KOMATSU

Pure Water Heating Unit

Appendix

Model PWH-144i-R-CE

PART NO. 20020060

KELK Ltd.

No. 301766600

Revision history

Rev	Date	Contents	Approval	Examination	Making

CONTENTS

1 Specifications

1.1 Basic specifications

Model	PWH-144i-R-CE
RoHS order	Conformity product
Standards	CE conformity
Painting color	White: Munsell No. N-9 corresponding
External dimensions (㎜)	W1050×D700×H2300
Dry weight	440 kg ※ Reference calculated value
Storage temp./humidity	0 ~ 50℃ / 20 ~ 85%RH (no condensation or freezing)
Operation temp./humidity	15 ~ 30℃ / 35 ~ 85%RH (no condensation)
Inlet temperature range	15.0 ~ 55.0℃ (Don't exceed a heatproof temperature of the pure water inlet connection material.)
Set temperature range	25.0 ~ 85.0℃ (Only when the inlet temp. is lower than the setting.)
Temp. control precision	±1.0℃(Depend on the following condition.) ①The use flowing quantity: Ratings use flowing quantity ±10% (The heating capacity is different depending on flowing quantity.) ②Range of Inlet temperature change :± 5% ③Range of power-supply voltage change ± 5% (Within rated voltage ±10%) However, three above-mentioned items must not change simultaneously and, the range of the following condition. ● There must be a generation interval among rapid flowing quantity, the inlet temperature, and the power-supply voltage change for one minute or more. ● Use the heating ability by 90% or less of the amount of the electric power of the heater. ● Do not use the Power Set function. There is a possibility of deviating from the temperature control precision on the condition when flowing quantity is switched rapidly and used while heating it. Accuracy is in the above-mentioned condition it when preset temperature – Inlet temperature (henceforth Δ T) is less than 10℃ and there is a possibility of deteriorating at ± about 2.0℃.
Max. heating capacity	36 LPM, Δ T = 55℃ (When 200/208V is input.) Heating capacity (kW) = (ΔT × flowing quantity LPM) / 13.75 However, it is a preset temperature maximum value 85℃ in range of the use flowing quantity. *There is a possibility that temperature control cannot control by turbulence when using it while heating full driven. The heating capacity is recommended to be used by 90% or less of the amount of the electric power of the heater.
Rated flow	10 ~ 40 LPM However, ΔT is limited according to flowing quantity. Please use it within the range where pure water permissible pressure (0.4MPa) is not exceeded though 40LPM or more can be thrown. Accuracy is on the turbulence condition for 50LPM or more and there is a possibility of deteriorating at ± about 2.0℃. Heating current of the times amount lower bound judgment value: 4 LPM / each UNIT, Total 8 LPM.

Flow display range	0～50 LPM　However, It is not a range of the guarantee of the temperature control accuracy. The lower bound value: About 6LPM or less (3LPM or less for each unit) is out of the sensor detection range. The upper bound value: Even 140LPM (70LPM/UNIT) can be displayed.
Heating system	Halogen lamp heater
Heater power	144 kW
Temp. control system	PID control
Self diagnostic function	See 『2. Alarm code list』
External I/O signal	See 『3. External I/O signals』
Communication function (Option)	None
REMOTE POWER ON	External power supply (DC24V supply by PWH)
Liquid contact part material	Heating unit: Highly pure silica glass　Pipes：PFA・PVDF Devices：PFA・PTFE　Pipe couplers：PFA・PTFE・PVDF Utility：Refer to 『Piping diagram』 of 『Appendix』 Coupler connections differ depending on specifications.
Permissible pressure	Pure water：MAX 0.4MPa（relief pressure：0.35MPa）　※1 Air：MAX 0.9MPa（pressure reducing valve setting：0.5-.0.6MPa）　※2 ※1　Keep the pressure at 0.4MPa or less including the surge pressure. ※2　Adjust within the operation pressure range using the internal pressure reducing valve.
Environmental atmosphere	No toxic gas nor dust
Others	Operation panel silk indication is an English. Caution label is English and French writing together. Drain pan Capacity：65L

1.2 The primary power supply specification

Source voltage/current	3 phase 3 wire, AC200V±10%		Rated (Max) 416A
	3 phase 3 wire, AC208V±10%		Rated (Max) 400A
Power supply frequency	50/60±3Hz		
Withstand amount at instant stop SEMI F47-0200	The unit keeps operation within the standard. However, the contactor will be OFF when the voltage drops to 25 - 30% and power to the heater is tentatively shut down, which will automatically resume when the voltage returns to the normal value.		
Leak current	15m A or less		
Withstand voltage	AC2300V Two second Leak current 30mA or less (Between primary side-PE) However, the noise filter after the main breaker is removed and executed.		
Dielectric resistance	DC500V 20MΩ or more (Between primary side - PE) However, the noise filter after the main breaker is removed and executed.		
Power supply	Main breaker (Fuji)	Type: Earth leakage breaker (ELB) Series: EW630RAGU Current rating: 600A Sensed current rating (mA): 100/200/500/1000 Setting,100 Connection bolt: M12	
	PM breaker (Fuji)	Type: Earth leakage breaker (ELB) Series: EW100EAGU Current rating: 100A Sensed current rating: 30mA	
Control power	Source voltage	1 phase AC200/208V±10%	
		The connection to the control source is done at the time of our shipment because internal connections. Internal terminal block connection (M4 screw)	
	Reference SWR Input: Input voltage (ACV): 180-229, Input current (ACA): 1.7typ (AC200V is input.)		

1.3 Power cable

Tightening torque

Main breaker	48N·m
Earth (PE)	48N·m

Size of power cable / earth cable

Power cable	Ratings 600V or more AWG 4/0 × 2 ～ Kcmil 350 × 2 / 75℃
Earth cable (PE)	Ratings 600V or more AWG 4/0 × 2 ～ Kcmil 350 × 2 / 75℃

2 Alarm code list

Error #	Item names	Sensor	Anomaly detection condition	Detection time	Heating	Inlet valve-main	Inlet valve-bypass	External output: Flow amount alarm	Continue alarm	PV sensor disconnection short-circuit alarm	Unit internal temperature error	Remote	Water level alarm	Power system anomaly	Stop alarm	Liquid leakage alarm	Upper limit alarm	Over temperature alarm	Dry operation or sensor disconnection	Door open alarm	Stability	Internal communication error alarm	Errror release conditions	Remarks
100	PLC Trouble	PLC	At an inside abnormal sequencer (When the heavy breakdown bit is turned on, it is judged it is abnormal). If the bit stands on the operation panel side, it abnormally displays it.	Immediate	Stop	Close	Close	○	○	○	○		○	○	○	○	○	○	○	○		○	Power OFF	[The PLC heavy breakdown] screen is displayed, and the buzzer doesn't rumble.
		PLC	At an inside abnormal sequencer (When the light breakdown bit is turned on, it is judged it is abnormal). If the bit stands on the operation panel side, it abnormally displays it.	1 sec	Stop	—	Open								○							○	Power OFF	
101	Thermo-Control Board Trouble	Control board	The access is abnormal of EEPROM It is generated in the abnormal circumstances of reading of EEPROM(communication abnormality of IIC)	1 sec	Stop	—	Open								○							○	Power OFF	
102	Control Panel Trouble	PLC	When control panel anomaly occurred This abnormality doesn't occur because the breakdown bit is not set up when the operation panel is abnormality. It is judged the communication abnormality from the PLC side, and becomes Er111.	1 sec	Continue	—	Open		○														Error reset	
103	PM I/F Board Trouble (Unit1)	PM_I/F board UNIT1	At abnormal PM_I/F(Unit1) The access is abnormal of EEPROM It is generated in the abnormal circumstances of reading of EEPROM(communication abnormality of IIC)	5 sec	Stop	—	Open								○							○	Power OFF	
104	PM I/F Board Trouble (Unit2)	PM_I/F board UNIT2	At abnormal PM_I/F(Unit2) The access is abnormal of EEPROM It is generated in the abnormal circumstances of reading of EEPROM(communication abnormality of IIC)	5 sec	Stop	—	Open								○							○	Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
110	Internal Communication Anomaly (PLC - Thermo-Control Board)	Control board	Control board communication abnormality(Er100 in case of abnormal PLC)	4 sec	Stop	—	Open								○							○	Power OFF	
111	Internal communication anomaly (PLC - Control Panell)	PLC	Cintrol panel communication abnormality(Er100 in case of abnormal PLC)	10 sec	Continue	—	Open		○														Error reset	
112	Internal communication anomaly (Thermo-Control Board - PM I/F Unit1)	Control board	Communication anomaly	2sec	Stop	—	Open								○							○	Power OFF	
		PM_I/F UNIT1		1.2sec	Stop	—	Open								○							○	Power OFF	
113	Internal communication anomaly (Thermo-Control Board - PM I/F Unit2)	Control board	Communication anomaly	2sec	Stop	—	Open								○							○	Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
		PM_I/F UNIT2		1.2sec	Stop	—	Open								○							○	Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
120	Non Setup of the model	PLC	When the model type or the voltage is not set.	1 sec	Stop	—	Open								○								Error reset	It occurs when the battery of PLC emptied.
150	Low Battery of PLC	Battery	When the voltage of the backup battery drops	1 sec	Continue	—	Open		○														Error reset	Back up by using the "Backup" function when it is generated. and, exchange the batteries without intercepting the device power supply.
151	Low Battery of Control Panel	Battery	When the voltage of the backup battery drops	1 sec	Continue	—	Open		○														Error reset	↑

The "—" mark of the inlet valve : It differs while controlled.

It gives priority to entrance valve bypass, main, and "Close" when two or more errors occur, and the one done, the state of the entrance valve is "open or close" exists together.

Alarm code list

Error #	Item names	Sensor	Anomaly detection condition	Detection time	Heating	Inlet valve-main	Inlet valve-bypass	External output: Flow amount alarm	Continue alarm	PV sensor disconnection short-circuit alarm	Unit internal temperature error	Remote	Water level alarm	Power system anomaly	Stop alarm	Liquid leakage alarm	Upper limit alarm	Over temperature alarm	Dry operation or sensor disconnection	Door open alarm	Stability	Internal communication error alarm	Error release conditions	Remarks
200	Liquid Leakage Inside	Liquid leakage sensor	When the sensor activated	5 sec	Stop	Close	Close					＼			○	○					＼		Error reset	
201	Liquid Leakage (Option)	Liquid leakage sensor 2	When the liquid leakage sensor 2 activated	5 sec	~~Stop~~/ Continue	~~Close~~/ –	~~Close~~/ –		★	◯		＼			☆	☆					＼		Error reset	Optional function. Operation status may be selected
203	Over Temperature in Heating (Unit 1)	Temperature SW	When the sensor （60℃） activated	1 sec	Stop	–	Open				○	＼			○						＼		Error reset	
204	Over Temperature in Heating (Unit 2)	Temperature SW	When the sensor （60℃） activated	1 sec	Stop	–	Open				○	＼			○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
205	Temp-Sensor Anomaly in Unit1 Bottle Outlet	Outlet Temp-Sensor	Disconnection(210℃), short-circuit(-30℃)	5 sec	Stop	–	Open			○		＼			○						＼		Error reset	
206	Temp-Sensor Anomaly in Unit2 Bottle Outlet	Outlet Temp-Sensor	Disconnection(210℃), short-circuit(-30℃)	5 sec	Stop	–	Open			○		＼			○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
207	Inlet Temp-Sensor Anomaly	Inlet Temp-Sensor	Disconnection (210℃), short-circuit(-30℃)	5 sec	Stop	–	Open			○		＼			○						＼		Error reset	
210	Over Temperature in Outlet (Unit1)	Outlet Temp-Sensor	When it reach 98±2℃ Disconnection: when sensor output is 'o'	1sec	Stop	Open	–					＼			○			○			＼		Power OFF	
211	Over Temperature in Outlet (Unit2)	Outlet Temp-Sensor	When it reach 98±2℃ Disconnection: when sensor output is 'o'	1sec	Stop	Open	–					＼			○			○			＼		Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
220	Heating of Empty Bottle 1 (Unit1)	Temperature fuse	When the temperature reaches 135±3℃ or the harness is disconnected.	1 sec	Stop	–	Open					＼			○				○		＼		Error reset	
221	Heating of Empty Bottle 2 (Unit1)			1 sec								＼			○				○		＼		Error reset	
222	Heating of Empty Bottle 3 (Unit1)			1 sec								＼			○				○		＼		Error reset	
223	Heating of Empty Bottle 4 (Unit1)			1 sec								＼			○				○		＼		Error reset	
224	[Heating of Empty Bottle 1 (Unit2)	Temperature fuse	When the temperature reaches 135±3℃ or the harness is disconnected.	1 sec	Stop	–	Open					＼			○				○		＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
225	Heating of Empty Bottle 2 (Unit2)			1 sec								＼			○				○		＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
226	Heating of Empty Bottle 3 (Unit2)			1 sec								＼			○				○		＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
227	Heating of Empty Bottle 4 (Unit2)			1 sec								＼			○				○		＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
230	Temperature Anomaly (Unit1 M1)	Temperature SW	When the sensor （90℃） activated	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	
231	Temperature Anomaly (Unit1 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12 and 24kW.
232	Temperature Anomaly (Unit1 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, and 48kW.
233	Temperature Anomaly (Unit1 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 144kW.
234	Temperature Anomaly (Unit2 M1)	Temperature SW	When the sensor （90℃） activated	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
235	Temperature Anomaly (Unit2 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
236	Temperature Anomaly (Unit2 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
237	Temperature Anomaly (Unit2 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, 96,and 144kW.
238	Welding of Contact (Unit1 M1)	Contactor	When the contactor does not turn "OFF"	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	
239	Welding of Contact (Unit1 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12 and 24kW.
240	Welding of Contact (Unit1 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, and 48kW.
241	Welding of Contact (Unit1 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 144kW.
242	Welding of Contact (Unit2 M1)	Contactor	When the contactor does not turn "OFF"	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
243	Welding of Contact (Unit2 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
244	Welding of Contact (Unit2 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
245	Welding of Contact (Unit2 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, 96,and 144kW.
246	Contactor OFF (Unit1 M1)	Contactor	When the contactor does not turn "ON" or the breaker is "OFF".	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	
247	Contactor OFF (Unit1 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12 and 24kW.
248	Contactor OFF (Unit1 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, and 48kW.
249	Contactor OFF (Unit1 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 144kW.
250	Contactor OFF (Unit2 M1)	Contactor	When the contactor does not turn "ON" or the breaker is "OFF".	5 sec	Stop	–	Open					＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
251	Contactor OFF (Unit2 M2)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
252	Contactor OFF (Unit2 M3)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
253	Contactor OFF (Unit2 M4)			5 sec								＼		○	○						＼		Error reset	Does not occur at 12, 24, 48, 72, 96,and 144kW.

The "－" mark of the inlet valve：It differs while controlled.

It gives priority to entrance valve bypass, main, and "Close" when two or more errors occur, and the one done, the state of the entrance valve is "open or close" exists together.

Error #	Item names	Sensor	Anomaly detection condition	Detection time	Heating	Inlet valve-main	Inlet valve-bypass	External output																Error release conditions	Remarks
								Flow amount alarm	Continue alarm	PV sensor disconnection short-circuit alarm	Unit internal temperature error	Remote	Water level alarm	Power system anomaly	Stop alarm	Liquid leakage alarm	Upper limit alarm	Over temperature alarm	Dry operation or sensor disconnection	Door open alarm	Stability	Internal communication error alarm		
350	Stoppage of Fan 1	FAN1	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	
351	Stoppage of Fan 2	FAN2	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12 and 24kW.
352	Stoppage of Fan 3	FAN3	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, and 48kW.
353	Stoppage of Fan 4	FAN4	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, and 144kW.
354	Stoppage of Fan 5	FAN5	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
355	Stoppage of Fan 6	FAN6	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
356	Stoppage of Fan 7	FAN7	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
357	Stoppage of Fan 8	FAN8	Fan stop signal	5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, 96,and 144kW.
380	Heater Disconnection	Current sensor	When the sensor current drops below the threshold when the heater is activated	5 sec	Continue	—	Open		○														Power OFF	
381	SCR Anomaly (Unit1 M1)	Current sensor	When you continuously detect the current of the heater 5A or more for five seconds while operation is stopping	5 sec	Stop	—	Open							○	○								Power OFF	
382	SCR Anomaly (Unit1 M2)			5 sec										○	○								Power OFF	Does not occur at 12 and 24kW.
383	SCR Anomaly (Unit1 M3)			5 sec										○	○								Power OFF	Does not occur at 12, 24, and 48kW.
384	SCR Anomaly (Unit1 M4)			5 sec										○	○								Power OFF	Does not occur at 12, 24, 48, 72, and 144kW.
385	SCR Anomaly (Unit2 M1)			5 sec										○	○								Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
386	SCR Anomaly (Unit2 M2)			5 sec										○	○								Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
387	SCR Anomaly (Unit2 M3)			5 sec										○	○								Power OFF	Does not occur at 12, 24, 48, 72, and 96kW.
388	SCR Anomaly (Unit2 M4)			5 sec										○	○								Power OFF	Does not occur at 12, 24, 48, 72, 96,and 144kW.

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It gives priority to entrance valve bypass, main, and "Close" when two or more errors occur, and the one done, the state of the entrance valve is "open or close" exists together.

Alarm code list

Error #	Item names	Sensor	Anomaly detection condition	Detection time	Heating	Inlet valve-main	Inlet valve-bypass	External output															Error release conditions	Remarks
								Flow amount alarm	Continue alarm	PV sensor disconnection short-circuit alarm	Unit internal temperature error	Remote	Water level alarm	Power system anomaly	Stop alarm	Liquid leakage alarm	Upper limit alarm	Over temperature alarm	Dry operation or sensor disconnection	Door open alarm	Stability	Internal communication error alarm		
400	Sync Transformer Anomaly (Unit1)	Source voltage	When the power source voltage is abnormality Vmax = max(U,V,W) Vmin=min(U,V,W) When Vmax <= 100[v] is anomaly Vmin=0[v] Vmax>At 100 v, it is abnormal in Vmax/Vmin>=1.5	5 sec	Stop	—	Open							○	○								Error reset	
401	Sync Transformer Anomaly (Unit2)	Source voltage		5 sec	Stop	—	Open							○	○								Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
402	Flow Anomaly for Lower Limit (Unit1)	Flow meter	When 0.5(LPM) or less.(12kW) When 1(LPM) or less.(24kW) When 4(LPM) or less.(48, 72, 96kW) When each unit:4(LPM) or less.(144 and 192kW)	5 sec	Stop	—	Open	○							○								Error reset	Monitored during operation only
403	Flow Anomaly for Lower Limit (Unit2)	Flow meter		5 sec	Stop	—	Open	○							○								Error reset	Monitored during operation only Does not occur at 12, 24, 48, 72, and 96kW.
405	Flow Anomaly for Upper Limit (Unit1)	Level sensor	70LPM or more	5 sec	Stop	—	Open	○							○								Error reset	Monitored during operation only
406	Flow Anomaly for Upper Limit (Unit2)	Platinum resistor		1 sec	Stop	—	Open	○							○								Error reset	Monitored during operation only Does not occur at 12, 24, 48, 72, and 96kW.
408	Water level anomaly	Level sensor	When the water level sensor doesn't detect the pura water even if about ten seconds have passed since the operation began. No pure water detection while operation: When the water level sensor doesn't detect pura water five seconds more continuously.	10sec 5 sec	Stop	—	Open						○		○								Error reset	
420	Temperature Anomaly of Inlet	Inlet temperature sensor	When the inlet temperature shifts outside the 0-150℃ range.	5 sec	Stop		Open			○					○								Error reset	
421	Temperature Anomaly of Bottle Outlet (Unit1)	Outlet temperature sensor	When the outlet temperature shifts outside the 0-150℃ range.	5 sec	Stop	—	Open			○					○								Error reset	
422	Temperature Anomaly of Bottle Outlet (Unit2)	Outlet temperature sensor	When the outlet temperature shifts outside the 0-150℃ range.	5 sec	Stop	—	Open			○					○								Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
440	Front maintenace cover open (UNIT1)	Door SW	When the panel is open during power supply	1 sec	Stop	—	Open								○					○			Error reset	
441	Side maintenance cover open (UNIT1)	Door SW	When the panel is open during power supply	1 sec	Stop	—	Open								○					○			Error reset	
442	Front maintenace cover open (UNIT2)	Door SW	When the panel is open during power supply	1 sec	Stop	—	Open								○					○			Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
443	Side maintenance cover open (UNIT2)	Door SW	When the panel is open during power supply	1 sec	Stop	—	Open								○					○			Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
450	The Plural SV Selection Alarm	PLC	When two ore more external SV commands are input	5 sec	Continue	—	Open		○													○	Error reset	
456	Abnirmal SV or PV Offset setting	PLC	When false setting occurred for setting of SV_#, SV_INI_# and PVOffset. Or when SV value which deviated from the range of the aim temperature setting of the serial communication was set.	Immedi ate	Stop	—	Open								○								Error reset	Only the serial communications model is generated in the error of serial communications.
460	Temperature Band Alarm for Upper Limit (Unit1)	Outlet temperature sensor	When the current temperature has passed standby time set for the stable width for the target temperature and has shifted off the specific setting width: Upper/lower limit set width::0～30℃	5 sec	Stop	—	Open								○		○						Error reset	
461	Temperature Band Alarm for Upper Limit (Unit2)	Outlet temperature sensor		5 sec	Stop	—	Open								○		○						Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
462	Temperature Band Alarm for Lower Limit (Unit1)	Outlet temperature sensor		5 sec	Continue	—	Open		○														Error reset	
463	Temperature Band Alarm for Lower Limit (Unit2)	Outlet temperature sensor		5 sec	Continue	—	Open		○														Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
465	Flow Alarm for Lower Limit	Flow meter	When becoming more than the set flowing quantity lower limit value.	5 sec	Continue	—	Open		○														Error reset	Monitored during operation only
466	Overtemp. Alarm (Unit1)	Outlet temperature sensor	When becoming more than the set temperature	5 sec	Stop	—	Open								○		○						Error reset	
467	Overtemp. Alarm (Unit2)	Outlet temperature sensor	When becoming more than the set temperature	5 sec	Stop	—	Open								○		○						Error reset	Does not occur at 12, 24, 48, 72, and 96kW.
-		Non-fuse, breaker	Control breaker activated		Stop	Close	Close	○	○	○	○		○	○	○	○	○	○	○	○		○	Power OFF	
-		Emergency stop switch	When emergency stop switch is activated		Stop	Close	Close	○	○	○	○		○	○	○	○	○	○	○	○		○	Power OFF	

The ”—” mark of the inlet valve : It differs while controlled.

It gives priority to entrance valve bypass, main, and "Close" when two or more errors occur, and the one done, the state of the entrance valve is "open or close" exists together.

3 External I/O signals

3.1 Content of external I/O signal

3.1.1 Output list

No	signal name	classification	content
1	Flow amount alarm	Output	When flowing quantity becomes less than lower bound threshold, PWH outputs this signal.
2	Continue alarm (general alarm 2)	Output	When the alarm that continues heating is generated, PWH outputs this signal.
3	Disconnection or short of the PV sensor	Output	When it disconnects, and do the short-circuit of temperature (inlet and outlet) sensor, PWH outputs this signal.
4	Unit internal temperature error	Output	When the temperature switch in the heating unit becomes 60℃ or more, PWH outputs this signal.
5	Remote	Output	When the PWH is selected in the remote setting, PWH outputs this signal.
6	Water level alarm	Output	When the pure water is not filled in the device, PWH outputs this signal..
7	Power system anomaly alarm	Output	When the power module detects abnormality, PWH outputs this signal.
8	Stop alarm (general alarm 1)	Output	When the alarm that stops heating is generated, PWH outputs this signal.
9	Liquid leakage alarm	Output	When the liquid leakage sensor works, PWH outputs this signal.
10	Upper limit alarm	Output	When becoming an upper bound band abnormal alarm arbitrarily set, PWH outputs this signal.
11	Over temperature alarm	Output	When the bottle outlet temperature becomes 98±2℃, PWH outputs this signal.
12	Heating of empty or sensor disconnection alarm	Output	When the no-liquid heating temperature fuse works, PWH outputs this signal.
13	Door open alarm	Output	When the maintenance panel in heating unit is opened, PWH outputs this signal.
14	Stable	Output	When becoming a stability bandwidth condition arbitrarily set, PWH outputs this signal.
15	Internal communication error alarm	Output	When an internal communication becomes abnormal, PWH outputs this signal.
16	Emergency shutdown	Output	When the emergency stop switch works, the point of contact is opened.
17	EMO contact output	Output	Two b points of contact of the EMO switch are output in connectors. However, because the I/O connector is another system output, it is not included in the pin assignment list.

3.1.2 Input list

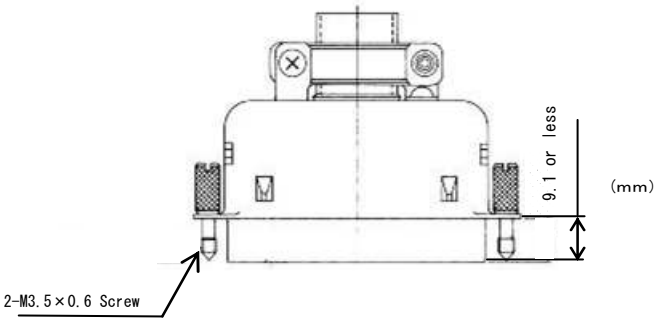
No	signal name	classification	content
1	Error reset signal	Input	It is an error reset signal of PWH.
2	Water supply signal	Input	The inlet valve is made an opening and the heating operation begins.
3	Operation signal	Input	It is a signal that makes the inlet valve an opening.
4	External temperature command 1	Input	It is a signal to which the setting is changed at preset temperature (SV-1) arbitrarily set.
5	External temperature command 2	Input	It is a signal to which the setting is changed at preset temperature (SV-2) arbitrarily set.
6	External temperature command 3	Input	It is a signal to which the setting is changed at preset temperature (SV-3) arbitrarily set.
7	External temperature command 4	Input	It is a signal to which the setting is changed at preset temperature (SV-4) arbitrarily set.
8	External temperature command 5	Input	It is a signal to which the setting is changed at preset temperature (SV-5) arbitrarily set.
9	Buzzer reset signal	Input	It is a buzzer reset signal of PWH.
10	Remote power ON (+)	Input	The same function as power on switch is possessed from the point of contact of an external device.
11	Remote power ON (-)	Input	
12	Remote power shut down (+)	Input	The same function as power off switch is possessed from the point of contact of an external device.
13	Remote power shut down (-)	Input	

3.2 Pin assignment list

Pin assign-ment	Signal name		Pin assign-ment	Signal name	
1	Flow amount alarm	Output	19	Liquid leakage alarm	Output
2	Continue alarm (general alarm 2)	Output	20	Upper limit alarm	Output
3	Disconnection or short of the PV sensor	Output	21	Over temperature alarm	Output
4	Unit internal temperature error	Output	22	Heating of empty or sensor disconnection alarm	Output
5	Remote	Output	23	Door open alarm	Output
6	Water level alarm	Output	24	Stable	Output
7	Power system anomaly alarm	Output	25	Internal communication error alarm	Output
8	Stop alarm (general alarm 1)	Output	26	(spare)	—
9	Output COM 1 (*1)	—	27	Output COM 0 (*2)	—
10	Error reset signal	Input	28	External temperature command 4	Input
11	Water supply signal	Input	29	Buzzer reset signal	Input
12	Operation signal	Input	30	External temperature command 5	Input
13	External temperature command 1	Input	31	Emergency shutdown signal	Output
14	External temperature command 2	Input	32	Emergency shutdown signal	Output
15	External temperature command 3	Input	33	External temperature setting (+) *6	Input
16	Input COM (*3)	—	34	External temperature setting (-) *6	Input
17	Remote power ON signal(-) *4	Input	35	Remote power ON signal(+) *4	Input
18	Remote power shutdown signal(-) *5	Input	36	Remote power shutdown signal(+) *5	Input

《Connector name》

Plug (user side): 57-30360-D76 The soldering type (DDK) is attached to the system.



DDK Connector Pin Layout

*1: Output COM1 is a COM common to connector pins NO. 1-8.

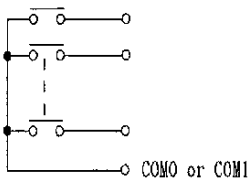
*2: Output COM0 is a COM common to connector pins NO.19-26.

*3: Input COM is a COM common to connector pins NO.10-13 and NO.28-30.

*4: It supplies a pulse of DC24V between each pin.

*5: Impress DC24V between each pin.

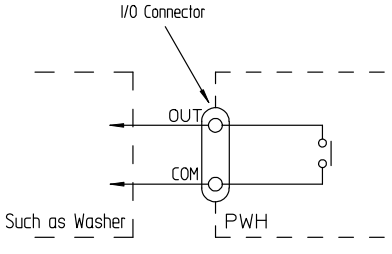
*6: If you intend to use the external temperature settings, please contact us.



3.3 I/O connector output signals list

No	Output signal name	Unit status	Contact status	Remarks
1	Flow amount alarm	Faulty	Open	The contact is short-circuited in normal condition; open in faulty condition. The contact is "open" while the unit power is "OFF".
2	Continue alarm (general alarm 2)			
3	Disconnection or short of the PV sensor			
4	Unit internal temperature error			
5	Water level alarm			
6	Power system anomaly alarm			
7	Stop alarm (general alarm 1)			
8	Liquid leakage alarm			
9	Upper limit alarm			
10	Over temperature alarm			
11	Heating of empty or sensor disconnection alarm			
12	Door open alarm			
13	Emergency shutdown signal *	Emergency stop SW ON		The contact changes to "OPEN" every time the emergency stop SW is activated irrespective of the unit power supply is "ON" of "OFF".
14	Stable	Instability	Open	The stable signal is output when the temperature stays continuously within the given range within any set band. Note that the item will be non-active when the following conditions are met. ① When set temperature is changed ② When heating is stopped ③ When the outlet temperature goes outside the stable width for the OFF Delay setting value consecutively during heating. Refer to " Initial setting list (factory setting)" of "Maintenance Manual" ④ When upper/lower band alarm or heating stop error occurred (heating stop). Note that the function will stop when 0 is input in the band.
		Stable	Short	
15	Remote	Local	Open	The contact is short-circuited in Remote mode. The contact is open in Local and Serial mode.

- Output specification: Max. DC24V, 100 mA. Min. DC5V, 1 mA.
- * The contact of emergency shutdown signal is Max. DC24V, 100 mA. Min. DC5V, 5 mA.



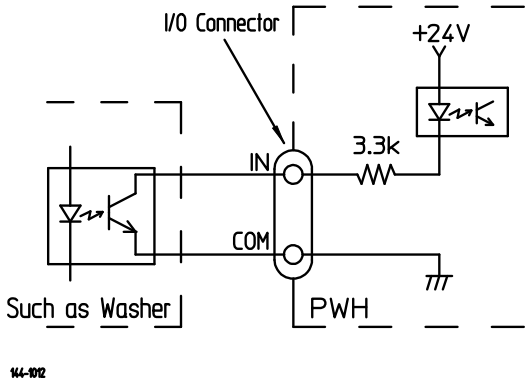
3.4 I/O connector input signal list

No	Input signal names	Status	Contact status	Remarks
1	Error reset signal	Reset	Short	Do not start heating while the error reset signal is short-circuited. The error will be reset when edge is detected.
2	Water supply signal	Inlet valve open	Short	See “3.8 Description of operation of the operation signal and the water flow signal.” The signal is edge detection.
		Inlet valve Close	Open	
3	Operation signal	Start	Short	See “3.8 Description of operation of the operation signal and the water flow signal.” The signal is edge detection.
		Stop	Open	
4	External temperature command1	Set	Short	When two or more external temperature commands are input at the same time, the Er 450 will be triggered and the external temperature command having the smallest number will take precedence over others. The signal is edge detection.
5	External temperature command 2	Set	Short	
6	External temperature command 3	Set	Short	
7	External temperature command 4	Set	Short	
8	External temperature command 5	Set	Short	
9	Buzzer reset signal	Reset	Short	Do not start heating while the error reset signal is short-circuited. The error will be reset when edge is detected.
10	Remote power on signal	On	DC24V Pulse impression	Remote power on turning on has the same function as the power on/off switch (insertion) by driving an internal relay by the DC24V supply by an external device. The relay is G5NB-1 and DC24V (made in Omron) equivalent goods are used. Impress DC24V between pins when you use it. Remote power on turning on has the self-holding circuit in the inside, and gives the input to me as a pulse input (1-2 second). Refer to '3.7 remote power supply turning on signal and remote power supply interception signal'.
		Not on	Open	
11	Remote power shut off signal	Power supplied	Short	Remote power on shut off has the same function as the power OFF switch by the point of contact of an external device. The power supply doesn't enter even if the power ON switch is pushed when opening and push the power ON switch short, please when turning on power. See “3.7 remote power supply turning on signal and remote power supply interception signal.”

- Input each input signal after 20 seconds or more have passed after turning power on.
- As long as between 36-18 pins are not short-circuited, you cannot turn power on even if the remote power on function is not used.
- Connect between 36-18 pins with the circuit of the host side to intercept PWH from the outside in the emergency when the serial communication facility (option) is used. The power supply of PWH cannot be intercepted in the serial communication facility (option).
- Input specification: DC24V, 3.3KΩ, approx. 7 mA.

3.5 I/O input (transistor)

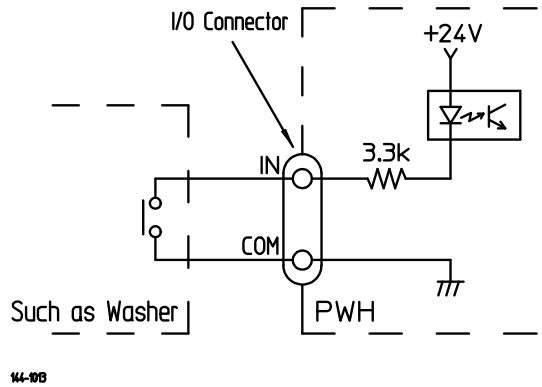
Transistor drive: Input shall be made only after the GND line has been isolated with a photo coupler.



3.6 I/O input (relay)

Relay drive : Input to the contact with a no-voltage contact.

When a contact is used for inputting signals, use a minimal current type contact.



3.7 About the remote power on / shut off signals

Signal name	PWH internal circuit	Pin number	Washer	
Remote power on signal(+)	Internal relay DC24V 8.3mA	35	DC24V	Please power supply.
Remote power on signal(-)		17	0V	Pulse input : Power on
Remote power shut off signal(+)	(+)	36		OPEN : Power shut-off
Remote power shut off signal(-)	(-)	18		SHORT : Energized

Even when the function is not used, you cannot turn power on unless between 36 – 18 pins are short-circuited.

3.8 Description of operation signal and the water supply signal

			External I/O connector input signal		Operation of PWH	
			Input signal			
			Operation signal※3 (Contact status)	Water supply signal (Contact status)	Inlet valve (main)	Heating
Normal state			ON: Start (Short)	ON：Water supply (Short)	Open	Heating
			↑	OFF：Stop (Open)	Open	Heating
			OFF：Stop (Open)	ON：Stop (Short)	Open	Stop
			↑	OFF：Stop (Open)	Close	Stop
During an error status	Stop alarm	Inlet valve(main) Close	ON: Start (Short)	ON：Water supply (Short)	Close	Stop
			↑	OFF：Stop (Open)	Close	Stop
			OFF：Stop (Open)	ON：Water supply (Short)	Close	Stop
			↑	OFF：Stop (Open)	Close	Stop
		Inlet valve(main) Control	ON: Start (Short)	ON：Water supply (Short)	Open	Stop
			↑	OFF：Stop (Open)	Close	Stop
			OFF：Stop (Open)	ON：Water supply (Short)	Open	Stop
		※1	↑	OFF：Stop (Open)	Close	Stop
	Continue alarm		ON: Start (Short)	ON：Water supply (Short)	Open	Heating
			↑	OFF：Stop (Open)	Open	Heating
			OFF：Stop (Open)	ON：Water Supply (short)	Open	Stop
			↑	OFF：Stop (Open)	Close	Stop

※1 This indicates the “-“ mark in the alarm code list.

※2 Even when heating is active the output will become OFF when flow amount error should occur.

※3 The operation start signal is an edge detection signal. When the unit stops due to an error, the operation will not resume automatically even if the error is reset with the error reset signal. First turn the operation start signal OFF and then turn it ON again

3.9 Emergency stop (EMO) switch point of contact output

Two b points of contact of the emergency stop switch (opening in abnormal circumstances) are output in connectors.

Connector symbol	Pin assignment	EMO points of contact	Remarks
EMO1	1		Connector: 1-179553-2 (tab housing) Contact: 353718-2 (0.38μ gold-plated) Maker: Tyco Electronics (D-3200S series)
	2		
EMO2	1		
	2		

- Output specification: Max. DC24V, 1A. Min. DC3V, 5mA.

  *EMO switch: AR22V2R-*R (Fuji Electric)

4 Accessory list

Name	Number
Earthquake-proof bracket(T=12mm) A fixed screw on the case side has clung to the device.	4pcs
External I/O connector (an phenol full-pitch 36p) Model / Manufacturer：57-30360-D76 / DDK	1pcs
Certificate(pass a product test)	1part
Inspection report	1part
Operation manual (Japanese・English) Describes operating procedures and precautions on operation.	Each 1book
Maintenance manual (Japanese・English) Describes operation of the maintenance screen, cautions on corrective measures for maintenance errors and initial setting. This manual shall be safely stored by the maintenance manager.	Each 1book
Installation manual (Japanese・English) Describes precautions on installation.	Each 1book
Appendix (Japanese・English) Externals chart, wiring diagram, and change parts have been described.	Each 1book

5 Replacement part list

Consumable part list

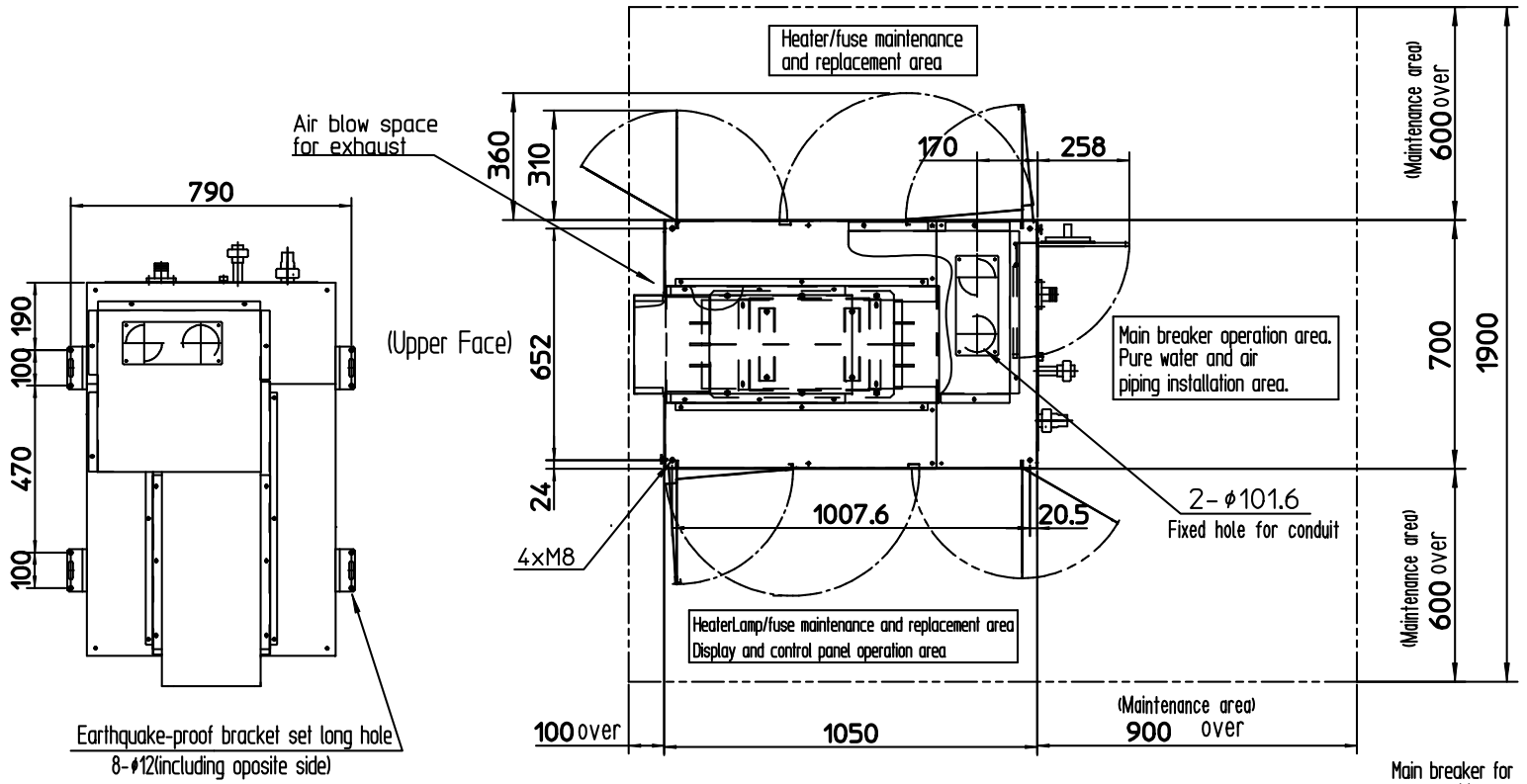
No	name	part number	pcs／unit	replacement time
1	Heater	CUL316G31	36	Guarantee at heating time 5,000h
2	Heater Holder	CAAF059700	72	Set replacement with heater. Two one heater necessities
3	Inlet temp. sensor	4002176	1	Two years after it operates
4	Outlet temp. sensor	4002178	2	Two years after it operates
5	Battery for PLC	4002285	1	Two years after it operates
6	Battery for control panel	4002286	1	Two years after it operates

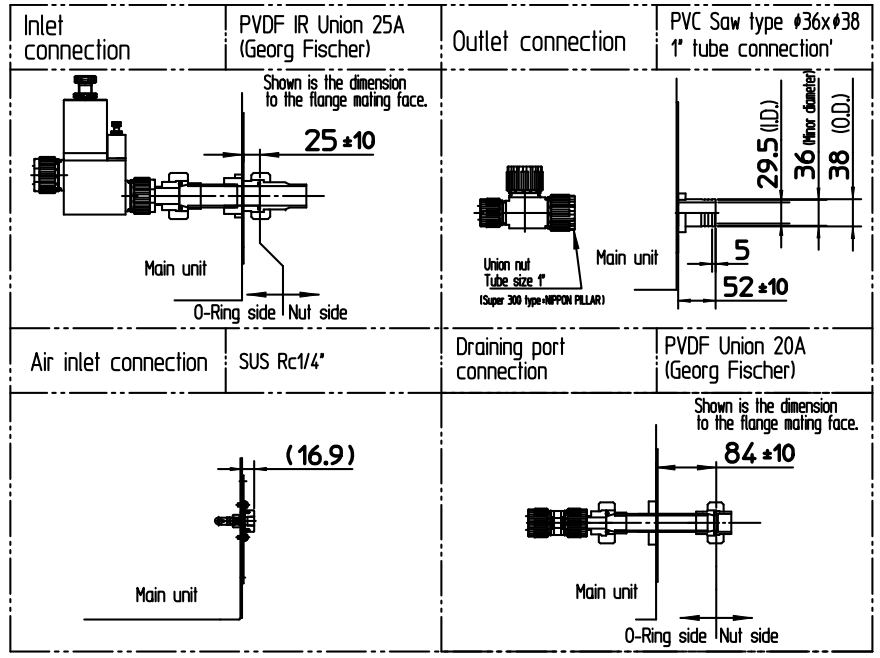
Maintenance part list

No.	name	part number	Remarks
1	PLC	4002015	PLC①：Power supply module
2	PLC	4002016	PLC②：CPU module
3	PLC	4002017	PLC③：Output module
4	PLC	4002018	PLC④：Input module
5	PLC	4002020	PLC⑤：I/O module
6	PLC	4002021	PLC⑥：Communication module
7	PLC	4002022	PLC⑧：AD module
8	Control board	30088891	
9	Control panel	4002012	
10	PM_I/F board	30096681	UNIT1, UNIT2 commonness
11	Door switch	4002006	UNIT1, UNIT2 commonness
12	FAN	30105161	FAN1 – 7 commonness
13	No-liquid heating temp. fuse	30164780	UNIT1 Bottle1
14	No-liquid heating temp. fuse	30164790	UNIT1 Bottle2
15	No-liquid heating temp. fuse	30164800	UNIT1 Bottle3
16	No-liquid heating temp. fuse	30164820	UNIT2 Bottle1
17	No-liquid heating temp. fuse	30164830	UNIT2 Bottle2
18	No-liquid heating temp. fuse	30164840	UNIT2 Bottle3
19	Fuse	4002282	Interlock board：F3、F6、F7、F8、F9
20	Fuse	4002283	Interlock board：F2、F4、F5
21	Fuse	4002284	Interlock board：F1
22	Fuse	4002562	Controller floor：F1、F2、F3
23	Power module	30099281	UNIT1、UNIT2 commonness
24	Synchronous transformer	30104973	T1
25	Synchronous transformer	30104984	T2
26	Synchronous transformer	30104994	T3

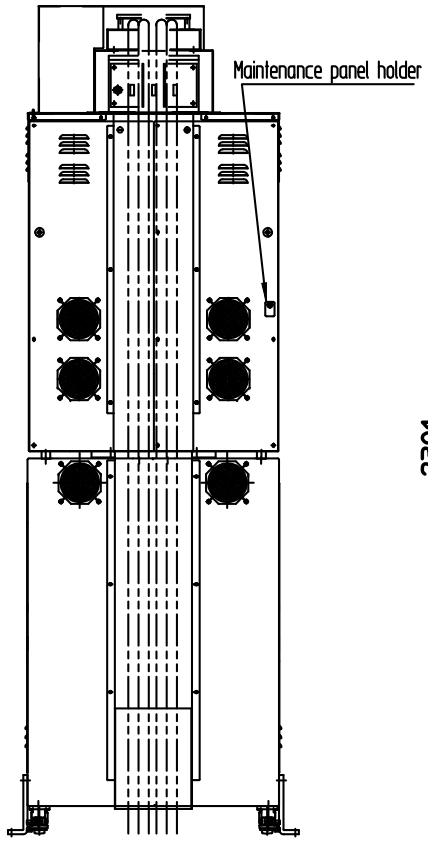
6 Drawing

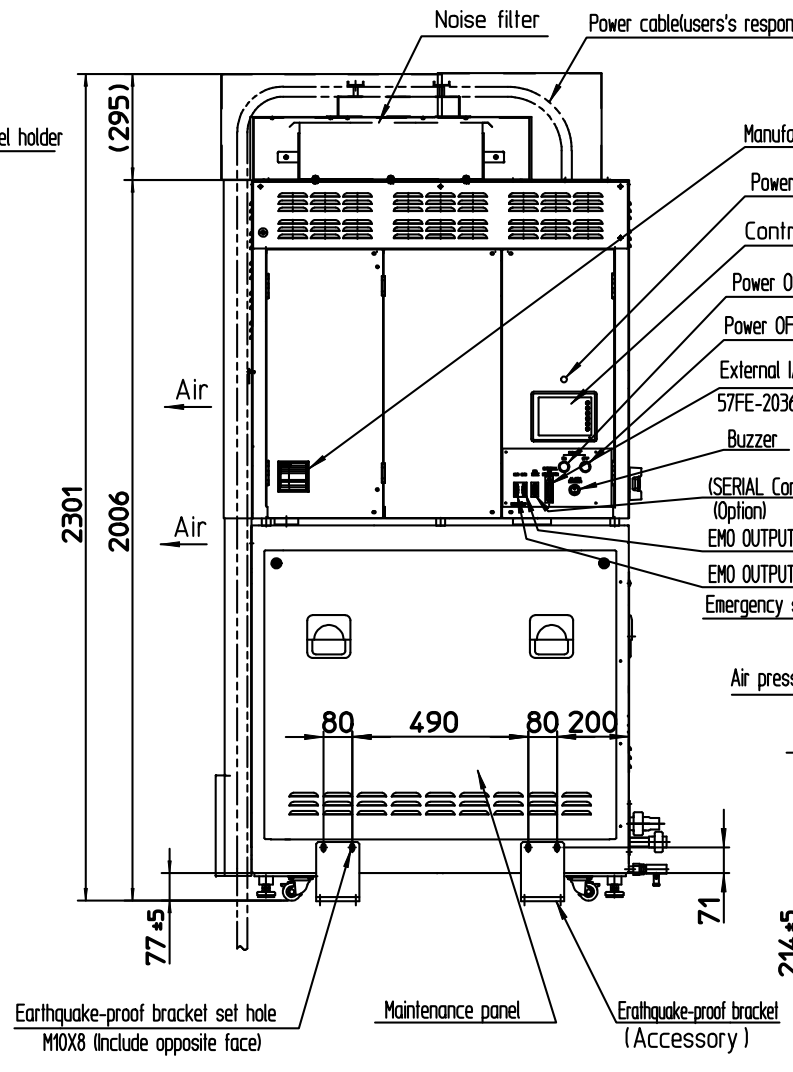
'Sketch drawing', 'Inter view (controller unit)', 'Inter view (heating unit)', 'Piping diagram', and 'Wiring drawing' are appended since next page.

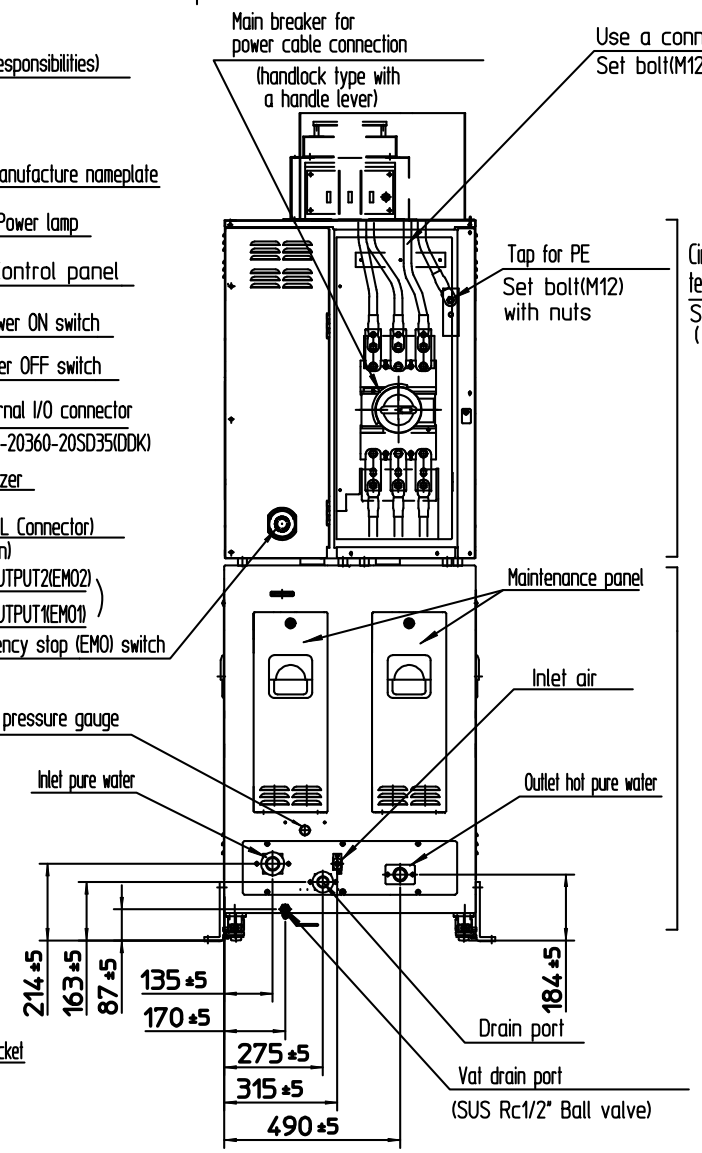


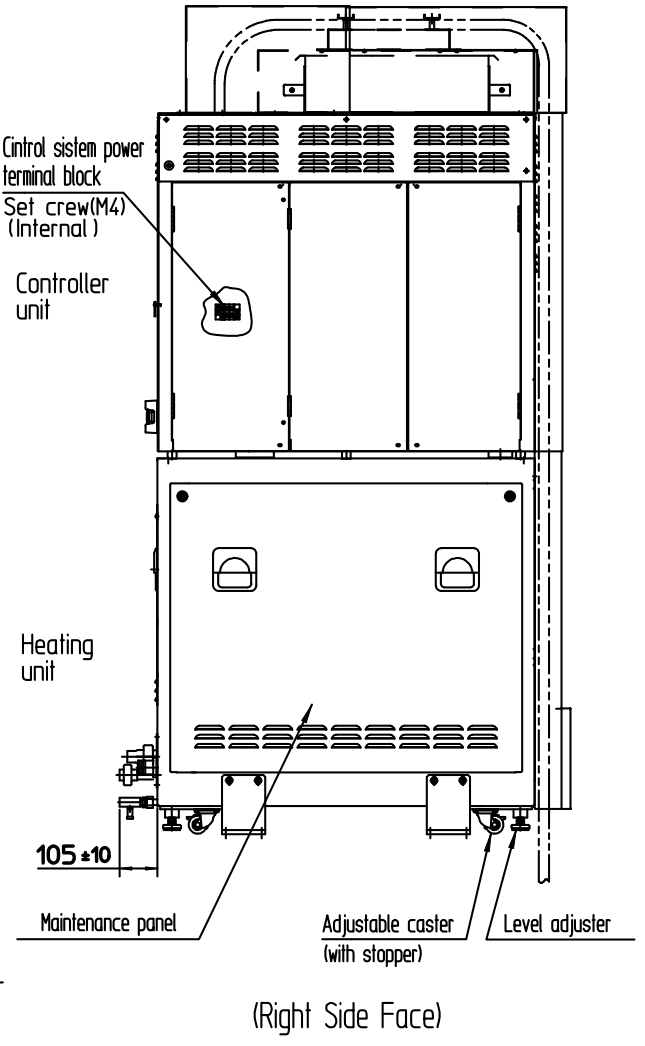


NOTE
1. Refer to the paragraph of 'The primary power supply specification' for an electric specification.

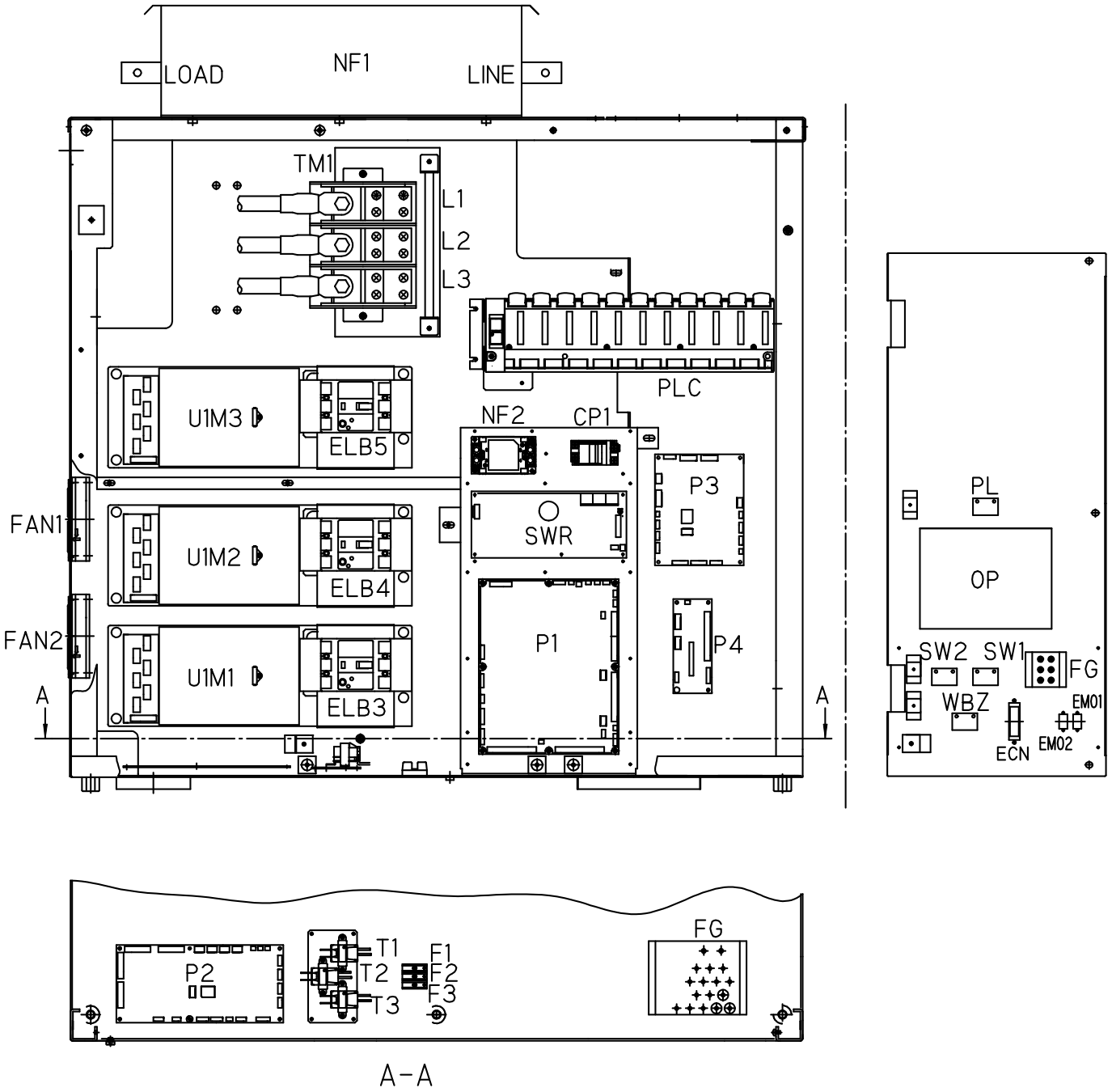








Sketch Drawing

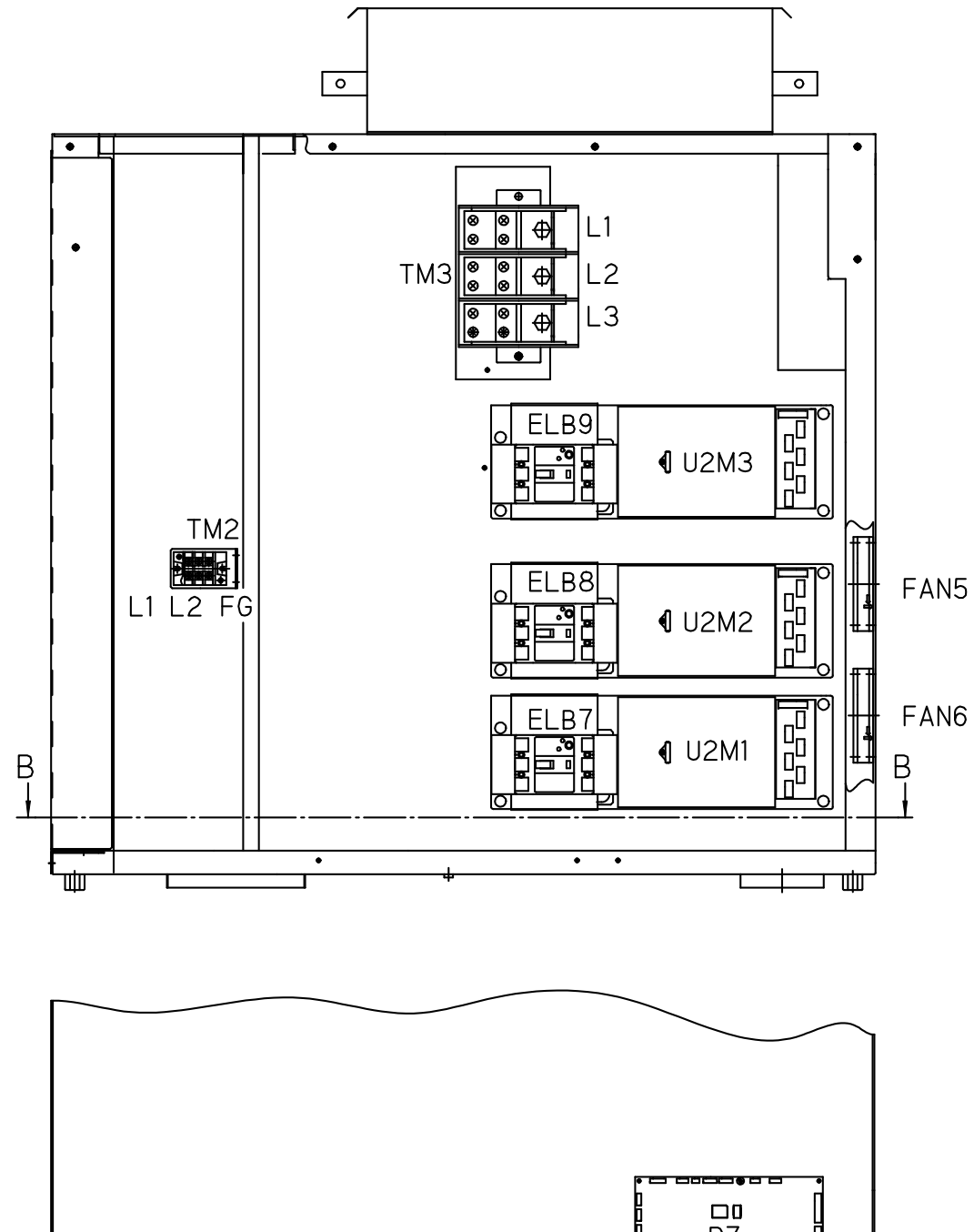


A-A

UNIT1

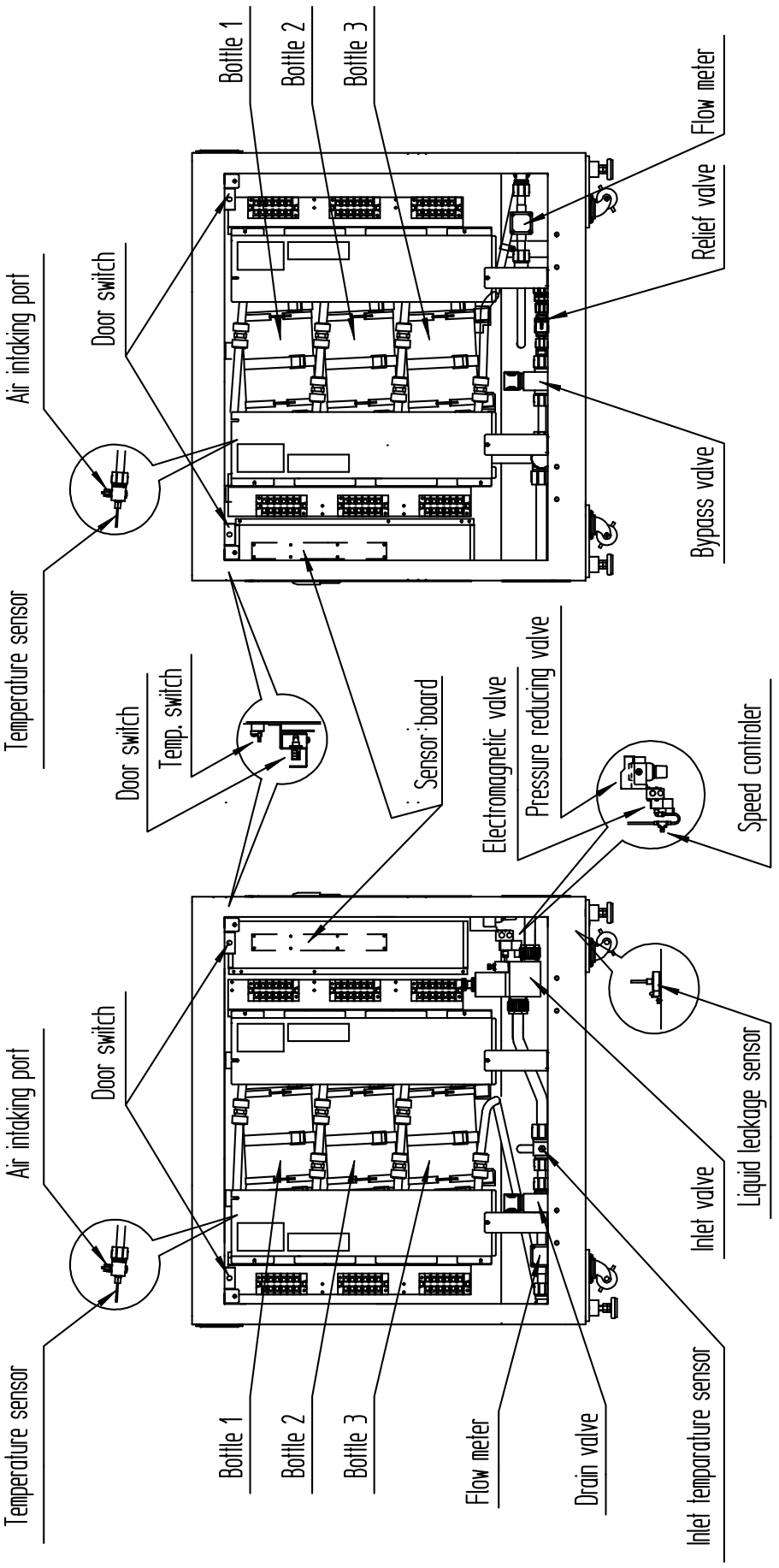
Simbol	No.	Name	Simbol	No.	Name	Simbol	No.	Name
NF	1,2	Noise filter	SWR	-	DC power board	P	3	Cintrol board
TM	1,2,3	Terminal block	PLC	-	Sequencer	P	4	Connector board
L	1,2,3	Power line	PL	-	Power lamp	P	7	PM_I/F board
U1M#	1,2,3	Power molule UNIT1	SW	1	Power ON switch	OP	-	Control panel
U2M#	1,2,3	Power molule UNIT2	SW	2	Power OFF switch	EMO	1,2	EMO output connector
FAN	1,2,5,6	Fan	WBZ	-	Buzzer			
ELB	3-5,7-9	PM Breaker	ECN	-	External I/O connector			
CP	1	Circuit protector	FG	-	Earth			
F	1,2,3	Fuse	P	1	Interlock board			
T	1,2,3	Trance	P	2	PM_I/F board UNIT1			

144/20020060TC



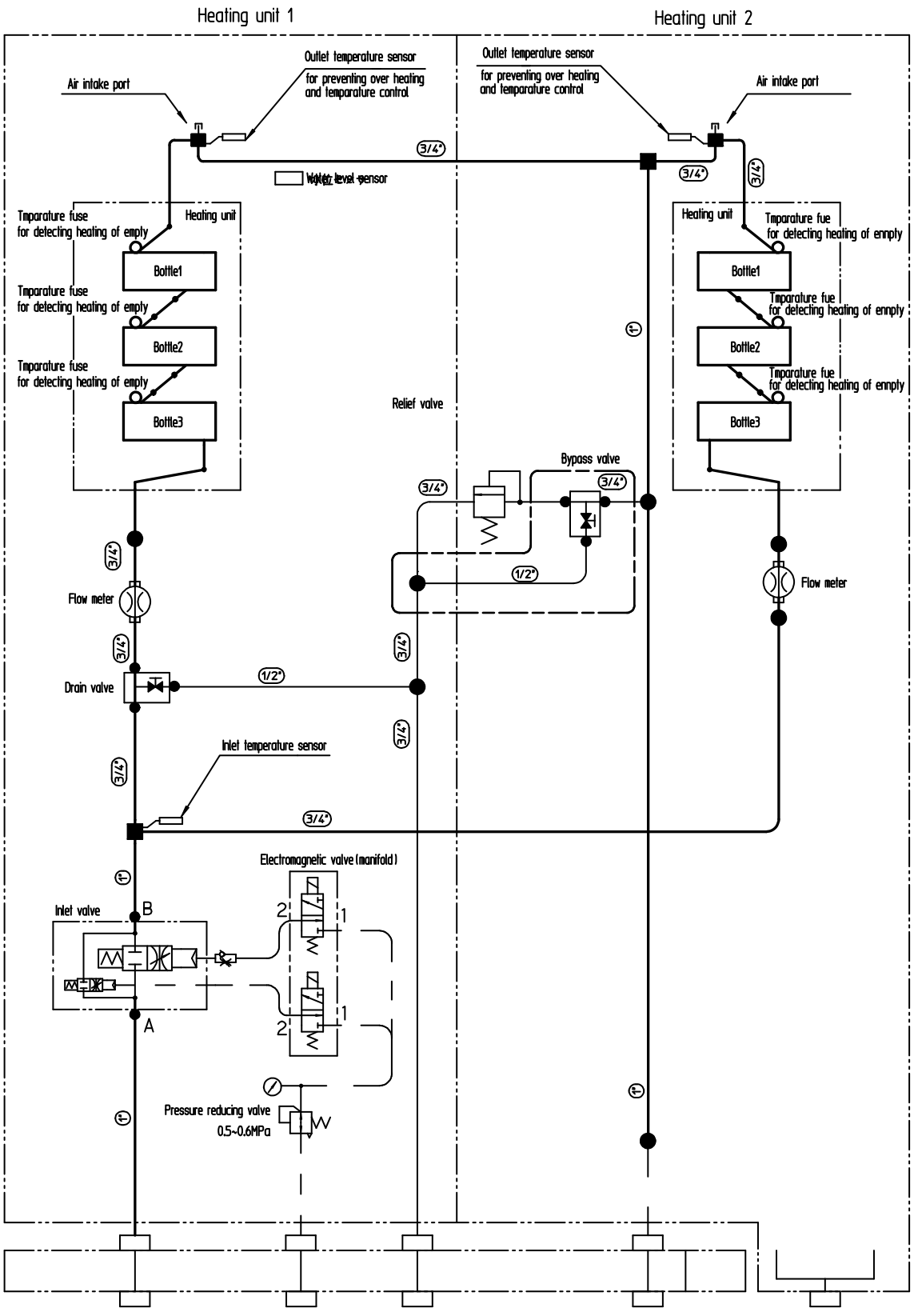
B-B

UNIT2



144/20017190TK

Inter view (Heating unit)



Inlet pure water	Inlet air	Drain port	Outlet hot pure water	Vat drain port
PVDF IR Union 25A (GEORG FISCHER)	SUS Rc1/4"	PVDF Union 20A (GEORG FISCHER)	ø36xø38 PVC Saw type (1" tube connect internally)	SUS Rc1/2" Ball valve

144/20020060TH

Piping Diagram

3~3W 200/208V
ELB1
FG19.20
NF1
PE
416/400A
208/200A
TM1
TM2
CP1
3A
NF2
SWR
Connection with a NF2
250V
0.315A
F1
F2
F3
208/200A
TM3
ELB5
ELB4
ELB3
ELB9
ELB8
ELB7
69/67A
U1M3 : Power Module3
U1M2 : Power Module2
U1M1 : Power Module1
U2M3 : Power Module3
U2M2 : Power Module2
U2M1 : Power Module1
CN0
CN1
CN2
CN4
TM10 (U1)
TM11 (U1)
TM8 (U1)
TM9 (U1)
TM6 (U1)
TM7 (U1)
TM10 (U2)
TM11 (U2)
TM8 (U2)
TM9 (U2)
TM6 (U2)
TM7 (U2)
20A
FAN1 (U1)
FAN2 (U1)
FAN5 (U2)
FAN6 (U2)
PL
WBZ
BUZZER
P1 : Interlock Board
30099220
(KE-2030)
P2 : PM_I/F Board Unit1
30096681
(KE-2029)
P7 : PM_I/F Board Unit2
30096681
(KE-2029)
T1
T2
T3
P3 : Control Board
30088891
(KE-2023)
Flat Cable
P8-CN22
PLC-S-OUT
PLC-S-IN
P1-CN20
P1-CN18
OFF SW
SW2
SW1
Control panel
MJ2
PLC-1
PLC-2
PLC-3
PLC-4
PLC-5
PLC-6
PLC-7
PLC-8
PLC-9
PLC-10
NP1S-42
LOADER
Bat Data
Base board
NP1BS-11
P6 : Sensor Board Unit
30099771
(KE-2033)
P8 : Sensor Board Unit2
30099771
(KE-2033)
U1 Bottle1 temperature sensor Pt100Ω for temperature over-rise detection
U1 Bottle1 temperature fuse for dry operation detection
U1 Bottle2 temperature fuse for dry operation detection
U1 Bottle3 temperature fuse for dry operation detection
U1 temperature SW for heating unit temperature over rise detection
U1 Front door SW
U1 Side door SW
FAN3(U1)
Liquid leakage sensor
level sensor
Inlet temperature sensor
U1 Outlet temperature sensor Pt100Ω
U1 Flow meter
Electromagnetic valve for inlet valve bypass
Electromagnetic valve for inlet valve tank1
U2 Bottle1 temperature sensor Pt100Ω for temperature over-rise detection
U2 Bottle1 temperature fuse for dry operation detection
U2 Bottle2 temperature fuse for dry operation detection
U2 Bottle3 temperature fuse for dry operation detection
U2 temperature SW for heating unit temperature over rise detection
U2 Front door SW
U2 Side door SW
FAN7(U2)
U2 Outlet temperature sensor Pt100Ω
U2 Flow meter
EMO
Red Red
Red B contact 1-2-3-4
EMO2
EMO1
P4 : Connector Board
30099751
(KE-2031)
ECN1
Panel
UNIT2
UNIT1
front face
Earth plate A
Earth plate B
Earth plate C
OUT SIDE
UPPER
Layout of Earth plate
144/20020060TD
Wiring Drawing