

Service Manual

Biomedical freezer

SANYO Electric Biomedical Co., Ltd

MDF-136

MDF-236

MDF-436



MDF-236

Effective models

This service manual is effective following models.

Model name	Model code	Voltage and Frequency	
MDF-236	823 165 51	115V	60Hz
	823 165 52	220V	50Hz
	823 165 53		
	823 165 54	230V	50Hz
	823 165 55	240V	50Hz
	823 165 56	230V	50Hz
	823 165 57	220V	50Hz
	823 165 58	110V	60Hz
	823 165 59	220V	50Hz
	823 165 60	240V	50Hz
	823 165 61		
	823 165 62		
MDF-136	823 166 51	115V	60Hz
	823 166 52	220V	50Hz
	823 166 53	220V	60Hz
	823 166 54	230V	50Hz
	823 166 55	240V	50Hz
	823 166 56	220V	50Hz
	823 166 57	110V	60Hz
	823 166 58	230V	50Hz
	823 166 59	220V	50Hz
	823 169 60	240V	50Hz
	823 166 61		
	823 166 62		
MDF-436	823 167 51	115V	60Hz
	823 167 52	220V	50Hz
	823 167 53	220V	60Hz
	823 167 54	230V	50Hz
	823 167 55	240V	50Hz
	823 167 56	240V	50Hz
	823 167 57	230V	50Hz
	823 167 58	110V	60Hz
	823 167 59	220V	50Hz
	823 167 60	220V	50Hz
	823 167 61		
	823 167 62		

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Features

■ HFC refrigerant

Refrigerant circuit contains HFC refrigerant that effect to environment little.

Latest cooling system reduces negative factor to global environment. With ambient temperature shown at 35°C, while temperature inside chamber maintains -35°C.

■ PCM structure

PCM structure reduces amount of organic solvent.

■ Easy operation

Balance hinge have better safety and operation on door opening/closing.

Display panel and keypad settled in upper part of unit, which makes operation easily.

■ Specification unified

Unified specification for same categories, which also unify performance for high/low temperature alarm (SV is changeable in the range $\pm 5 \sim \pm 15^{\circ}\text{C}$), power failure alarm, remote alarm terminal, setting memorization by non-volatile memory.

■ Self diagnosis function

Abnormal condition for temperature sensor is indicated by self-diagnosis system.

■ Validation

Control panel enables zero “0” adjust for validation.

■ Various function mode

Specification

MDF-136

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-136
Outer dimension (Max)		W 640 × D 687 × H 881 mm
Inner dimension		W 525 × D 440 × H 715 mm
Effective chamber capacity		138 lit.
Cooling performance		-35°C at 1/2 height of the chamber (AT: 35°C, No load)
Exterior		Zinc galvanized steel w/powder polyester coating (new bio-gray)
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam ... Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/powder polyester coating (new bio-gray)
Hinge		Balance hinge(2 pcs) CWVS3300 1 pc, CMVS3345 1 pc
Door lock		1 pc (Action stroke: 10mm)
Accessories	Basket	Hard steel wire PE coating
		2 pcs (Max: 5 pcs)
	Plate	2 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		φ 17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder: MTR-4014LH,MTR-G85 Basket: MDF-13B2 (2 pcs) :MDF-13B3(3 pcs)
Weights		45 Kg

Items		Specification
Internal temp. control range		-20°C~-35°C (AT: -5°C~35°C、No load)
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18°C~-40°C
Temperature sensor		Thermistor
Temperature display		LED digital display (green colored) by 1°C. Range : -50°C~50°C
Alarm	High/Low Temperature	Changeable SV $\pm$ 5°C~15°C. (Initial SV $\pm$ 10°C) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON
	Remote	Remote alarm terminal 2P: contact capacity DC30v, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV >: To shift the set digit Λ: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press > key for five seconds L0: Unlock L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E1/E2) and internal temperature are displayed alternately. Remote alarm contact turns ON with buzzer sounds. When battery switch OFF check is in fault, (available during alarm test), Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

Specification

MDF-236

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-236
Outer dimension (Max)		W 905 × D 687 × H 881 mm
Inner dimension		W 790 × D 440 × H 715 mm
Effective chamber capacity		221 lit.
Cooling performance		-35°C at 1/2 height of the chamber (AT: 35°C, No load)
Exterior		Zinc galvanized steel w/powder polyester coating
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam ... Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/acrylic resin print coating
Hinge		Balance hinge (2 pcs) CMVS3342
Door lock		1 pc (10mm for action stroke)
Accessories	Basket	Hard steel wire PE coating
		3 pcs (max: 8pcs)
	Plate	3 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		φ 17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder : MTR-4014LH, MTR-G85 Basket : MDF-13B2 (2 pcs) :MDF-13B3 (3 pcs)
Weights		54 Kg

Items		Specification
Internal temp. control range		-20°C~-35°C (AT: -5°C~35°C、No load)
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18°C~-40°C
Temperature sensor		Thermistor
Temperature display		LED digital display (green colored) by 1°C. Range : -50°C~50°C
Alarm	High/Low Temperature	Changeable SV $\pm$ 5°C~15°C. (Initial SV $\pm$ 10°C) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON.
	Remote	Remote alarm terminal 2P: contact capacity DC30V, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: turns ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV >: To shift the set digit Λ: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press > key for five seconds L0: Unlock L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E1/E2) and internal temperature are displayed alternately. Remote alarm contact turns ON with buzzer sounds. When battery switch OFF check is in fault, (available during alarm test) Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

Specification

MDF-436

Items		Specification
Model description		Biomedical freezer
Model Number		MDF-436
Outer dimension (Max)		W 1265 × D 807 × H 905 mm
Inner dimension		W 1140 × D 550 × H 735 mm
Effective chamber capacity		426 lit.
Cooling performance		-35°C at 1/2 height of the chamber (AT: 35°C, No load)
Exterior		Zinc galvanized steel w/powder polyester coating (New bio-gray)
Interior		Colored aluminum steel
Insulation		Rigid polyurethane foam ... Insulation: RU-1050 Foam: R-142b/R-22
Outer door		Zinc galvanized steel w/powder polyester coating (New bio-gray)
Hinge		Balance hinge (2 pcs) CWVS3346 (1 pc) CMVS3348 (1 pc)
Door lock		1 pc (Action stroke: 10mm)
Accessories	Basket	Hard steel wire PE coating 4 pcs (max: 11 pcs)
	Plate	4 pcs
	Others	Defrosting spatula 1 pc, card holder 1 pc, key 1 set
Caster		4 pcs. (Front & rear movement wheels)
Leveling legs		2 pcs in front side.
Access hole		φ 17mm. 1 places in right side of access hole and 2 in left side of bottom of recorder sensor access hole.
Option		Chart recorder: MTR-4014LH, MTR-G85 Basket: MDF-43B2 (2 pcs) : MDF-43B3 (3 pcs)
Weights		71 Kg

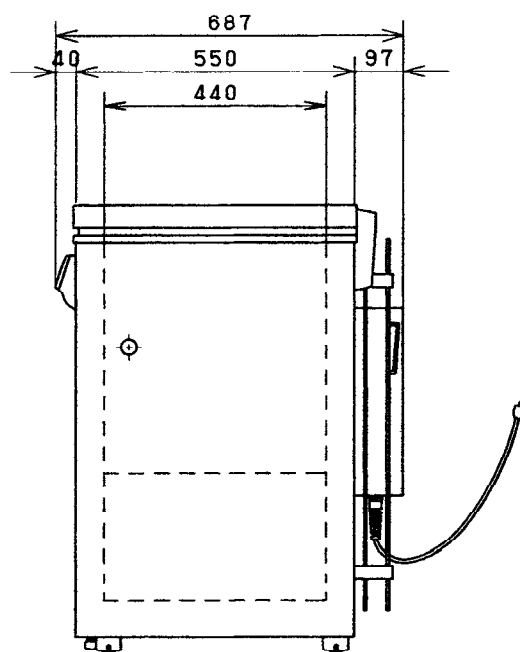
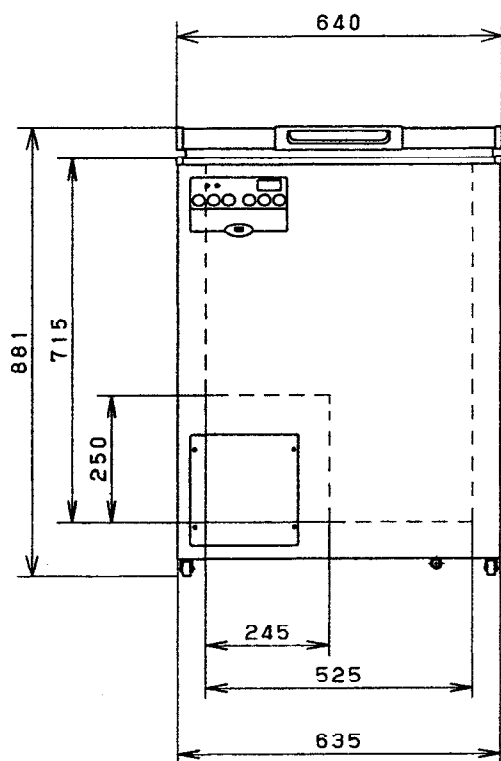
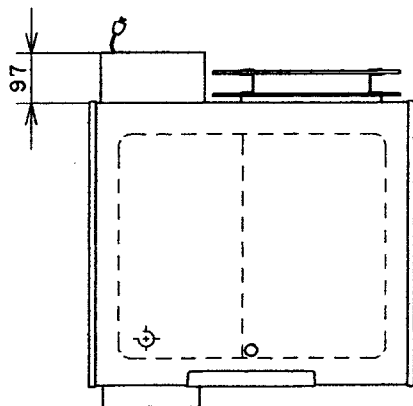
Items		Specification
Internal temp. control range		-20°C~-35°C (AT: -5°C~35°C, No load)
Temperature controller		Microprocessor controlled system with non-volatilized memory. Temp. set range : -18°C~-40°C
Temperature sensor		Thermistor
Temperature display		LED digital display by 1°C. Range : -50°C~50°C
Alarm	High/Low Temperature	Changeable SV $\pm$ 5°C~15°C. (Initial SV $\pm$ 10°C) ALARM lamp brinks and buzzer sounds intermittently (about 15 min. delay) Remote alarm contact: turns ON with buzzer sounds
	Power failure	ALARM lamp brinks, buzzer sounds intermittently, remote alarm contact turns ON.
	Remote	Remote alarm terminal 2P: contact capacity DC30V, 2A, N.O. – COM. (During temperature alarm, power failure alarm, alarm test: turns ON)
Control panel		ALARM lamp BUZZER: Buzzer key ALARM TEST: Alarm test key SET: To switch the SV and PV >: To shift the set digit Λ: To change the SV DEF: Defrost key Battery switch: Power switch for power failure alarm
Key lock function		Press > key for five seconds L0: Unlock L1: Lock
Self diagnosis function		When temperature sensor is in fault, Error code (E01/E02) and internal temperature are displayed alternately. When compressor protect sensor is in fault, Error code (E03/E04) and internal temperature are displayed alternately. When temperature of compressor abnormally rises, Error code (E10) and internal temperature are displayed alternately. When butterfly switch OFF check is in fault (available during alarm test), Error code (E09) and internal temperature are displayed alternately.
Power switch		Side on rear box
Battery switch		Side on rear box
Power supply		Local voltage

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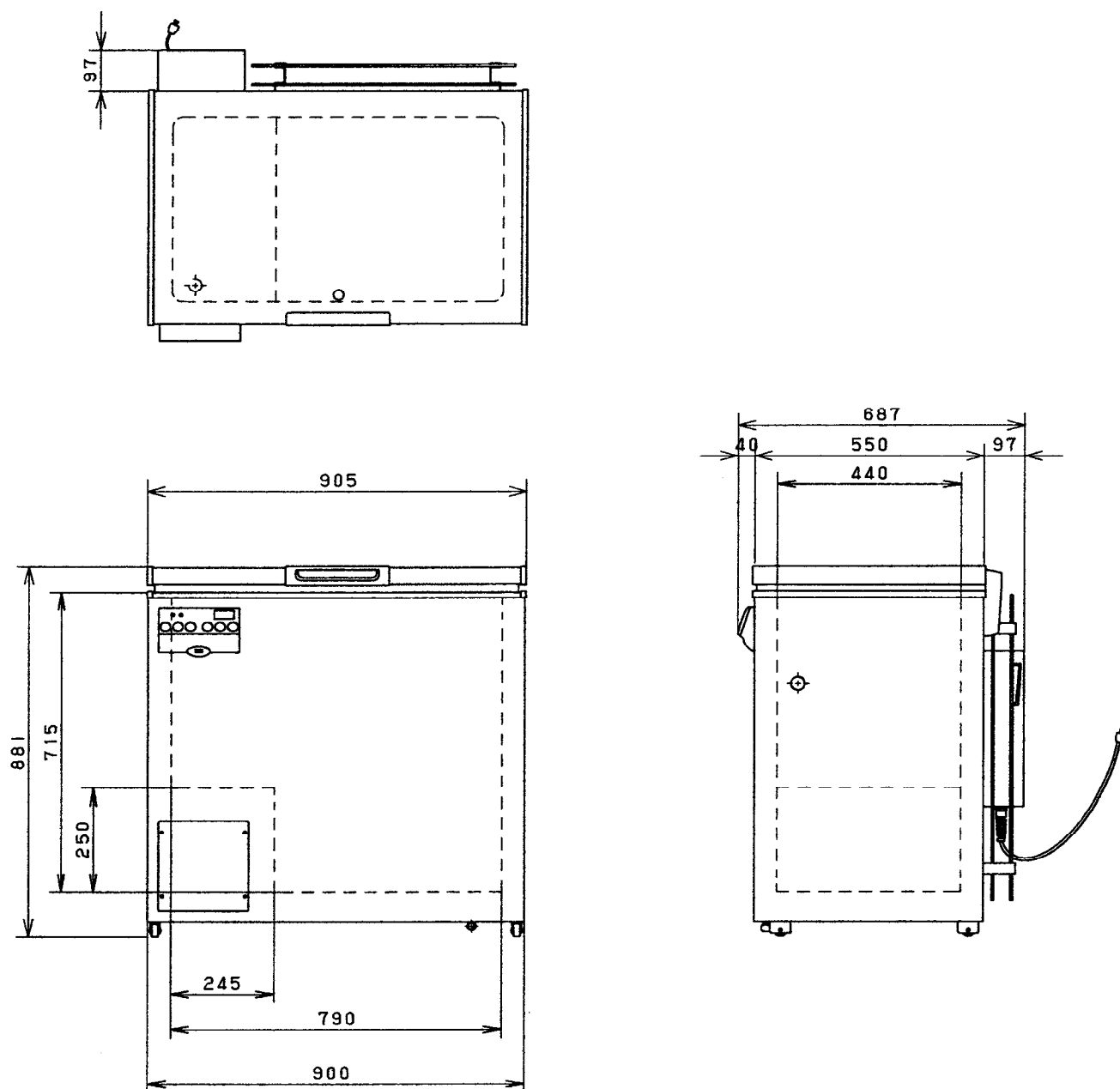
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Dimensions

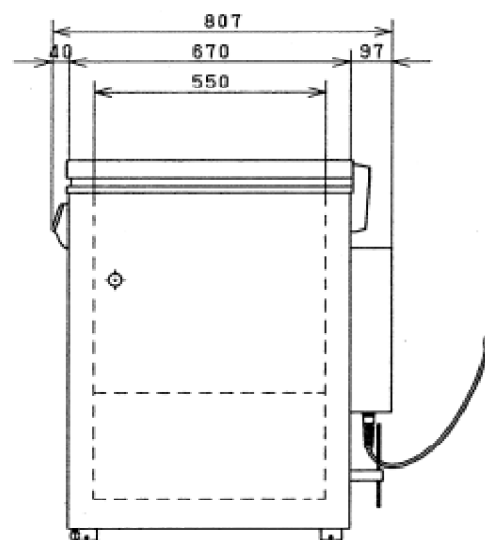
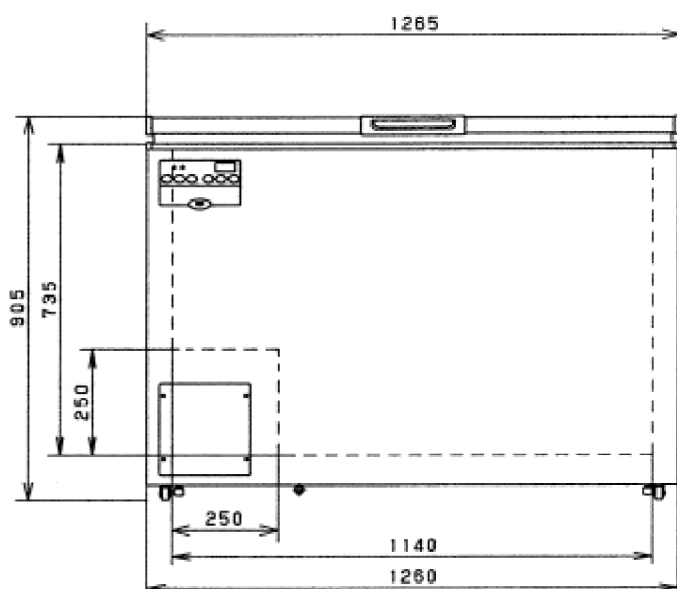
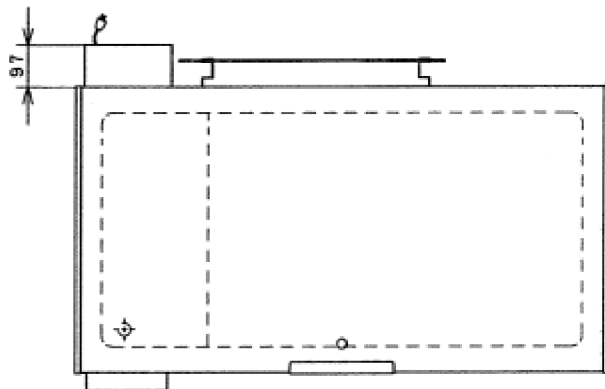
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MDF-236

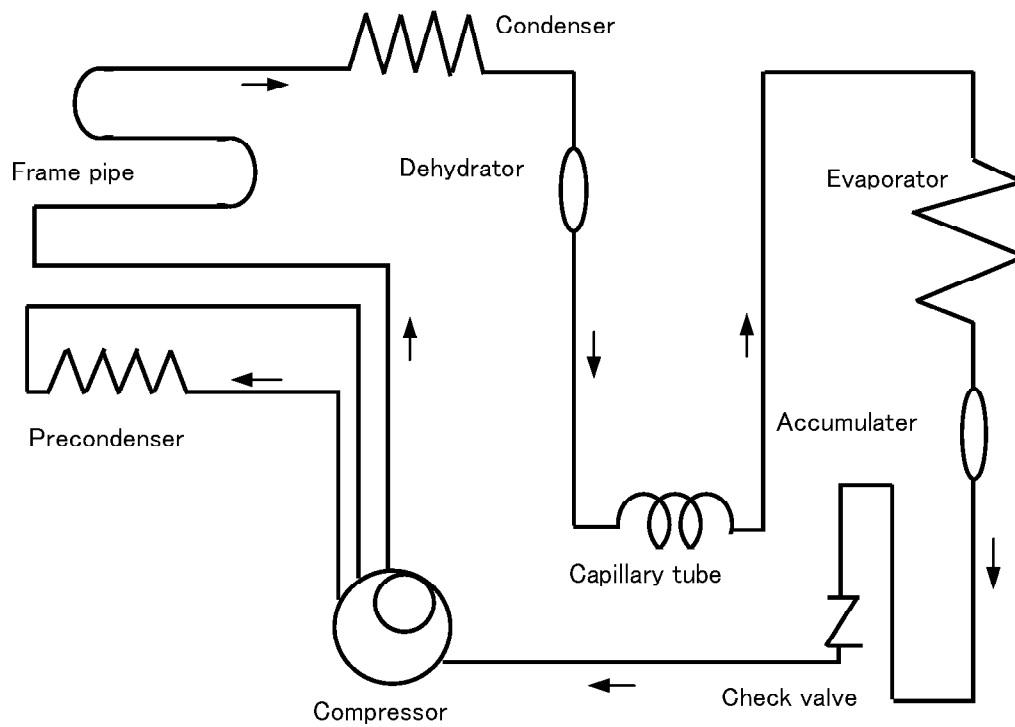


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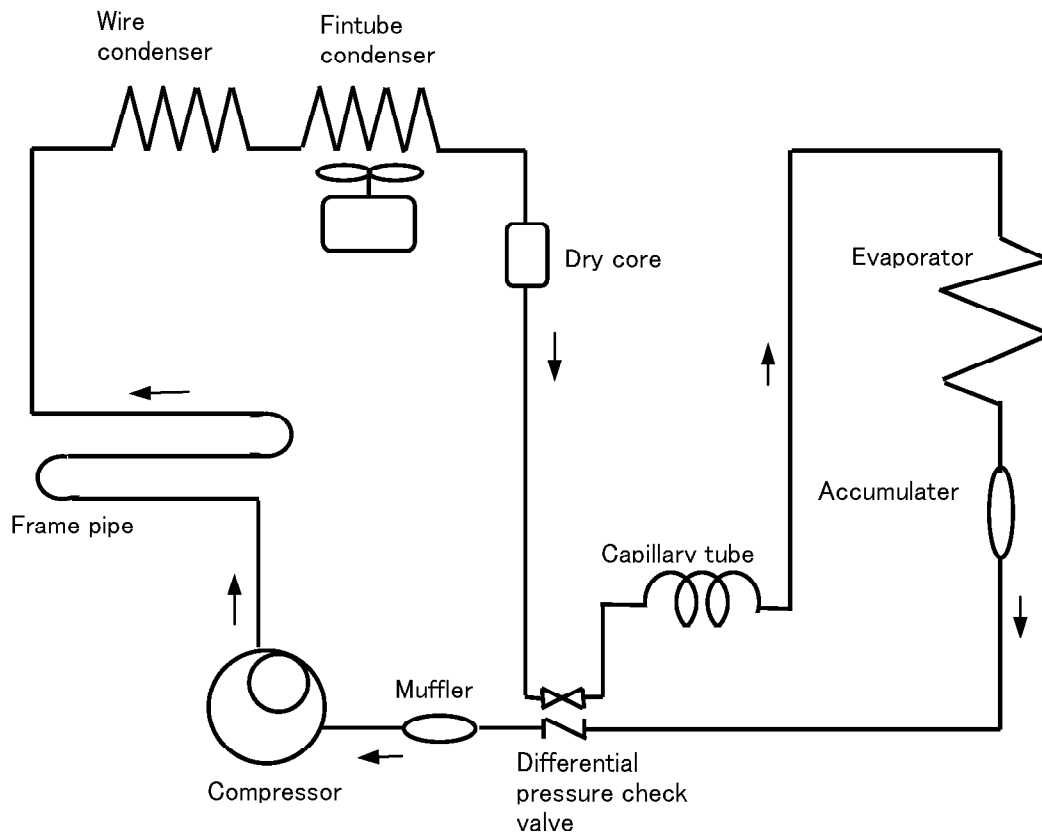


Refrigeration circuit principle diagram

MDF—136•236



MDF—436



Refrigeration circuit

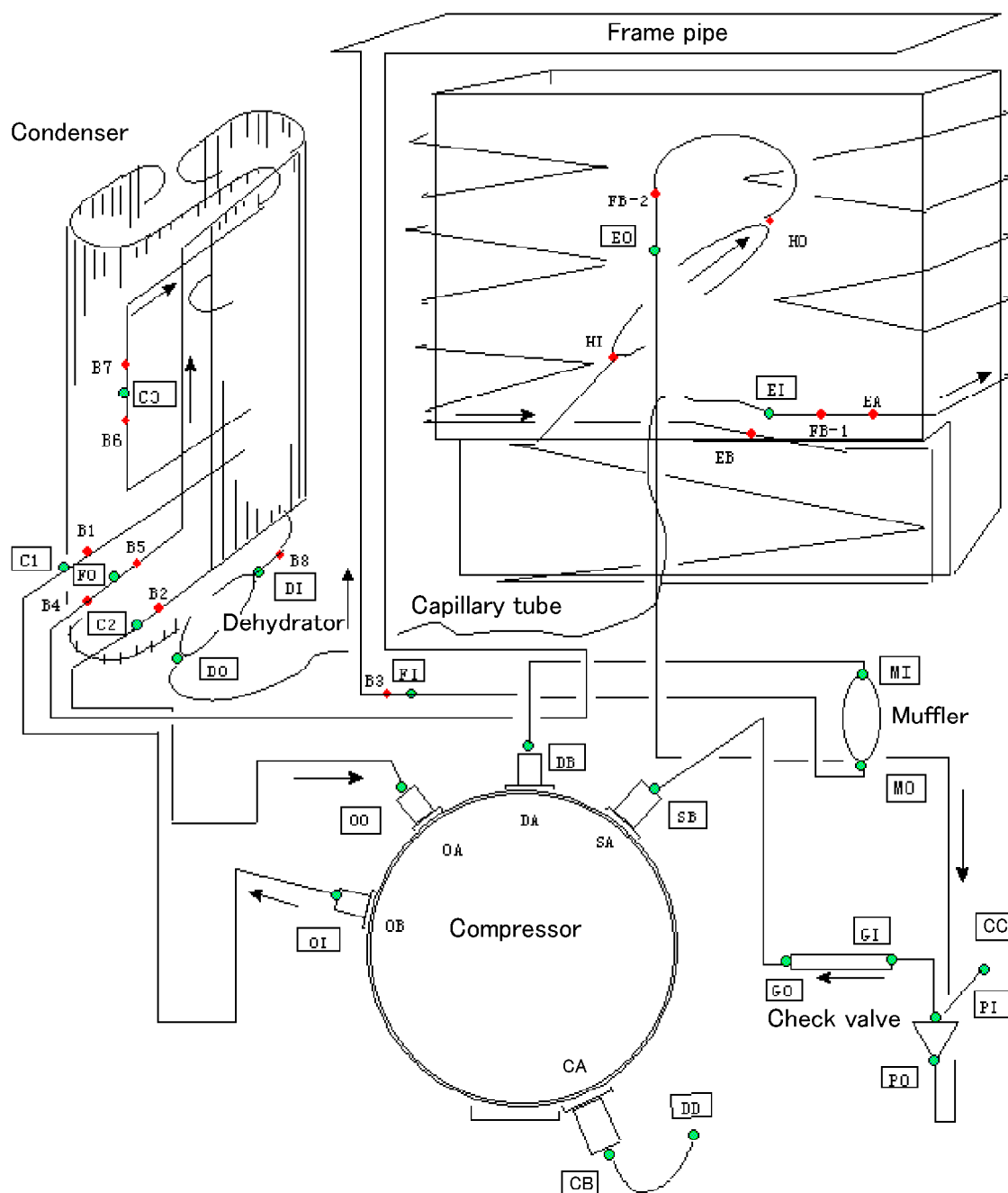
MDF-136

Unit: mm

Parts description	Specification	
Evaporator	Type	Tube on sheet
	Material	Aluminum (ϕ 8.0)
Dehydrator	Type of molecular sieves	4A-XH9 (134 sealed)
	Charged q'ty	10 ± 1 g
Capillary tube	Resistance	0.882MPaG (9Kgf/cm ² G)
	Dimension	ϕ 1.8 $\times$ (ϕ 0.65) $\times$ 2000mm
	Resistance indicator color	—
Condenser assembly A	Type	Wire and tube
	Dimension	^w 440 $\times$ ^P 40 $\times$ 14 columns Cat-ion (black)
Condenser assembly B	Type	Wire and tube
	Dimension	^w 440 $\times$ ^P 40 $\times$ 14 columns Cat-ion (black) Note: Lower 4 columns are used in desuper circuit.
Frame pipe	Material	S-TUBE-P (MFZN3-C)
	Dimension	ϕ 4.76 $\times$ $\pm$ 0.7
Pull vacuum and vacuum pressure	Pull time: over than 30min. by 2 ports (high pressure and low pressure side). (N2 exchange) When charged, vacuum pressure is lower than 1.0torr (pump ability: 300L/min, 6.7×10^{-2} Pa)	
Refrigerant and oil	Refrigerant : R404A	Charged q'ty : 211 ± 5 g
	Oil : CF—32	Charged q'ty : 280 ± 10 cc
	Oil additive : n-pentane	Charged q'ty : 9g
Refrigeration circuit spec. and welding points	Refer to following pages	

Refrigeration circuit Welding points

MDF-136



Refrigeration circuit

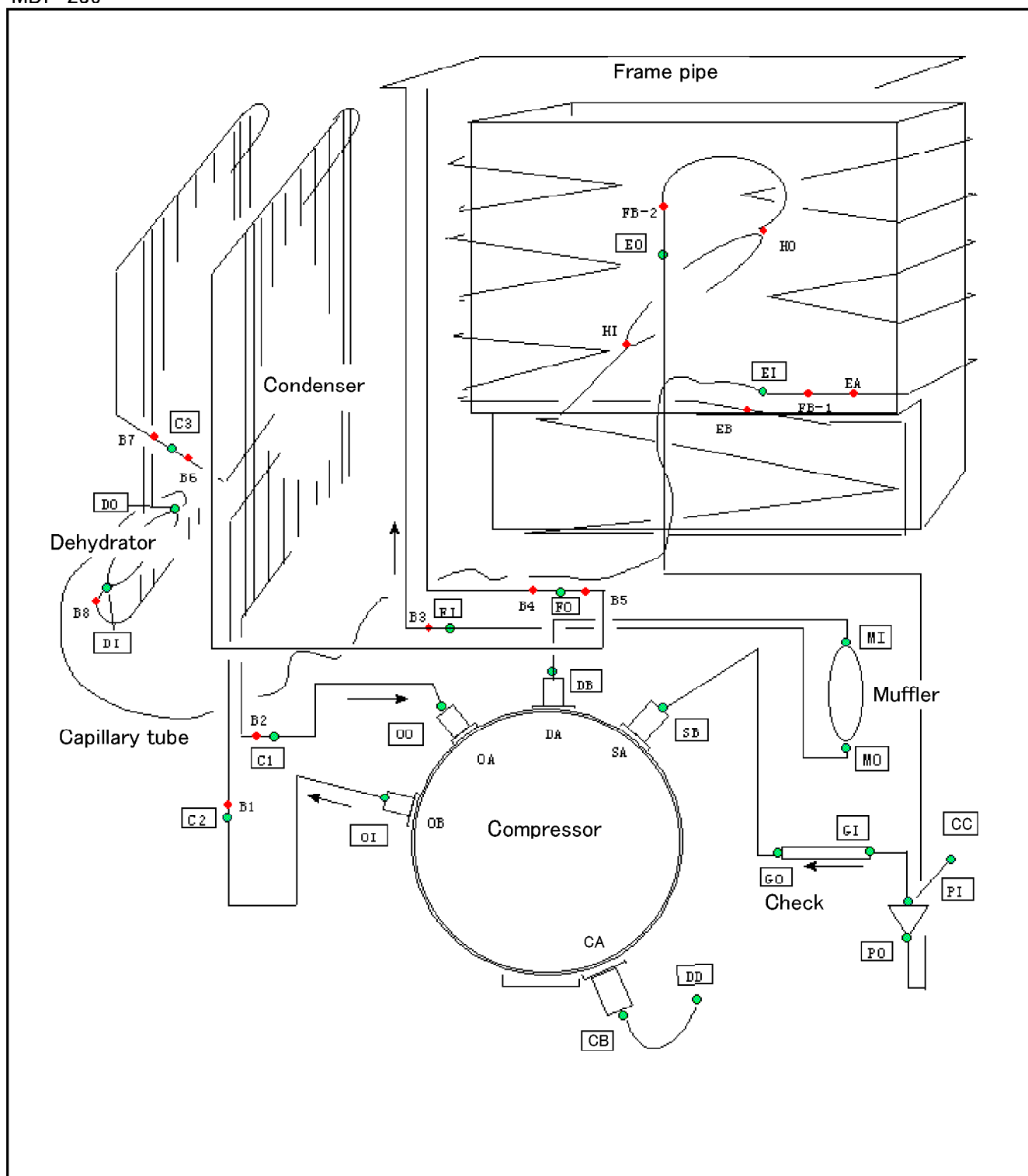
MDF-236

Unit: mm

Parts description	Specification	
Evaporator	Type	Tube on sheet
	Material	Aluminum (ϕ 8.0)
Dehydrator	Type of molecular sieves	4A-XH9 (134 sealed)
	Charged q'ty	10 ± 1 g
Capillary tube	Resistance	0.882MPaG (9Kgf/cm ² G)
	Dimension	ϕ 1.8 $\times$ (ϕ 0.65) $\times$ 2000mm
	Resistance indicator color	—
Condenser assembly A	Type	Wire and tube
	Dimension	^w 620 $\times$ ^P 40 $\times$ 16 columns Cat-ion (black)
Condenser assembly B	Type	Wire and tube
	Dimension	^w 620 $\times$ ^P 40 $\times$ 16 columns Cat-ion (black) Note: Lower 4 columns are used in desuper circuit.
Frame pipe	Material	S-TUBE-P (MFZN3-C)
	Dimension	ϕ 4.76 $\times$ $\pm$ 0.7
Pull vacuum and vacuum pressure	Pull time: over than 30min. by 2 ports (high pressure and low pressure side). (N2 exchange) When charged, vacuum pressure is lower than 1.0torr (pump ability: 300L/min, 6.7×10^{-2} Pa)	
Refrigerant and oil	Refrigerant : R404A	Charged q'ty : 221 ± 5 g
	Oil : CF—32	Charged q'ty : 280 ± 10 cc
	Oil additive : n-pentane	Charged q'ty : 9g
Refrigeration circuit spec. and welding points	Refer to following pages	

Refrigeration circuit welding points

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Refrigeration circuit

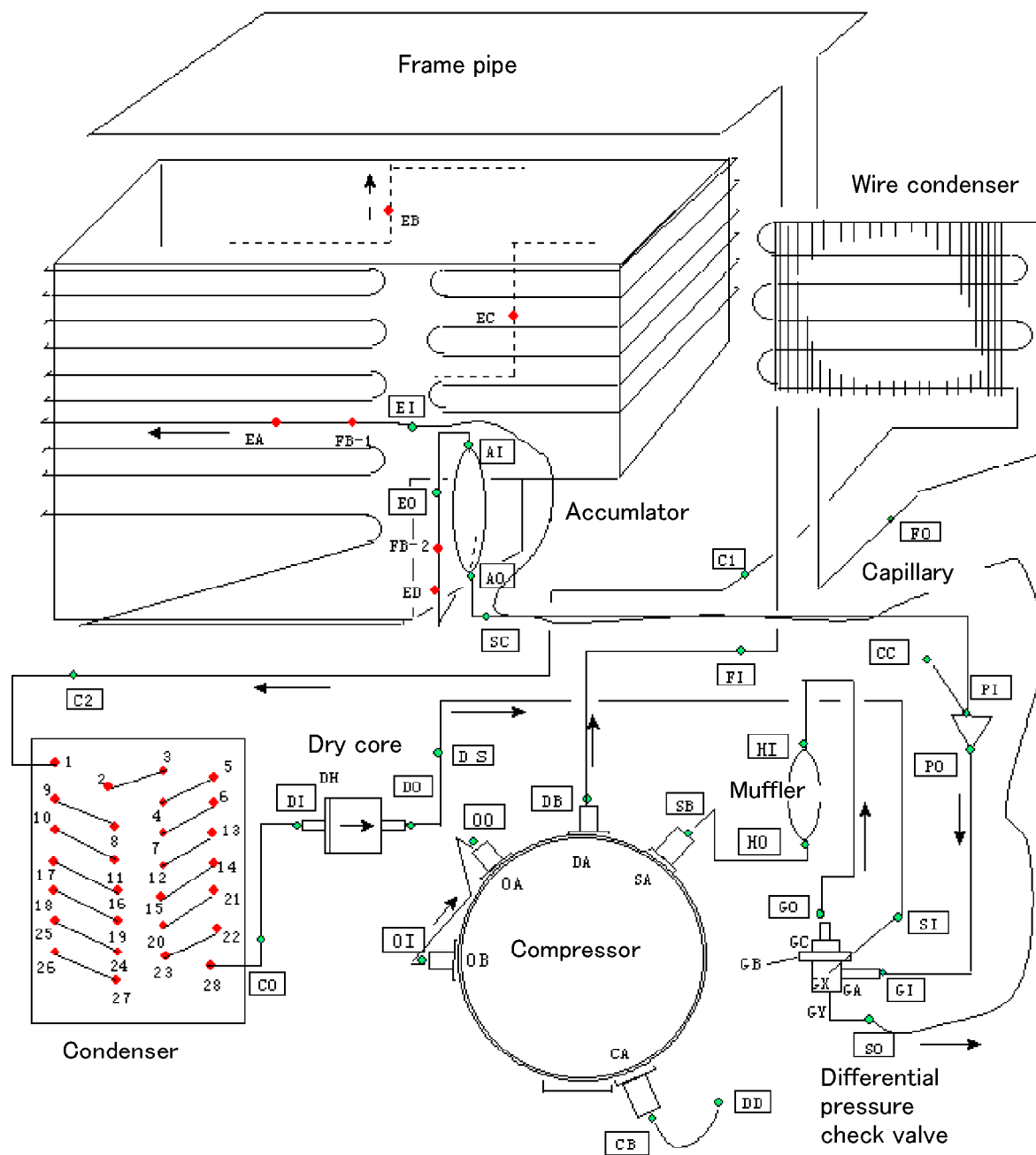
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Unit: mm

Parts description	Specification	
Evaporator	Type	Tube on sheet
	Material	Aluminum (ϕ 8.0)
Dry core	Type	D-S032T
	Manufacturer	Sanyo Danhosu
	Solid core	50 cm ²
Capillary tube	Resistance	0.588MPaG (6Kgf/cm ² G)
	Dimension	ϕ 1.8 × (ϕ 0.65) × 2000mm
	Resistance indicator color	Black
Condenser assembly (Plate fin)	Type	Plate fin
	Dimension	^w 140 × ^P 4 × 7columns × ϕ 9.52
Condenser assembly (Rear wire)	Type	Wire and tube
	Dimension	^w 620 × ^P 40 × 6 columns Cat-ion (black)
Frame pipe	Material	C1220T
	Dimension	ϕ 4.0 × ^t 0.5
Pull vacuum and vacuum pressure	Pull time: over than 30min. by 2 ports (high pressure and low pressure side). (N2 exchange) When charged, vacuum pressure is lower than 1.0torr (pump ability: 300L/min. 6.7×10^{-2} Pa)	
Refrigerant and oil	Refrigerant : R404A	Charged q'ty : 317±5g
	Oil : CF—32	Charged q'ty : 280±10cc
	Oil additive : n-pentane	Charged q'ty : 13g
Refrigeration circuit spec. and welding points	Refer to following pages	

Refrigeration circuit Welding points

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Specification of electrical parts

MDF- 136 / 236		AC110-115V,60Hz	AC220-240V , 50/60Hz
Compressor	Type	C-2SN170L0S	C-2SN170L6S
	Code	807675201	807675261
	Rated voltage (50/60Hz)	100 / 100 - 115	220,240 / 220
	Winding resistance C-S(Aux)	7.5 Ω	35.4 Ω
	C-R(Main)	2.9 Ω	11.3 Ω
Starting relay	Type	AMVL-165	AMVL-300A
	Pick up voltage(50Hz)	AC79V~99V	AC185V~217V
	(60Hz)	AC95~115V	AC215~232V
	Drop out voltage(50Hz)	AC20~55V	AC60~120V
	(60Hz)	AC25~60V	AC69~132V
Overload relay	Type	P15KU	P80KU
	Action to the temp. (No current)		
	OFF	150 $\pm$ 10 $^{\circ}$ C	150 $\pm$ 8 $^{\circ}$ C
	ON	85 $\pm$ 10 $^{\circ}$ C	85 $\pm$ 10 $^{\circ}$ C
	Action to the current (AT25 $^{\circ}$ C)	15.5A	8A
	Operation time	6~15 seconds	6~15 seconds
	Non-Action to the temp. (80 $^{\circ}$ C)		
	Non-Action	3.8A more than 30 minutes	2.35A more than 30 minutes
	Action	5.1A within 15 minutes	3.1A within 15 minutes
Starting capacitor	Rating	100 μ F,160VAC	20 μ F,300VAC
Running capacitor	Rating	16 μ F,220VAC	5 μ F,400VAC
Power relay	Type	G4F-11123T	G4F-11123T
	Contact capacity	AC220V,20A	AC220V,20A
	Coil	DC12V	DC12V
Switching power supply	Type	ZWS10-12/J	ZWS10-12/J
	Input	AC100-240V,50/60Hz,0.3A	AC100-240V,50/60Hz,0.3A
	Rated output	DC12V,0.85A	DC12V,0.85A
Temperature sensor	Type	502AT-1	502AT-1
	Rating	5k Ω ,25 $^{\circ}$ C	5k Ω ,25 $^{\circ}$ C
P.C.B.	Type	DF-236	DF-236
Battery	Type	5HR-AAC(Ni-MH)	5HR-AAC(Ni-MH)
	Rating	6V 1100mAH	6V 1100mAH
Battery switch	Type	SLE6A2-5	SLE6A2-5
	Rating	AC250V 4A	AC250V 4A
Breaker switch	Type	BAM215131	BAM215131
	Rating	AC250V 15A	AC250V 15A

Specification of electrical parts

MDF- 436		AC110-115V,60Hz	AC220-240V , 50/60Hz
Compressor	Type	C-2SN350I 0R	C-2SN350I 5S
	Code	807764201	807763251
	Rated voltage (50/60Hz)	— / 110-115V	220-240V / 220V
	Winding resistance C-S(Aux)	5.8 Ω	30.6 Ω
	C-R(Main)	1.6 Ω	7.8 Ω
Starting relay	Type	AMVL-180A	AMVL-300A
	Pick up voltage(50Hz)	AC91V~111V	AC185V~217V
	(60Hz)	AC108~128V	AC215~232V
	Drop out voltage(50Hz)	AC30~65V	AC60~120V
	(60Hz)	AC30~75V	AC69~132V
Overload relay	Type	P24KU	P10MU
	Action to the temp. (No current)		
	OFF	150±10℃	130±8℃
	ON	85±10℃	69±10℃
	Action to the current (AT25℃)	24.0A	10A
	Operation time	6~15 seconds	6~15 seconds
	Non-Action to the temp. (80℃)		
	Non-Action	6.1A more than 30 minutes	2.5A more than 30 minutes
	Action	8.0A within 15 minutes	3.4A within 15 minutes
Starting capacitor	Rating	100 μ F,160VAC	30 μ F,300VAC
Running capacitor	Rating	25 μ F,220VAC	5 μ F,400VAC
Power relay	Type	G4F-11123T	G4F-11123T
	Contact capacity	AC220V,20A	AC220V,20A
	Coil	DC12V	DC12V
Switching power supply	Type	ZWS10-12/J	ZWS10-12/J
	Input	AC100-240V,50/60Hz,0.3A	AC100-240V,50/60Hz,0.3A
	Rated output	DC12V,0.85A	DC12V,0.85A
Temperature sensor	Type	502AT-1	502AT-1
	Rating	5k Ω ,25℃	5k Ω ,25℃
Compressor protect sensor	Type	502AT-1	502AT-1
	Rating	5k Ω ,25℃	5k Ω ,25℃
P.C.B.	Type	DF-436	DF-436
Battery	Type	5HR-AAC(Ni-MH)	5HR-AAC(Ni-MH)
	Rating	6V 1100mAH	6V 1100mAH
Battery switch	Type	SLE6A2-5	SLE6A2-5
	Rating	AC250V 4A	AC250V 4A
Breaker switch	Type	BAM215131	BAM215131
	Rating	AC250V 15A	AC250V 15A
Condensing fan motor	Type	FL2-C021R1MP	FL2-C021R5MP
	Rating	AC110-115V 50/60Hz	220-240V 50/60Hz
	Thermal fuse	130℃	130℃

Specifications of sensor

The following show temperature and resistance characteristics on each thermistor sensor (type 502).

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
−50	154.50	−7	17.92	12	8.17
−45	116.50	−6	17.16	13	7.85
−40	88.85	−5	16.43	14	7.55
−35	68.15	−4	15.74	15	7.27
−30	52.84	−3	15.08	16	6.99
−25	41.19	−2	14.45	17	6.73
−20	32.43	−1	13.86	18	6.48
−19	30.92	0	13.29	19	6.24
−18	29.50	1	12.74	20	6.01
−17	28.14	2	12.22	25	5.00
−16	26.87	3	11.72	30	4.18
−15	25.65	4	11.25	35	3.51
−14	24.51	5	10.80	40	2.96
−13	23.42	6	10.37	45	2.51
−12	22.39	7	9.96	50	2.14
−11	21.41	8	9.57	55	1.83
−10	20.48	9	9.20	60	1.57
−9	19.58	10	8.84		
−8	18.73	11	8.49		

Control specification

<MDF·136·236·436>

1. Key and switch

BZ : When alarm lamp is blinking and buzzer sounds, buzzer and remote alarm Output Force to turn off
: Buzzer is not turned off during alarm test.
: When alarm lamp is blinking and buzzer is off, buzzer will not turn on.
: When press this key during power failure, current temperature is displayed for 5 seconds.

SET : Press once to setting mode and press again to memorize the set value.
(It works as ENTER key)

DEF : In PV display keep pressing the key over 5 seconds to start defrosting.
During defrosting, press the key to quit defrosting.
During defrosting, internal temperature and “dF” is displayed Alternately.
During defrosting, high·low temperature alarm is cancelled.
When sensor error is occurred during defrosting, error code and internal temperature is displayed alternately, and “dF” display is turned off.
During defrosting, only buzzer key is acceptable.

ALARM TEST: Keep pressing the key over than 5 seconds in PV display, it will be start alarm test.
Press again then quit alarm test.
During alarm test, alarm lamp will blink ,buzzer will sound intermittently and remote alarm contact will turn on.
Digital display will be turned off.
During alarm test, only alarm test key is acceptable.



: During setting mode, shift between the first digit and the second digit.
In PV display, keep pressing the key over 5 seconds to enter the key lock mode. (“L0” display)



: During setting mode, count up the blinking digit. In PV display, keep pressing the key over 5 seconds to enter the function mode (“F00” display)

2.

<Temperature control>

Setting range : -18°C~·40°C

Display range : -50°C~+50°C

Setting method : Press SET key and set the required value with key and Key. Press SET key again to memorize the set value,
And then return to PV display.

Out of setting range : Change to out of setting range value and press SET key for 1 second continuously.

<Alarm>

High temperature alarm :

When the internal temperature is higher than SV (-5°C~+15°C), alarm lamp and digital display is blinking. After 15min.later, buzzer will sound and remote alarm output will turn ON. (initial value: +10°C)

Low temperature alarm :

When the internal temperature is lower than SV(-5°C~-15°C), alarm lamp and digital display is blinking. After 15min.later, buzzer will sound and remote alarm output will turn ON. (initial value: -10°C)

Setting method :

Keep pressing  key over 5 seconds to enter function mode ("F00").

Then press the key to count up value. The value "F01" means to enter high temperature alarm value, "F02" means to enter low temperature alarm value.

Set either "F01" or "F02" then press SET key and turn to alarm temperature setting mode to set required value with  key and  key. Press SET key again and memorize set value.

Out of setting range :

When press SET key with changed to out of setting range value, buzzer sounds for 1second continuously and keep the setting status.

3. Defrosting

In PV display keep pressing DEF key over 5 seconds, it will be start defrosting.

The function is forced to turn compressor OFF. Press again DEF key to quit defrosting.
(Manual start and end)

4. Self diagnosis function

E01 : Temperature sensor is open circuit

E02 : Temperature sensor is short circuit

E03 : Compressor protect sensor is open circuit (MDF-436 only)

E04 : Compressor protect sensor is short circuit (MDF-436 only)

E09 : Forget to turn battery switch ON or battery no-charged (available during alarm test)

E10 : Compressor temperature is abnormal (MDF-436 only)

When temperature sensor is open circuit, display shows alternately E01 with -50°C.

When temperature sensor is short circuit, display shows alternately E02 with +50°C.

Self diagnosis of open circuit is done when it is lower than -60°C for temperature exchange.

Self diagnosis of short circuit is done when it is higher than +60°C for temperature exchange.

E09 is functioned only during ALARM TEST is performed.

In E10 is displayed, it regards as abnormal when condenser temperature is higher than 100°C, and as normal when lower than 65°C.

When it is lower than 65°C, E10 is regarded as normal.

5. Key lock function

Push  key to 1 key rock ON
0 key rock OFF

Note) With key lock ON to enter SET mode, but unable to change value.

6. Power failure alarm

Press BZ key to turn power failure alarm buzzer OFF.

Press BZ key to check PV, PV will be displayed for 5 seconds.

7. Alarm test

The function is to check performance for alarm lamp, buzzer and remote alarm.

In PV display, press ALARM TEST key to blink alarm lamp, to sound buzzer intermittently, to turn remote alarm on. (Without time lag)

Digital display will be turned off.

During alarm test, any but ALARM TEST key is available.

During alarm test, turn butterfly switch OFF to display error code E09.

During alarm test, error code E09 takes priority over other error codes to display.

Notes:

*Above power failure alarm is performed with buttery switch ON and charged.

With butterfly switch OFF or discharged, only remote alarm is performed.

*Power failure alarm will be performed for 12 hours continuously with battery full charged. Running freezer for 2days to charge battery fully.

8. Auto return function

During setting mode, key lock mode and function mode with any key not pressed for 90 seconds, value will not be memorized to return to PV mode automatically.

Note: In F09 and F10 (line test mode) displayed, Auto return function will not be performed.

9. Compressor time lag

During cycle time, turn compressor ON to be forced turn OFF after 2 minutes.

10. Function mode

Functions are as follow.

- F00 : To return to PV display (use in case entered by mistake)
- F01 : To change temperature of high temperature alarm
- F02 : To change temperature of low temperature alarm
- F03 : Not functioned
- F04 : Not functioned
- F05 : To set compressor time lag
- F06 : To input service code (384)
- F07 : To set temperature zero adjustment ($\pm 9.9^{\circ}\text{C}$, differential value input)
- F08 : Not functioned
- F09 : Line test mode (Maximum cooling test)
- F10 : Line test mode (program)
- F11 : No functioned
- F12 : To display temperature of temperature control sensor (per 0.1°C)
- F13 : To display temperature of compressor protect sensor (per 1°C)
- F14 : Not functioned
- F15 : Not functioned
- F16 : Not functioned
- F17 : Family type code 001 : MDF-136、236 002 : MDF-436
- F18 : Not functioned
- F19 : Not functioned
- F20 : Not functioned
- F21 : To set communication ID (000~255)
- F22 : To set communication mode
- F25 : To set alarm reset time (applied for each models from S/N 020001 and after)

Setting method : In PV display, keep  key pressing over 5 seconds to enter function mode and will be displayed "F00". Press  key to input required function code then put SET key.

F00 : It is not functioned. In F00 displayed, press SET key to return PV display.

F01 : To set value of high temperature performance in the range of SV $+5^{\circ}\text{C} \sim +15^{\circ}\text{C}$.
(initial value : $+10^{\circ}\text{C}$)

F02 : To set value of low temperature performance in the range of SV $-5^{\circ}\text{C} \sim -15^{\circ}\text{C}$.
(initial value : -10°C)

F05 : To set compressor time lag
(performed only with main power supplied and microcomputer reset)
The function is to reduce numbers of units start-up at the same time that cause compressor's start-up failure or users' breakers blow out after power failure.
The range of time lag is 1~15 minutes. (On factory outgoing, initial value set at 1 minute) With F10 performed to memorize the initial value 1 minute.
Before F10 is performed, time lag set at 3 seconds. Therefore, the time lag is 3 seconds when PCB replacement is performed by service.

F06 : Put service code with  key and  key when F07 and following functions would be performed. Press SET key to memorize service code to enter function mode again to perform F07 or bigger figure functions.

In special case, F21, F22 and F25 changes communication parameter without input any service code. Service code: 384

Note) Above code is memorized unless input "000" again with "F06" displayed, or turn main power OFF.

F07 : To set 0 adjustment of temperature control sensor (setting range: $-9.9^{\circ}\text{C} \sim +9.9^{\circ}\text{C}$)
Setting method : In "F07" displayed, press SET key to display "00.0" (initial value).

Set temperature with  key and  key and press SET key again to memorize set value. Input by differential value.

Ex) With measured -28.5°C at 1/2H of chamber and -30°C at digital display shown, add $+1.5(-28.5 - (-30))$ to digital display (F07).

 key enables to change only "0" and "-" in second digit and to change "0" ~ "9" in first digit and first decimal.

 key enables to shift the second digit $\Leftrightarrow$ the first digit $\Leftrightarrow$ the decimal point $\Leftrightarrow$ the second digit.

F09 : Line test mode

This function is for arrival test, and force to turn compressor ON in spite of any SV.

(No time lag)

With E10 performed, cause to force compressor stop. (E10 takes advantage)

Setting method : In "F09" is displayed (digit is blinking), press SET key to display alternately "F09" with PV. (90seconds auto return will be not functioned)

Cancellation : Press SET key to cancel this mode to return to PV.

Note) During F09 is performed, high-low temperature alarm is not available.

F10 : Line test mode

The function is to set SV at -30°C after 3.5hrs running at SV -45°C .

Setting method : In "F10" is displayed with digit blinking, press SET key to display alternately "F10" with SV. (90 seconds auto return will be not functioned)

Cancellation : Automatically finish this mode after 3.5hours passed.

Press SET key to quit to return to PV.

Note) Automatically SV is forced to set at -30°C , in spite of any SV before F10 performed. Set compressor time lag for 1 minute. When main power turns off or power failure occurs during this mode, the SV will be not memorized.

F12 : Temperature of temperature sensor is indicated as per 0.1°C .

From second digit to first decimal point is shown in display.

It is not shown "-" in display when temperature is lower than -20°C .

(Ex. Actual temperature $-35^{\circ}\text{C} \rightarrow$ Display shows 35.0°C)

When temperature is within the range of $-19.9^{\circ}\text{C} \sim -0.1^{\circ}\text{C}$, "-" is displayed.

F13 : Temperature of compressor protect sensor(for MDF-436) is indicated as per 1°C.
Range: -50~+110°C

F17 : Family type code setting
001 : MDF-136、MDF-236
002 : MDF-436

Method : In “F17” displayed, press SET key to show initial value “001”.

Set value with  key and press SET key again to memorize value.

Followings are initial setting value.

Temperature setting value of internal chamber : -30°C

Key lock mode : 0 (OFF)

High temperature alarm : SV+10°C

Low temperature alarm : SV-10°C

0 adjustment : +0°C (for temperature sensor)

communication ID : 000

communication mode : 000

Set family type code as 002(for MDF-436) to activate compressor protect mode
(which forced compressor to stop).

F21 : To set serial communication ID.

Input range: 000~255 (Communication is OFF in 000)

F22 : To set serial communication mode.

Control mode (3rd digit) 0 : Local (initial value)

1 : Remote

Baud rate (2nd digit) 0 : 2400bps (initial value)

1 : 4800bps

2 : 9600bps

1st digit is not used.

Note) Set control mode as “remote” unable to change SV and defrosting.

F25 : To set alarm recovery time.

During alarm is performed and buzzer sounds, press BUZZER key to stop
buzzer sound and remote alarm perform. After alarm recovery time is passed
and alarm still remains, buzzer will sound and remote alarm will perform again.

Setting method: In “F25” displayed, press SET key to show current recovery
setting time with second digit brinks. Press  key to turn
large number in second digit. Press SET key to memorize
recovery time then return to PV display.

*It is available to set recovery time as 10min. 20min. 30min. 40min. 50min.
60min.

With set as 000, alarm recovery is not performed.

11. Differential (COMP ON/OFF point for program)

COMP ON : higher than SV+0.0°C

COMP OFF: lower than SV-0.6°C

12. Offset value

The function is to correct differential value between temperature of temperature sensor and internal 1/2H. Temperature indicated by temperature sensor is -2.0°C as offset value.

13. Remote alarm

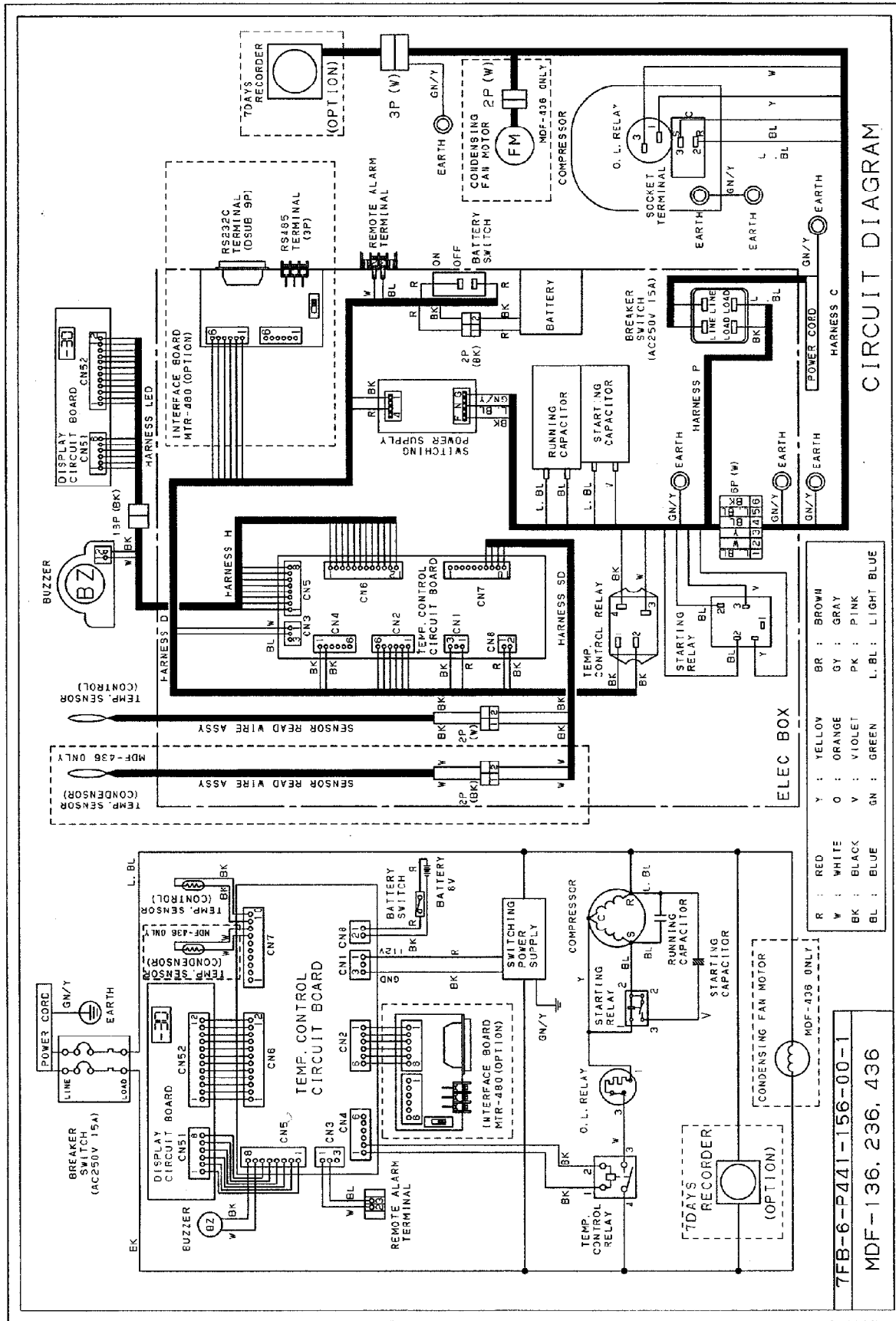
During normal operation Remote alarm contact is OPEN

During alarm or power failure Remote alarm contact is CLOSE

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Wiring diagram

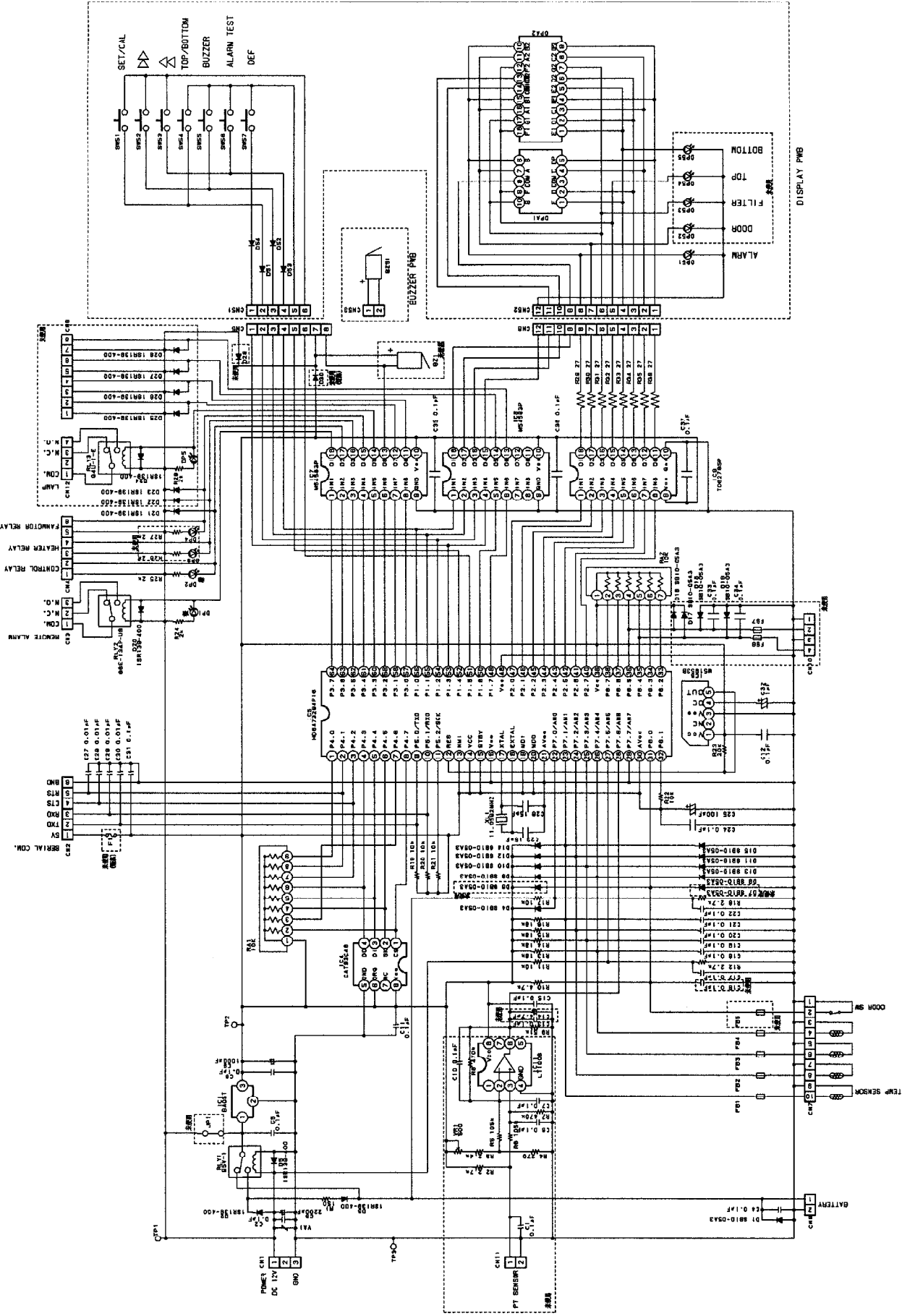


7FB-6-P441-156-00-1

MDF-136, 236, 436

CIRCUIT DIAGRAM

Circuit diagram

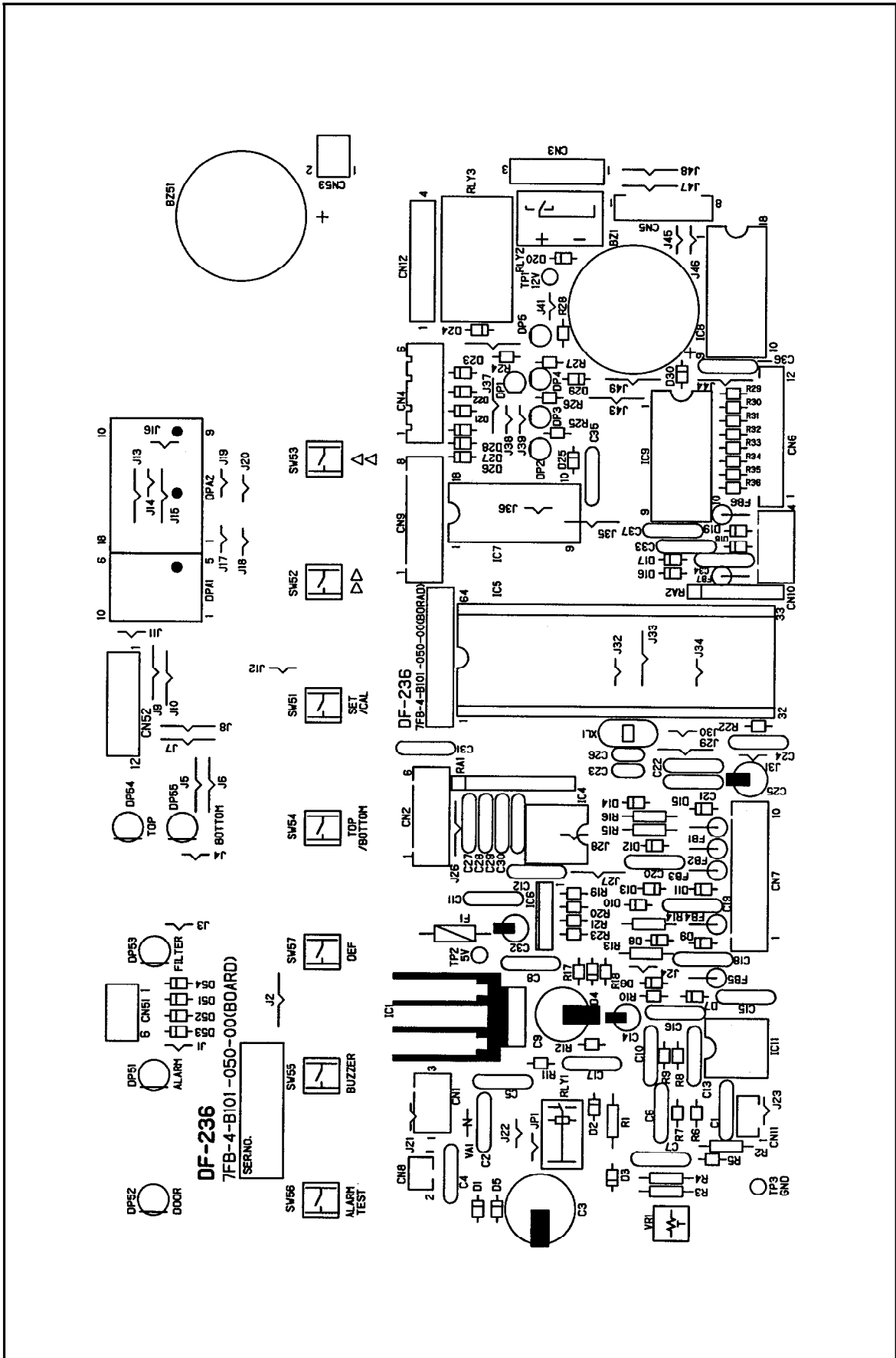


Connection on PCB

The following shows connections of connector (CN) on control PCB.

Connector	Connects to	Use
CN1	Battery #1: +12VDC #2: GND	To supply the power to PCB.
CN2	Not used	
CN3	Remote alarm terminal #1: Com #2: N.C.(when the power is not supplied) #3: N.O.(when the power is not supplied)	Remote alarm contact output • With no alarm occurred and power supplied, contact between #1—#2 is open. • #1 & #2 is connected to remote alarm contact.
CN4	Heater relay coil #1: +12V (relay is ON) #2: GND #3 - #6: not used	ON/OFF for heater relay.
CN5	Display PCB: CN51	To connect with each switch.
CN6	Display PCB: CN52	To connect with each LED.
CN7	Sensor #1 - #6: not used #7 - #8: compressor protect sensor #9 - #10: heater sensor	Compressor protect sensor is used for MDF-436 only.
CN8	Battery	To connect with power failure alarm battery.

Components on PCB



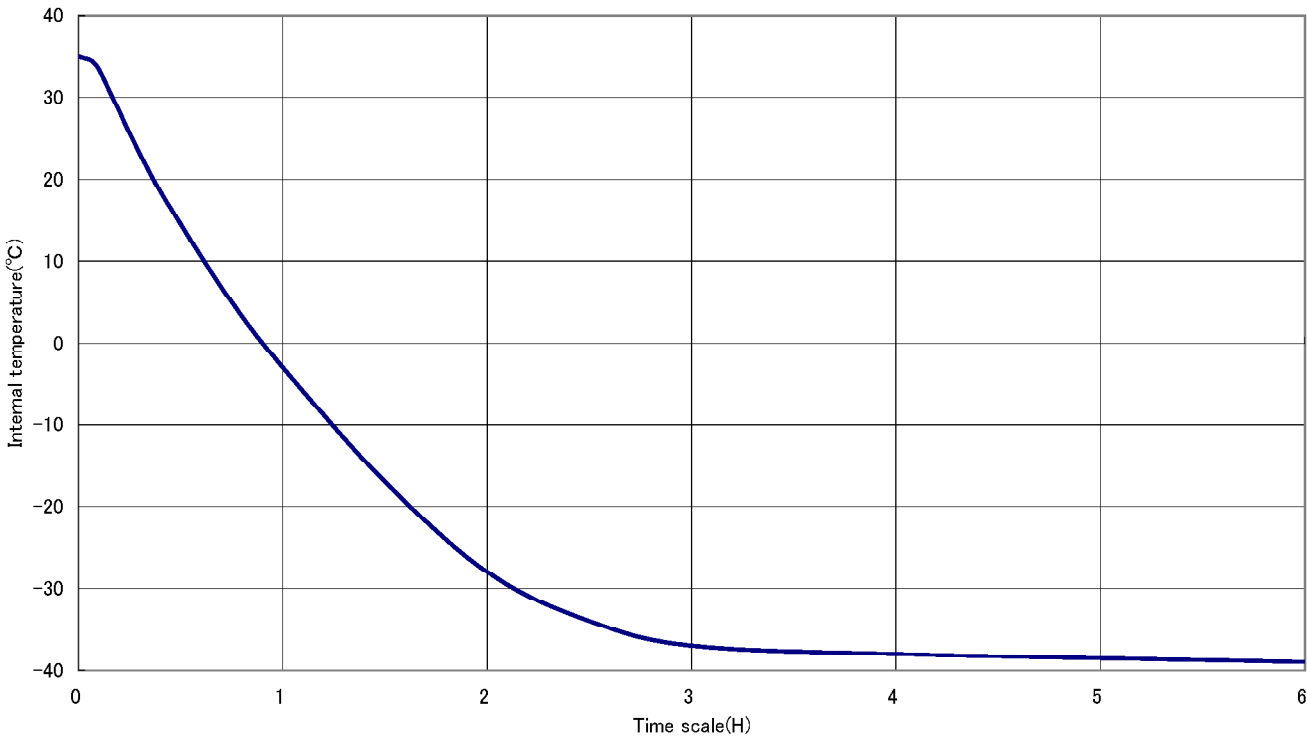
	Test data	
---	------------------	---

1. PULL DOWN SPEED
2. PULL UP SPEED
3. PULL DOWN PRESSURE
4. POWER CONSUMPTION AND CURRENT
5. TEMPERATURE UNIFORMITY AND FLUCTUATION TEST DATA

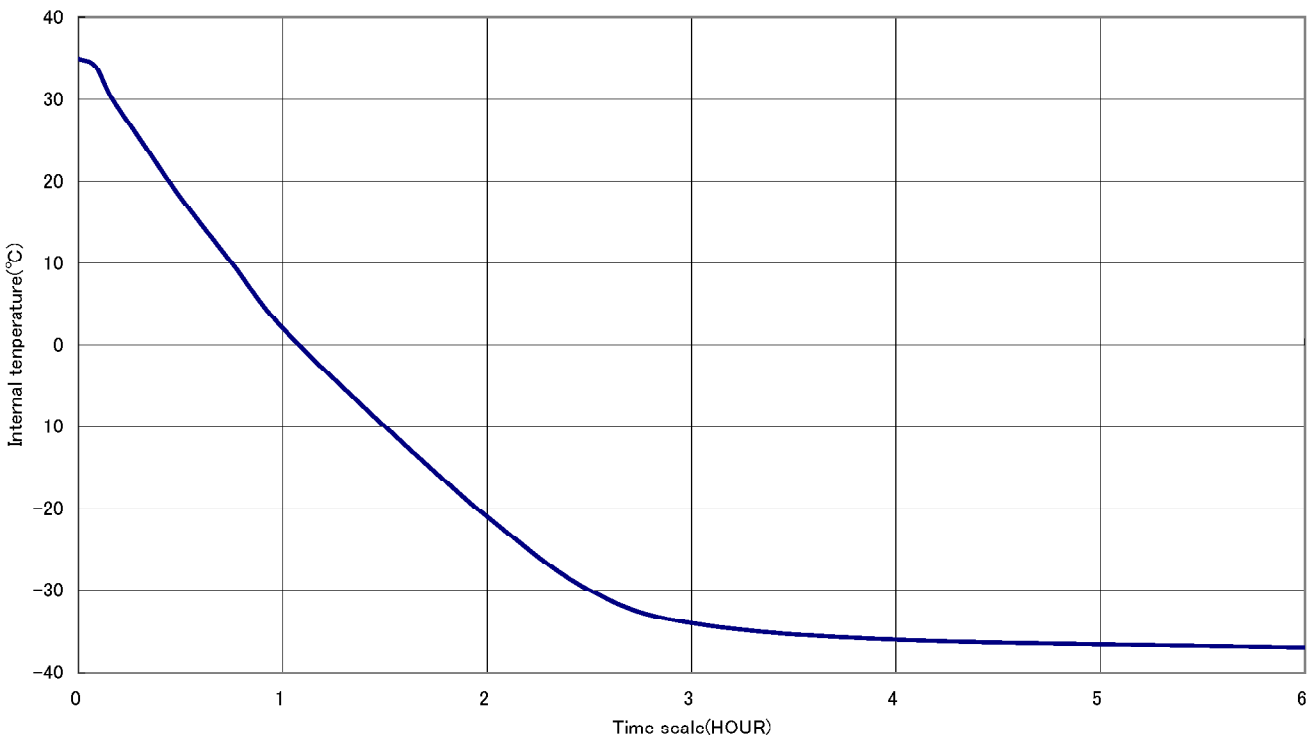
Note: These test data are only reference.

1. Pull down speed

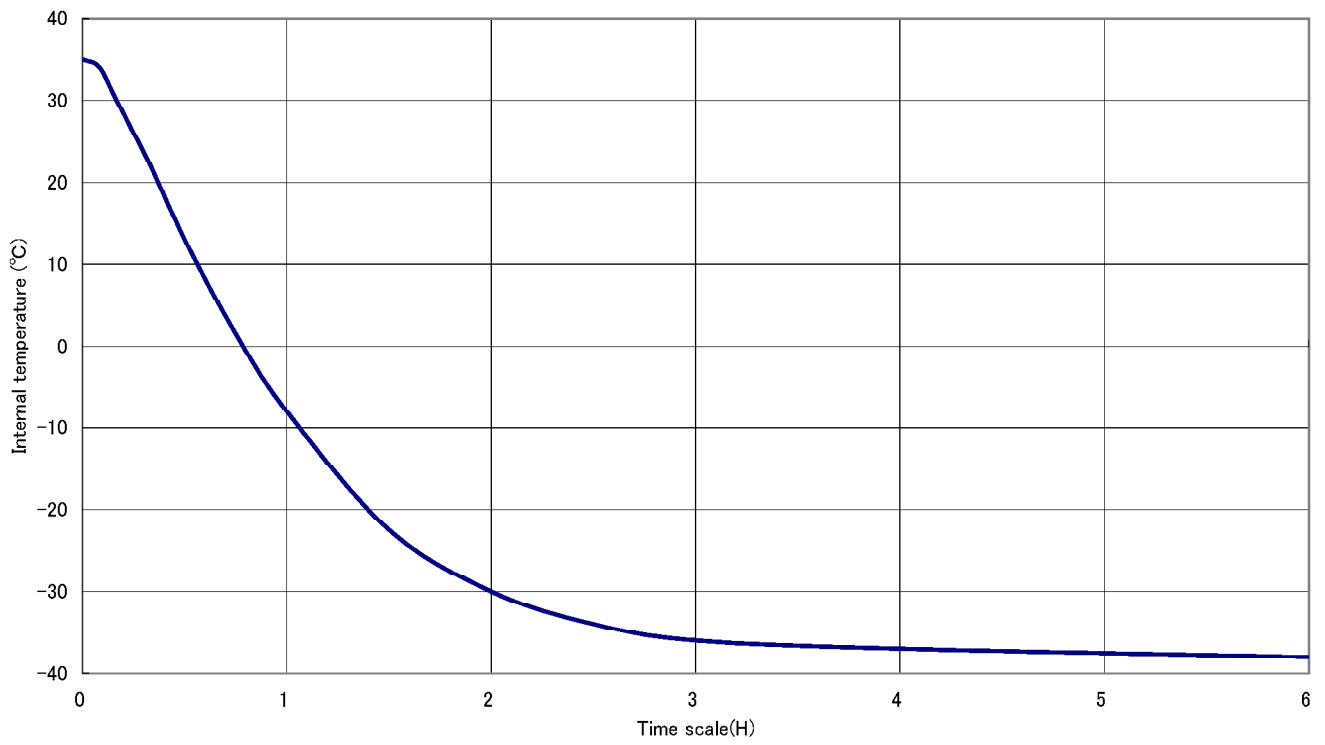
MDF-136 PULL DOWN 1 / 2H AIR (AT35°C 50Hz)



MDF-236 PULL DOWN 1 / 2H AIR (AT35°C 50Hz)

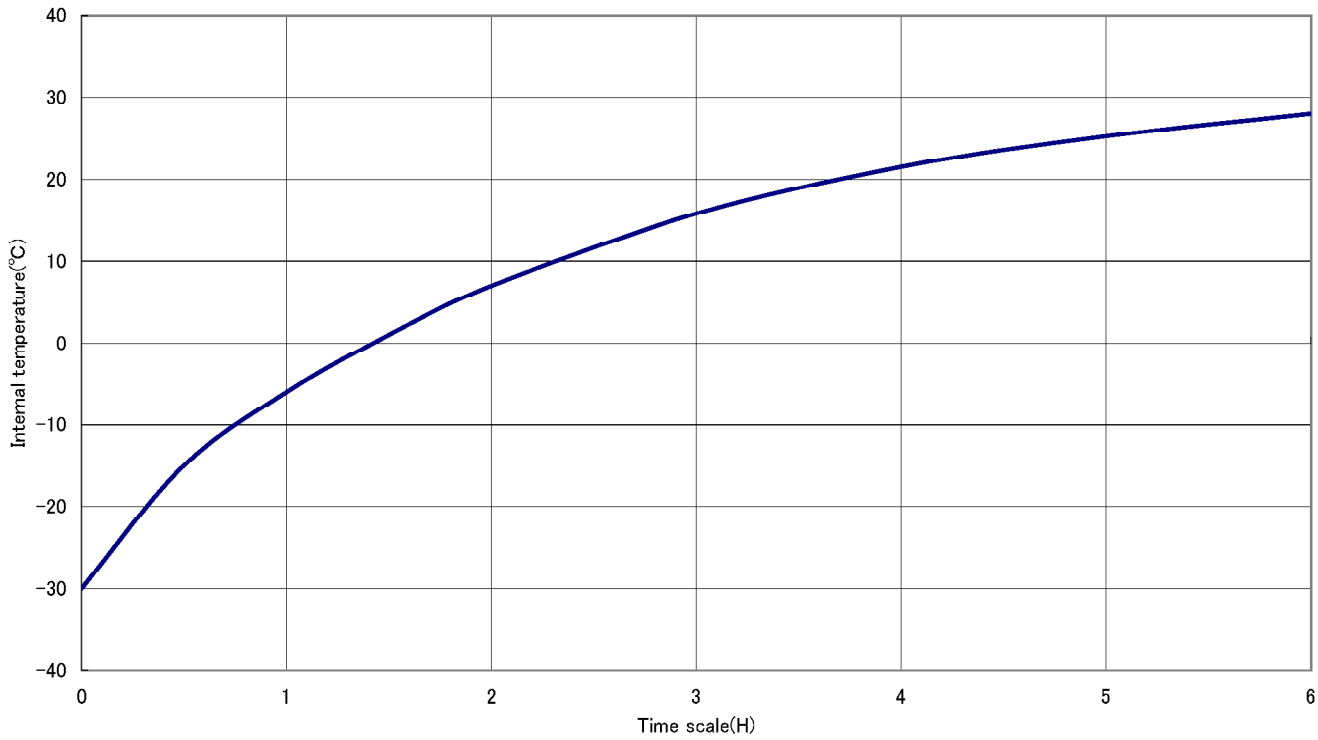


MDF-436 PULL DOWN 1 / 2H AIR (AT35°C 50Hz)

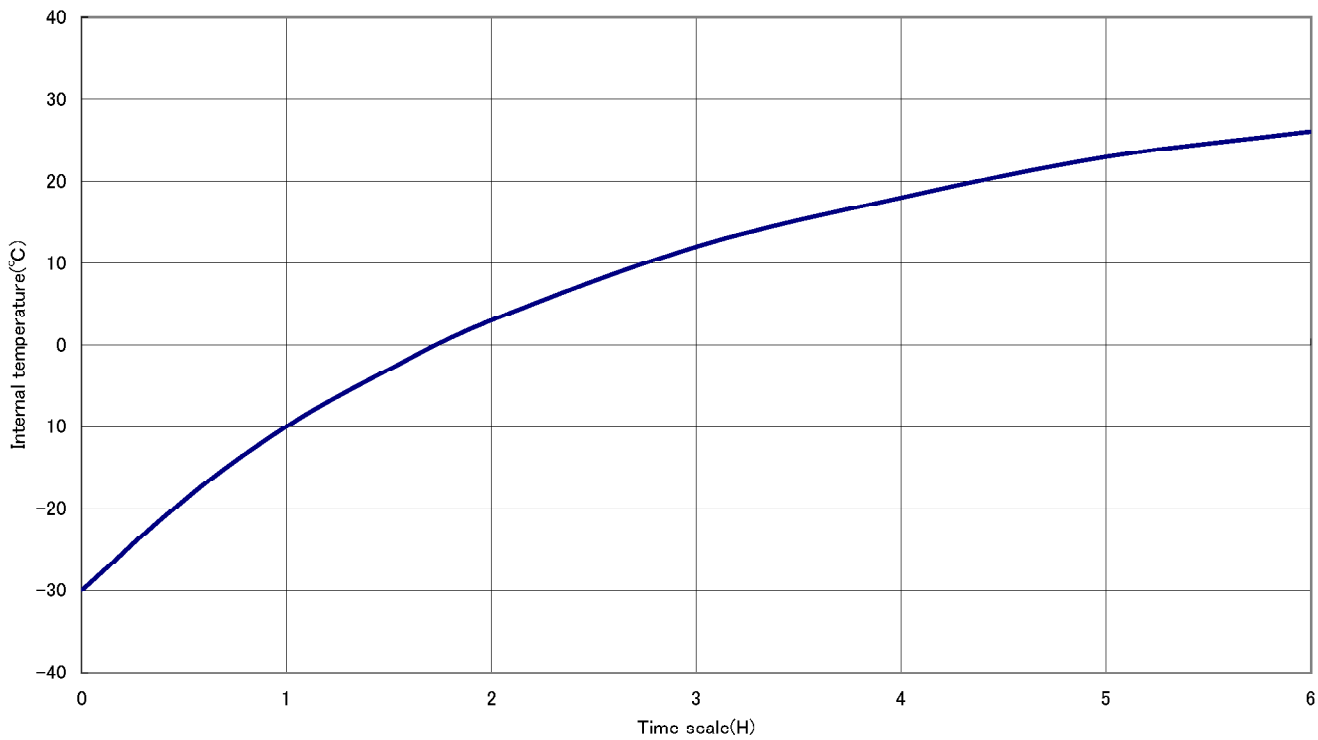


2. Pull up speed

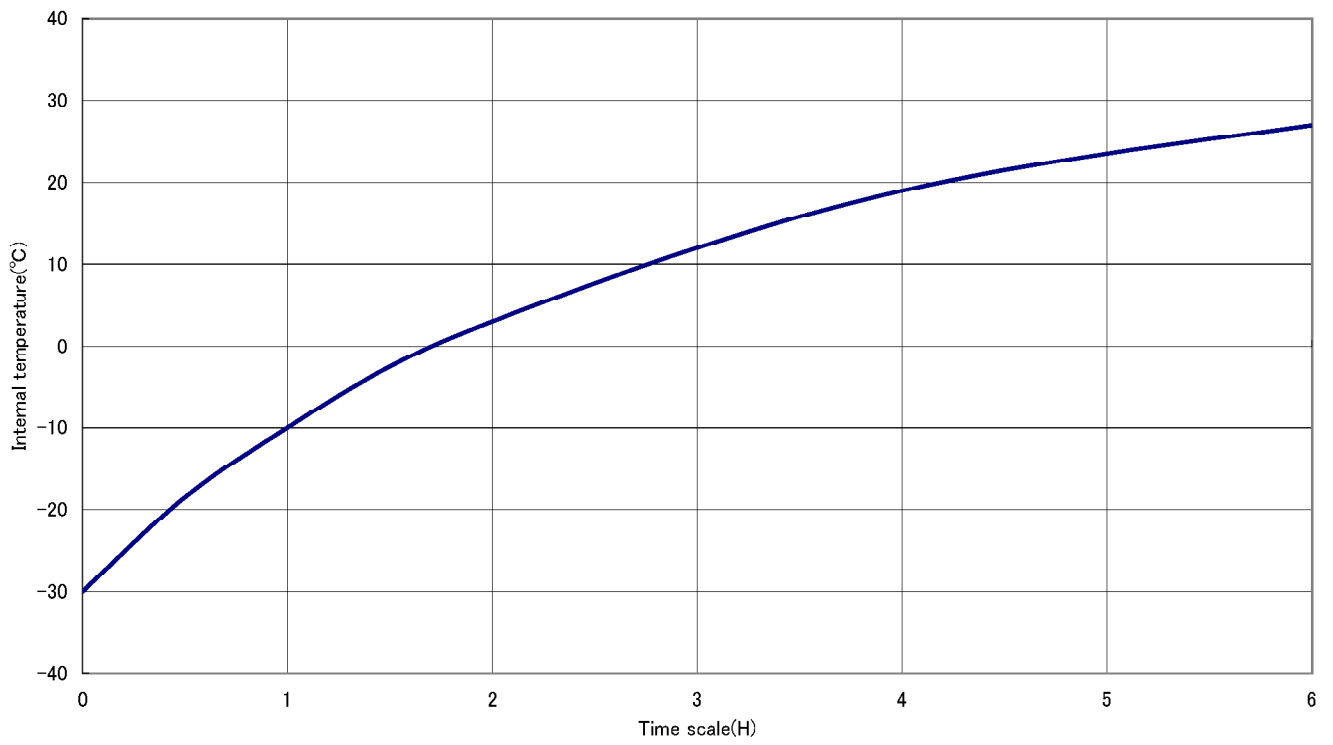
MDF-136 PULL UP 1 / 2H AIR (AT35°C)



MDF-236 PULL UP 1 / 2H AIR (AT35°C)

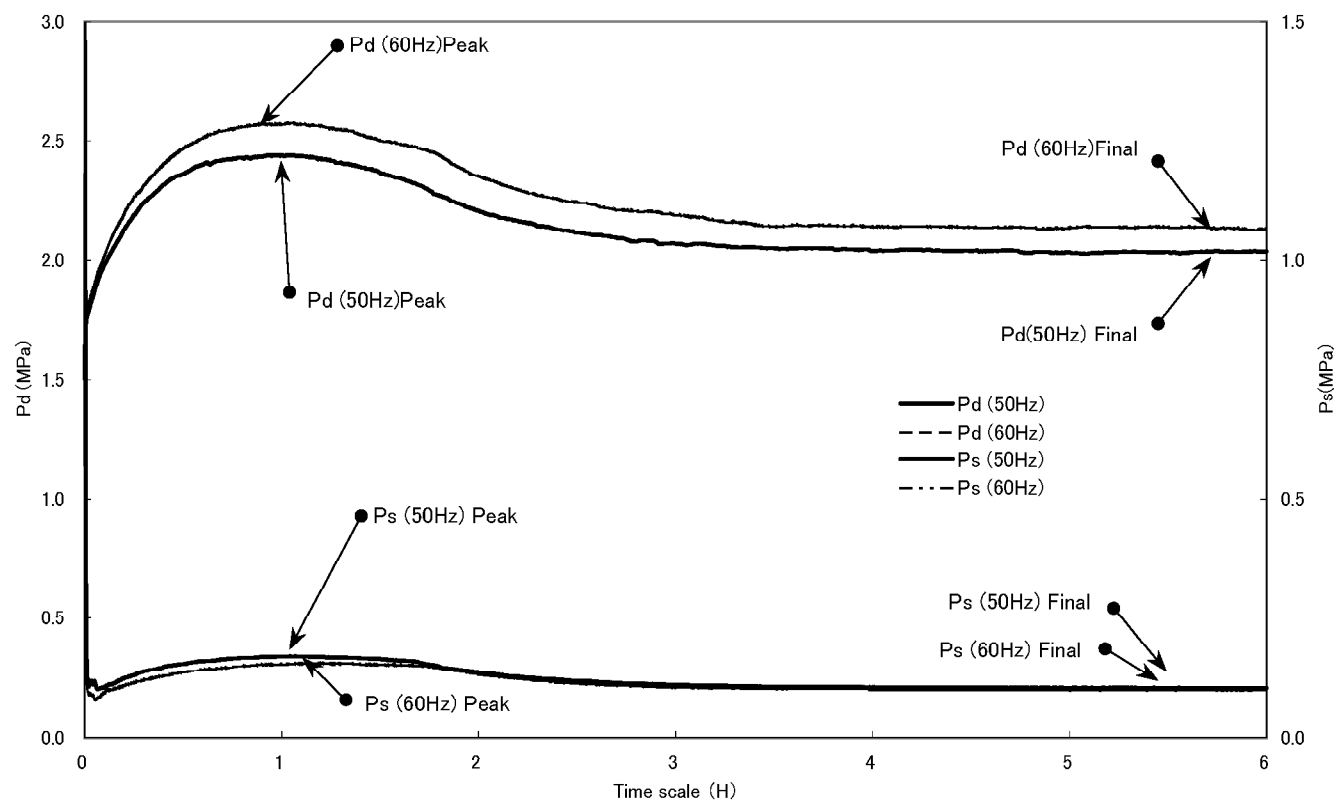


MDF-436 PULL UP 1 / 2H AIR (AT35°C)



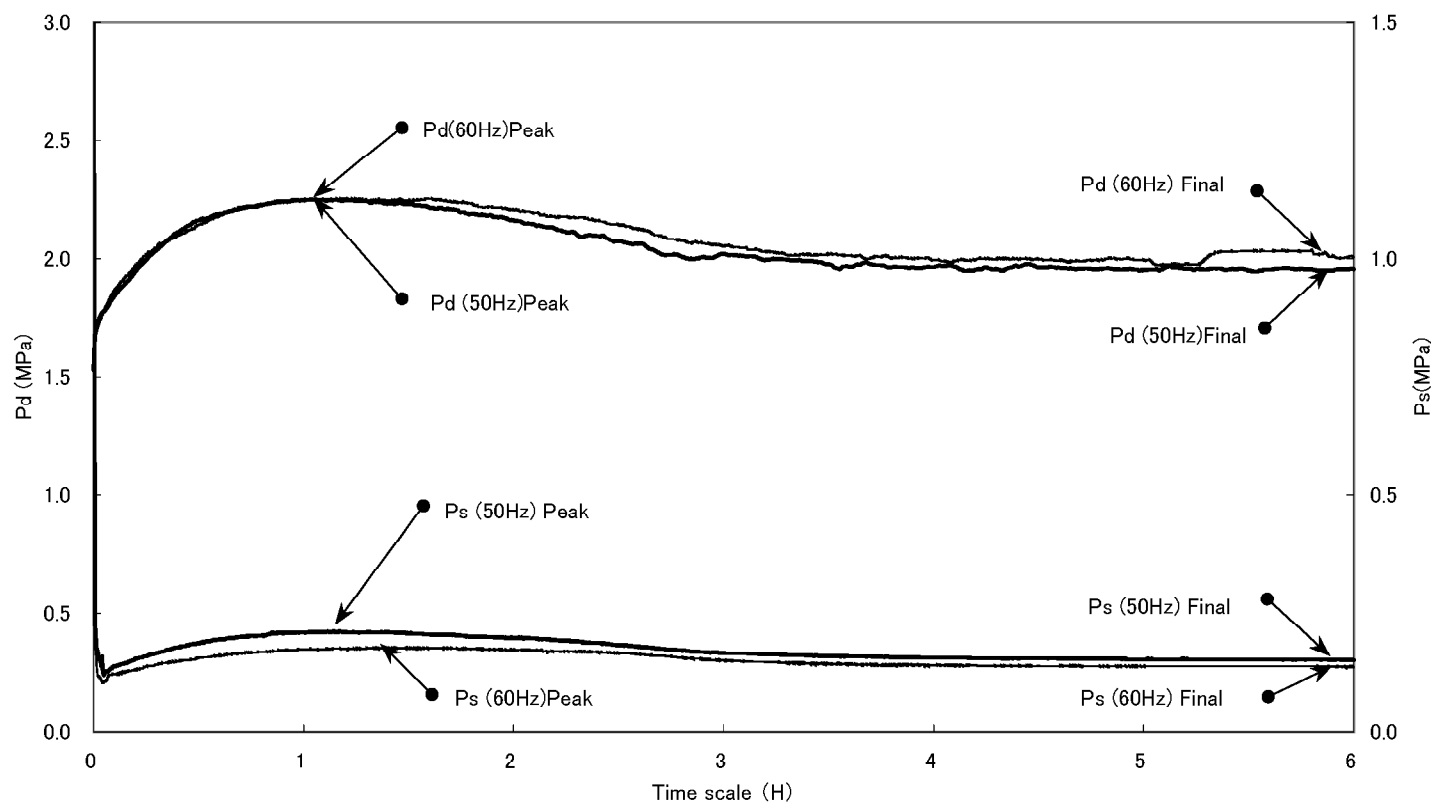
3.Pull down pressure

MDF—136 Pull down pressure (AT 35°C)

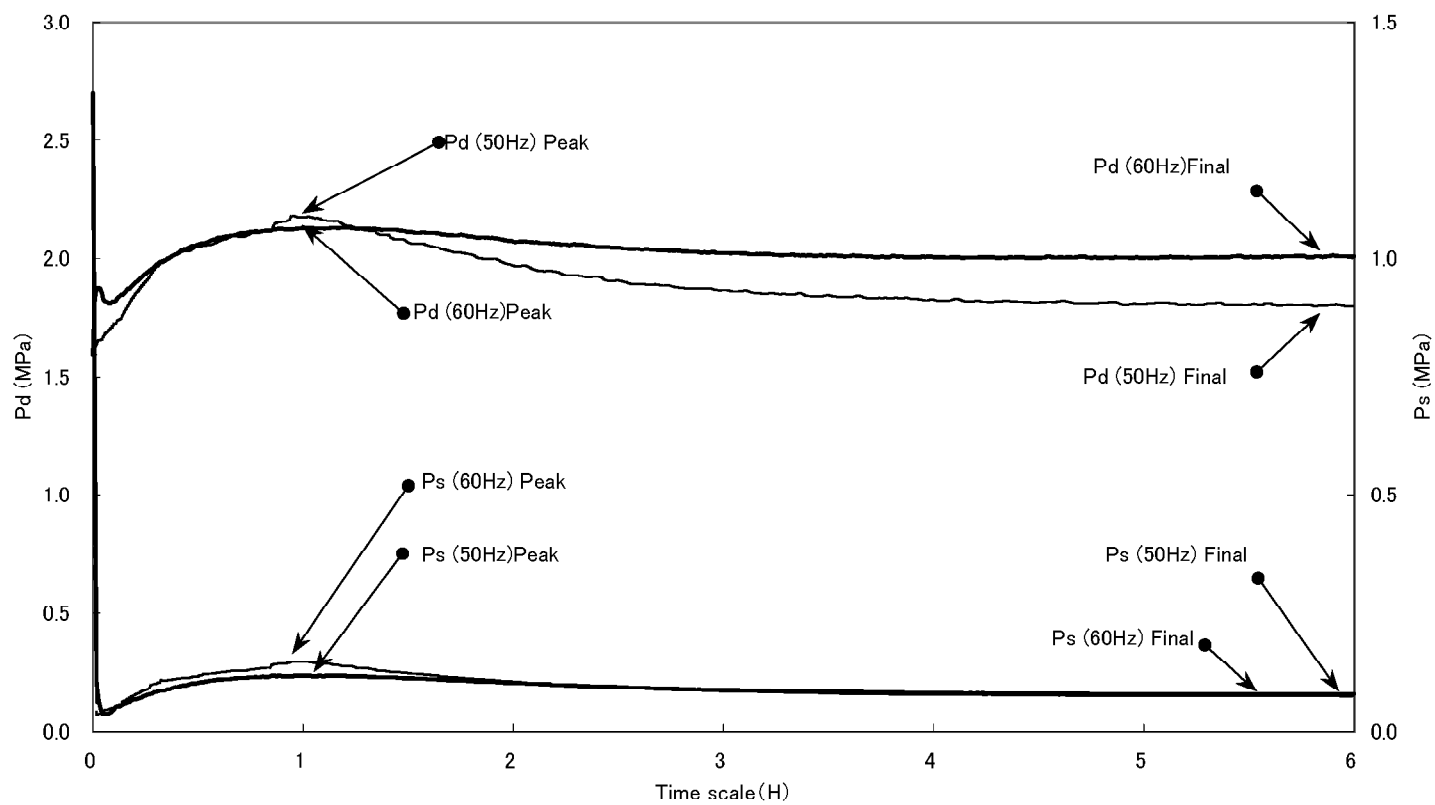


Pd:Pressure of discharge
Ps:Pressure of suction

MDF—236 Pull down pressure(AT 35°C)



MDF—436 Pull down pressure(AT 35°C)



4. Power consumption and current

Maximum power consumption and current
(Ambient temperature : 35°C)

MDF-136

Mains supply		peak (W)	peak (A)
V	Hz		
115	60	210	1.9
220	50	170	0.9
220	60	185	0.9
230	50	175	1.0
240	50	180	1.0

MDF-236

Mains supply		peak (W)	peak (A)
V	Hz		
115	60	180	1.6
220	50	170	0.9
220	60	195	0.9
230	50	205	1.0
240	50	190	1.0

MDF-436

Mains supply		peak (W)	peak (A)
V	Hz		
115	60	340	3
220	50	310	1.7
220	60	320	1.6
230	50	280	1.6
240	50	320	1.8

5. Temperature uniformity and fluctuation test data

[Measuring condition]

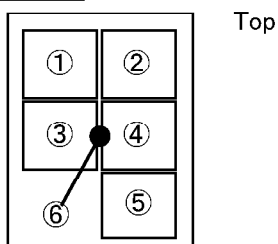
Ambient temperature : 35°C

No load

Measuring method : Air temp.

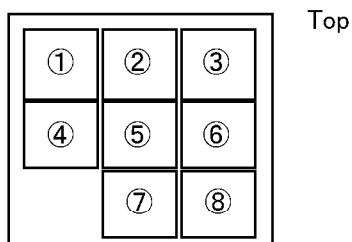
Measuring points : As below

MDF-136



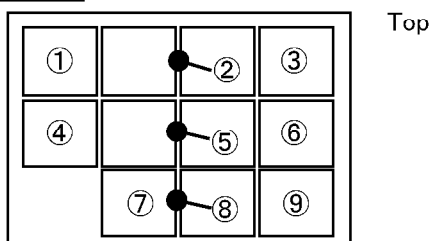
Measuring points		Set temperature (°C)			
		-20	-25	-30	-35
①		-19.0	-24.0	-29.3	-35.4
②		-19.1	-24.1	-29.5	-35.3
③		-20.0	-24.9	-30.3	-37.8
④		-19.8	-24.7	-30.2	-37.8
⑤		-19.9	-24.7	-30.2	-37.9
⑥		-19.6	-24.6	-30.0	-37.8
Uniformity	Max.	-19.0	-24.0	-29.3	-35.3
	Min.	-20.0	-24.9	-30.3	-37.9
	Range	1.0	0.9	0.9	2.7
Fluctuation of measuring point ⑥	Max.	-18.8	-24.0	-29.5	-36.1
	Min.	-20.4	-25.3	-30.5	-39.5
	Range	1.6	1.3	1.0	3.4

MDF-236



Measuring points		Set temperature (°C)			
		-20	-25	-30	-35
①		-18.0	-22.7	-28.0	-34.7
②		-18.5	-23.3	-28.7	-35.3
③		-18.5	-23.2	-28.6	-35.2
④		-19.5	-24.1	-29.5	-36.6
⑤		-19.1	-23.5	-29.0	-36.0
⑥		-19.2	-23.6	-29.1	-36.1
⑦		-19.9	-24.2	-29.5	-37.0
⑧		-19.4	-23.8	-29.4	-36.8
Uniformity	Max.	-18.0	-22.7	-28.0	-34.7
	Min.	-19.9	-24.2	-29.5	-37.0
	Range	1.8	1.5	1.5	2.2
Fluctuation of measuring point ⑤	Max.	-18.0	-22.9	-28.2	-34.3
	Min.	-20.2	-24.4	-29.7	-37.9
	Range	2.2	1.5	1.5	3.6

MDF-436



Measuring points		Set temperature (°C)			
		-20	-25	-30	-35
①		-21.3	-25.2	-29.4	-35.2
②		-21.3	-25.1	-29.5	-34.7
③		-21.4	-25.3	-29.5	-34.7
④		-21.6	-25.2	-30.0	-36.8
⑤		-22.5	-26.0	-30.0	-37.1
⑥		-22.7	-26.2	-30.0	-37.1
⑦		-22.7	-26.1	-29.6	-37.8
⑧		-22.8	-26.2	-29.7	-37.8
⑨		-23.0	-26.3	-29.9	-37.7
Uniformity	Max.	-21.3	-25.1	-29.4	-34.7
	Min.	-23.0	-26.3	-30.0	-37.8
	Range	1.7	1.2	0.7	3.1
Fluctuation of measuring point ⑤	Max.	-21.7	-25.5	-29.7	-36.2
	Min.	-23.2	-26.5	-30.3	-37.8
	Range	1.5	1.0	0.6	1.6

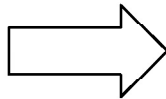
note) These data are reference only

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Parts layout

Door hinge cover



Door hinge cover removed



Control panel



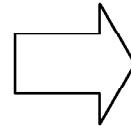
Control panel removed



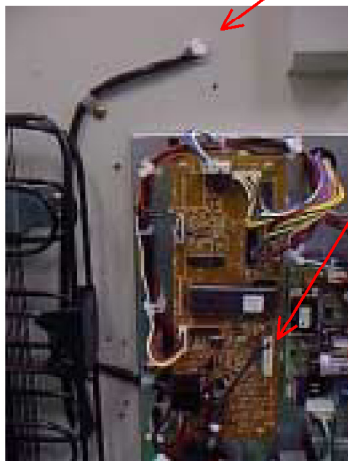
Temperature control sensor cover



Temperature control sensor (Loaded)



Entrance of temperature control sensor on the back



Temperature control sensor connector insert

Bend temperature control sensor to attach load with it.



Recorder connection terminal

Recorder cover removed

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