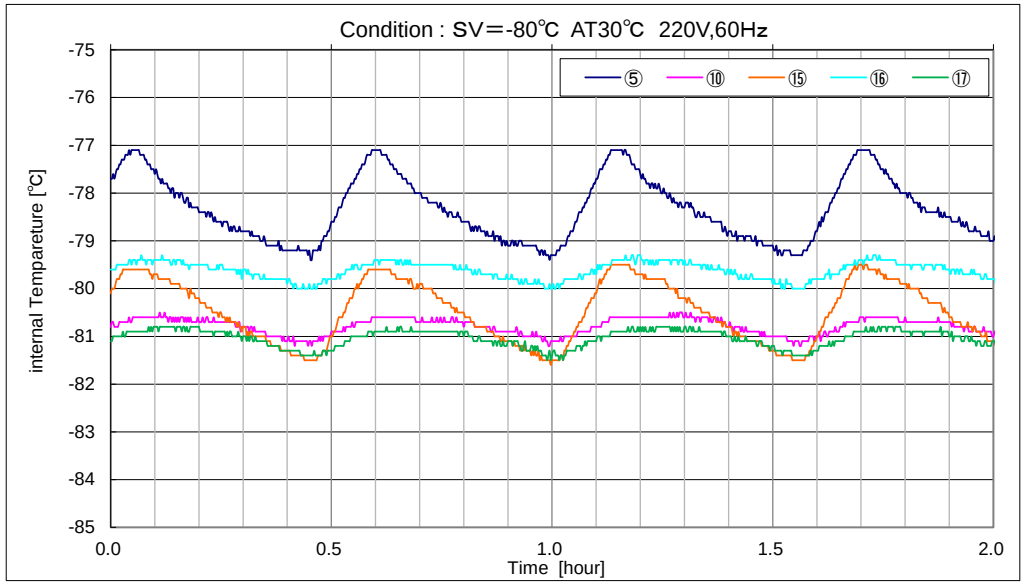


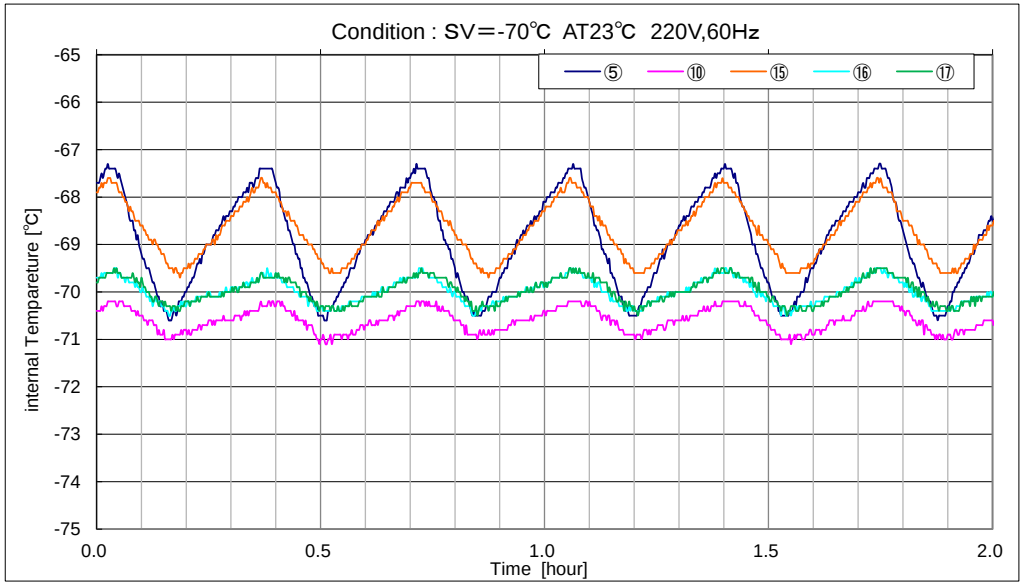


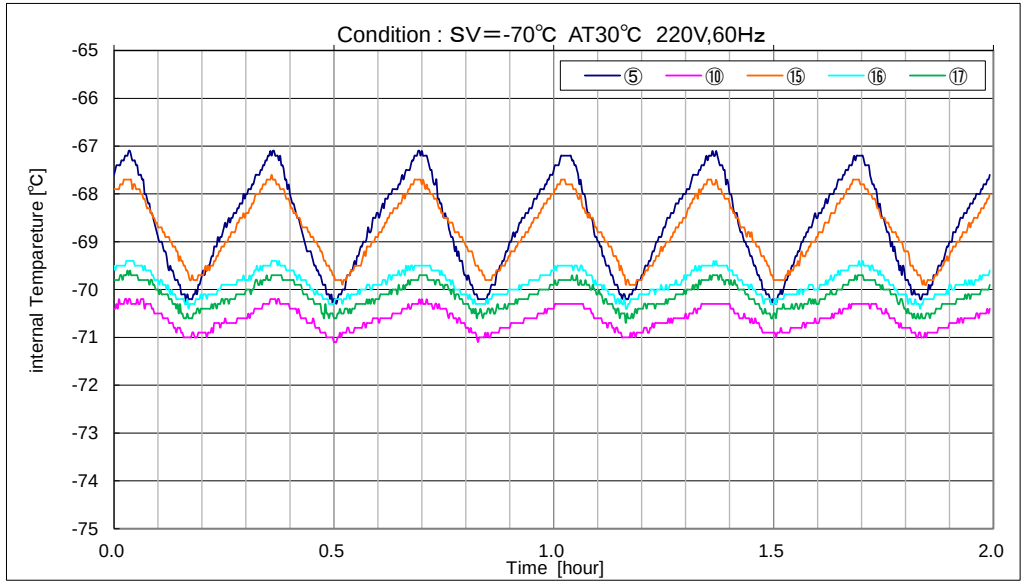




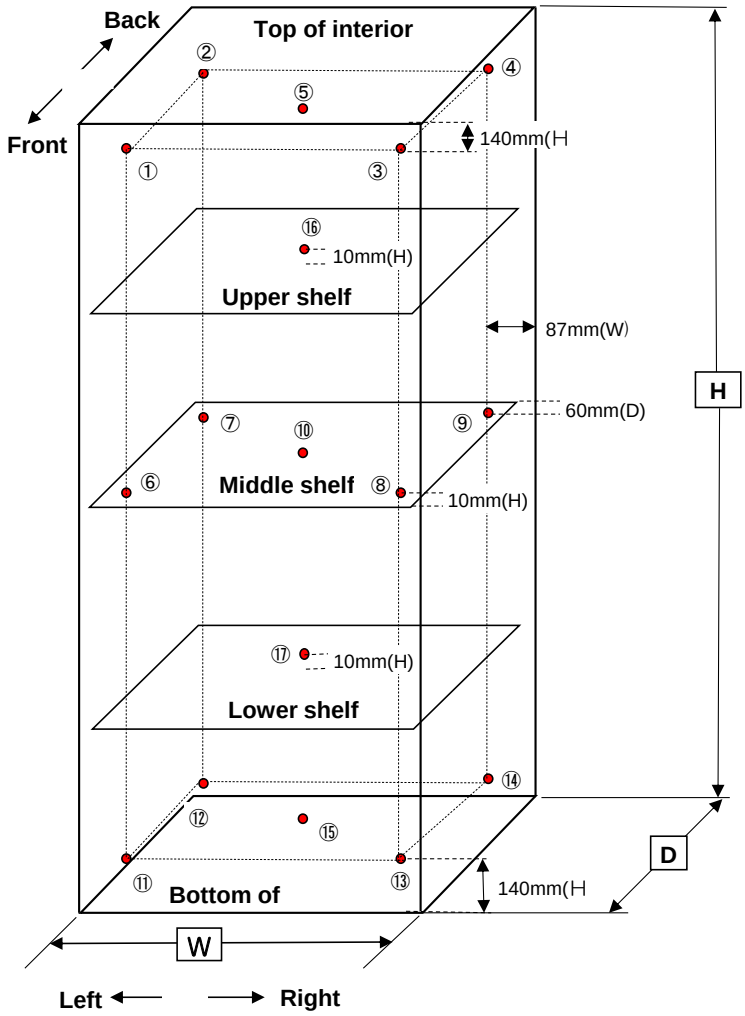

Condition : SV=-80℃ AT23℃ 220V,60Hz
⑤ ⑩ ⑮ ⑯ ⑰
internal Tempareture [℃]
-75 -76 -77 -78 -79 -80 -81 -82 -83 -84 -85
0.0 0.5 1.0 1.5 2.0
Time [hour]


Condition : SV=-80℃ AT30℃ 220V,60Hz
⑤ ⑩ ⑮ ⑯ ⑰
internal Tempareture [℃]
-75 -76 -77 -78 -79 -80 -81 -82 -83 -84 -85
0.0 0.5 1.0 1.5 2.0
Time [hour]


Condition : SV=-70℃ AT23℃ 220V,60Hz
⑤ ⑩ ⑮ ⑯ ⑰
internal Tempareture [℃]
-65 -66 -67 -68 -69 -70 -71 -72 -73 -74 -75
0.0 0.5 1.0 1.5 2.0
Time [hour]


Condition : SV=-70℃ AT30℃ 220V,60Hz
⑤ ⑩ ⑮ ⑯ ⑰
internal Tempareture [℃]
-65 -66 -67 -68 -69 -70 -71 -72 -73 -74 -75
0.0 0.5 1.0 1.5 2.0
Time [hour]

Temperature uniformity - 17points measuring
MDF-DU702VH



Upper area measuring points

①~④: 140mm(H) from the top of interior
60mm(D) and 87mm(W) from each corners of the interior.

⑤: 140mm(H) from the top of interior

⑯: 10mm(H) from the upper shelf

Middle area measuring points

⑥~⑨: 10mm(H), 60mm(D),87mm(W) from each corner of the interior.

⑩: 10mm(H) from the middle shelf

Bottom area measuring points

⑪~⑭: 140mm(H) from the bottom of interior
60mm(D) and 87mm(W) from each corner of the interior.

⑮ 140mm(H) from the bottom of interior

⑰: 10mm(H) from the lower shelf

Internal Temperature Uniformity (Reference Data)

MDF-DU702VH

＜Conditions＞

Ambient temperature: 23/30℃

Load: Unloaded

＜Distribution data＞

Temperature of the cycle in each area (SV=−80℃、air temperature)

Unit:℃

			Ambient temperature 23℃							
			230V 50Hz				220V 60Hz			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−76.1	−79.2	−77.7	±1.6	−76.1	−79.2	−77.7	±1.6
②		Left back	−76.7	−79.9	−78.3	±1.6	−76.7	−79.9	−78.3	±1.6
③		Right front	−76.7	−79.7	−78.2	±1.5	−76.7	−79.7	−78.2	±1.5
④		Right back	−77.0	−80.2	−78.6	±1.6	−77.1	−80.1	−78.6	±1.5
⑤		Center	−76.5	−79.5	−78.0	±1.5	−76.5	−79.5	−78.0	±1.5
⑥	Middle area	Left front	−78.9	−80.2	−79.6	±0.6	−78.9	−80.2	−79.6	±0.6
⑦		Left back	−79.1	−80.6	−79.9	±0.8	−79.0	−80.7	−79.9	±0.9
⑧		Right front	−78.9	−80.0	−79.5	±0.5	−78.9	−80.0	−79.5	±0.5
⑨		Right back	−79.2	−80.9	−80.1	±0.9	−79.3	−81.0	−80.2	±0.8
⑩		Center	−79.4	−80.5	−80.0	±0.5	−79.4	−80.5	−80.0	±0.5
⑪	Bottom area	Left front	−78.0	−80.6	−79.3	±1.3	−78.0	−80.6	−79.3	±1.3
⑫		Left back	−78.3	−80.8	−79.6	±1.3	−78.3	−80.8	−79.6	±1.3
⑬		Right front	−78.1	−80.5	−79.3	±1.2	−78.0	−80.5	−79.3	±1.3
⑭		Right back	−78.6	−81.3	−80.0	±1.4	−78.6	−81.3	−80.0	±1.4
⑮		Center	−78.5	−81.0	−79.8	±1.3	−78.5	−81.0	−79.8	±1.3
⑯	Center of Upper shelf		−78.9	−79.8	−79.4	±0.5	−78.9	−79.8	−79.4	±0.5
⑰	Center of Lower shelf		−79.8	−80.6	−80.2	±0.4	−79.9	−80.6	−80.3	±0.4
Average			−	−	−79.2	−	−	−	−79.2	−

＜Distribution data＞

Temperature of the cycle in each area (SV=−70℃、air temperature)

Unit:℃

			Ambient temperature 23℃							
			230V 50Hz				220V 60Hz			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−66.3	−70.4	−68.4	±2.1	−66.3	−70.3	−68.3	±2.0
②		Left back	−67.2	−71.5	−69.4	±2.2	−67.2	−71.5	−69.4	±2.2
③		Right front	−66.8	−70.5	−68.7	±1.9	−66.8	−70.4	−68.6	±1.8
④		Right back	−67.4	−71.6	−69.5	±2.1	−67.5	−71.5	−69.5	±2.0
⑤		Center	−67.0	−70.6	−68.8	±1.8	−67.0	−70.5	−68.8	±1.8
⑥	Middle area	Left front	−68.4	−69.8	−69.1	±0.7	−68.4	−69.8	−69.1	±0.7
⑦		Left back	−69.0	−71.1	−70.1	±1.1	−69.0	−71.1	−70.1	±1.1
⑧		Right front	−68.3	−69.7	−69.0	±0.7	−68.3	−69.7	−69.0	±0.7
⑨		Right back	−69.1	−71.4	−70.3	±1.2	−69.1	−71.3	−70.2	±1.1
⑩		Center	−69.4	−70.6	−70.0	±0.6	−69.4	−70.6	−70.0	±0.6
⑪	Bottom area	Left front	−66.6	−69.5	−68.1	±1.5	−66.6	−69.4	−68.0	±1.4
⑫		Left back	−67.5	−70.3	−68.9	±1.4	−67.5	−70.2	−68.9	±1.4
⑬		Right front	−66.5	−69.3	−67.9	±1.4	−66.5	−69.3	−67.9	±1.4
⑭		Right back	−67.4	−70.8	−69.1	±1.7	−67.3	−70.7	−69.0	±1.7
⑮		Center	−67.2	−69.9	−68.6	±1.4	−67.2	−69.8	−68.5	±1.3
⑯	Center of Upper shelf		−69.3	−70.8	−70.1	±0.8	−69.3	−70.7	−70.0	±0.7
⑰	Center of Lower shelf		−69.1	−70.2	−69.7	±0.5	−69.1	−70.1	−69.6	±0.5
Average			−	−	−69.1	−	−	−	−69.1	−

Unit:℃

			Ambient temperature 30℃							
			230V 50Hz				220V 60Hz			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−75.9	−78.9	−77.4	±1.5	−76.0	−78.9	−77.5	±1.5
②		Left back	−76.6	−79.8	−78.2	±1.6	−76.6	−79.7	−78.2	±1.6
③		Right front	−76.6	−79.4	−78.0	±1.4	−76.6	−79.4	−78.0	±1.4
④		Right back	−77.0	−80.0	−78.5	±1.5	−77.0	−79.9	−78.5	±1.5
⑤		Center	−76.4	−79.1	−77.8	±1.4	−76.3	−79.1	−77.7	±1.4
⑥	Middle area	Left front	−79.0	−80.2	−79.6	±0.6	−78.9	−80.2	−79.6	±0.6
⑦		Left back	−79.1	−80.6	−79.9	±0.8	−79.1	−80.5	−79.8	±0.7
⑧		Right front	−78.9	−80.0	−79.5	±0.5	−78.9	−80.0	−79.5	±0.5
⑨		Right back	−79.3	−80.8	−80.1	±0.8	−79.3	−80.9	−80.1	±0.8
⑩		Center	−79.5	−80.4	−80.0	±0.5	−79.5	−80.5	−80.0	±0.5
⑪	Bottom area	Left front	−78.1	−80.6	−79.4	±1.3	−78.1	−80.6	−79.4	±1.3
⑫		Left back	−78.4	−80.7	−79.6	±1.2	−78.4	−80.7	−79.6	±1.2
⑬		Right front	−78.2	−80.6	−79.4	±1.2	−78.2	−80.6	−79.4	±1.2
⑭		Right back	−78.8	−81.3	−80.1	±1.3	−78.8	−81.3	−80.1	±1.3
⑮		Center	−78.7	−81.1	−79.9	±1.2	−78.7	−81.1	−79.9	±1.2
⑯	Center of Upper shelf		−78.9	−79.7	−79.3	±0.4	−78.9	−79.7	−79.3	±0.4
⑰	Center of Lower shelf		−80.0	−80.7	−80.4	±0.4	−79.9	−80.7	−80.3	±0.4
Average			−	−	−79.2	−	−	−	−79.2	−

Note:This data does not represent a guarantee of product performance.

Unit:℃

			Ambient temperature 30℃							
			230V 50Hz				220V 60Hz			
			Maximum	Minimum	Middle of cycle	Differential	Maximum	Minimum	Middle of cycle	Differential
①	Upper area	Left front	−66.2	−70.2	−68.2	±2.0	−66.1	−70.2	−68.2	±2.1
②		Left back	−67.1	−71.4	−69.3	±2.2	−67.1	−71.4	−69.3	±2.2
③		Right front	−66.7	−70.4	−68.6	±1.9	−66.7	−70.4	−68.6	±1.9
④		Right back	−67.4	−71.5	−69.5	±2.1	−67.4	−71.5	−69.5	±2.1
⑤		Center	−66.9	−70.4	−68.7	±1.8	−66.8	−70.5	−68.7	±1.9
⑥	Middle area	Left front	−68.4	−69.7	−69.1	±0.6	−68.3	−69.8	−69.1	±0.8
⑦		Left back	−69.1	−71.1	−70.1	±1.0	−69.0	−71.1	−70.1	±1.1
⑧		Right front	−68.4	−69.7	−69.1	±0.6	−68.3	−69.7	−69.0	±0.7
⑨		Right back	−69.2	−71.3	−70.3	±1.1	−69.1	−71.4	−70.3	±1.2
⑩		Center	−69.5	−70.7	−70.1	±0.6	−69.4	−70.7	−70.1	±0.6
⑪	Bottom area	Left front	−66.7	−69.7	−68.2	±1.5	−66.8	−69.7	−68.3	±1.5
⑫		Left back	−67.5	−70.4	−69.0	±1.5	−67.5	−70.4	−69.0	±1.5
⑬		Right front	−66.6	−69.5	−68.1	±1.5	−66.6	−69.5	−68.1	±1.5
⑭		Right back	−67.5	−70.9	−69.2	±1.7	−67.4	−70.8	−69.1	±1.7
⑮		Center	−67.3	−70.1	−68.7	±1.4	−67.3	−70.1	−68.7	±1.4
⑯	Center of Upper shelf		−69.2	−70.7	−70.0	±0.8	−69.2	−70.7	−70.0	±0.8
⑰	Center of Lower shelf		−69.2	−70.2	−69.7	±0.5	−69.2	−70.2	−69.7	±0.5
Average			−	−	−69.1	−	−	−	−69.1	−

Note:This data does not represent a guarantee of product performance.

＜Amount of power consumption＞

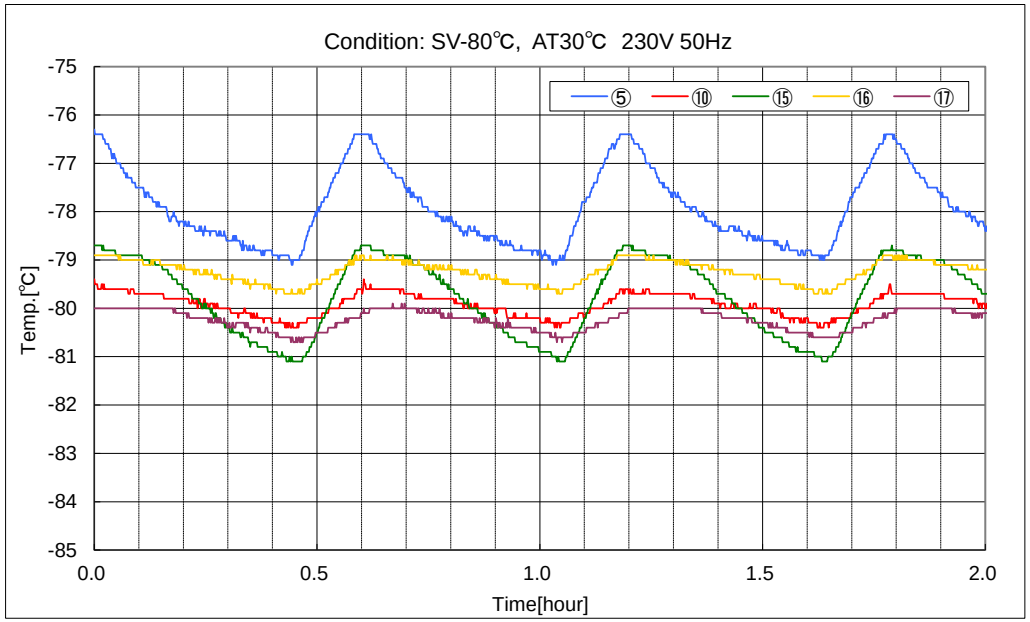
Amount of power consumption when driving at cycle

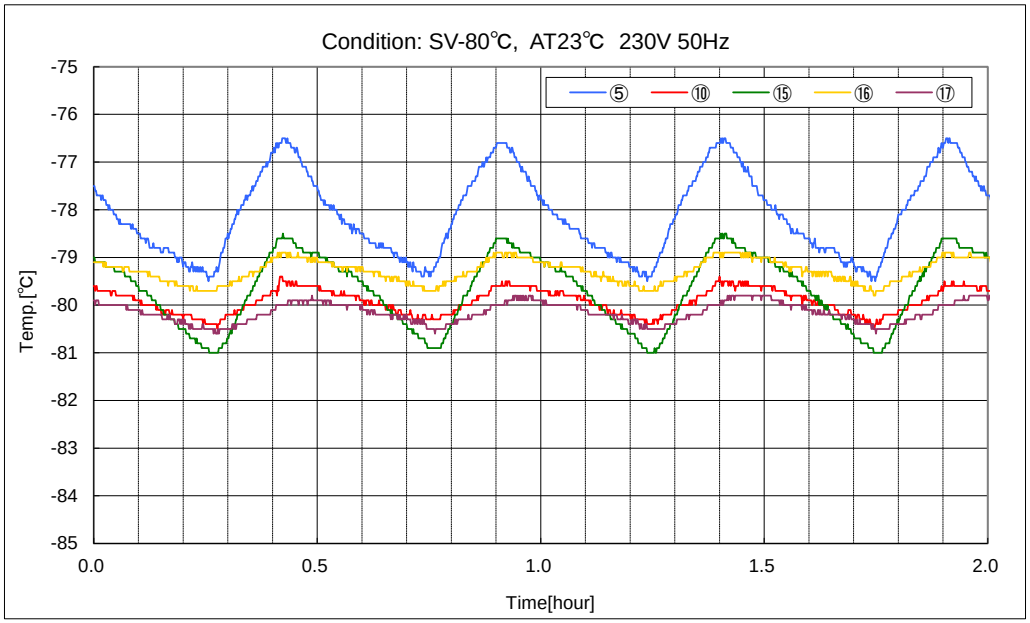
	AT 23℃		AT 30℃	
	230V 50Hz	220V 60Hz	230V 50Hz	220V 60Hz
SV=−80℃	7.7	7.8	9.3	9.4
SV=−70℃	5.6	5.7	7.1	7.2

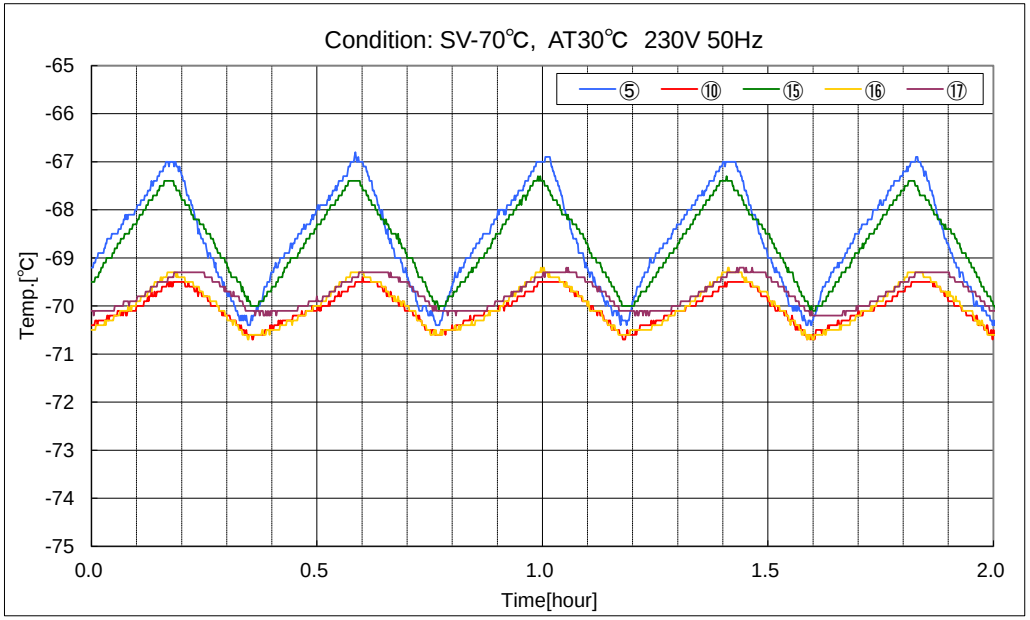
Unit：kWh/day

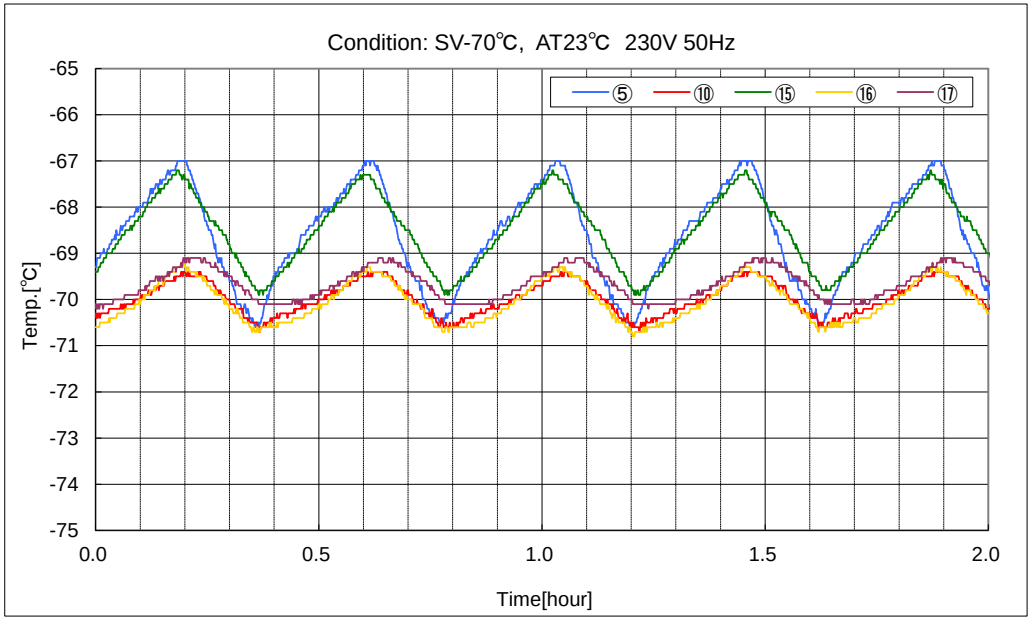
Note:This data does not represent a guarantee of product performance.

Running cycle
MDF-DU702VH

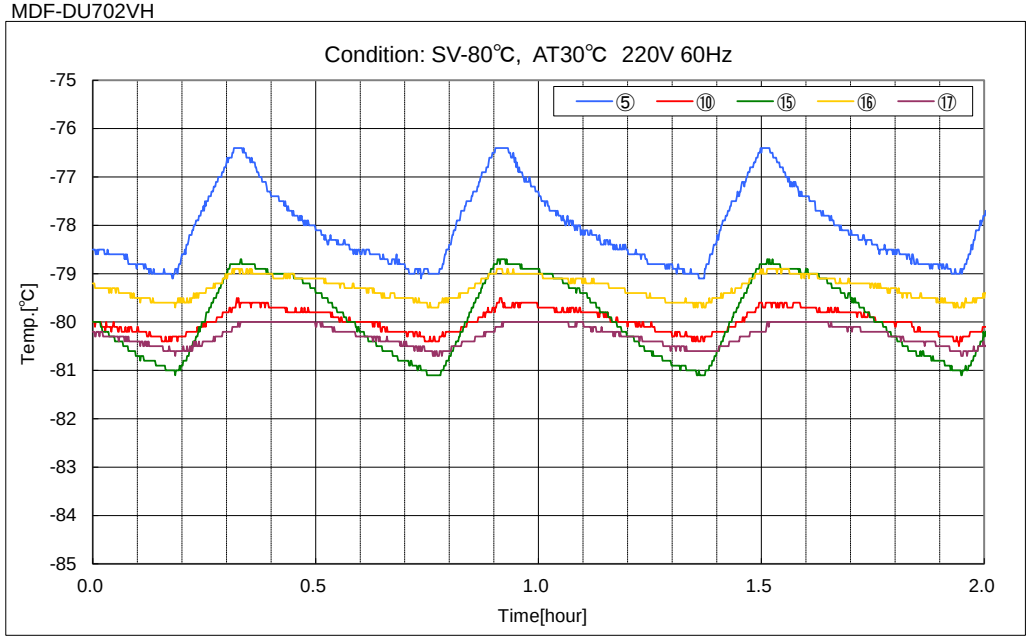


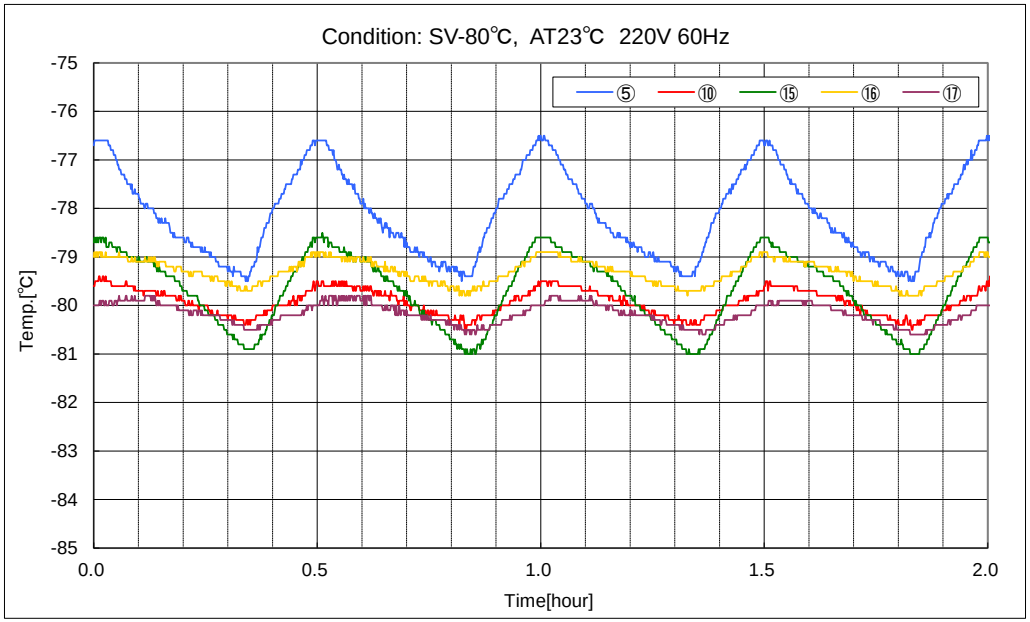


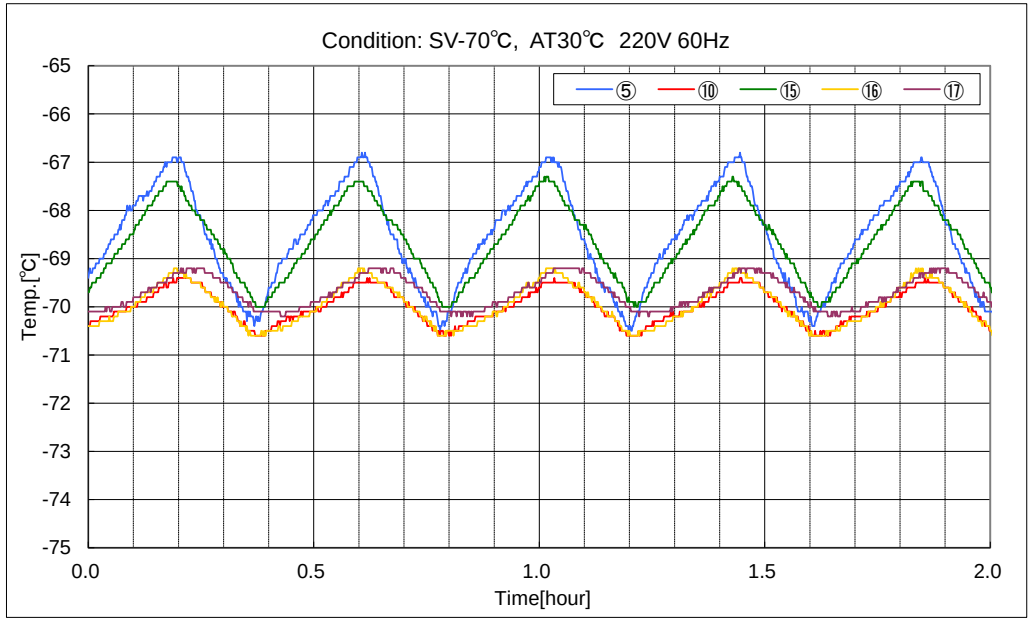


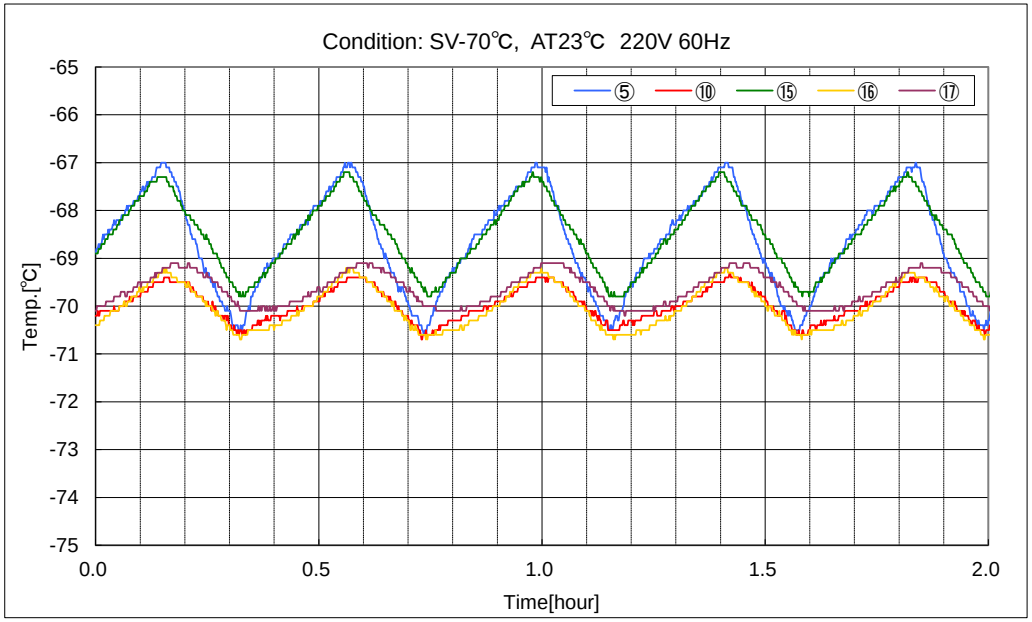


MDF-DU702VH


Condition: SV-80℃, AT30℃ 220V 60Hz
⑤ ⑩ ⑮ ⑯ ⑰
-75
-76
-77
-78
-79
-80
-81
-82
-83
-84
-85
Temp.[℃]
0.0
0.5
1.0
1.5
2.0
Time[hour]


Condition: SV-80℃, AT23℃ 220V 60Hz
⑤ ⑩ ⑮ ⑯ ⑰
-75
-76
-77
-78
-79
-80
-81
-82
-83
-84
-85
Temp.[℃]
0.0
0.5
1.0
1.5
2.0
Time[hour]


Condition: SV-70℃, AT30℃ 220V 60Hz
⑤ ⑩ ⑮ ⑯ ⑰
-65
-66
-67
-68
-69
-70
-71
-72
-73
-74
-75
Temp.[℃]
0.0
0.5
1.0
1.5
2.0
Time[hour]

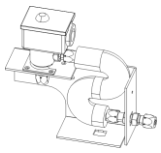
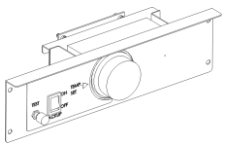
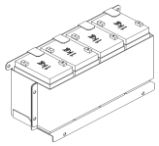
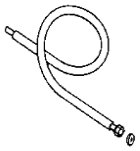
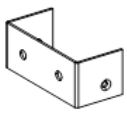
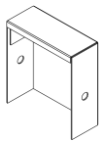
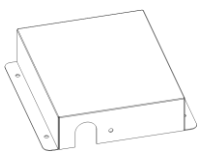

Condition: SV-70℃, AT23℃ 220V 60Hz
⑤ ⑩ ⑮ ⑯ ⑰
-65
-66
-67
-68
-69
-70
-71
-72
-73
-74
-75
Temp.[℃]
0.0
0.5
1.0
1.5
2.0
Time[hour]

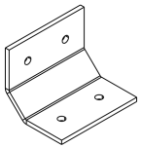
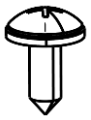
Backup cooling kit installation and setting procedure

Confirmation of packing items

① Before installing the optional component, check the accessories listed in table 1 below are enclosed.

Table 1

No.	PARTS NAME	Q'TY.	APPEARANCE	THE EXPLANATION OF THE USE
1	CO2 solenoid valve Assy.	1		Electromagnetic valve for injecting the LCO_2 gas into the freezer chamber (put together at the installation of MDF-UB7).
2	Back-up cooling kit body	1		For controlling the LCO_2 gas injection to prevent the temperature rise in the event of power failure.
3	Battery	1		Power source for backup board. ※Never touch the terminal portion. That may cause electric shock. DC 6 V x 4 pcs. = DC 24 V
4	Connecting pipe and joint packing	1		Pipe for connecting the LCO_2 gas cylinder with pipe joint. ※Metric screw type
5	Connecting pipe and joint packing	1		Pipe for connecting the LCO_2 gas cylinder with pipe joint. ※Inch screw type
6	Nozzle cover attachment	1		For fixing the nozzle cover.
7	Nozzle cover	1		To protect the nozzle in the chamber.
8	CO2 injection nozzle and thermal insulation	1		Component for CO_2 solenoid valve assy.
9	Solenoid cover	1		To protect the CO_2 solenoid valve assy.

10	Solenoid valve cover attachment	1		For fixing the solenoid valve cover.
11	Binder	2		For fixing the thermal insulation.
12	Truss screw M4×10 stainless	12		For fixing the back-up cooling kit body(4). For fixing the battery(4). For fixing the nozzle cover(2). For fixing the solenoid valve cover(2).
13	Truss tapping screw M4×12 stainless	16		For fixing the CO_2 solenoid valve assy(4). For fixing the solenoid valve cover(4). For fixing the valve cover attachment(2). For fixing the nylon clip(6).
14	Nylon clip 6N	1		For fixing the thermostat sensor of the back-up cooling kit body.
15	Nylon clip 2N	5		For fixing the thermostat sensor of the back-up cooling kit body.

BACKUP COOLING KIT INSTALLATION

② Unravel the bundled harness

Harness UB_BATTRY_1	R,BL 3P-3P
Harness MAIN_UBK	BL,R,OR.BU.Y.W 6P-6P,3P
Harness UB_VALVE_1	Y,G 2P-2P

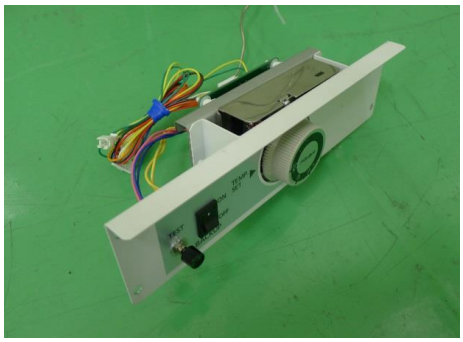


Fig.2-1

③ Remove the product unit cover R and the switch box cover

Fig.3-1

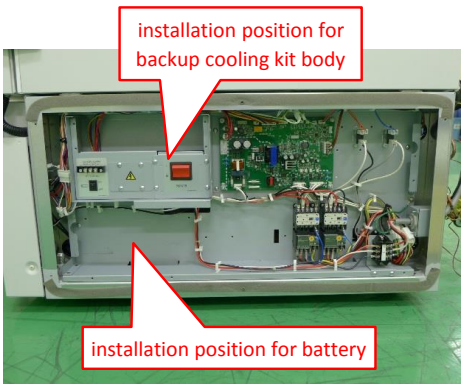
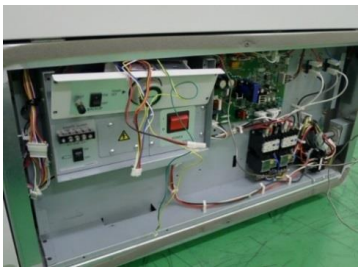
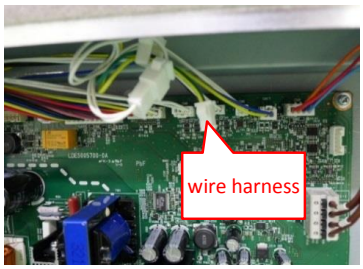


Fig.3-2

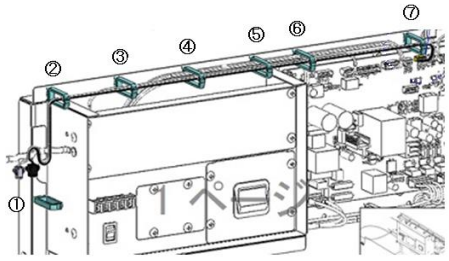
④ While lightly inserting the back-up cooling kit body into the installation position of the product, wire harnesses through the wire saddle and wire as shown in the figure.





Wire harnesses through wire saddles as shown in the figure.
・Wire harness UB_BATTRY_1 through wire saddle ② through wire saddle ①.
・Wire harness MAIN_UBK is passed through the wire saddles ⑤ to ⑥ in order, and connected to the CN 14 of the main board.

Wire harness UB_VALVE_1 in the order of wire saddle ③ → ④ → ⑤ → ⑥ → ⑦, and connect it to the harness UB_VALVE _ 2 that comes out from the bottom of the cabinet.



⑤ ・Wire the gas sensor as shown by the dotted line and set it free toward the upper part of the power supply box.

Fix the four marking parts in the right figure with the truss head screws M4x6.

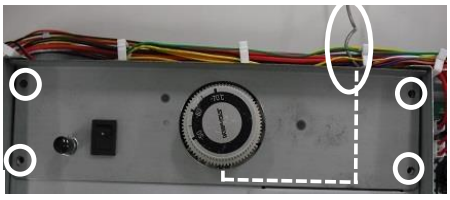


Fig.5-1

⑥ Wire the gas sensor cable using the clampers on the marking section on the bellow.
Remove CAP A attached to the base and wire the cable of the gas sensor from the hole of the base to the back of the body.

Fig.6-1


Fig.6-2

Fig.6-3

⑦ Connect the harness UB_BATTRY_2 to the position marked with the square in the right figure.
In the figure on the right, connect the red wire to the solid square marker portion and the black wire to the dotted square marker portion respectively.
Fix the four marking parts in the right figure with the truss head screws M4x6.

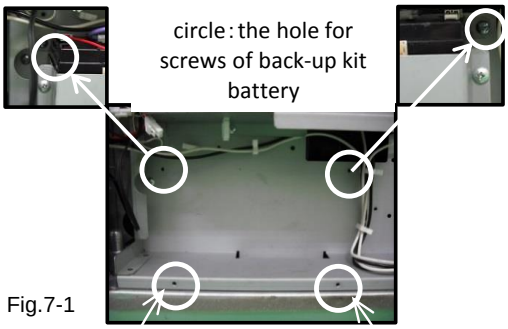


Fig.7-1

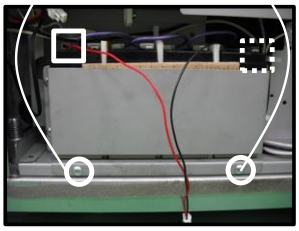


Fig.7-2

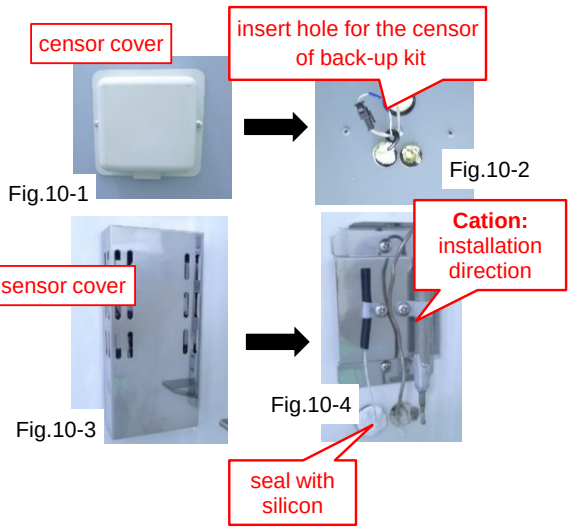
⑧ Route UB_BATTRY_ 2 through the two clampers on the right figure.


Fig.8-1

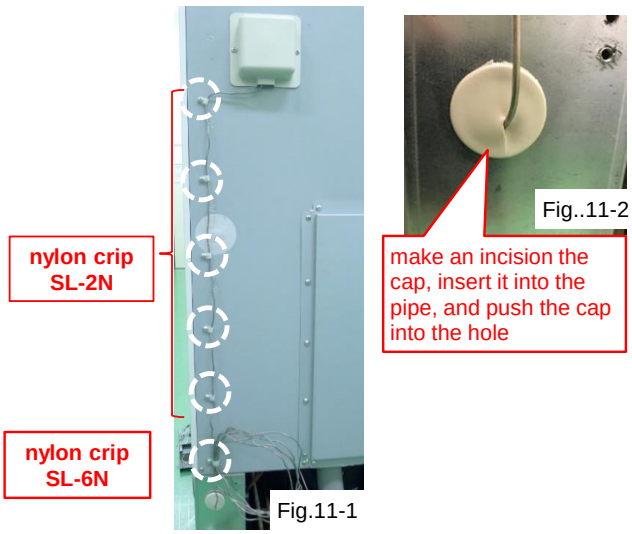
⑨ Connect UB_BATTRY_1 and UB_BATTRY_2.


Fig.9-1

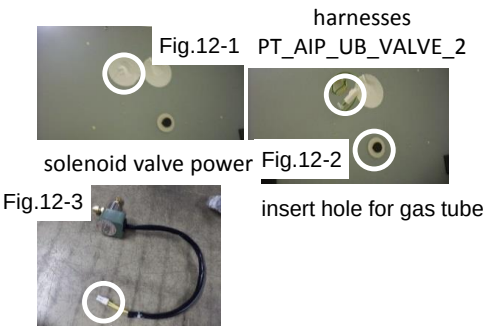
⑩ Remove the sensor outlet cover on the back and the temperature control sensor cover inside the chamber, and remove the silicone in the backup sensor insertion hole.
Insert the gas thermo into the backup sensor insertion hole from which silicon has been removed and fix the gas thermo using the nylon clip attached to the sensor mounting plate.
Fill the gap between sensor insertion hole and gas thermo with silicon.
Reinstall the temperature control sensor cover and the sensor outlet cover.



⑪ Attach the nylon clips SL - 2 N and SL - 6 N to the holes for those on the back and secure the gas thermo piping with them.
Insert a notch in the cap A that you removed, insert a gas thermo piping into it, and push A into the hole in the base so as to close the hole.



⑫ Remove the seal on the back side and take out the stored harness PT_AIP_UB_VALVE_ 2.



⑬ Insert the valve pipe from the back and secure it with the mounting plate.
Bend the valve tip downward at 90 degree.
After inserting the gas pipe, fill the gap with silicon.
When the cover is attached, the tip of the valve pipe does not interfere with the cover.

Fig.13-1

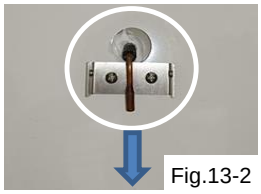
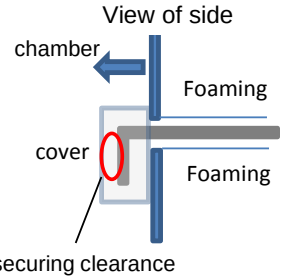


Fig.13-2

insert hole for gas tube

Fig.13-3



⑭ Fix the solenoid valve cover to the position shown in the figure with 2 truss tapping screws M4x12.

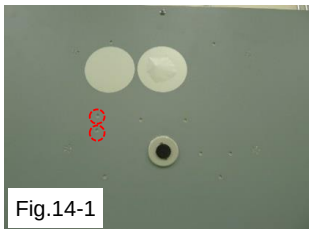


Fig.14-1

⑮ Cover the backup cover so that the various harnesses are not caught in, and fix the four places with screws.

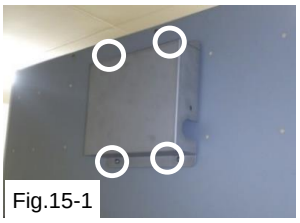
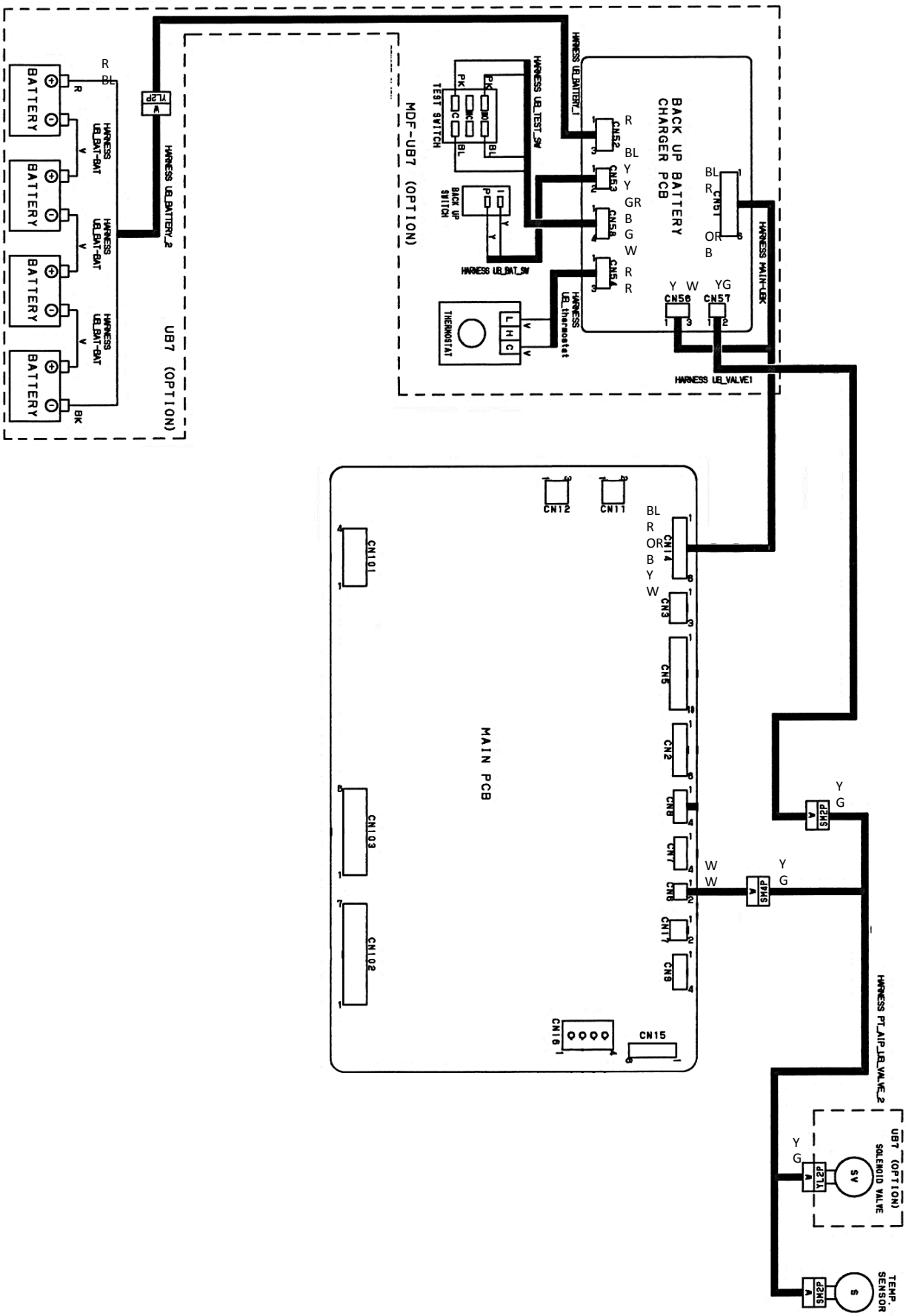


Fig.15-1

WIRING


UB7 (OPTION)
BATTERY
BATTERY
BATTERY
BATTERY
HARNESS UB_BATTERY_2
HARNESS UB_BAT-BAT
MDF-UB7 (OPTION)
TEST SWITCH
BACK UP SWITCH
HARNESS UB_TEST_SW
HARNESS UB_BAT_SW
HARNESS UB_BATTERY_1
THERMOSTAT
HARNESS UB_thermostat
BACK UP BATTERY CHARGER PCB
CN52
CN53
CN54
CN55
CN56
CN57
HARNESS MAIN-UBK
HARNESS UB_VALVE1
MAIN PCB
CN101
CN102
CN103
CN2
CN3
CN5
CN7
CN8
CN9
CN11
CN12
CN14
CN15
CN16
CN17
HARNESS PT_AIP_UB_VALVE_2
UB7 (OPTION) SOLENOID VALVE
SV
TEMP SENSOR
S

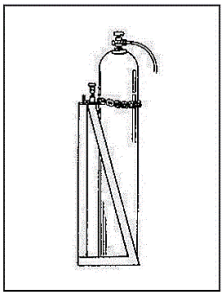
PRECAUTIONS

Before installation

●Liquid CO_2 cylinder should be a siphon type cylinder

●Only liquid CO_2 can be used for this system. Never use other kinds of gases.

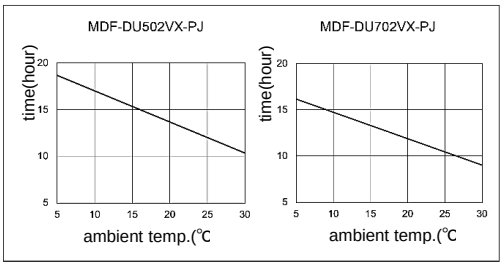
●Liquid CO_2 loses its cooling capacity when the ambient temperature is above +31℃. Do not install the liquid CO_2 cylinder in a place exposed to direct sunlight or near heat-emitting appliances such as stoves and heaters. The back-up time per 1 liquid CO_2 cylinder depends on the ambient temperature. Install a liquid CO_2 cylinder in the cool location.



●Liquid CO_2 cylinder should be installed in a special cylinder stand (see figure). Never install the cylinder without the stand. If you have difficulty in obtaining the stand, contact your dealer.

●The length of time in which a 30kg liquid CO_2 cylinder can maintain a temperature of -70℃ is shown in the another sheet "Ambient Temperature vs. -70℃ Holding Time of Liquid CO_2 cylinder (30kg)".

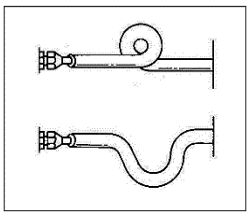
Install the required number of cylinders according to the customer's desired back-up time.



●Before installation, tell the customer about cylinder storage and exchange procedures at the time of cylinder inspection according to high-pressure gas regulations.

At installation

●The connecting pipe between the liquid CO_2 cylinder and the backup cooling kit should not be installed in a place where it may be bumped in a passage.



●Use the connecting pipe provided with the backup cooling kit. Run the connecting pipe in a coil or U-bend formation to act as a cushion (see figure).

●Do not let foreign particles or water get into the pipe or joints.

After installation

●Check that liquid CO_2 is injected into the freezer chamber. Refer to the "Injection Test" for an explanation of the testing procedure.

●Conduct a leakage test of the liquid CO_2 cylinder and connecting area.

INSTALLATION

1. Put the liquid CO_2 cylinder into the CO_2 cylinder stand. Secure each cylinder to the stand with chains.
2. Connect the valve on the CO_2 cylinder stand with the CO_2 outlet of the cylinder with a flexible hose.
3. Close the valve on the CO_2 cylinder stand completely and open the cylinder valve. Then check for CO_2 leakage at the cylinder valve, cylinder stand valve and the connecting area of the flexible
4. When no leakage is found, close the cylinder valve.
5. Cut the connecting pipe (total length; 2.5m) enclosed with the backup cooling kit into an appropriate length. The cut end should
6. Remove the cap covering the connecting port on the backup cooling kit. Place the flared nut, ring, and sleeve onto the end of
7. Insert the cut side of the connecting pipe all the way into the connecting port on the backup cooling kit and tighten the flared
8. Connect the other side of the connecting pipe with the cylinder valve (when 1 cylinder) or the cylinder stand valve (when more than 1 cylinder). Tighten the flared nut all the way.
Note: Run the connecting pipe in a coil or U-bend formation to act as a cushion (see Fig. 2).
9. Open the cylinder valve or cylinder stand valve (whichever applicable) and check for leakage at the both ends of the connecting pipe. The leakage can be checked by applying soapy water to the connecting area as shown in Fig. 3.
10. Close all of the cylinder valve and also the cylinder stand valve.
11. Check the injection by following the procedure in the “Injection Test” on the next page.

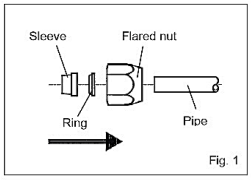


Fig. 1

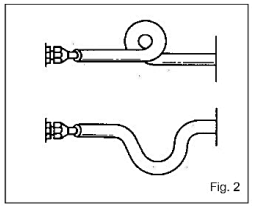


Fig. 2

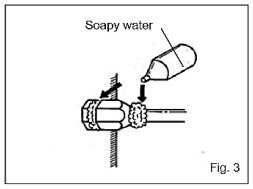


Fig. 3

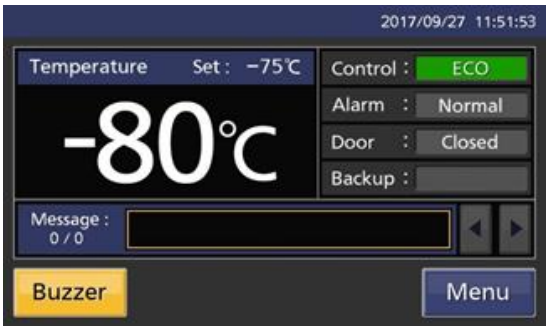
INJECTION TEST

1. Run the freezer until the chamber temperature reaches the appropriate level.
2. With the power switch of the backup cooling kit turned off, open the cylinder valve and the cylinder stand valve.
3. Set the temperature of the backup cooling kit to a temperature 10℃ or more higher than the freezer chamber tempera

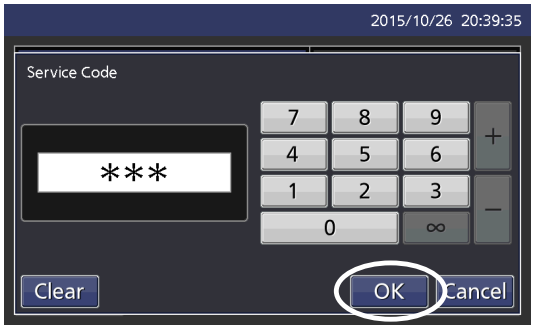
Note:
The temperature setting range of the backup cooling kit is between －50 and －70℃. The consumption of liquid CO_2 gas is increased and the backup cooling time is decreased considerably if the set temperature is lower than －70℃.

4. Turn on the power switch of the backup cooling kit with the freezer door closed.
For the up-right freezer, check the indicator lamp (green) on the door switch is ON.
5. Press the test switch for the backup cooling kit to check the liquid CO_2 gas is injected into the freezer chamber.
With the back-up system set in this way, the liquid CO_2 gas is injected into the freezer chamber automatically to ensure freezing when the chamber temperature reaches the set temperature of the backup cooling kit.
6. If the set temperature of the backup cooling kit is below －60℃, turn off the power switch of the freezer.
7. Check the liquid CO_2 gas is injected into the freezer chamber automatically when the chamber temperature rises.
Note the backup cooling time is decrease if the liquid CO2 gas is injected continuously.
8. Ensure the injection of the liquid CO_2 gas automatically stops when the chamber temperature goes down.
●Refer to the “Operating Instructions” for an explanation of the switches on the freezer.

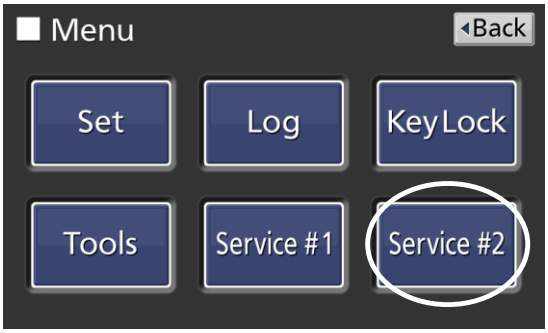
SETTING



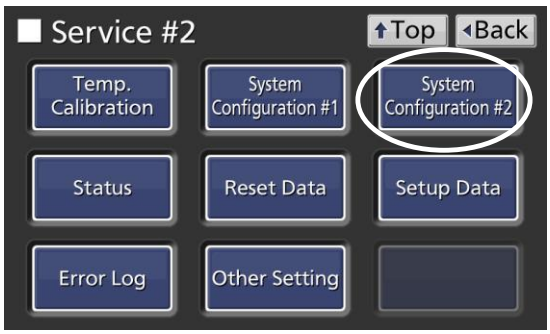
①Press Menu key at lower right of TOP display for 5 second



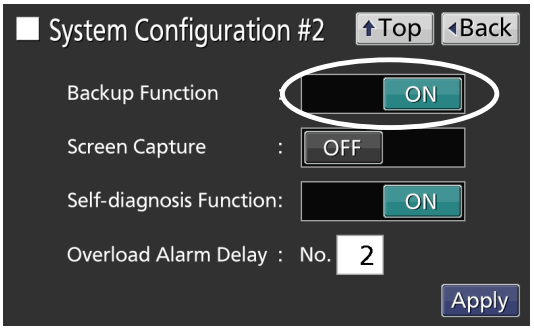
②Move to Service Code display. Input “335232” with number key at right of the display. And press OK



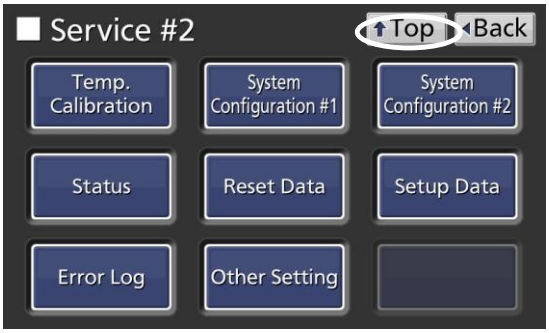
③Move to Menu display, press Service #2 key at the lower middle of the display.



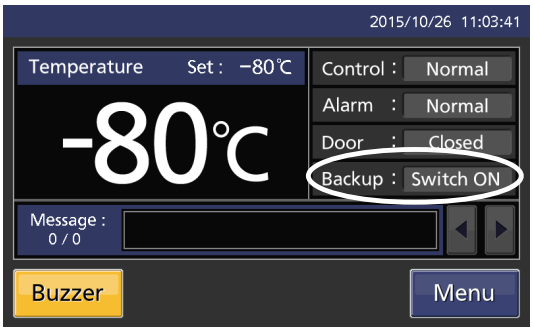
④Move to Service #2 display, press System Configuration #2 key at upper right of the display.



⑤Move to System Configuration #2. Press and slide the slide bar at right of Backup Function item at upper of the display, (Then the slide bar change “ON”). Make sure that the slide bar change and press Apply key.



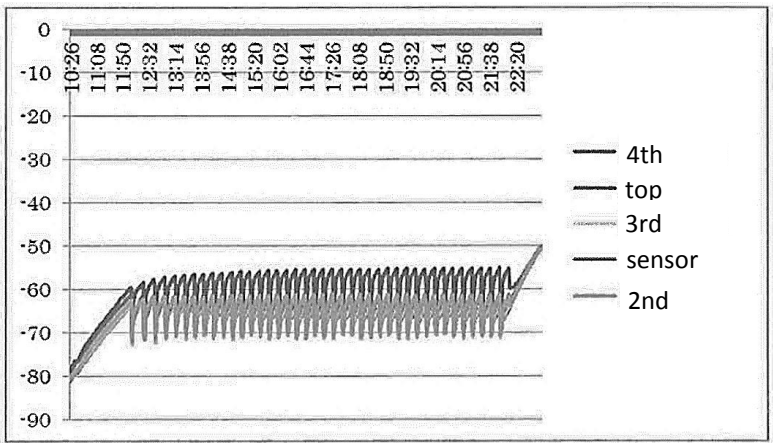
⑥Move to Service display, press TOP key at upper right of the display.

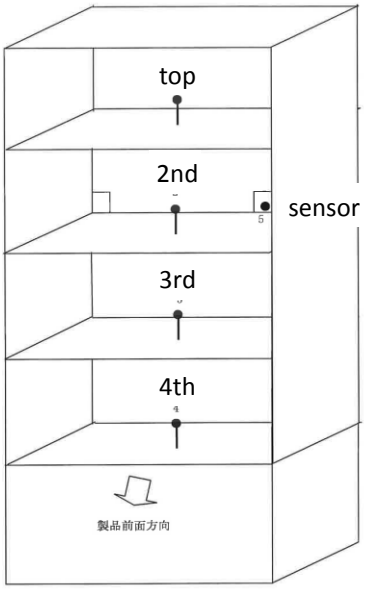


⑦Move to TOP display, make sure that display at Backup. Now this operation is completed.

MDF-DU500VX

AT23℃ no load SV=70℃





No.	thermo couple	Max. temp (℃)	Min. temp. (℃)	middle value (℃)
1	top stage	−55.1	−66.6	−60.9
2	2nd stage	−58.2	−71.5	−64.9
3	3rd stage	−57.8	−72.4	−65.1
4	4th stage	−58.2	−72.1	−65.2
5	gas sensor	−58	−66.8	−62.4

***Revision history**

Revision #	Date of revision	Reason of revision
SM0000002-01	Oct.17. 2017	Update Service manual for released catalogue.
SM0000002-02	Oct.27. 2017	Change firmware version to V1.04A for main PCB to fix the malfunction for optional backup system, MDF-UB7.
SM0000002-03	Feb.7. 2018	Update PL for MDF-DU502VH release.