

Please send this operation manual to the last customer without fail.

Please store carefully because this operation manual is not issued.



Super heater SH-series

Operation manual



Please read without fail before use.

- ◆ Thank you very much for purchasing Super-heater SH-Series this time.
- ◆ This book is explained about the necessary item for handling Super-heater SH-Series, safely and correctly.
- ◆ Optimal handling is necessary with each stage that reaches to actual operation after acquisition in addition to the maintenance inspection at the time of the operation for continuing fine operation extending for a period of long time, for preventing the accident preventively, and for demonstrating the performance of Super-heater SH-series sufficiently. Master this book without fail before doing the works of transport, installation, wiring, operation, maintenance, and inspection of Super-heater SH-series.
- ◆ Do not remodel Super-heater SH-series for safety. The accident that occurred by reconstruction becomes out of the responsibility range of our company.
- ◆ Please arrange as this book reaches the handling person.
- ◆ Please store carefully as this book can read anytime when it is necessary.
- ◆ Revision of this book and the improvement of Super-heater SH-series are conducted without notice.
- ◆ Please inquire to our company if there is inquiries.

Super-heater SH-series is ...

This is the clean safe heater. This is the heat source that included the A-sensor (for detecting the hot-air temp. of the outlet), B1-sensor (for overheat prevention), B2-sensor (for overheat prevention and for hot-start), C-sensor (for detecting the hot-air temp. of the inlet) and that makes as the medium the air (gas) for industry. This is the optimal heater to the heating, heat processing, reaction promotion, removal of discharge from the eyes at the time of the extrusion forming of the resin, heat source for the heat test of the engine and turbine, and rapid drying after printing to the pip. There are the important items about handling because this produces high temp. air by the use purpose.

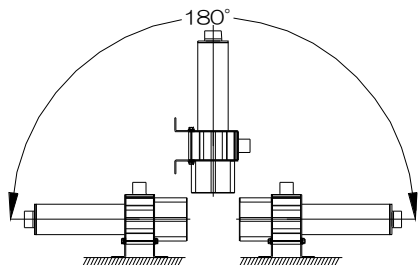
1. Confirmation before use

- Please confirm that the following contents are assembled. And, please confirm that there is not abnormality.
 - This machine (1 unit)
 - Operation manual (this book)
 - Sintering prevention medicine for piping (1pc.)
- Please confirm the model, type, inlet attachment (SH41 - 61), and voltage by the Reza carved seal of the inlet department chamber.

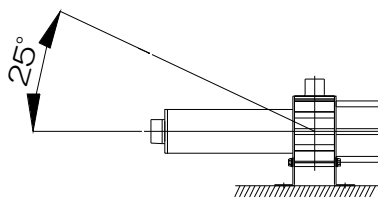
2. Installation

- Please use the place where is not exposed to the storm and where wind passes well (Indoor). Please never use in the box that was tightly sealed.
- Please never use the place near gasoline and gas and where there is the risk of the explosion and ignition. Please pay attention to burn and the ignition to the combustible sufficiently because the outside of the heater becomes hot.
- Please never use the place where has the floating products that pass electricity (Carbon fiber).
- Please use with the ambient temp. of more than -20°C less than $+40^{\circ}\text{C}$. (Non-condensation)
- There is not a problem in that establishes horizontally. But, the attachment attitude is restricted by operation condition in the case that the hot-air outlet is upward. Please refer to the following sketch for details. (This can not use in the attachment attitude of downward.) And, please pay attention so that heat does not flow backward when ventilation stopped even in the case of either attachment attitude. Please stop after the operation that cools without fail because the inside wiring, terminal, and connector are heated if heat flows backward.

Usually attachment attitude of operation

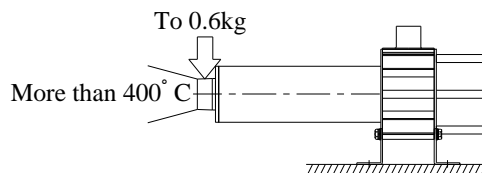
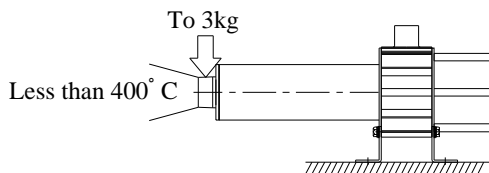


Attachment attitude of hot start operation



- Outlet may transform by the high temp. if the load hangs to the outlet at the time of hot-air operation. Please refer to the following sketch, and please establish and pipe.

Attention) Please do not fix the main body by only the outlet (screw dept.) of the super heater.



3. Piping

- Please use the piping material of the gas pipe and tube etc. that bear the air pressure. And, please use piping that have the sufficient heatproof to the hot-air outlet.
- Please pay attention sufficiently and select piping according to flux specification because the heater is overheated by the decrease of the gas capacity by the friction coefficient inside the pipe, bore, and curve of the pipe etc. in the case that piping becomes long.
- Temp. drops sharply by radiation because that piping becomes long from the hot-air outlet. So, please put closer to the heated thing as much as possible or please execute the insulating material sufficiently.
- Please connect piping certainly as there is not an air leakage.

4. Power supply

- Please ask the connection of the power supply and ground construction work to the electric repairing work technician.
- Please establish the power supply circuit of the exclusive use that secured sufficient capacity as the power supply. And, please execute the ground construction work without fail for the prevention of the electric shock accident. (Less than 300V : Class D ground, Less than 600V : Class C ground)
- Attachment of the electric leakage circuit breaker is obligated by the laws depending on the installation place. Please use the type that has sensitivity current of 100 - 200mA in the case that the electric leakage circuit breaker is attached.
※Sensitivity current of the electric leakage circuit breaker makes about 10 times of the early period leakage current value the rough standard.

5. Wiring

- Super heater SH-series is built 4 thermocouples [K] of A-sensor (for detecting the outlet temp.), B1-sensor (for overheat prevention), B2-sensor (for hot-start and overheat prevention), and C-sensor (for detecting the inlet temp.). Heater does not snap because the temp. is controlled by these 4 sensors. Please wire as temp. is controlled by 4 sensors without fail.

Hot-start operation is produced, and Super heater SH-series can be controlled with the performance of 100% because each temp. sensors are controlled completely by using Blower unit series or Multi-controller series.

◆ Upper limit setting temp. of each temp. sensor

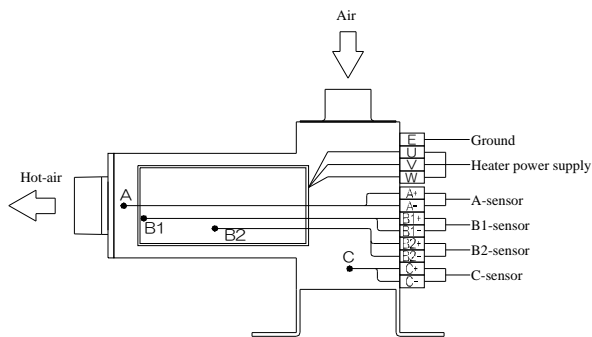
Upper limit setting of each temp. sensor differs by the type of Super heater. Please set up to the following temp. setting following in the case that the customer makes the temp. control circuit.

Kind of the sensor \ Model	SH 4 1	SH 5 1	SH 6 1	SH 7 1
Outlet hot-air temp. (A-sensor)	700° C	800° C	800° C	700° C
Overheat prevention temp. (B1-sensor)	950° C	950° C	950° C	850° C
Overheat prevention temp. (B2-sensor)	650° C	500° C	650° C	600° C
Inlet temp. (C-sensor)	100° C	100° C	100° C	100° C
Hot-start temp. (B2-sensor)	500° C	500° C	500° C	500° C

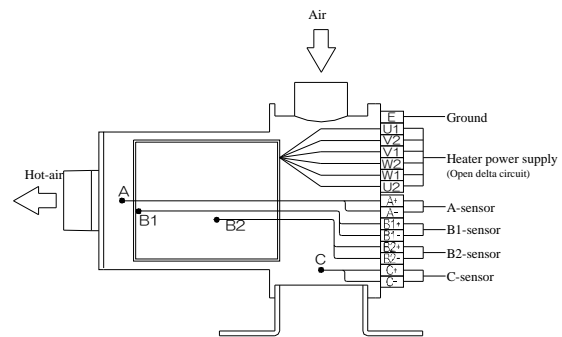
Attention : Hot-start operation can not be produced if Blower unit series or Multi-controller series is not used.

◆ Inside wiring

Inside wiring of SH41, 51, and 61



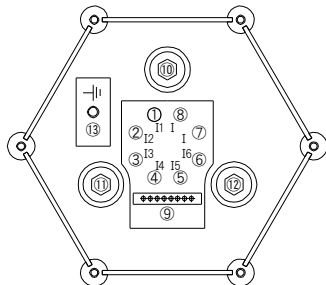
Inside wiring of SH71



※Heater circuit of SH71 is the open delta connection.

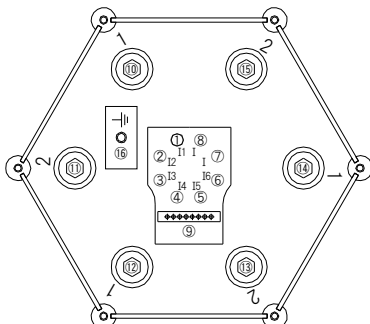
◆ Terminal arrangement

● SH 4 1 ~ 6 1



①	A-sensor terminal + (1)	For detecting the outlet hot-air temp. (M3) JIS [K]
②	A-sensor terminal - (2)	
③	B1-sensor terminal + (3)	For detecting the overheat prevention temp. (M3) JIS [K]
④	B1-sensor terminal - (4)	
⑤	B2-sensor terminal + (5)	For detecting the overheat prevention temp. and hot-start temp. (M3) JIS [K]
⑥	B2-sensor terminal - (6)	
⑦	C-sensor terminal + (7)	For detecting the inlet temp. (M3) JIS [K]
⑧	C-sensor terminal - ()	
⑨	Connector for the remote cord	Bundling wiring connector of the temp. sensor 1-8 VH-8P (JST)
⑩	Heater terminal U (U)	For the heater power supply (M5)
⑪	Heater terminal V (V)	
⑫	Heater terminal W (W)	
⑬	Ground terminal E	For the ground (M5)

● SH 7 1

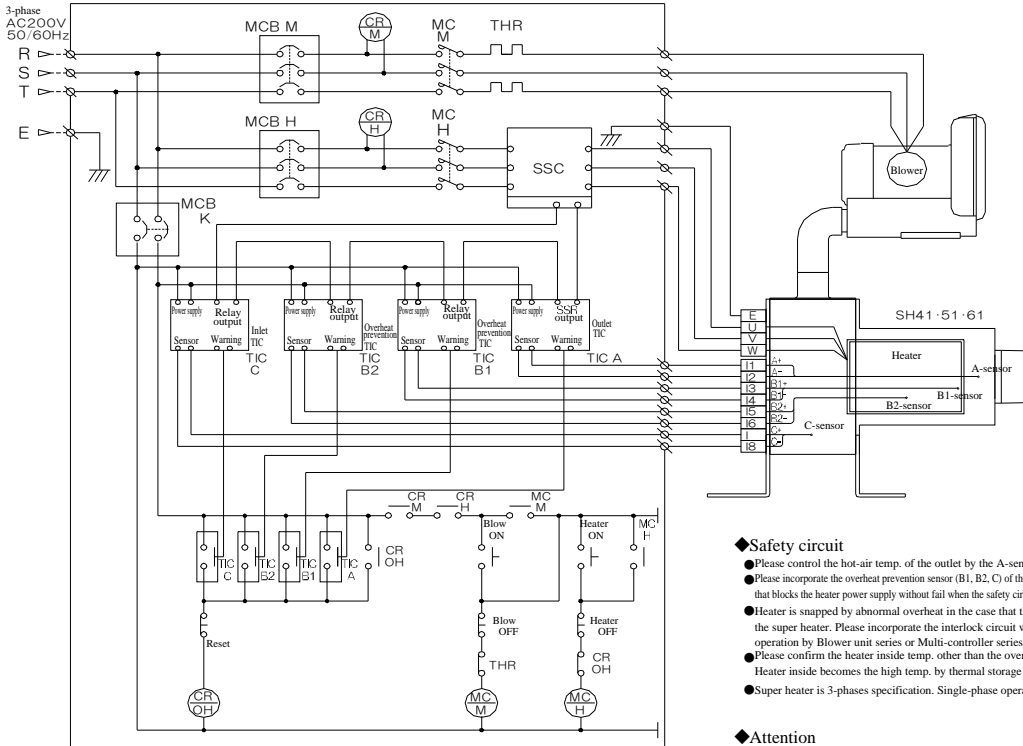


①	A-sensor terminal + (1)	For detecting the outlet hot-air temp. (M3) JIS [K]
②	A-sensor terminal - (2)	
③	B1-sensor terminal + (3)	For detecting the overheat prevention temp. (M3) JIS [K]
④	B1-sensor terminal - (4)	
⑤	B2-sensor terminal + (5)	For detecting the overheat prevention temp. and hot-start temp. (M3) JIS [K]
⑥	B2-sensor terminal - (6)	
⑦	C-sensor terminal + (7)	For detecting the inlet temp. (M3) JIS [K]
⑧	C-sensor terminal - ()	
⑨	Connector for the remote cord	Bundling wiring connector of the temp. sensor 1-8 VH-8P (JST)
⑩	Heater terminal U1 (U1)	For the heater power supply (M5) (This is open delta wiring.) ※Please refer to the reference circuit example of P.4.
⑪	Heater terminal V2 (V2)	
⑫	Heater terminal V1 (V1)	
⑬	Heater terminal W2 (W2)	
⑭	Heater terminal W1 (W1)	
⑮	Heater terminal U2 (U2)	For the ground (M5)
⑯	Ground terminal E	

◆ Reference circuit example

Please consult this circuit diagram in the case that the control unit is designed by own company. And, please design the circuit corresponding to the usage.

● SH 4 1 ~ 6 1 Reference circuit example



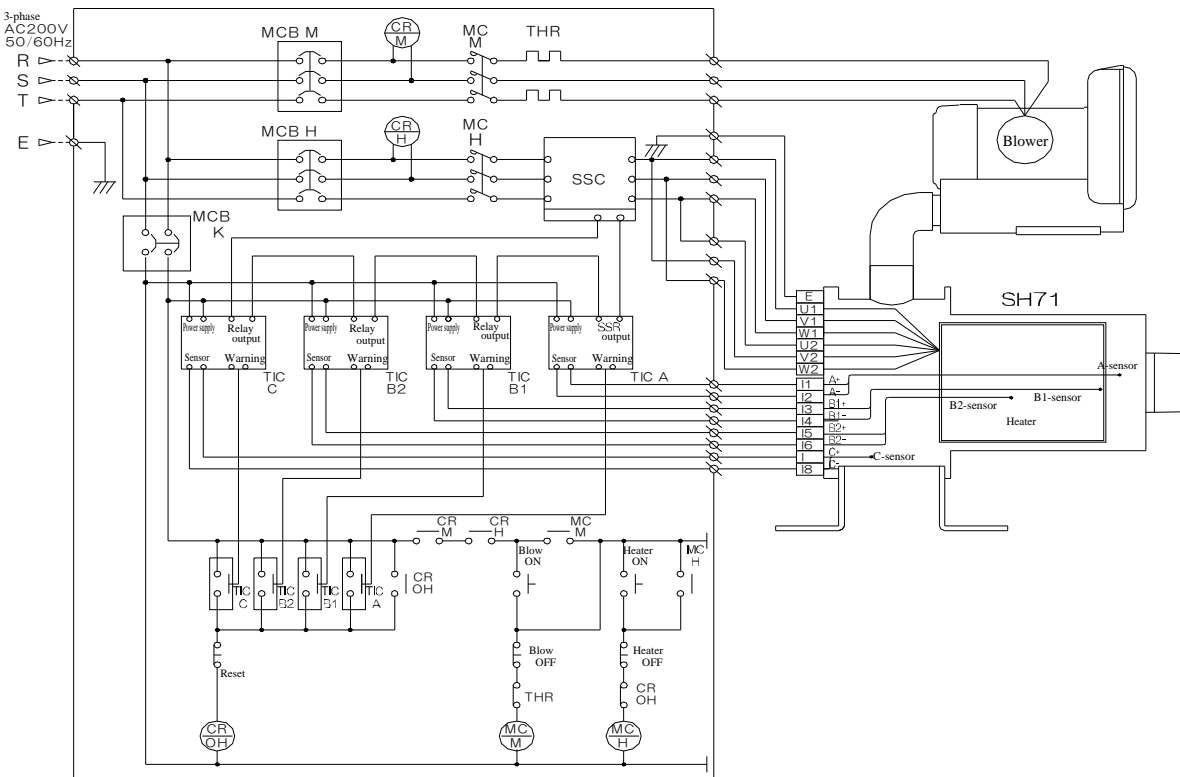
◆ Safety circuit

- Please control the hot-air temp. of the outlet by the A-sensor without fail. Temp. can control by the B1-sensor and B2-sensor.
- Please incorporate the overheat prevention sensor (B1, B2, C) of the super heater to the safety circuit without fail. Please incorporate the circuit that blocks the heater power supply without fail when the safety circuit operated or when the electricity to the control circuit was blocked.
- Heater is snapped by abnormal overheat in the case that the electricity is supplied the heater if the air is not supplied to the super heater. Please incorporate the interlock circuit with the blower without fail. (Please carry out the hot-start operation by Blower unit series or Multi-controller series without fail.)
- Please confirm the heater inside temp. other than the overheat prevention function by using the B1-sensor and B2-sensor. Heater inside becomes the high temp. by thermal storage in the case that there is little supply air. And, the heater may snap.
- Super heater is 3-phases specification. Single-phase operation becomes the cause of heater snapping of a wire.

◆ Attention

- Please wire the wiring the temp. sensor (A, B1, B2, C) particularly with the high circumference wave wire because the wrong action by the noise is avoided. (We recommend the shield processing.) Please use the compensating wire to wiring without fail.
- Leak current is flowing th the heater in the case that control by using the semiconductor element of SSC and thyristor control etc. like the reference circuit example. Please compose the circuit that blocks the power supply by the electromagnet contactor and breaker etc. at the time of stop to electric shock accident prevention.
- Please block the heater circuit by using the breaker and electromagnet contactor as the final safety circuit when the overheat prevention circuit operated.
- Please establish the exclusive use circuit to the power supply. And, please secure sufficient capacity.
- Please decide the power supply wire and heater wire after need capacity and length are considered.
- Please ask the ground construction work and wiring work to the electric repairing work technician.
- We can not guarantee when the heater snapped by high temp. using in the case of that Blower unit series or Multi-controller series is not used. And, please carry out the hot-start operation by Blower unit series or Multi-controller series without fail.

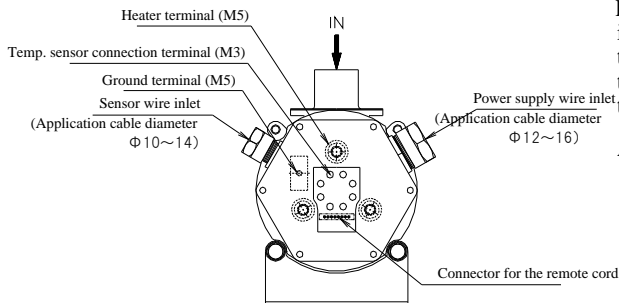
● SH 7 1 Reference circuit example



This circuit example is the reference. Trouble by abnormally of the control system is out of the responsibility range of our company. We suggest that Blower unit series or Multi-controll series of the auto-temp. controller for this super heater SH-series are used in order that the safety and certain control is conducted.

◆Wiring

—Back figure of SH41 - 61—

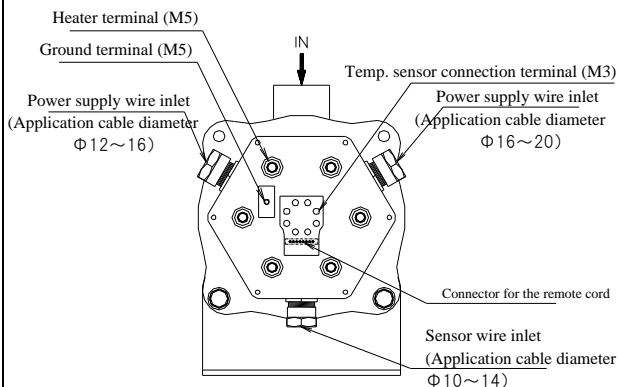


Please insert the heater power supply line and ground wire from the power supply wire inlet. And, please wire to each heater terminal (U, V, W) and ground terminal (E) of the inside. Please insert each temp. sensor wire from the sensor wire inlet. Please wire to each temp. sensor terminal (A+, A-, B1+, B1-, B2+, B2-, C+, C-) of the inside. Please tighten the connector of the power supply wire inlet and sensor wire inlet after wiring.

And, the remote cord is sold at option.

(Heater power supply wire is with the terminal, and the temp. sensor is with the connector. Please take out wiring from the inside because the connector of the temp. sensor can not insert from the sensor wire inlet. Please plug the connector firmly to the connector for the remote cord.)

—Back figure of SH41 - 61—



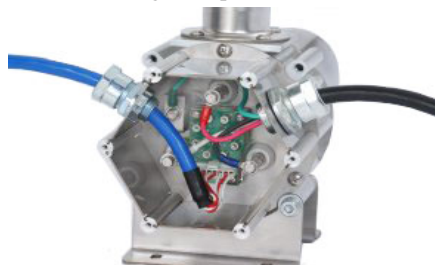
Please insert the heater power supply line and ground wire from the power supply wire inlet. And, please wire to each heater terminal (U1, V1, W1, U1, V1, W1) and ground terminal (E) of the inside.

※The power supply wire of the heater is the open-delta connection. Please insert each temp. sensor wire from the sensor wire inlet. Please wire to each temp. sensor terminal (A+, A-, B1+, B1-, B2+, B2-, C+, C-) of the inside. Please the connector of the power supply wire inlet and sensor wire inlet after wiring.

And, the remote cord is sold at option.

(Heater power supply wire is with the terminal, and the temp. sensor is with the connector. Please take out wiring from the inside because the connector of the temp. sensor can not insert from the sensor wire inlet. Please plug the connector firmly to the connector for the remote cord.)

【Wiring example (SH51)】



Remote cord (Option)



● Cord length of 3m and 5m is prepared.

【Electric wire and terminal screw】

Model	Terminal symbol	Size of terminal screw	Size of recommendation electric wire(mm ²)	Tightening torque (N.m)	Kind of the electric wire
SH41	U, V, W, E	M5	2	3	Electric wire cable etc. of 2PNCT etc.
	A+, A-, B1+, B1-, B2+, B2-, C+, C-	M3	0.75	0.6	Compensating wire (with shield)
SH51	U, V, W, E	M5	3.5	3	Electric wire cable etc. of 2PNCT etc.
	A+, A-, B1+, B1-, B2+, B2-, C+, C-	M3	0.75	0.6	Compensating wire (with shield)
SH61	U, V, W, E	M5	5.5	3	Electric wire cable etc. of 2PNCT etc.
	A+, A-, B1+, B1-, B2+, B2-, C+, C-	M3	0.75	0.6	Compensating wire (with shield)
SH71	U1, V1, W1, U2, V2, W2, E	M5	5.5	3	Electric wire cable etc. of 2PNCT etc.
	A+, A-, B1+, B1-, B2+, B2-, C+, C-	M3	0.75	0.6	Compensating wire (with shield)

※Please decide in consideration of need capacity and length in the case of the length other than it.

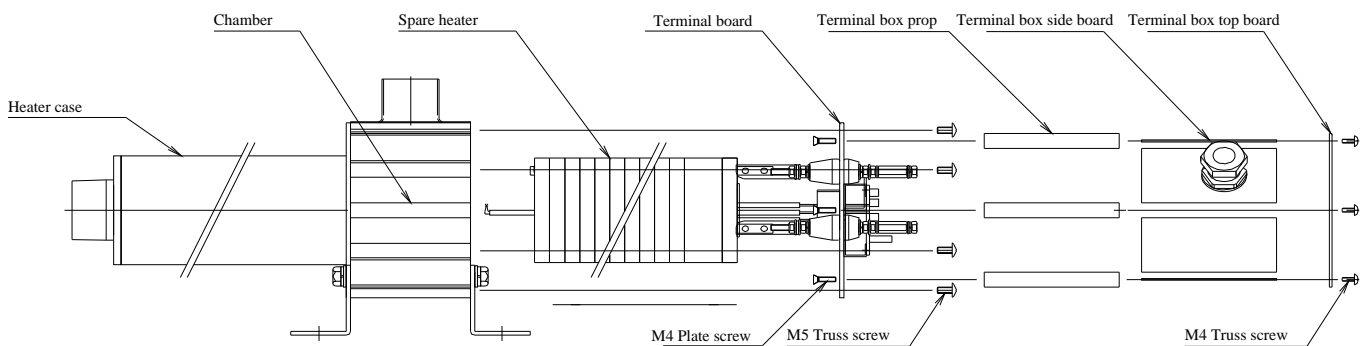
6. Operation

- Heater snaps and overheats within several minutes if the electricity was turned on to the heater without air-flow and control.
- Please use the clean air without dust, oil-mist, moisture etc. for the air source. Life of the heater becomes short by the insulation of the heater falls off if dust, oil-mist, moisture etc. mix to the heater inside. Dust is heated with the heat of the heater if dust mix to the heater inside. And, It is very dangerous because dust jumps out from the hot-air outlet in the condition of the spark.
- Please decompress supply pressure to less than 490kPa in the case that the compressor is used to the air supply source, and please supply the air less than max. usable gas capacity that is entered to the catalog. (Please make supply pressure less than 30kPa when the supply inlet attachment of SH41 - 61 is the flange FD38 and FD50.)
- Please supply the air that does not do the condensation under high pressure from normal pressure and the air of more than 0° C and less than 70° C.
- Use of case that the combustibility gas and inflammability liquid steam mixes is dangerous.
- Please install the adiabatic cover DK-series etc. of the option fro burn prevention because the heater case becomes hot during operation.
- Heater may do the condensation in the case that the humidity inside piping is high after operation is stopped. Condensation is gone and insulation recovers by ventilating for several minutes if the insulation decline occurred by the condensation.

7. Heater exchange

- Heater department is exchanged if the heater of the super heater SH-series snaps during use. Please refer to the spare heater of the maintenance parts of the catalog No.2 P.21 of the super heater and please exchange after the model, heater capacity, and voltage are confirmed.

Model	SH41S (For SH41)	SH51S (For SH51)	SH61S (For SH61)	SH71S (For SH71)
Type (at 200V)	3 2 0 0 - 3 K 4 K	3 2 0 0 - 6 K 8 K	3 2 0 0 - 1 0 K 1 2 K	3 2 0 0 - 1 5 K 2 0 K



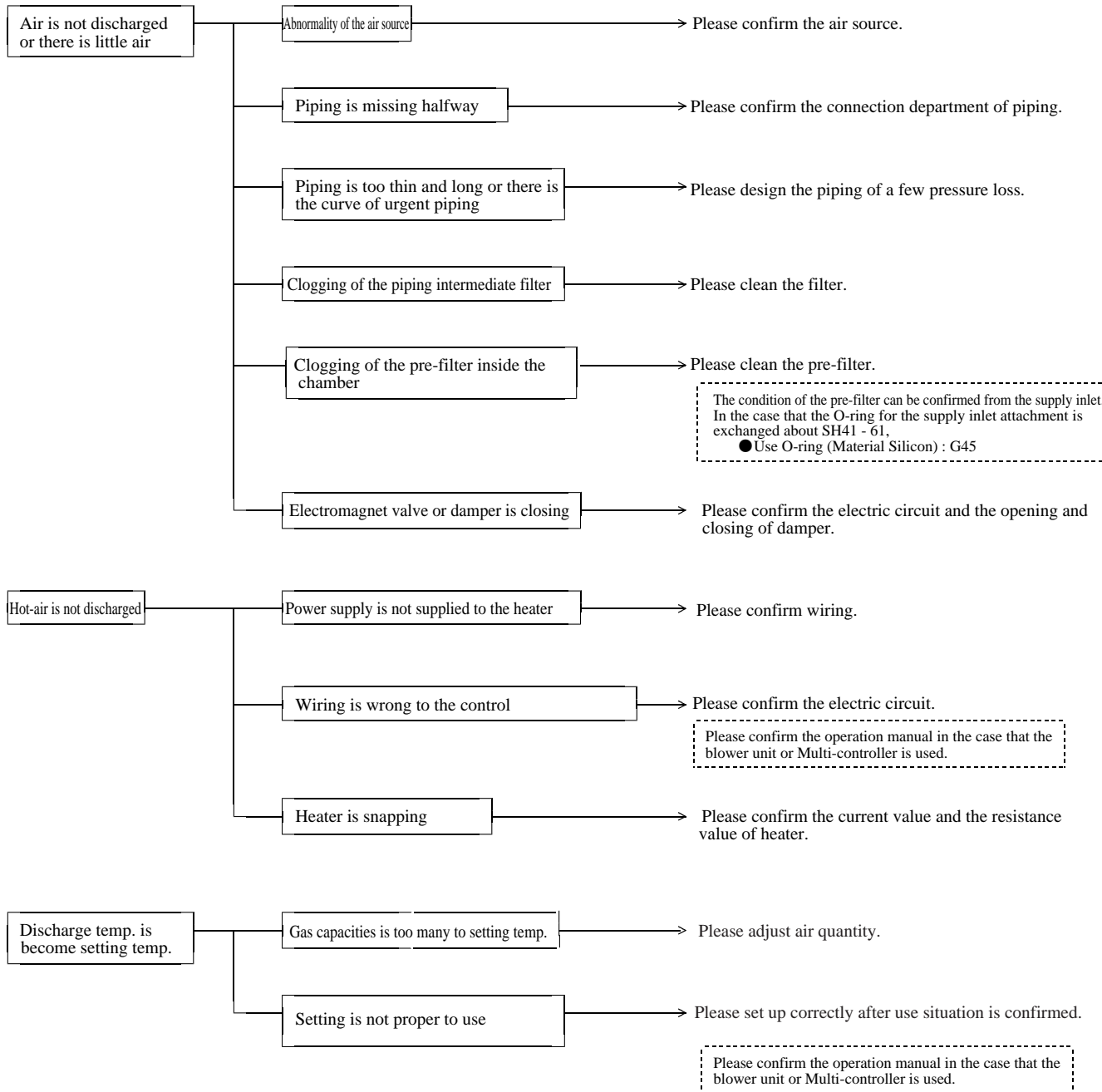
◆ Exchange procedure of the spare heater

- ① Please remove the M4 truss screw (6 places) that is in the circumference of the terminal box top panel of the main body back and remove the terminal box top panel after confirming that the power supply is not ON.
- ② Please remove the heater wire, ground wire, and sensor wire of the inside. And, please draw out the terminal box side board (6 places).
- ③ Please remove the M5 truss screw (SH41 - 61 : 6 places, SH71 : 10 places) of the circumference of the terminal board. And, please take out the heater element of the inside after the terminal board is drawn. At this time, please remove them if the remnants (Heate wire, water, and dust) are remaining to the pre-filter inside the heater case and chamber.
- ④ Please remove the plate screw (6 places) of the circumference inside of the terminal board. And, please remove the terminal box prop (6 pcs.).
- ⑤ Please install tentatively the terminal box prop (6 pcs.) that is removed to the terminal board of the spare heater that is exchanged by the M4 plate screw (6 places).
- ⑥ Please plug the terminal box side board that was removed with (6 pcs.) to the ditch of the terminal box prop.
- ⑦ Please tighten the plate screw (6 pcs.) of the circumference inside of the terminal board.
- ⑧ Please confirm that O-ring of the chamber is attached. (Please remove dirt in the case that there is dirt in O-ring. Please exchange the parts to the new parts as occasion demands in the case that there is damage.)
 - Use O-ring (Material Silicon) SH41 - 61 : G115 SH71 : G145
- ⑨ Please insert the spare heater to the heater case. And, please tighten firmly with the fixation screw. Please confirm the air leakage by flowing air after attaching.
- ⑩ Please install the terminal box top board that was removed with by the M4 truss screw (6 places).

There are some causes without fail in the case that the heater snapped. Please confirm sufficiently before driving once again, and please drive after the cause is removed.

8. Malfunction diagnosis

Please confirm in the case that it may be malfunction.



Please consult in the case that the faulty can not improve by the above contents or that the faulty other than the above occurred.

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