SANYO

Service Manual

FILE No.

Ultra-Low Temperature Freezer

MDF-C2156VAN

MDF-C2156VANC

SANYO Electric Co., Ltd.
Biomedical Business Unit



RoHS

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

WARNING

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

SM9910079

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Effective models

This service manual is effective following models.

Model name	Product code	Voltage and Frequency	
MDF-C2156VAN	823 189 82	220V	50Hz
	823 189 83	220V	60Hz
	823 189 84	230/240V	50Hz
	823 189 87	220V	60Hz
MDF-C2156VANC	823 189 86	220V	60Hz

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Features

■ The chest type -150℃ VIP series freezer has large effective capacity, 231L.

■ Safety storage and security
- New double door gasket to prevent heat leakage.
- New VIP+ is adopted for insulation makes reduction of power consumption.
- Notice of failure prediction by additional new status function.
- Recording of chamber temperature and outer door open.

■ Environmental friendly
- 2-stage mixed refrigerant system with NON-HCFC refrigerant.

■ Optional component
- Automatic temperature recorder + Mounting kit: MTR-155H+MDF-S30150
- Interface board: MTR-480
- Liquid N2 gas container: MDF-135N

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Specifications

■Structural specifications

Item	MDF-C2156VAN	MDF-C2156VANC
Name	Ultra-Low Temperature Freezer	
External dimensions	W1730 × D765 × H1010 (mm)	
Internal dimensions	W760 × D495 × H615 (mm)	
Effective capacity	231 L	
Exterior	Painted steel	
Interior	Aluminum plate	
Outer lid	Painted steel	
Insulation	Vacuum insulation panel + Rigid polyurethane foamed-in place	
Access port	ϕ40mm, 1 place in the side table	
Cooling circuit	2-stage cooling circuit and Low stage Auto cascade system	
Compressor	High stage side; Hermetic type, Output; 1100W Low stage side; Hermetic type, Output; 1100W	
Evaporator	High stage side; Cascade condenser type Low stage side; Tube on sheet type	
Condenser	High stage side; Fin and tube type Low stage side; Shell and tube type, and Wire tube type	
Refrigerant	H stage side; R-407D L stage side; HFC mixed refrigerant	
Refrigerating oil	Ze-NIUS32SA	
Power supply	Local voltage	
Battery	Lead storage battery, 6VDC, 7.2Ah x 4pcs, Auto-recharge	
Weight	318 kg	325kg
Voltage booster	None	Built-in
Accessories	1 set of key for outer door latch, 1 set of key for panel door, 6 recording chart rolls, 1 dry cell 1 set connect tube for back-up system	
Optional component	Automatic temperature recorder + Mounting kit (MTR-155H+MDF-S30150) Liquid nitrogen gas container (MDF-135N) Interface board (MTR-480)	

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■Control specifications

Item		MDF-C2156VAN	MDF-C2156VANC
Cooling performance		Center of the chamber; -150℃（AT30℃, No load）	
Temp. controller		Micro-processor control system Setting range; -125℃～-155℃（Unit;1℃） Non-volatile memory	
Temp. sensor		Platinum resistance; Pt.1000Ω	
Temp. display		Digital display	
Alarm	High temp.	Setting range: +5℃~+20℃ (Initial; +10℃) ALARM lamp and LCD display flashes, intermittent buzzer tone with 15min. delay Remote alarm contact: Normal Open, Rating; DC30V, 2A Remote alarm contact activates with 15min delay	
	Low temp.	Setting range: -5℃~-20℃ (Initial; -10℃) ALARM lamp and LCD display flashes, intermittent buzzer tone with 15min. delay Remote alarm contact: Normal Open, Rating; DC30V, 2A Remote alarm contact activates with 15min delay	
	Door	When outer door is open, indication of 'Door Open' is shown. ALARM lamp blinks and buzzer beeps intermittently after delay time is passed.	
	Filter	ALARM lamp flashes, message indication and intermittent buzzer tone emitted	
	Power failure	When the power to the unit is not connected or power failure, ALARM lamp flashes and intermittent buzzer tone emitted Remote alarm contact activates.	
	Remote alarm	3P remote alarm terminal: DC30V, 2A, NC-COM, NO-COM Temperature alarm turns on during power failure.	
Display		LCD panel Temperature display; Digital display (1℃ increment) Internal temperature is displayed by graphics, 24hours record can be displayed per screen.	
Control panel		Lamp: BATTERY, ALARM, STANDBY Buzzer key: BUZZER Menu key: MENU Clear key: CE Entry key: ENT Figure input key LCD contrast adjusting knob: CONT Shift key:▲▼◀ ▶	

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Item		MDF-C2156VAN	MDF-C2156VANC
Status monitor function		When ambient temperature is higher than approx. 35℃ or lower than approx. 0℃, 'Ambient temp is abnormal ' is displayed on LCD. When power supply voltage is lower than approx.170V, 'The power supply is abnormal' is displayed on LCD.	
Data log function		● Recordable for approx. 4weeks in 12min. intervals. ● Door delay time (more than 2min.) is recordable. ● Temperature for cascade sensor, filter sensor and AT sensor are recordable. ● Log data is transmittable to PC with interface, MTR-480.(Option)	
Self diagnosis function		In the event of any failure among temp. sensor, filter sensor and cascade sensor; ● Error code and message are emitted. ● ALARM lamp flashed, remote alarm contact turns over and intermittent buzzer emit.	
Key lock function		Key lock '0': Key lock is released. Key lock '1': Key locks	
Compressor protection	L stage	When the temperature in cascade sensor is -34℃ or lower, compressor (L) turns on. When the temperature in cascade sensor is -12℃ or higher, compressor (L) turns off. Overload relay and High pressure switch (L) are controlled.	
	H stage	When the temperature in filter sensor is +60℃ or higher, compressor (H) turns off. When the temperature in filter sensor is 10℃ lower than ambient temperature, compressor (H) turns on.	
Back-up systems		● Automatic liquid N_2 injection device ● Temp. setting range; ● Indication: BACK-UP (Green) ● Back-up test switch; 8R2021 ● Power switch; Locker switch ● Back-up systems can be available for 48 hours by full charged lead storage battery.	

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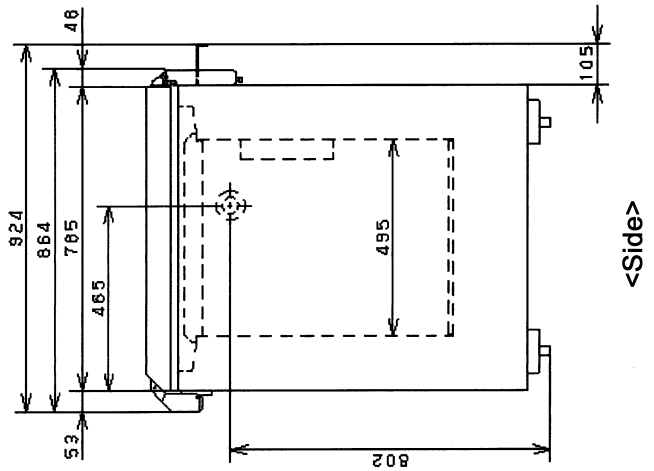
■Performance specifications

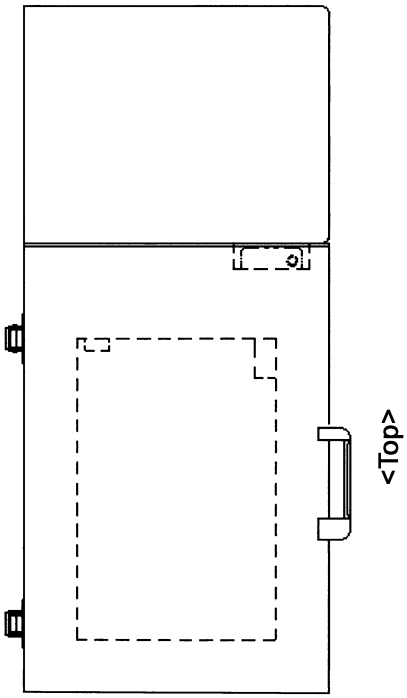
Cooling performance	Center of the chamber: -150℃（AT30℃, no load）			
Temp. control range	-125℃～-150℃（AT30℃, no load）			
Rated power consumption	220VAC, 50Hz	220VAC, 60Hz	230VAC, 50Hz	240VAC, 50Hz
	1550W	1700W	1550W	1600W
Noise level	51 dB (A) (background noise; 20dB)			
Maximum pressure	3085 kPa			
Usable conditions	AT:5℃～30℃, less than 80%RH			

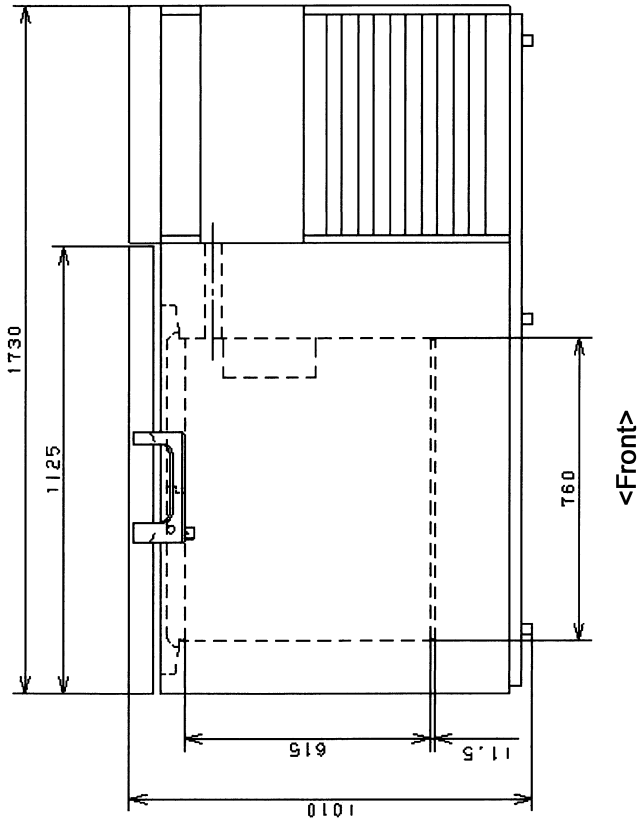
Note: Specifications will be subject to change without notice.

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Dimensions







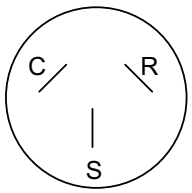
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Cooling unit parts

<MDF-C2156VAN/VANC>

Item	Specifications					
	H side	L side				
Compressor						
220V, 60Hz	Type: KS370J1NS-7A Compressor code: 7FB-0-M101-001-06					
220V, 50Hz	Type: KS370J1NS-4A Compressor code: 7FB-0-M101-001-04					
230/240V, 50Hz	Type: KS370J1NS-4A1 Compressor code: 7FB-0-M101-001-05					
Refrigerant oil	Ze-NIUS32SA Charged q'ty: 850cc	Ze-NIUS32SA Charged q'ty: 850cc				
Cooling system	Forced air cooling (partially) Oil cooler	Forced air cooling (partially) Oil cooler				
Condenser						
Type	Fin and tube	Cascade condenser				
Condenser	12 columns x 4 lines P6.35mm Fin 88pcs.	Coil pipe ϕ6.35mm x (t)0.7				
Pre-condenser	W 350mm	——				
Frame pipe	ϕ6.35mm	——				
Evaporator Type	Shell tank ϕ80mm	Tube on sheet				
Capillary tube		(upper)	(Middle)	(Lower)	(Ex)	
Resistance PSI・kg/cm^2	56 PSI/G	9.9kg/cm^2	11.0kg/cm^2	3.7kg/cm^2	1.9kg/cm^2	
Length (mm)	1300	3000	8000	3000	500	
Outer diameter (mm)	ϕ2.4					
Inner diameter (mm)	ϕ1.2					
Refrigerant	R-407D Charged q'ty: 432+/-10g	MU-N721 (HFC refrigerant) Charged q'ty: 880g				
Oil additive	n-Pentane Charged q'ty: 46cc (28g)	n-Pentane Charged q'ty: 17cc (10g)				
Dryer	4A-XH-9 Charged q'ty: 18g	4A-XH-6 Charged q'ty: 58g				
Condensing fan	ϕ230 mm、4 blades Material: ABS					
Condensing fan motor	Type: SE4-E11L5P					
Oil separator	——	SPK-0S02S3				

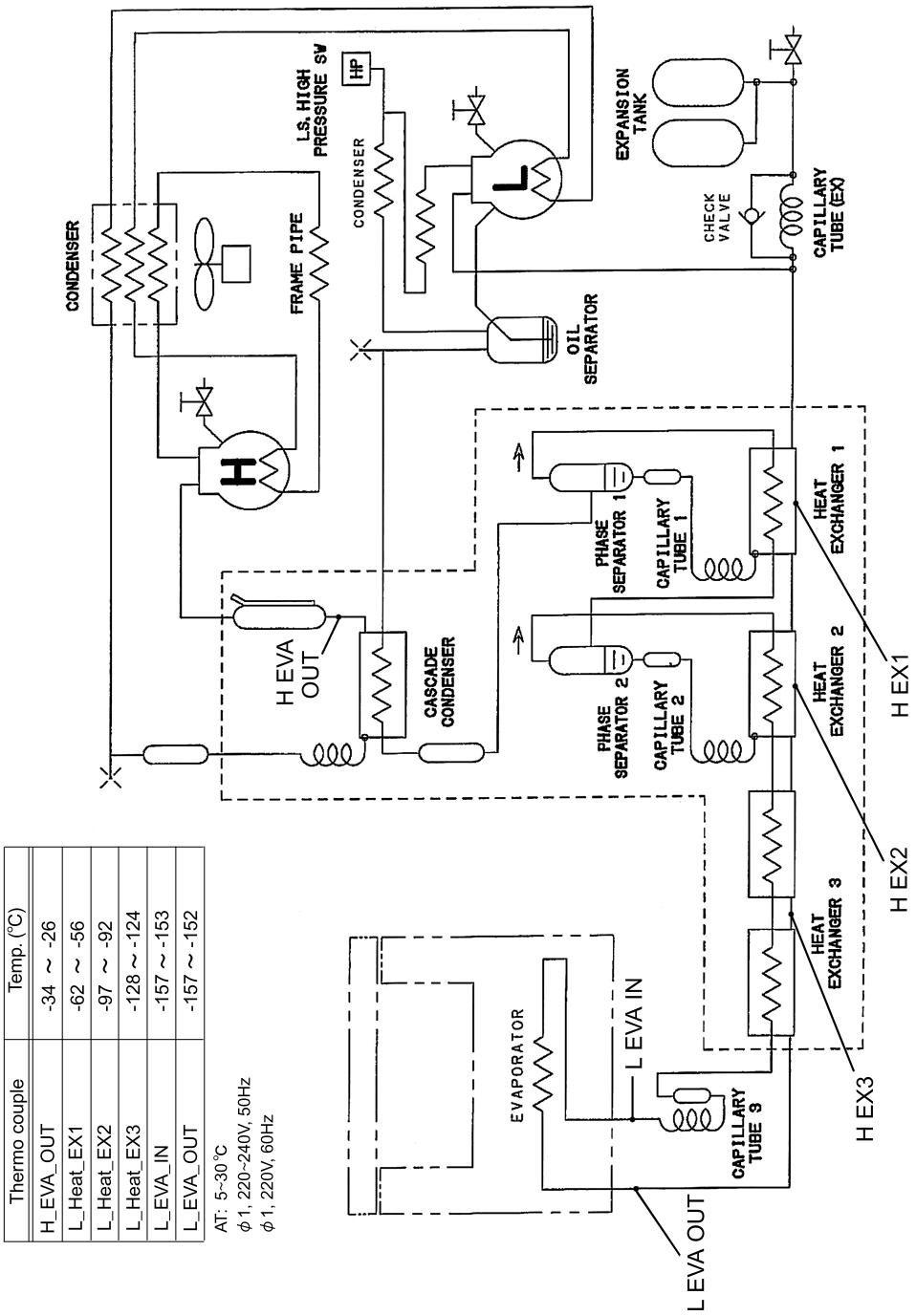
<Compressor terminals layout>



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Refrigeration circuits

TWO STAGE CASCADE & LOW STAGE AUTOCASCADE SYSTEM (MDF-C2156VAN)



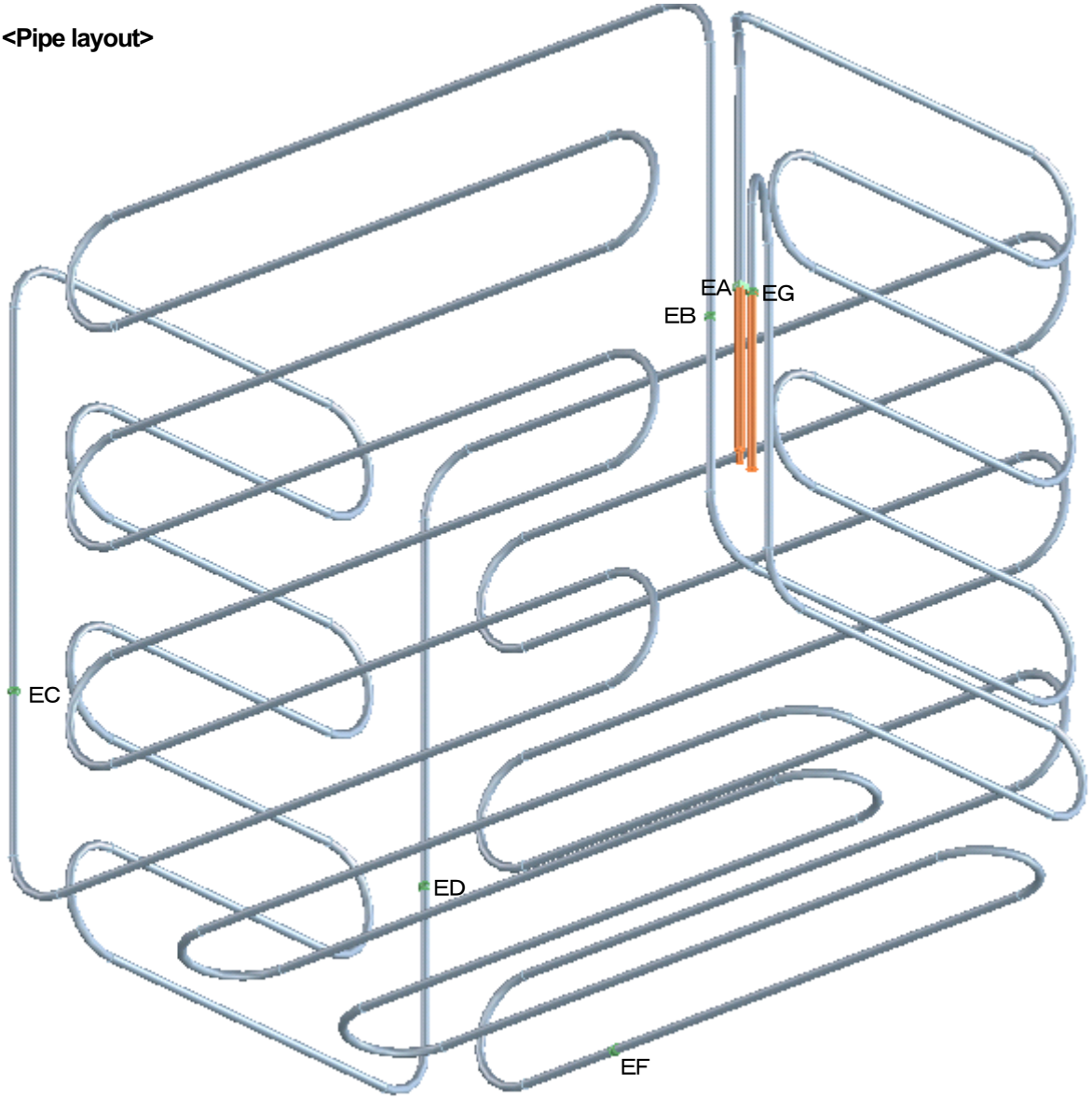
Thermo couple	Temp.(°C)
H_EVA_OUT	-34 ~ -26
L_Heat_EX1	-62 ~ -56
L_Heat_EX2	-97 ~ -92
L_Heat_EX3	-128 ~ -124
L_EVA_IN	-157 ~ -153
L_EVA_OUT	-157 ~ -152

AT: 5~30 °C
ϕ1, 220~240V, 50Hz
ϕ1, 220V, 60Hz

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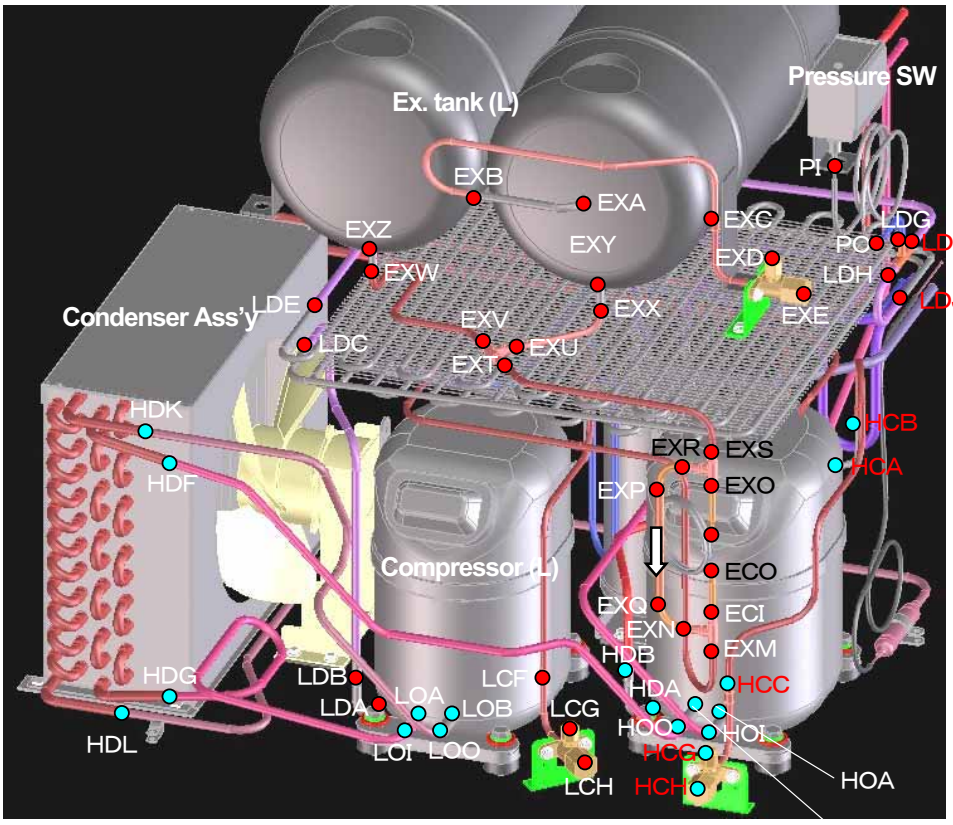
Refrigeration circuit welding points

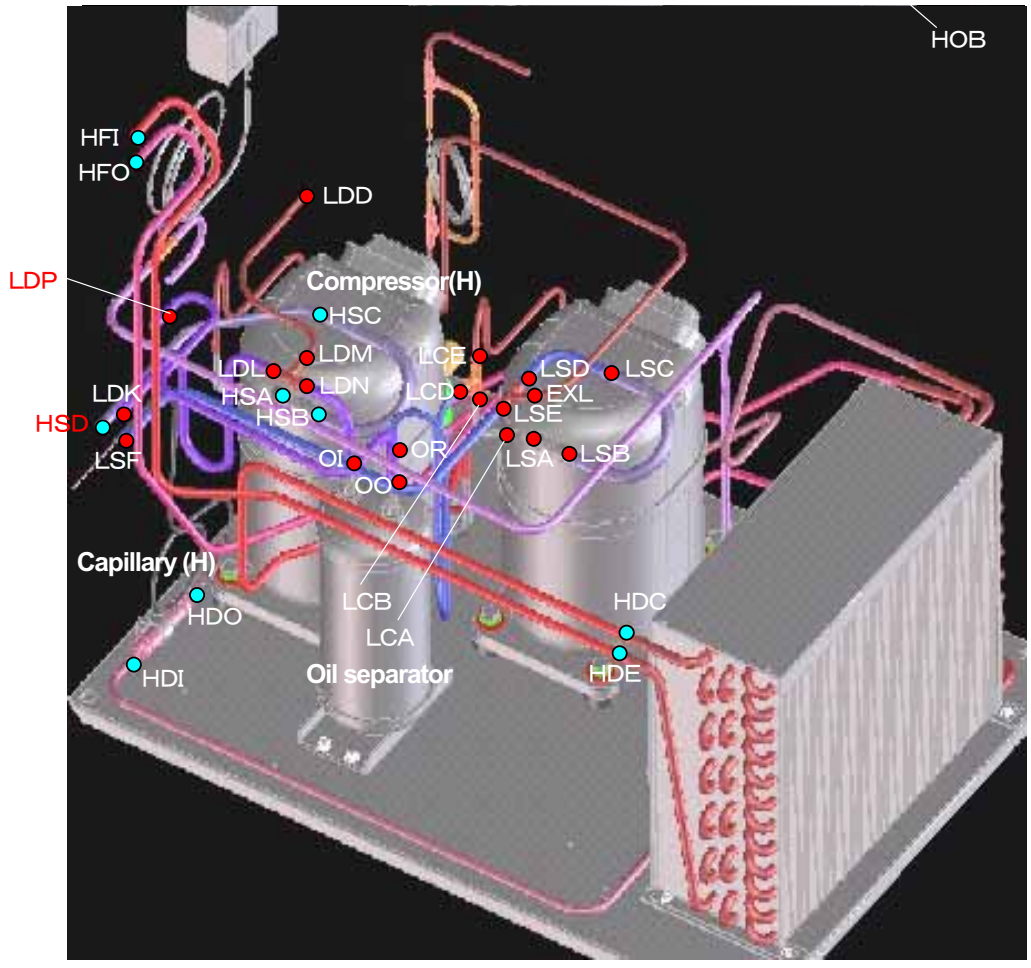
<Pipe layout>



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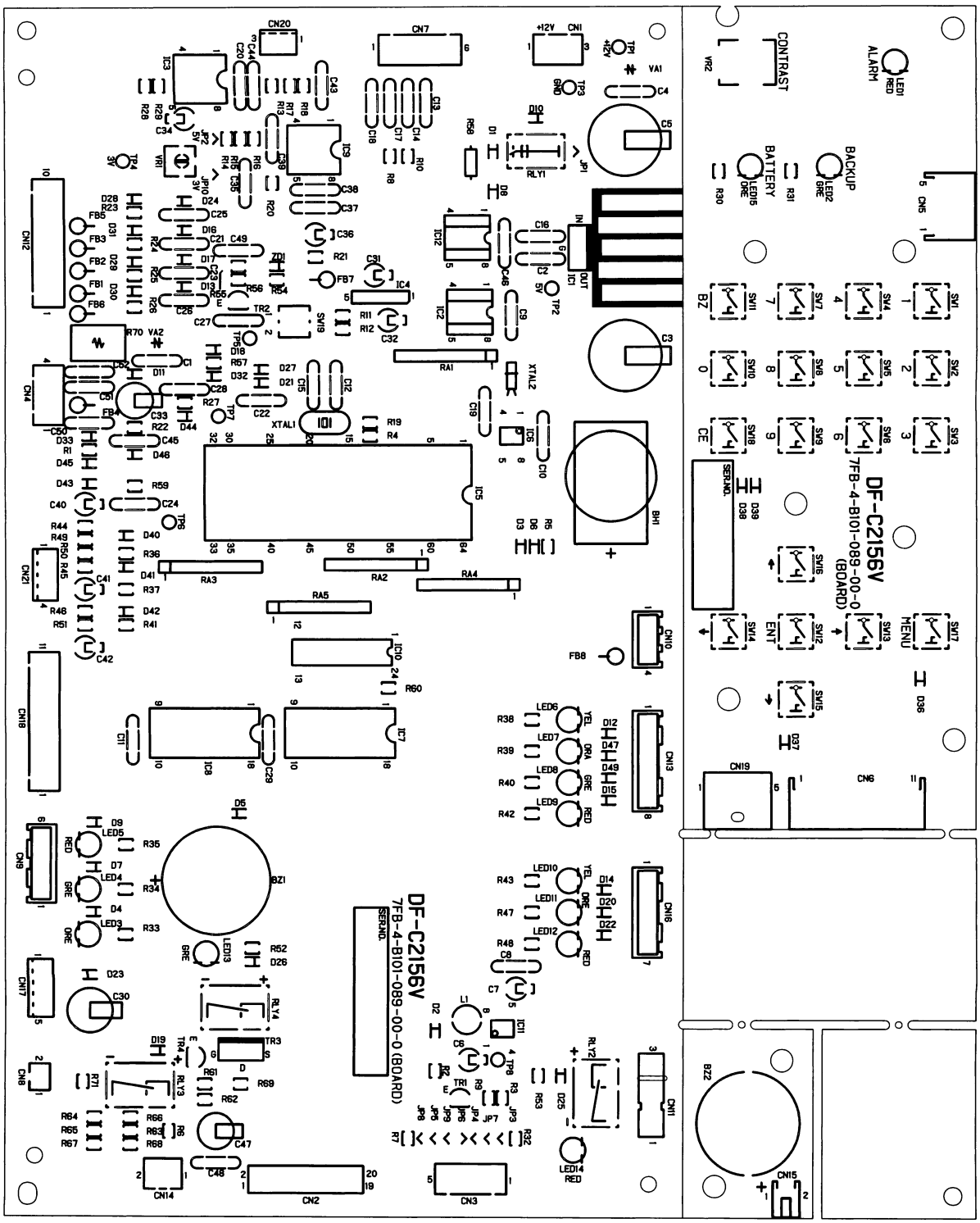
<Unit base Ass'y>





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Components on PCB



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Electric parts

MDF-C2156VAN/2156VANC		220V, 60Hz	220V, 50Hz	230/240V, 50Hz
Compressor (H), (L)	Type	KS370J1NS-7A	KS370J1NS-4A	KS370J1NS-4A1
	Parts code	7FB 0 M101 001 06	7FB 0 M101 001 04	7FB 0 M101 001 05
	Rated voltage	220V, 60Hz	220/230V, 50Hz	230/240V, 50Hz
	Winding resistance (C-S)	1.64Ω	2.53Ω	2.53Ω
	Winding resistance (C-R)	3.35Ω	4.8Ω	4.8Ω
Starting relay (H), (L)	Type	AMVL-300A	AMVL-300A	AMVL-300A
	Pick-up voltage	215~247VAC	185~217VAC	185~217VAC
	Drop-out voltage	69~132VAC	60~120VAC	60~120VAC
	Parts code	626 100 1503	626 100 1503	926 100 1504
Overload relay (H), (L)	Type	MRA999549201	MRA999539201	MRA999539201
	Action to temp. (no current)	ON:69±10℃ OFF:135±10℃	ON:69±10℃ OFF:135±10℃	ON:69±10℃ OFF:135±10℃
	Action to current (AT25℃)	29.5A	22.5A	22.5A
	Operation time	6~16 sec.	6~16 sec.	6~16 sec.
	Parts code	624 226 3173	624 226 3166	924 226 3167
Starting capacitor (H), (L)	Type	160UF, 250V	100UF, 250V	100UF, 250V
Running capacitor (H), (L)	Type	25UF, 400VAC	25UF, 400VAC	25UF, 400VAC
Condensing fan motor	Type	SE4-E11L5P	SE4-E11L5P	SE4-E11L5P
	Rated voltage	220-240V	220-240V	220-240V
	Parts code	624 224 0167	624 224 0167	924 224 0168
Cap.tube heater	Rated voltage	100V, 15.7W	100V, 15.7W	100V, 15.7W
	Resistance(25℃)	638Ω	638Ω	638Ω
	Parts code	624 030 2492	624 030 2492	924 030 2493
Temp. control relay (H)	Type	G4F-11123T	G4F-11123T	G4F-11123T
	Rated voltage	20A, 12VDC	20A, 12VDC	20A, 12VDC
	Parts code	624 173 2397	624 173 2397	924 173 2398
Heater relay	Type	G2R-1A-T	G2R-1A-T	G2R-1A-T
	Rated voltage	12V, 1-A, 250V	12V, 1-A, 250V	12V, 1-A, 250V
	Parts code	624 188 9299	624 188 9299	924 188 9290
Temp. control relay (L)	Type	G4F-11123T	G4F-11123T	G4F-11123T
	Rated voltage	20A, 12VDC	20A, 12VDC	20A, 12VDC
	Parts code	624 173 2397	624 173 2397	924 173 2398
Switching power supply	Type	ZWS15-12/J	ZWS15-12/J	ZWS15-12/J
	Rated voltage	15W, 12V	15W, 12V	15W, 12V
	Parts code	624 227 1291	624 227 1291	924 227 1292
Transformer	Type	ATR-C50	ATR-C50	ATR-C50
	Rated voltage	200-240V	200-240V	200-240V
	Parts code	624 006 0408	624 006 0408	924 006 0409
Pressure switch	Type	SNS-C135Q002	SNS-C135Q002	SNS-C135Q002
	Rated voltage	OFF:2.75MPA ON:0.78MPA	OFF:2.75MPA ON:0.78MPA	OFF:2.75MPA ON:0.78MPA
	Parts code	624 227 0959	624 227 0959	924 227 0950
Door switch	Type	SS160-A15	SS160-A15	SS160-A15
	Rated voltage	28V, 50MA	28V, 50MA	28V, 50MA
	Parts code	624 197 1925	624 197 1925	924 197 1926
Temp. sensor	Type	PT-1000Ω	PT-1000Ω	PT-1000Ω
Transformer	Type	S41-RN98PV	S41-RN98PV	S41-RN98PV
	Rated voltage	P:100V, 9V, 0.46A	P:100V, 9V, 0.46A	P:100V, 9V, 0.46A
	Parts code	624 227 0836	624 227 0836	924 227 0837
Battery switch	Type	SLE6A2-5	SLE6A2-5	SLE6A2-5
	Rated voltage	4A, 250VAC	4A, 250VAC	4A, 250VAC
	Parts code	624 213 1472	624 213 1472	924 213 1473
Battery	Type	LC-P067R2J	LC-P067R2J	LC-P067R2J
	Rated voltage	6V, 7.2AH	6V, 7.2AH	6V, 7.2AH
	Parts code	624 227 0843	624 227 0843	924 227 0844
Cascade sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
Filter sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
AT sensor	Type	502AT	502AT	502AT
	Rated voltage	5KΩ, 25℃	5KΩ, 25℃	5KΩ, 25℃
Remote switch	Type	HLS208N	HLS208N	HLS208N
	Rated voltage	250VAC, 6A	250VAC, 6A	250VAC, 6A
	Parts code	624 169 9690	624 169 9690	924 169 9691
Solenoid valve	Type	X8263205LT	X8263205LT	X8263205LT
	Rated voltage	24VDC	24VDC	24VDC
	Parts code	624 226 8215	624 226 8215	924 226 8216
Back up switch	Type	HLS208N	HLS208N	HLS208N
	Rated voltage	250VAC, 6A	250VAC, 6A	250VAC, 6A
	Parts code	624 169 9690	624 169 9690	924 169 9691
Test switch	Type	8R2021	8R2021	8R2021
	Rated voltage	3A, 125VAC	3A, 125VAC	3A, 125VAC
	Parts code	624 194 3984	624 194 3984	924 194 3985

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MDF-C2156VAN/2156VANC		220V, 60Hz	220V, 50Hz	230/240V, 50Hz
Relay	Type	G4F-1123T	G4F-1123T	G4F-1123T
	Rated voltage	1C, 15A, 24VDC	1C, 15A, 24VDC	1C, 15A, 24VDC
	Parts code	624 001 4586	624 001 4586	924 001 4587
Power transformer	Type	ATR-K285T	ATR-K285T	ATR-K285T
	Rated voltage	P:100V, 115V, 230V	P:100V, 115V, 230V	P:100V, 115V, 230V
	Parts code	624 227 0850	624 227 0850	924 227 0851
Back up sensor	Type	PT-1000Ω	PT-1000Ω	PT-1000Ω
Breaker switch	Type	BAM215171	BAM215171	BAM215171
	Rated voltage	250V, 15A	250V, 15A	250V, 15A
	Parts code	624 226 3623	624 226 3623	924 226 3624
Noise filter	Type	ZAC2220-11	ZAC2220-11	ZAC2220-11
	Rated voltage	250VAC, 20A	250VAC, 20A	250VAC, 20A
	Parts code	624 204 3294	624 204 3294	924 204 3295
Time delay fuse	Type	SD4 UL E39265	SD4 UL E39265	SD4 UL E39265
	Rated voltage	250V, 0.5A	250V, 0.5A	250V, 0.5A
	Parts code	423 018 2109	423 018 2109	323 018 2102
Breaker switch (MDF-C2156VANC only)	Type	IR11A2E201R		
	Rated voltage	250VAC, 20A		
	Parts code	624 225 9589		
Power relay (MDF-C2156VANC only)	Type	G7L-1A-TUB		
	Rated voltage	30A, 220V, 24VDC		
	Parts code	624 208 1043		
Boost relay (MDF-C2156VANC only)	Type	G7L-1A-TUB		
	Rated voltage	30A, 220V, 24VDC		
	Parts code	624 208 1043		
Power transformer (MDF-C2156VANC only)	Type	ATR-HJ61TC-1		
	Rated voltage	200, 225, 240V		
	Parts code	624 226 7614		
Power transformer (MDF-C2156VANC only)	Type	ATR-D35003		
	Rated voltage	P:208V, S:230V		
	Parts code	624 226 7621		

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Specification of sensor

1. Following shows temperature and resistance values in thermistor sensor (502AT-1).

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

2. Following shows temperature （-170℃～0℃） and resistance values in temp. sensor (Pt1000Ω).

（℃）	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-170	330.4	326.2	322.1	318.0	313.8	309.7	305.5	301.4	297.3	293.1
-160	371.4	367.3	363.2	359.1	355.0	350.9	346.8	342.7	338.6	334.5
-150	412.2	408.2	404.1	400.0	395.9	391.9	387.8	383.7	379.6	375.5
-140	452.8	448.7	444.7	440.6	436.5	432.5	428.5	424.4	420.4	416.3
-130	493.0	489.0	485.0	481.0	477.0	472.9	468.9	464.9	460.8	456.8
-120	533.1	529.1	525.1	521.1	517.1	513.1	509.1	505.1	501.1	497.1
-110	572.9	569.0	565.0	561.0	557.0	553.0	549.1	545.1	541.1	537.1
-100	612.6	608.6	604.6	600.7	596.7	592.8	588.8	584.8	580.9	576.9
-90	652.0	648.1	644.1	640.2	636.2	632.3	628.4	624.4	620.5	616.5
-80	691.3	687.3	683.4	679.5	675.6	671.6	667.7	663.8	659.9	655.9
-70	730.3	726.4	722.5	718.6	714.7	710.8	706.9	703.0	699.1	695.2
-60	769.3	765.4	761.5	757.6	753.7	749.8	745.9	742.0	738.1	734.2
-50	808.1	804.2	800.3	796.4	792.6	788.7	784.8	780.9	777.0	773.2
-40	846.7	842.8	839.0	835.1	831.3	827.4	823.5	819.7	815.8	811.9
-30	885.2	881.4	877.6	873.7	869.8	866.0	862.1	858.3	854.4	850.6
-20	923.6	919.8	915.9	912.1	908.3	904.4	900.6	896.7	892.9	889.1
-10	961.9	958.0	954.2	950.4	946.6	942.7	938.9	935.1	931.3	927.4
0	1000.0	996.2	992.4	988.6	984.8	980.9	977.1	973.3	969.5	965.7

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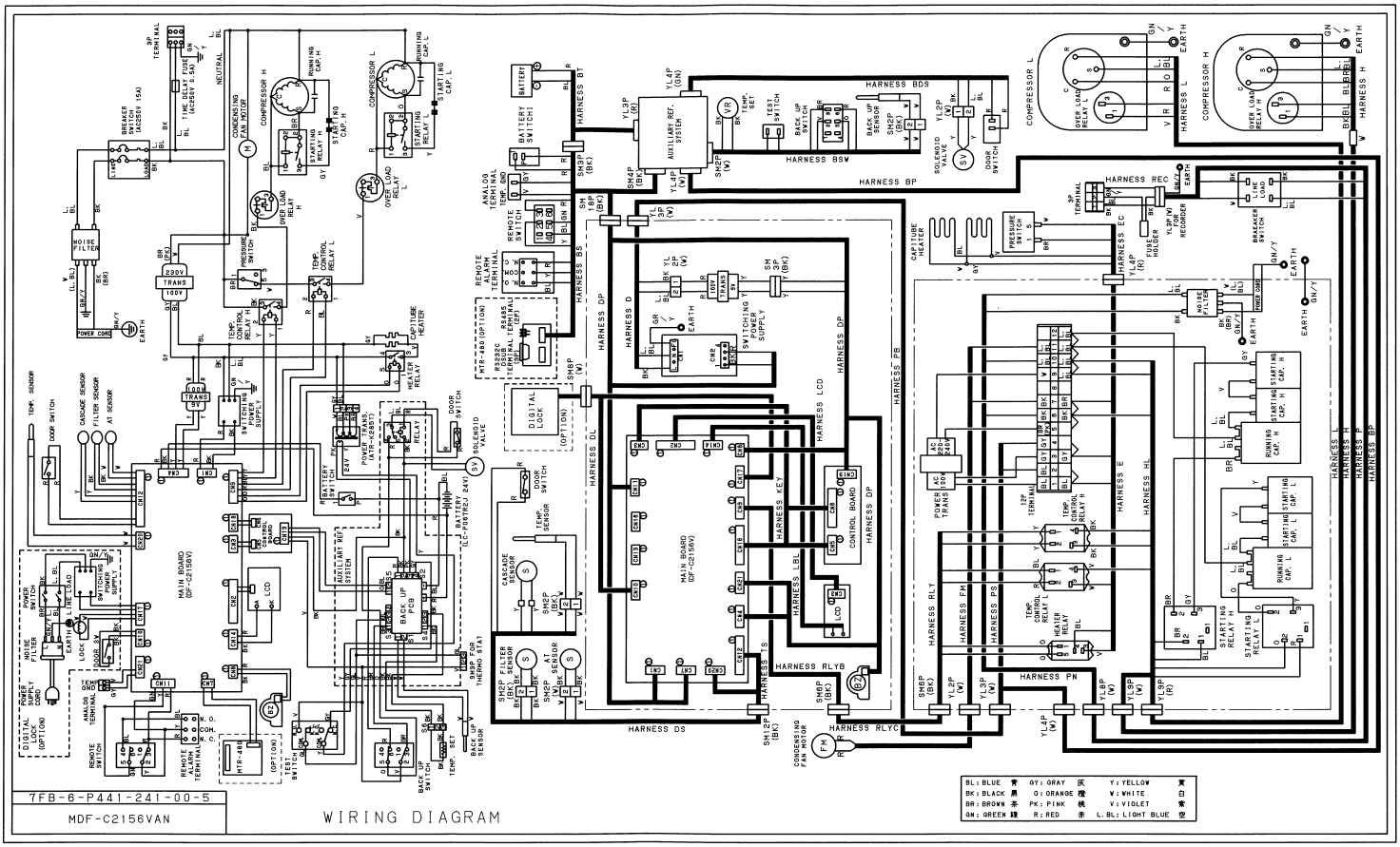
2. Following shows temperature （0℃～100℃） and resistance values in temp. sensor (Pt1000Ω).

（℃）	0	1	2	3	4	5	6	7	8	9
0	1000.0	1003.8	1007.6	1011.4	1015.2	1019.0	1022.8	1026.6	1030.4	1034.2
10	1038.0	1041.8	1045.6	1049.4	1053.2	1057.0	1060.8	1064.6	1068.4	1072.2
20	1076.0	1079.7	1083.5	1087.3	1091.1	1094.9	1098.7	1102.4	1106.2	1110.0
30	1113.8	1117.5	1121.3	1125.1	1128.8	1132.6	1136.4	1140.1	1143.9	1147.7
40	1151.4	1155.2	1159.0	1162.7	1166.5	1170.2	1174.0	1177.7	1181.5	1185.2
50	1189.0	1192.7	1196.5	1200.2	1204.0	1207.7	1211.5	1215.2	1219.0	1222.7
60	1226.4	1230.2	1233.9	1237.6	1241.4	1245.1	1248.8	1252.6	1256.3	1260.0
70	1263.8	1267.5	1271.2	1274.9	1278.7	1282.4	1286.1	1289.8	1293.5	1297.2
80	1301.0	1304.7	1308.4	1312.1	1315.8	1319.5	1323.2	1326.9	1330.6	1334.3
90	1338.0	1341.7	1345.4	1349.1	1352.8	1356.5	1360.2	1363.9	1367.6	1371.3
100	1375.0	1378.7	1382.4	1386.1	1389.8	1393.4	1397.1	1400.8	1404.5	1408.2

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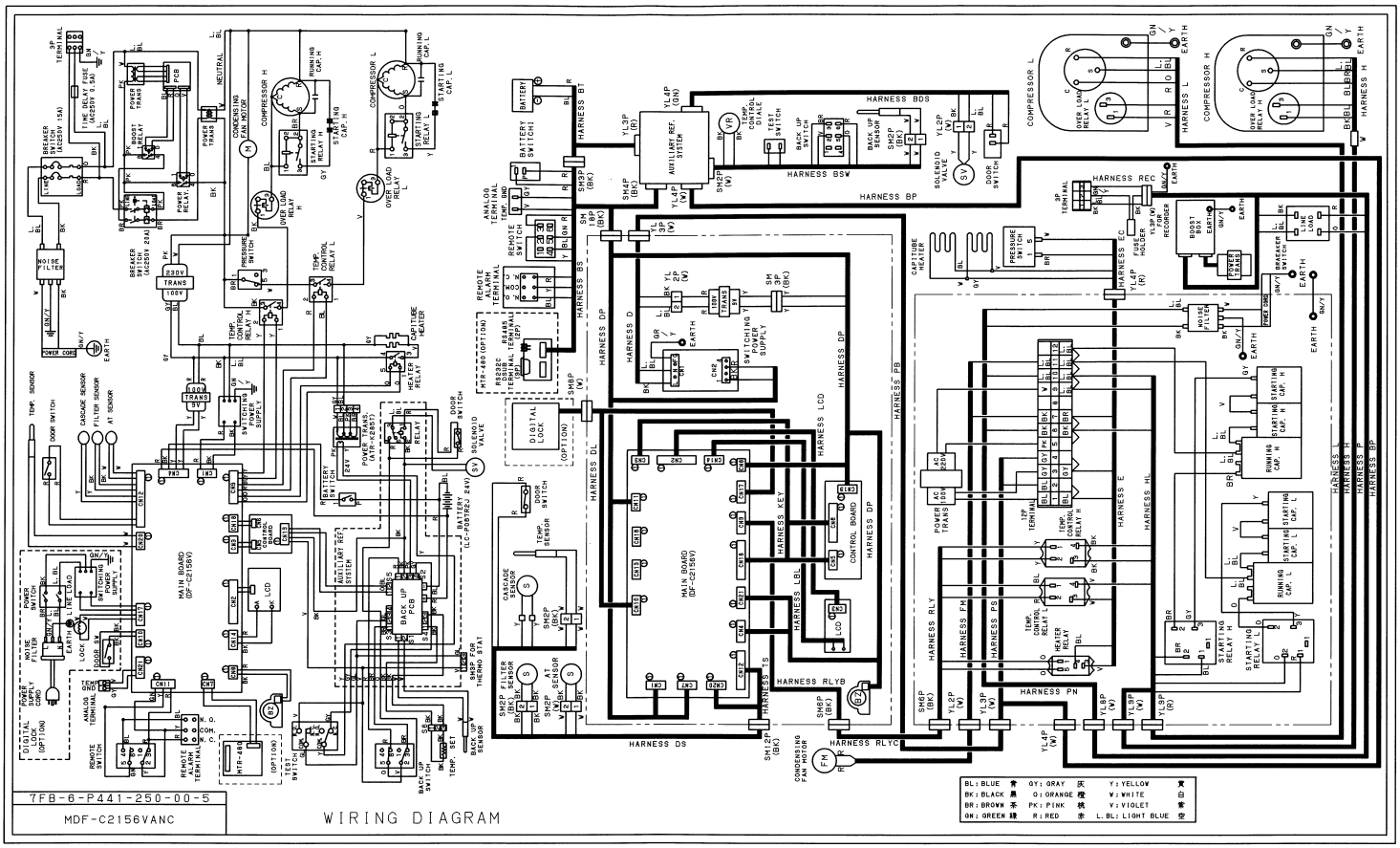
Wiring Diagram

<MDF-C2156VAN>



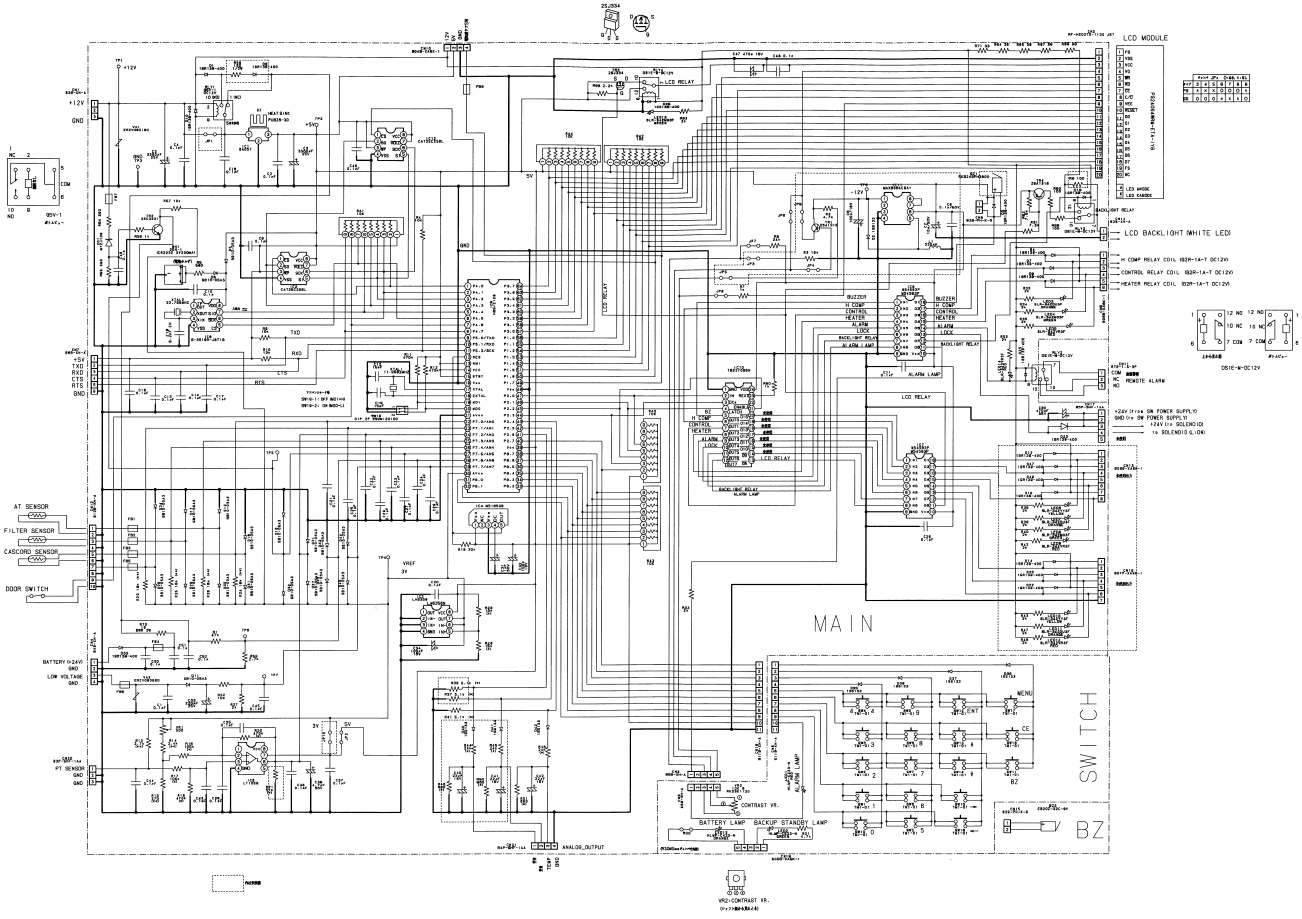
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<MDF-C2156VANC>



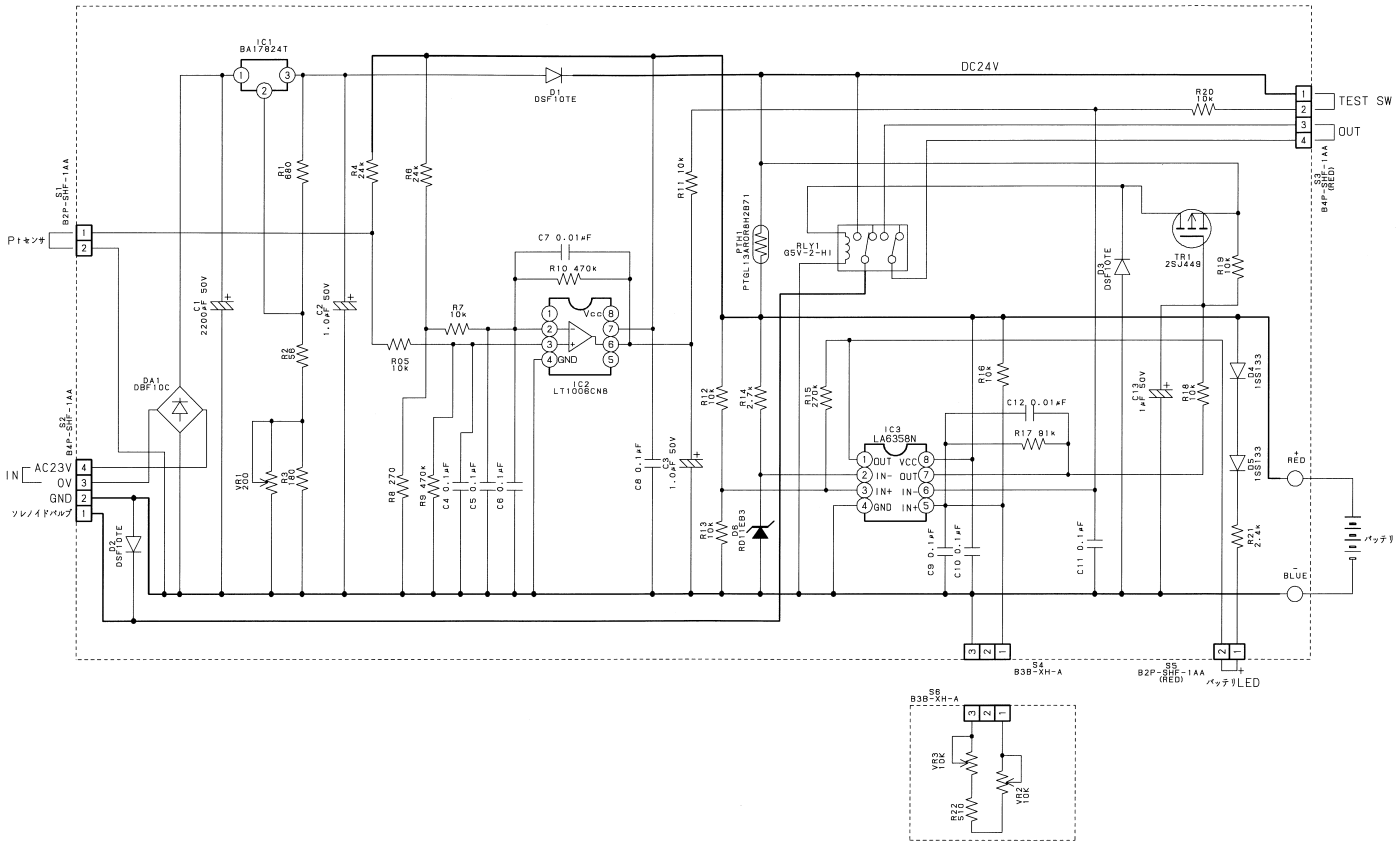
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Circuit Diagram



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CR Circuit Diagram



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Connections on PCB

* Following are explanation of connections on the Main PCB.

Connector	Connects to	Usage	Voltage
CN1	Switching power supply	To supply the power to PCB.	#1: 12V
CN2	LCD module	To connect with LCD.	
CN3	Control Board (CN5)	To connect with LCD contrast adjusting knob.	
CN4	#1-#2: Battery switch #3-#4: Transformer(100V, 9V)	To supply the power to Main PCB during power failure. To detect abnormal low voltage.	#1-#2: 24V
CN5	Main PCB (CN3)		
CN6	Main PCB (CN18)		
CN7	MTR-480 (Option)	To connect with interface.	#1: 5V
CN8	#1-#2: Buzzer PCB	To connect with buzzer.	
CN9	#1-#2: Temp. control relay H #3-#4: Temp. control relay L #5-#6: Heater relay	To control compressor H. To control internal temperature. To supply the power to cap. tube heater.	
CN10	#3-#4: Door switch	To control digital lock (Option).	#1: 12V #2: 5V
CN11	Remote alarm terminal Remote switch	To output remote alarm	#1: COM #2: N.C. #3: N.O.
CN12	#1-#2: AT sensor #3-#4: Filter sensor #5-#6: Cascade sensor #9-#10: Door switch	To detect ambient temperature. To detect temperature at condenser outlet pipe. To detect temperature at cascade. To control door switch.	
CN13	Unused		
CN14	LCD module	To supply the power to back lamp for LCD.	
CN15	Main PCB (CN8)		
CN16	Unused		
CN17	#1-#2: Switching power supply #3-#4: Lock	To supply the power to digital lock.	#1: 24V #3: 24V
CN18	Control board (CN6)	To connect with each keys.	
CN19	#3-#4: Back up PCB	To connect with back-up system.	
CN20	#1-#3: Temp. sensor	To detect internal temperature.	
CN21	#3-#4: Analog terminal	To output analog.	

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* Following are explanation of connectors on the Back-up PCB.

Connector	Connects to	Usage	Voltage
S1	Back-up sensor	To detect internal temperature.	
S2	#1-#2: Solenoid valve #3-#4: Power transformer	To supply the power to solenoid valve. To supply the main power	24V
S3	#1-#2: Test switch	To test back-up system.	
S4	Temperature control knob	To set temperature for back-up.	
S5	Battery LED	To light LED when low battery.	
S6	Temperature control dial		

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Control specifications

1. Temperature control range

Settable temperature: -125℃ ~ -155℃

Internal temperature display range: -180℃ ~ +50℃

Setting method: In 'TopScreen', press MENU key and step into temperature setting mode with Shift key (upward, downward, rightward, leftward), then set your desired value with Figure Input key. Press MENU/OK to store the value.

2. Alarm and safety functions

(1) Error code

E01: Temp. sensor is open circuited.
When temperature in temp. sensor is equal or higher than -180℃, 'E01' is displayed in 'TopScreen', the basic screen.

E02: Temp. sensor is short circuited.
When temperature in temp. sensor is equal or lower than +50℃, 'E02' is displayed in 'TopScreen', the basic screen.

E03: Cascade sensor is open circuited.
When temperature in cascade sensor is equal or lower than -70℃, 'E03' is displayed in 'TopScreen', the basic screen.

E04: Cascade sensor is short circuited.
When temperature in cascade sensor is equal or higher than +100℃, 'E04' is displayed in 'TopScreen', the basic screen.

E05: Filter sensor is open circuited.
When temperature in filter sensor is equal or lower than -70℃, 'E05' is displayed in 'TopScreen', the basic screen.

E06: Filter sensor is short circuited.
When temperature in filter sensor is equal or higher than +100℃, 'E06' is displayed in 'TopScreen', the basic screen.

E07: AT sensor is open circuited.
When temperature in AT sensor is equal or lower than -70℃, 'E07' is displayed in 'TopScreen', the basic screen.

E08: AT sensor is short circuited.
When temperature in AT sensor is equal or higher than +100℃,'E08' is displayed in 'TopScreen', the basic screen.

E09: When Alarm test is performed with battery uncharged or battery switch is OFF position, 'E09' is displayed in 'TopScreen', the basic screen.

E10: When temperature in filter sensor is equal or higher than +60℃,'E10' is displayed in 'TopScreen', the basic screen, and Compressor H is ceased.

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(2) High temp. alarm

When internal temperature is higher than high temperature alarm setting value, alarm lamp flashes, intermittent buzzer beeps with 15 minutes of delay and remote alarm activates.

Press BUZZER key to stop buzzer beeping. However, buzzer beeps again after Ring Back time is passed. Remote alarm is still activated during this period.

High temp. alarm setting range: SV+5℃ ~ +20℃ (Initial: +10℃)

Ring Back time setting range: 1 ~ 99 minutes (Initial: 30 minutes)

* 0 minutes = Alarm does not recover.

* Note) During pull-down, both buzzer and remote alarm don't activate.

(3) Low temp. alarm

When internal temperature is lower than low temperature alarm setting value, alarm lamp flashes, intermittent buzzer beeps with 15 minutes of delay and remote alarm activates.

Press BUZZER key to stop buzzer beeping, however, buzzer beeps again after Ring Back time is passed. Remote alarm is still activated during this period.

Low temp. alarm setting range: SV-5℃ ~ -20℃ (Initial: -10℃)

Ring Back time setting range: 1 ~ 99 minutes (Initial: 30 minutes)

* 0 minutes = Alarm does not recover.

* Note) During pull-down, both buzzer and remote alarm don't activate.

(4) Door alarm

When door is open, intermittent buzzer beeps and 'DOOR' at 'TopScreen' flashes.

Shut door or press BUZZER key to stop buzzer beeping. Remote alarm does not activate during this period.

Door alarm setting range: 1 ~ 15 minutes (Initial: 2 minutes)

(5) Filter alarm

When temperature in filter sensor is equal or higher than +48.0℃, intermittent buzzer beeps and 'FILTER' at 'TopScreen' flashes. Remote alarm does not activate.

Press BUZZER key to stop buzzer beeping. (Buzzer does not recover automatically)

When temperature in filter sensor is equal or lower than +43.0℃, buzzer stops beeping and indication is disappeared.

If you set buzzer does not activate, buzzer does not beep.

(6) Remote alarm

Remote alarm is output from the terminal.

Contact status 'Normal': 'Open' between COM. and N.O.

'Close' between COM. and N.C.

Contact status 'Abnormal': 'Open' between COM. and N.C.

'Close' between COM. and N.O.

*Note) When remote alarm is OFF position at Default setting screen, remote alarm does not activate. (Initial: 1 (=ON))

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3. Buzzer Auto-recovery (Ring Back function)

You can stop buzzer beeping temporary with BUZZER key pressed. Remote alarm contact does not activate at the time.

Ring Back setting time: 1 ~ 99 minutes

* 0 minute = Buzzer does not recover if BUZZER key pressed once.

4. ON/OFF control for Compressor H

Start-up: Compressor H turns on with 2 minutes of delay after the power is supplied.
Compressor H starts with designed delay time after the power failure.

Protection: Compressor H is forcibly turned off when temperature in filter sensor is equal or higher than +60℃.

Recovery: Compressor H is turned on when temperature in filter sensor is equal or lower than AT + 10℃ and also compressor delay time is passed.

5. ON/OFF control for Compressor L

ON: When cascade temperature is equal or lower than -34℃, Compressor L is turned on.

OFF: When cascade temperature is equal or higher than -12℃, Compressor L is turned off.

Differential: When compressor delay timer is set at '0' and controlled temperature is higher than SV+0.5℃, Compressor L is turned on.
When controlled temperature is SV-0.5℃, Compressor L is turned off.

6. Monitor of freezer status

(1) Abnormal ambient temperature
When ambient temperature is equal or lower than 0℃, or equal or higher than +35℃, 'Status-1' is displayed.

(2) Voltage decline
When the voltage decreases in about 170V, 'Status-2' is displayed.

When the unit detects above abnormal status, the Status indication flashes on the basic screen with massage indication.

(3) Compressor running rate
You can see compressor running rate in the indication of MENU/Svc – Status in the screen of 'Hardware Status'.

* Running rate of Compressor L
= {Compressor ON time / (Compressor ON time + Compressor OFF time)} x 100 (%)

7. Control of Cap. tube heater

Cap. tube heater is permitted to turn on once every 18 hours.

Cap. tube heater is forcibly turned on for 8 minutes after compressor L is turned off and

8. MENU screen

In MENU is displayed on the basic screen, MENU is automatically disappeared if there is not any key inputs for 1 minute.

In MENU is not displayed on the basic screen, the screen is changed for renewal once every hours.

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9. Operation in power failure

Unit checks power failure by the port for detecting power failure in every 0.42 seconds.
Operation in power failure;

- All ports for controlling compressor, cap. tube heater, LCD back lamp, signal lines and digital lock turn off and unit operates to the mode in low power consumption.
- LCD is turned off and intermittent buzzer beeps.
- If you press BUZZER key, buzzer stops beeping, LCD back lamp is lit for 5 seconds and you can check the time when power failure was occurred. However, buzzer beeps again after buzzer resume time is passed.
- Log data is stored.

10. Auto Return

Display changes to the basic screen if there are any key inputs for 90 seconds.

11. Notice of parts replacement

- Battery replacement: When battery accumulating time is over than 2.8 years, 'Please exchange batteries' is indicated.
- Fan motor replacement: When fan motor accumulating time is over than 5.6 years, 'Please exchange fan motor' is indicated.

12. Warning message

Y M D H M S

- High temp. alarm: ' High Temp Warning 20XX/XX/XX XX:XX:XX '
- Low temp. alarm: ' Low Temp Warning 20XX/XX/XX XX:XX:XX '
- Power failure alarm: ' Power failure Warning 20XX/XX/XX XX:XX:XX '
- Filter alarm: ' Please check a condenser filter '

13. Setting specifications

Internal temperature	-155℃~-125℃ (Initial: -150℃)	Ring Back	1~99 min. 0: OFF (Initial: 30 min.)
High temp. alarm	+5℃~+20℃ (Initial: +10℃)	Door delay time	1~15 min. (Initial: 2 min.)
Low temp. alarm	-5℃~-20℃ (Initial: -10℃)	Log record time	2~30 min. (Initial: 15 min.)
Alarm delay time	15 min.	Compressor L delay time	2 min.
Compressor L ON/OFF	ON: -34℃ OFF: -12℃	Compressor delay time after power failure	2~15 min. (Initial: 15 min.)
Cycle of Cap. tube heater ON	Every 18hrs.	Cap. tube heater ON time	6~15 min. (Initial: 8 min.)
Differential of Compressor L	+/- 0.5℃	Compressor H protection	OFF: +60℃ up ON: AT+10℃
Filter alarm operation	Message Buzzer:ON/OFF (Initial: ON)	Internal temp. offset	-4.0℃
Auto Return	90 sec.	Auto MENU OFF	60 sec.
Key lock password	Initial: 0000		

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Operation of Control Panel

Note: For the operations of 'Basic Screen', 'Function', 'Key Lock function', 'Display of Log', 'Various Setting', 'Initialization' 'Setting of date, time, log interval' and 'Key Lock Password', please refer to P.15~P.22 in the Instruction Manual.

1. Buzzer

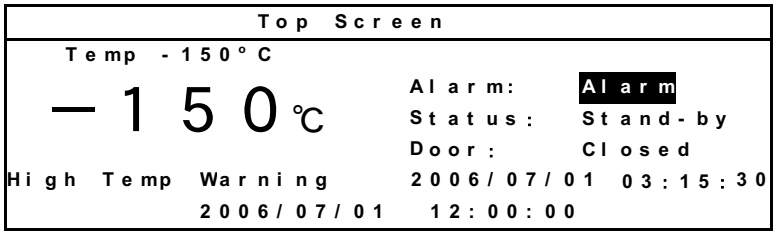
・Buzzer for Temperature Alarm (Intermittent tone)
Buzzer beeps intermittently after 15 minutes has passed since the unit was detected High Temp. alarm or Low Temp. alarm. Press BUZZER key to stop buzzer beeping.
Buzzer beeps again if the unit still keeps alarming condition even after Ring Back time has passed.

- Intermittent buzzer tone and message indication emitted even after Auto Recovery.
- Press BUZZER key to erase message and buzzer tone.

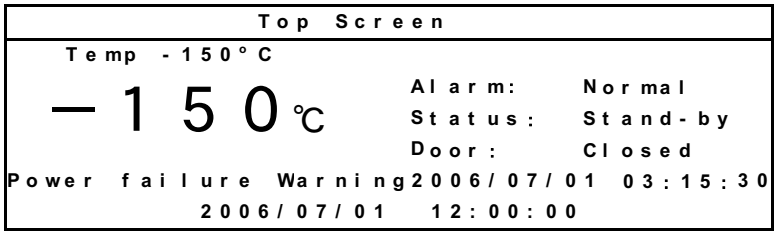
・Buzzer for Door Alarm (Intermittent tone)
Buzzer beeps intermittently after delay time has passed since door was open.
Shut door or press BUZZER key to stop buzzer beeping.
- Remote alarm does not activate.

・Buzzer for Filter Alarm (Intermittent tone)
Buzzer beeps intermittently when temperature in filter sensor is equal or higher than +48.0℃
Buzzer stops beeping when temperature in filter sensor is equal or lower than +43.0℃.
- Remote alarm does not activate.

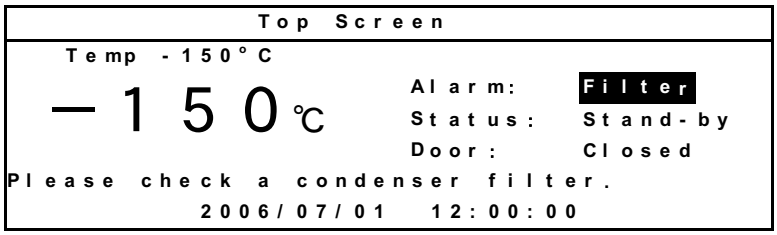
Screen of High Temp. alarm



Screen of power failure



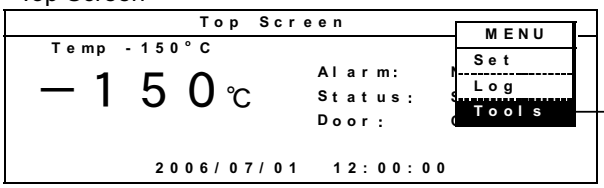
Screen of filter alarm



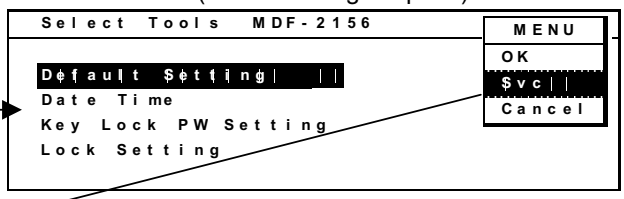
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2-1. MENU/Tools – Select Tools Svc
Temperature calibration, Service function - Secret function for Customers

Top Screen



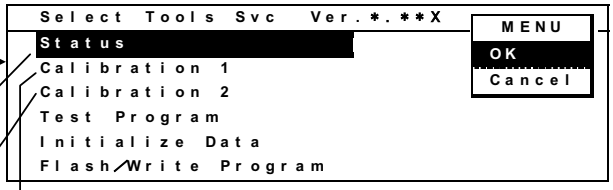
Select Tools (* Lock Setting is option)



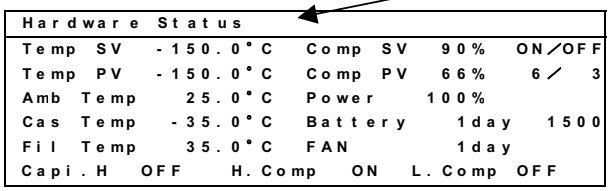
Password (for service): 384



Select Tools for service

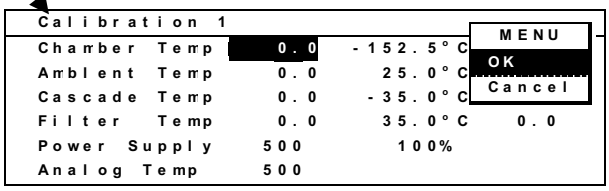


Status indication



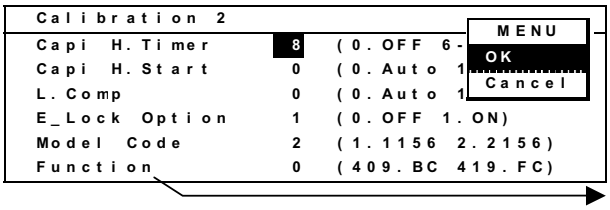
Indication for Internal temp, Ambient temp, Cascade temp, Filter temp, Power supply voltage, Compressor status, Compressor running rate, Battery accumulating time, Fan motor accumulating time and battery life

Calibration 1



Calibration for Intermal temp, Ambient temp, Cascade temp and Filter temp

Calibration 2

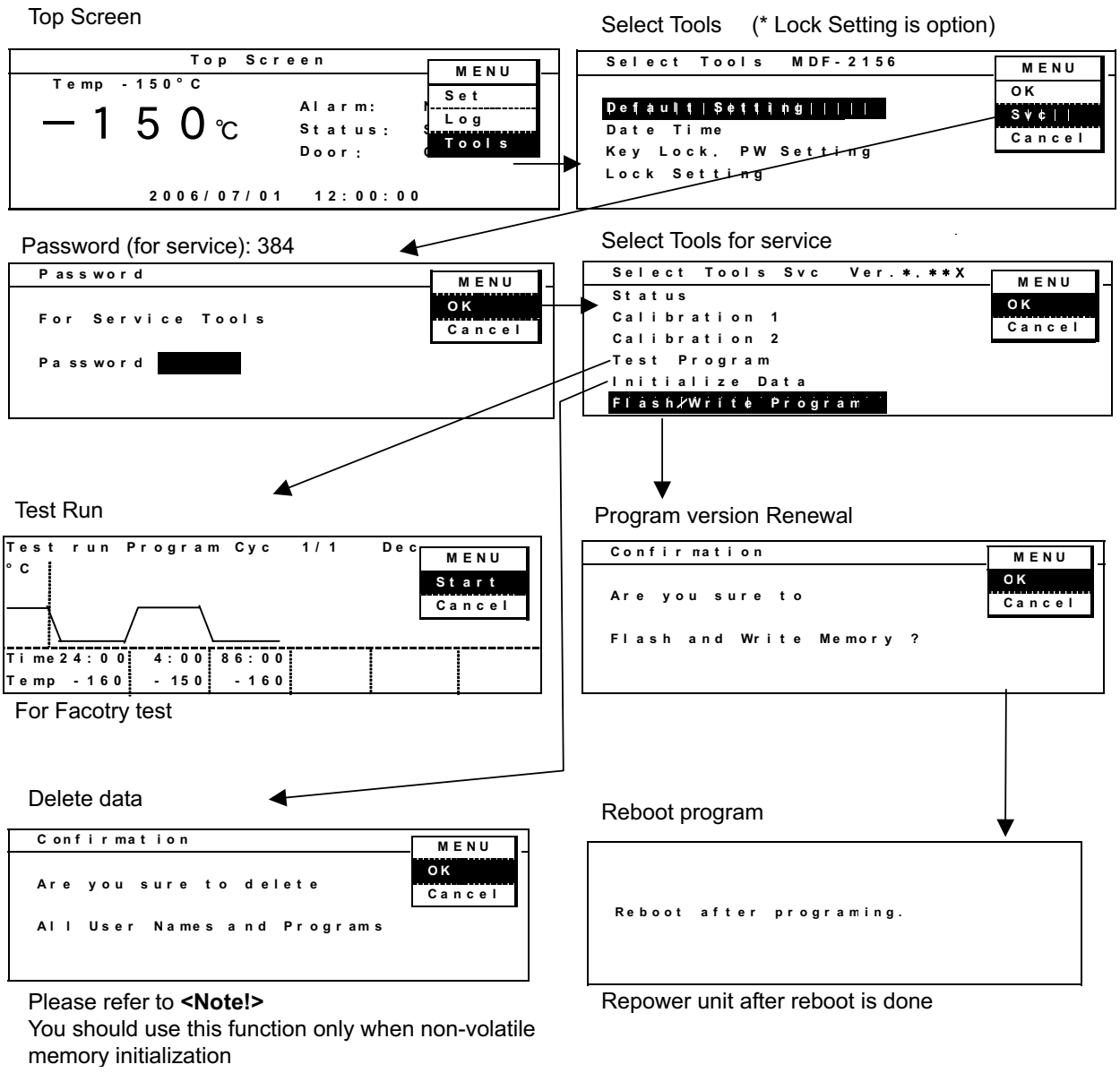


Capi H.Timer: Cap. tube heater ON time
Setting range: 6～15min. (Initial: 8min.)
Capi H.Start: Operation of Cap. tube heater
0: ON every 18hrs.
1: Forcibly ON
2: OFF
E_Lock Option: Usage of Digital Lock (Option)
0: Unused
1: Used
Model Code: Products model code
1: MDF-1156ATN
2: MDF-C2156VAN
Function:
Indications of Key lock Password and Master ID Password
Reset for battery and fan motor accumulating time, Memory initialization

Function #	Function
0	Mode for shipment
101	Key lock Password is indicated forcibly
102	Master ID and Password are indicated forcibly
103	Log indication (Cascade temp, Ambient temp)
104	Log Address is indicated during data ansmission to PC
105	Digital Lock Password is indicated during data transmission to PC
409	Reset battery replacement
419	Reset fan motor replacement
925	Non-volatile memory initialization Set '925' and perform 'MENU/Tools - Svc - Initialize All Data' to initialize value. Repower unit to set initial value. Function # automatically reverts to '0' after initialization done. <Note> You should perform Temp. Calibration because temp. calibration value is also initialized.

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2-2. MENU/Tools – Select Tools Svc
Maintenance function – Secret function for Customers



Please refer to **<Note!>**
You should use this function only when non-volatile memory initialization

Repower unit after reboot is done

<Note!>

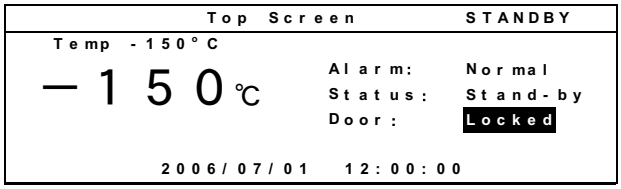
1. Initialization for Calibration data and all accumulating data
   (1) Set Function # '925' at screen of 'Calibration 2'.
   (2) Erase all data at screen of 'Initialize All Data MENU/OK'.
   (3) Cut the power off and repower unit.

2. Flash memory reboot
   Interface board, MTR-480 (option) and communication cable for RS232C are necessary to reboot memory.

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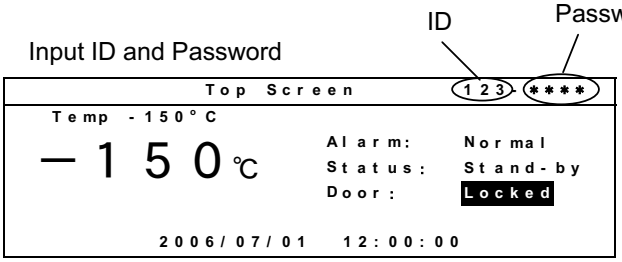
3-1 Digital Lock – Unlock

Locked



・Door is closed with locked (Solenoid OFF)

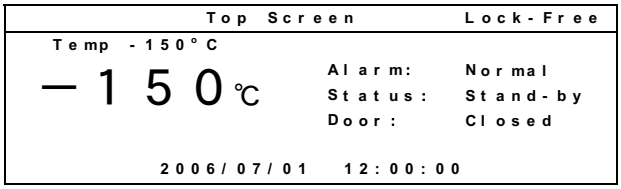
Input ID and Password



Input ID and Password without pressing ENTER key to indicate digits one by one. Press ENTER key after all 7 digits are input.
(Ex. ID 123, Password * * * *)

Note) If you don't press ENTER key within 30 seconds since you input 1st digit of ID, buzzer beeps to revert to STANDBY automatically.

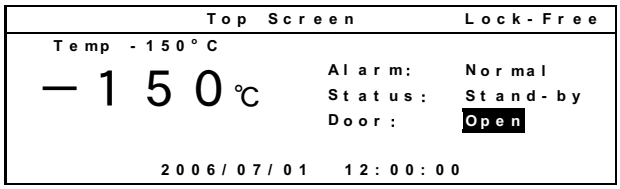
Unlocked



Buzzer beeps with unlocked after ID and Password input correctly.

Note) If you don't open door within 30 seconds since unlocked, buzzer beeps to lock again.

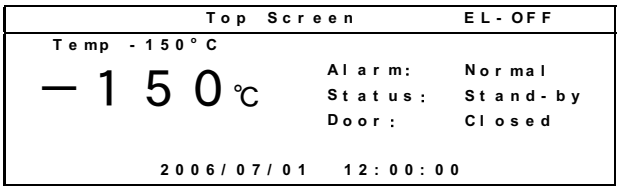
Unlocked and door open



The screen shows unlocked and door open.

Note) You cannot input ID and Password at the time.

Digital Lock is unused

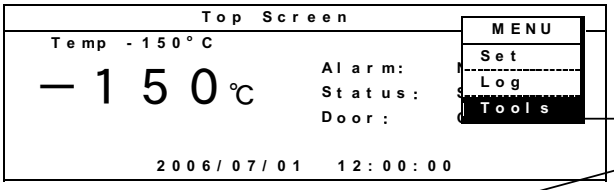


The screen shows Digital Lock is unused when you set '0' (Disable) in Lock Setting screen.

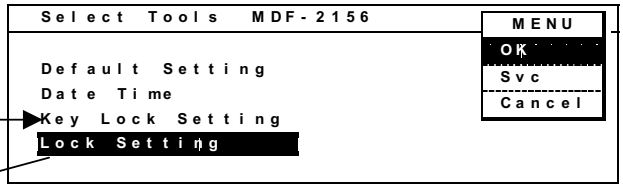
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3-2. Digital Lock - MENU/Tools - Lock Setting

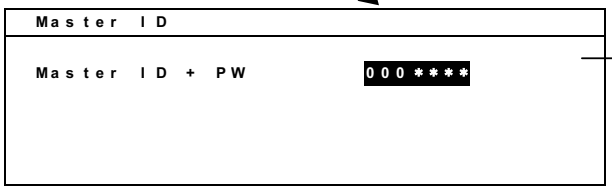
Top Screen



Select Tools

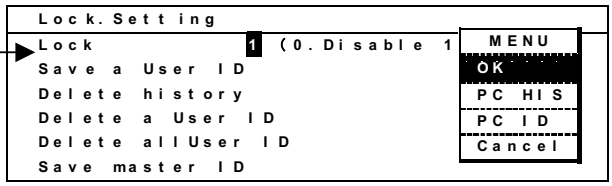


Master ID and Password input



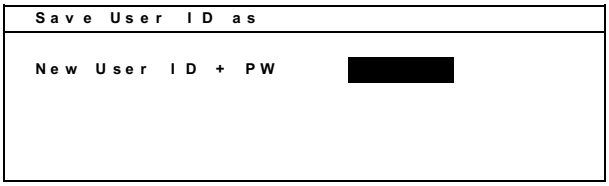
Initial setting: Master ID '000' Password '0000'
Secondary Master ID '384↑' Password '384←'

Lock Setting screen



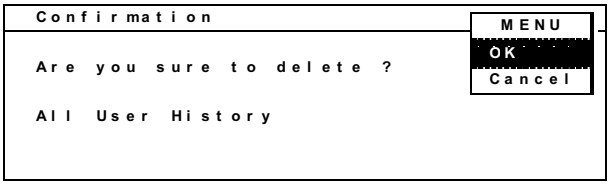
Lock setting: 0: Disable 1: Able

Saving of ID and Password



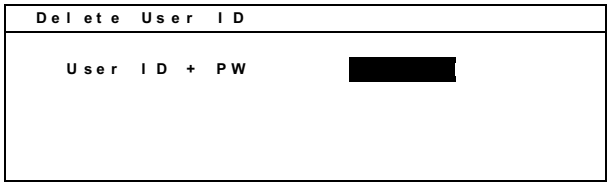
Input desired ID and Password then press ENTER key. Input ID and Password again for confirmation and press ENTER key again to save ID and Password.
Note) In case your input ID and Password are already saved or not matched, they are cleared to standby.

Delete all history of door open-and-shut



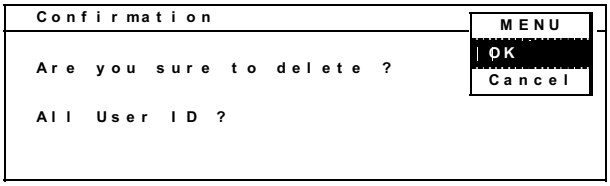
History opened by Master ID is not deleted.

Delete specified ID and Password



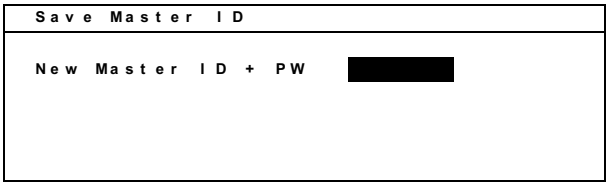
Input specified ID and Password then press ENTER key. Input ID and Password again for confirmation and press ENTER key again to delete specified ID and Password.
Note) In case your input ID and Password are not saved or not matched, they are cleared to standby.

Delete all ID and Password



All saved ID and Password is deleted.

Saving of Master ID and Password



Input desired Master ID and Password and press ENTER key. Input master ID and Password again for conformation and press ENTER key again to save Master ID and Password.

Initial setting: Master ID '000' Password '0000'

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Parts layout

<Control panel>



Digital temperature indicator





Communication box cover

Back-up test switch

Remote alarm switch

Remote alarm terminal

Back-up switch

Analog output terminal

Temp. control knob

Battery switch

Power supply switch

AT sensor

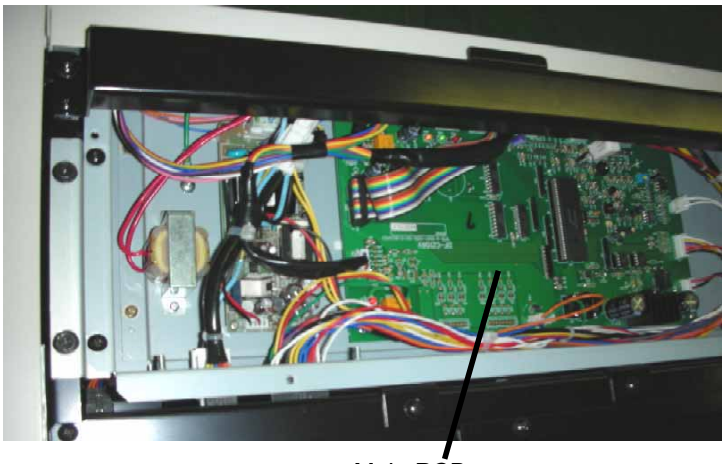
<Grille>



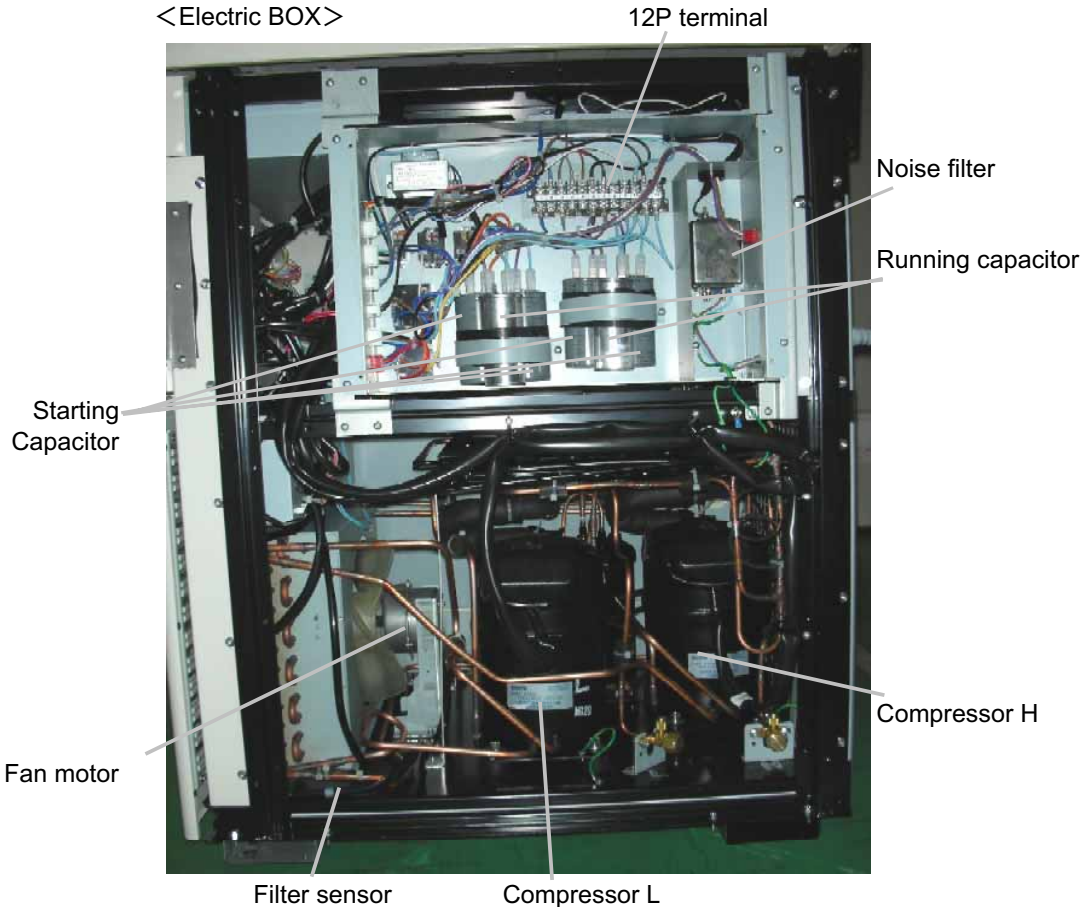
Exhaust air vent

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＜Control BOX＞

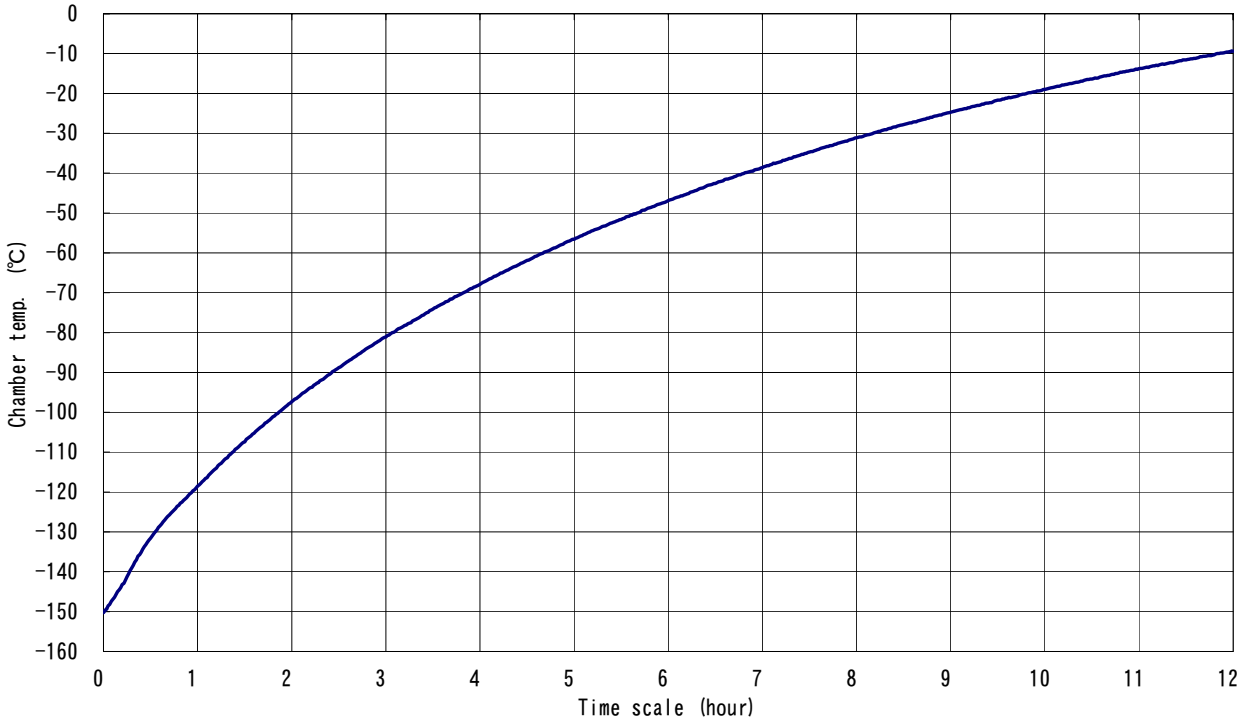


＜Electric BOX＞

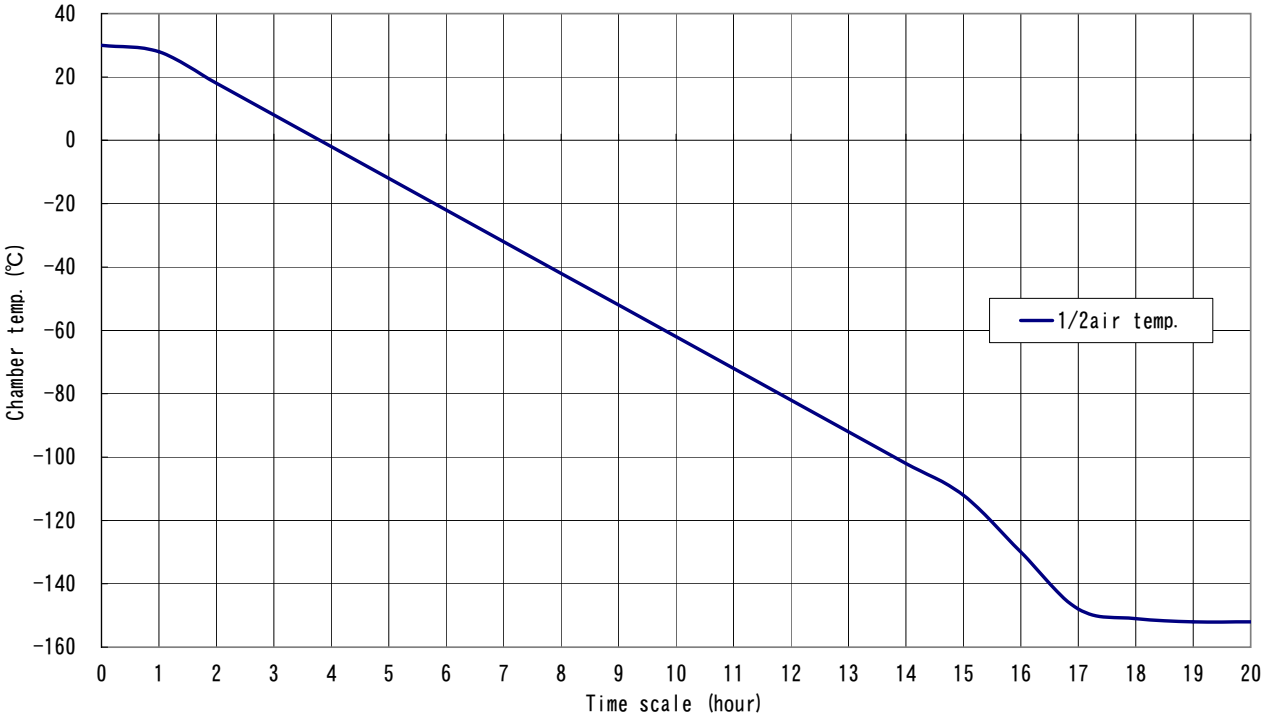


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Test Data



Pull-up data (AT30℃)



Pull-down data (Φ3, 50Hz AT30℃)

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*** Temperature uniformity for MDF-C2156VAN**

Conditions: (chamber air temp. ϕ3, 50Hz , AT30℃)

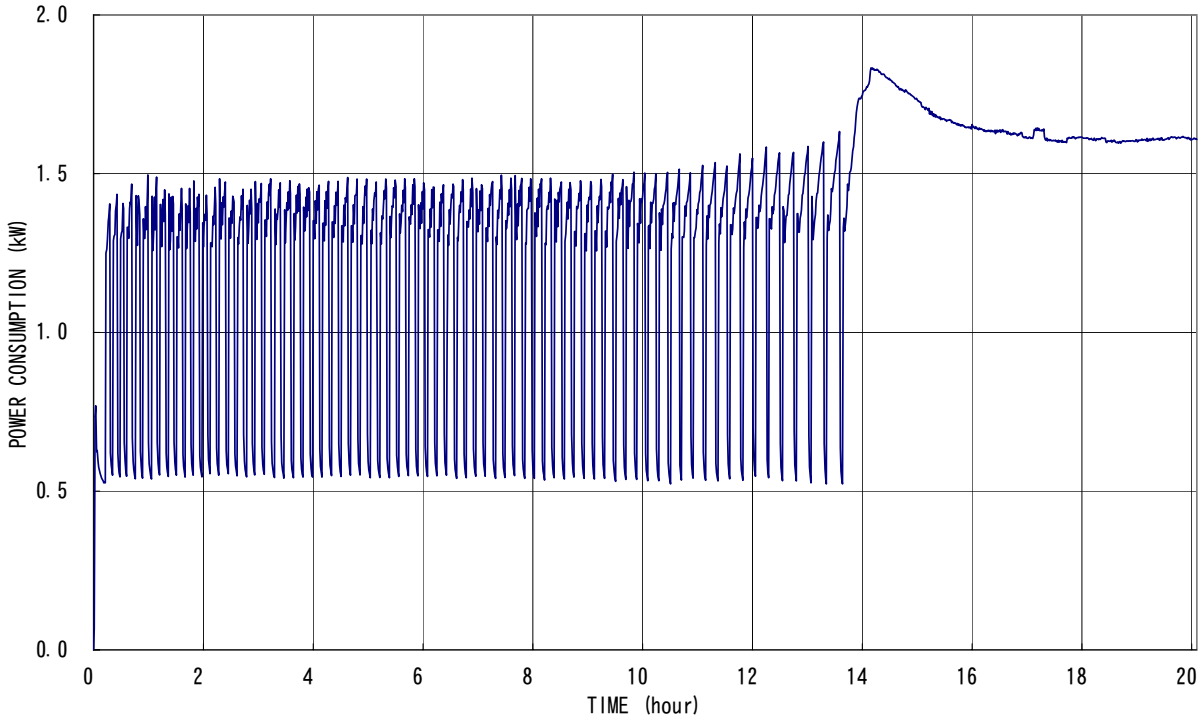
−147℃	−146℃	−149℃	
−149℃	−150℃	−150℃	
−149℃	−150℃	−151℃	

*** Temperature variation for MDF-C2156VAN**

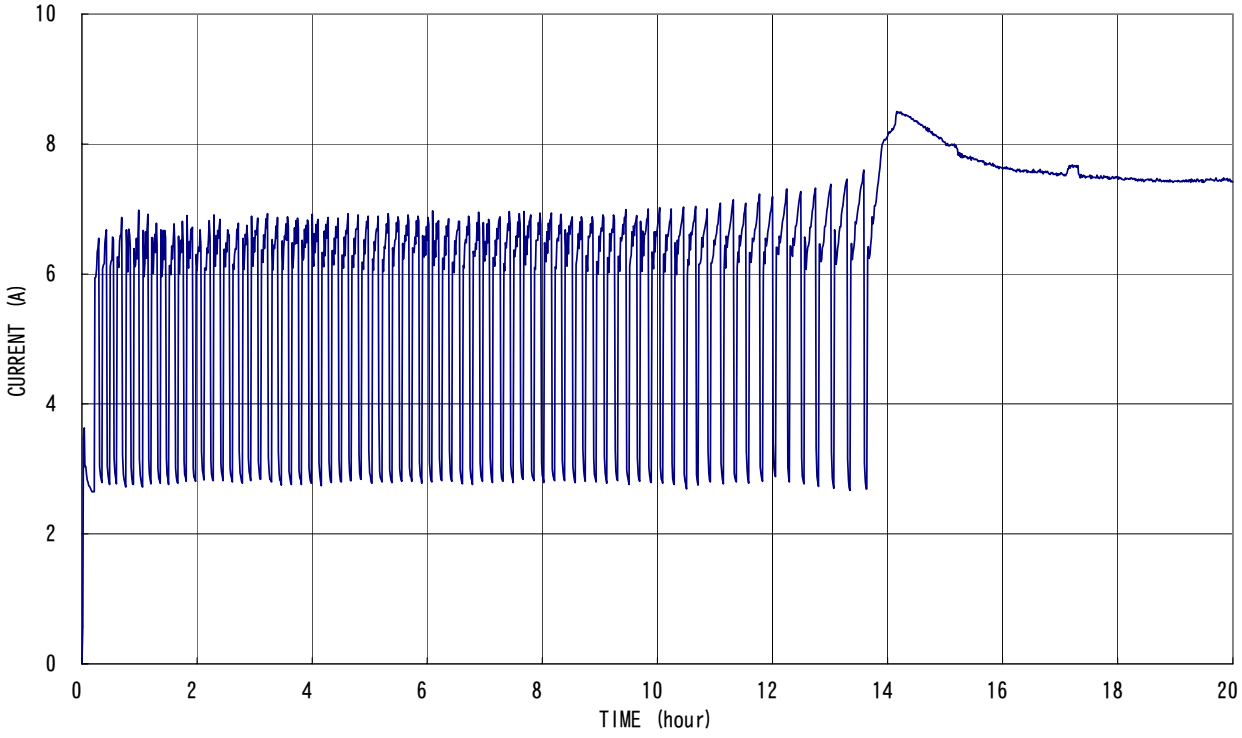
Conditions: (chamber air temp. ϕ3, 50Hz, AT30℃)

	+2℃ -150℃ -2℃		

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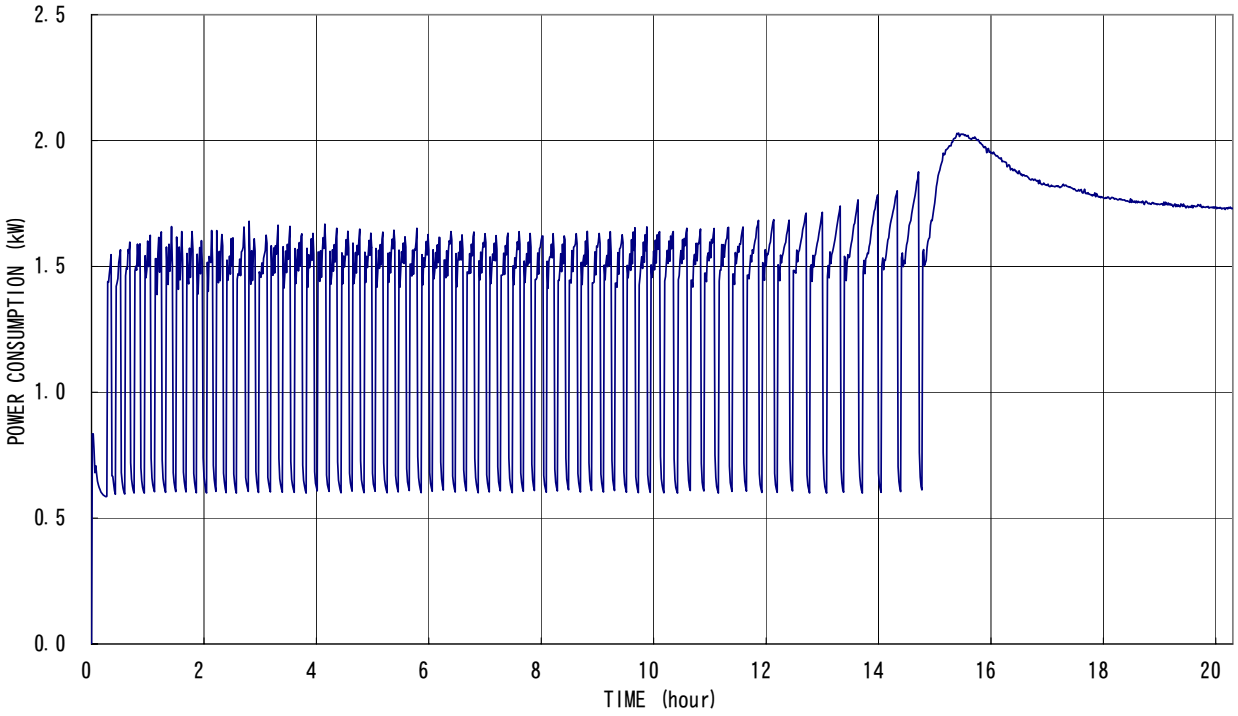


POWER CONSUMPTION (220V50Hz, AT30℃)

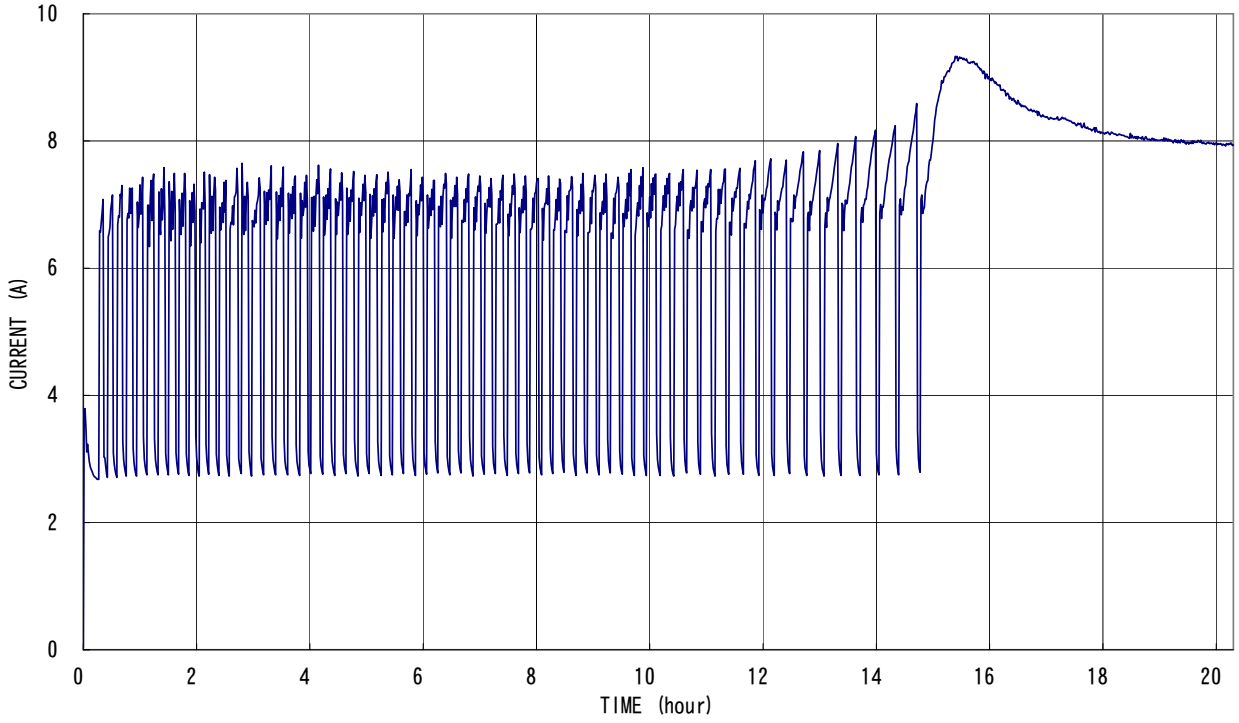


CURRENT (220V50Hz, AT30℃)

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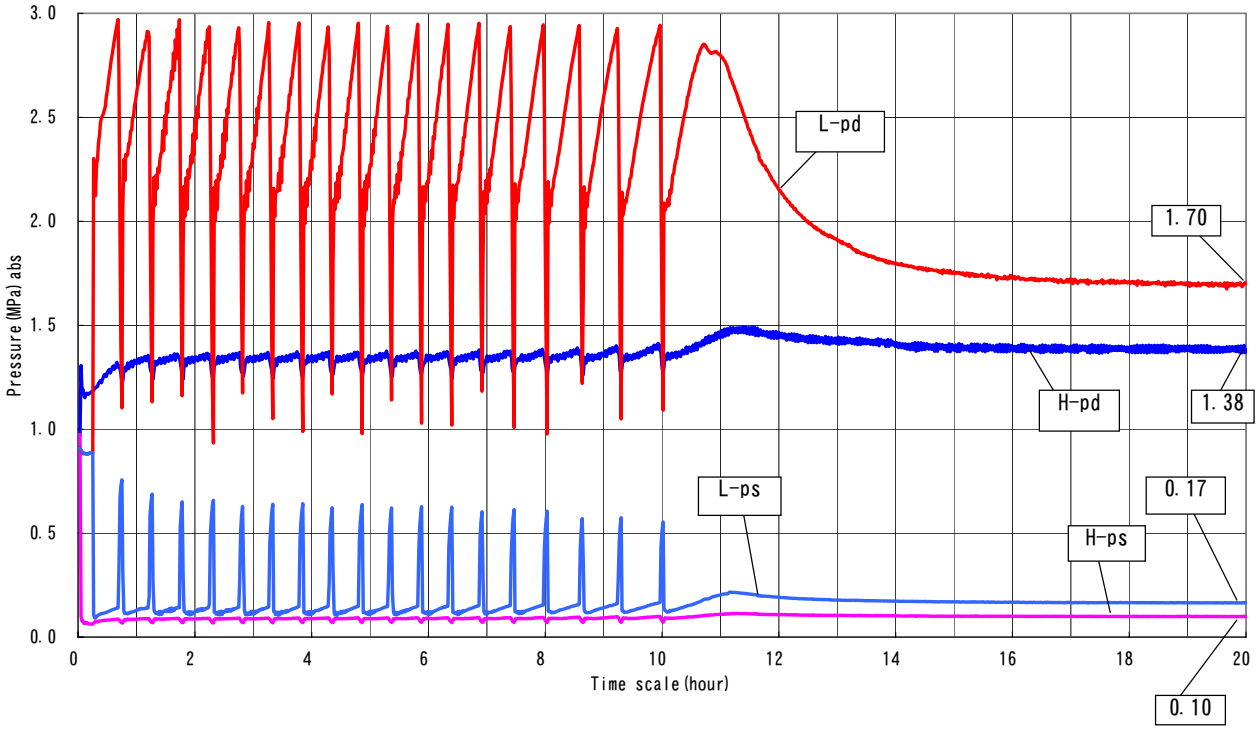


POWER CONSUMPTION (220V60Hz, AT30℃)

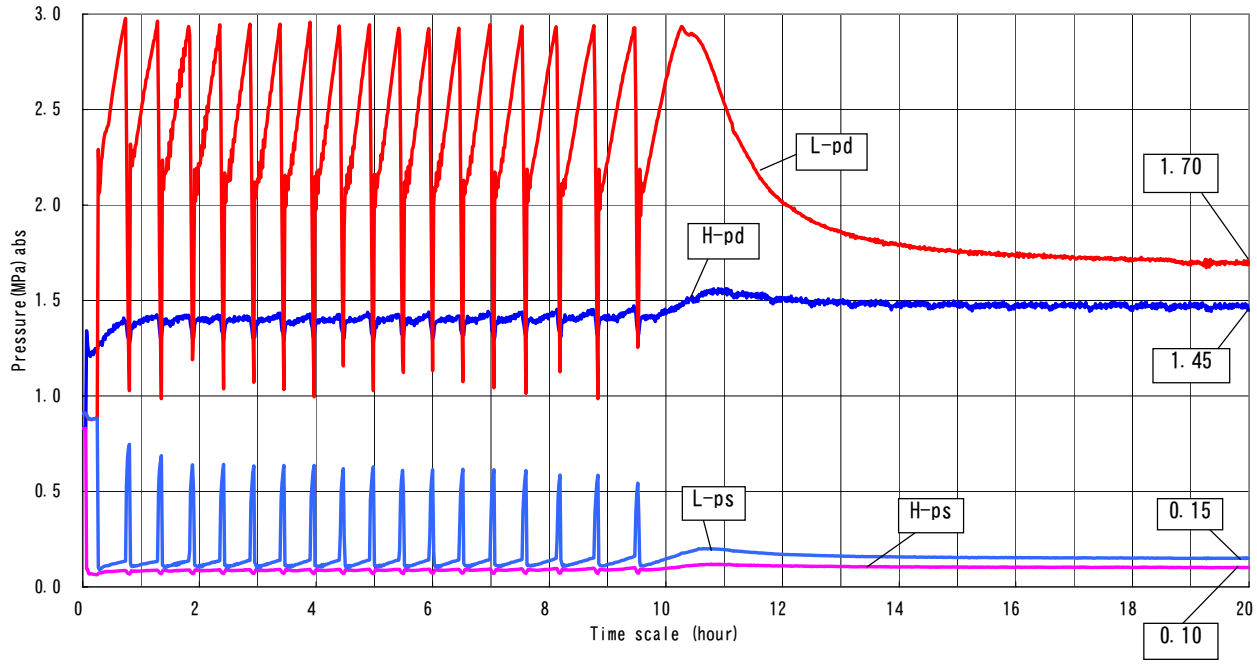


CURRENT (220V60Hz, AT30℃)

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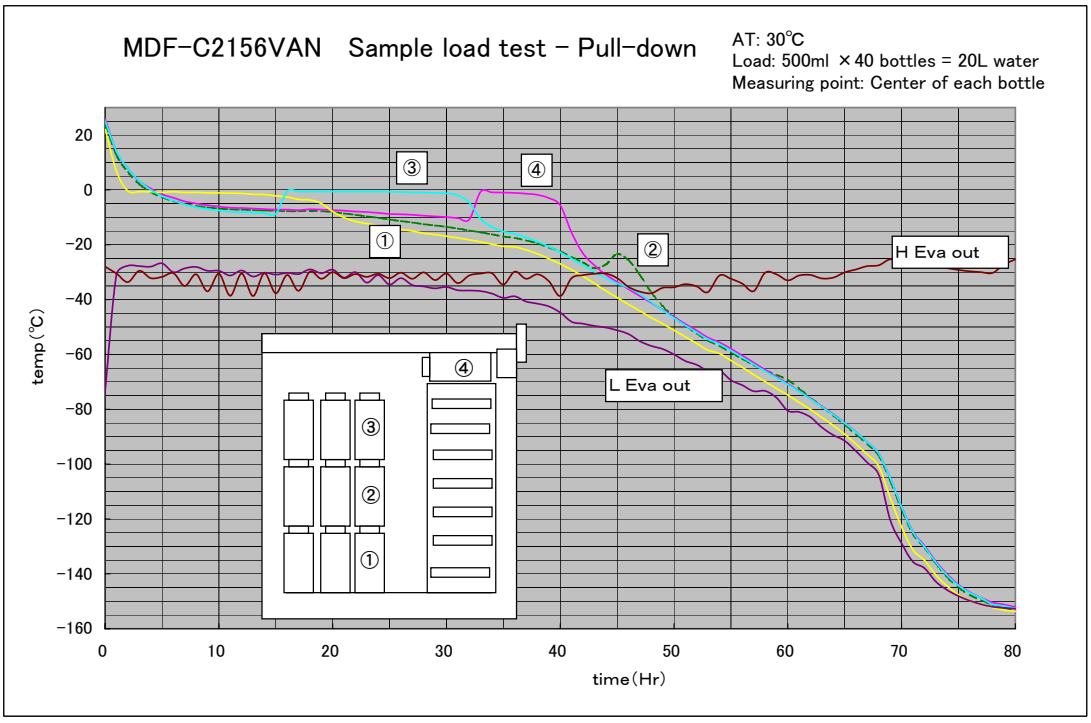


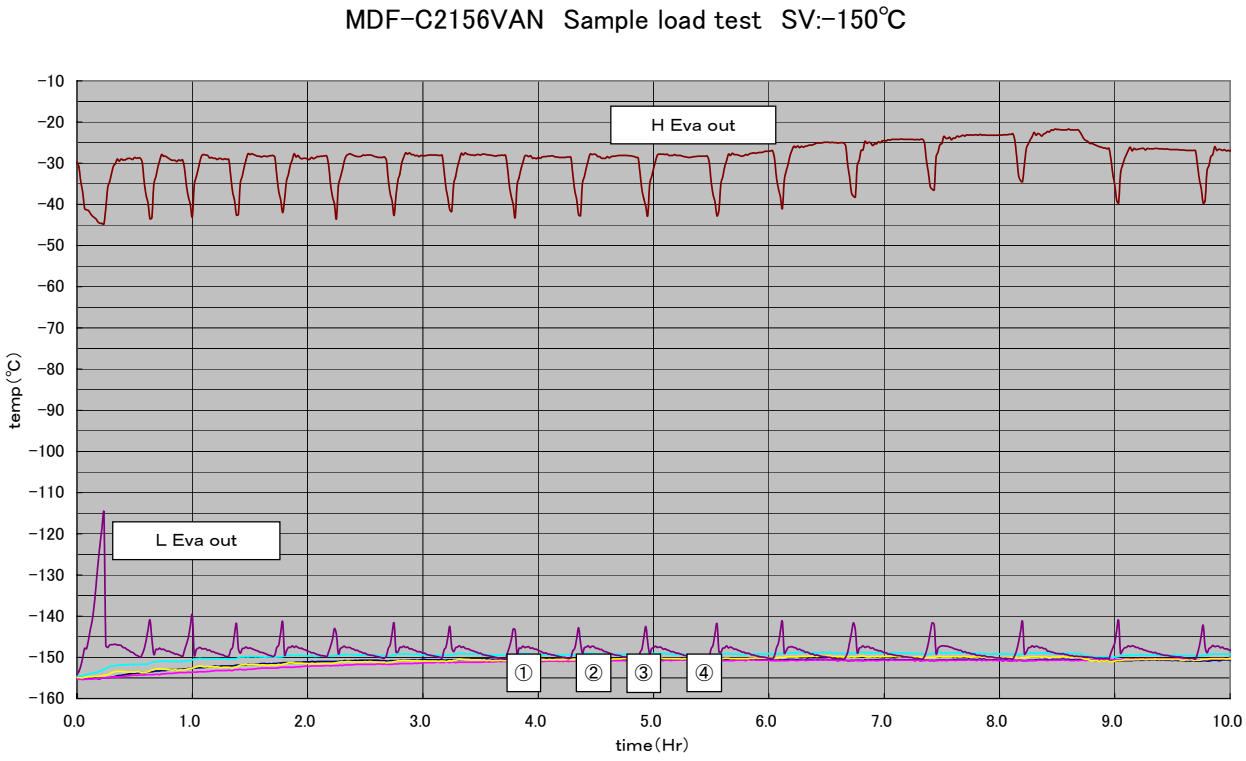
Unit pressure data (50Hz, AT30℃)



Unit pressure data (60Hz, AT30℃)

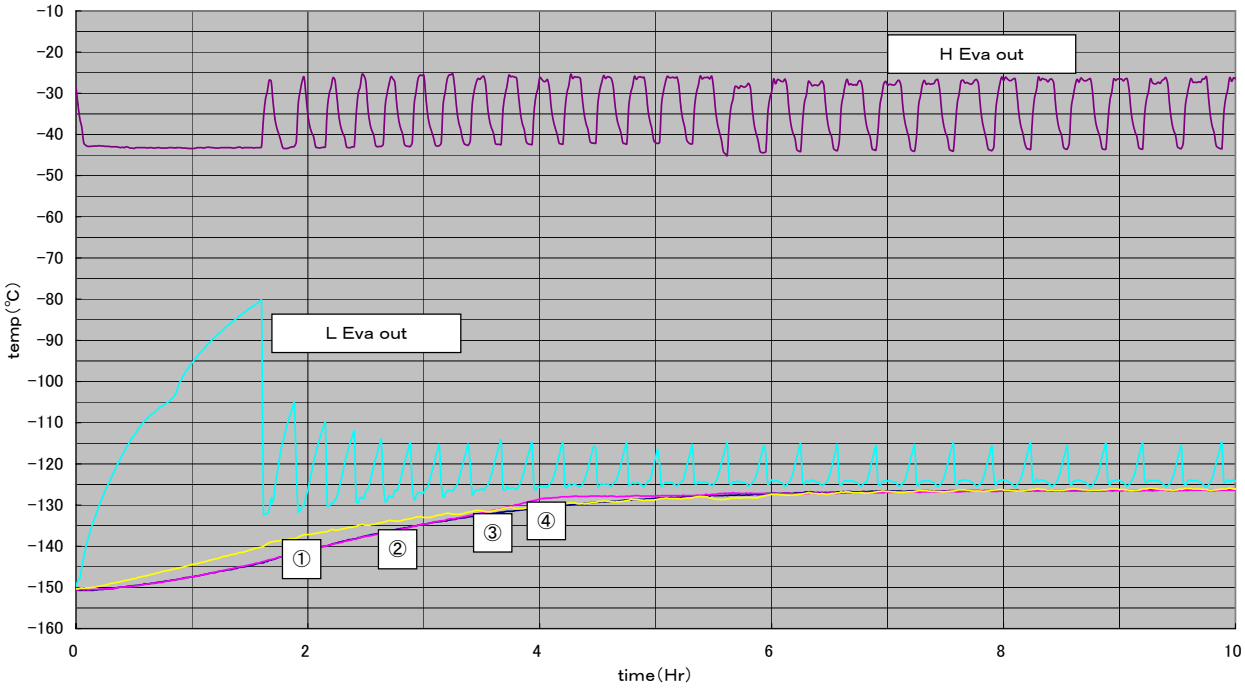
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