COMMERCIAL ELECTRIC FRYER

FL-20B-SEA

SERVICE MANUAL

78FE-1173 (110823)

CONTENTS

PAGE

GENERAL INFORMATION

1. SAFETY INSTRUCTIONS

The following instructions contain important safety precautions and should be strictly observed. The terms used here are defined as follows:

DANGER: There is a high possibility of death or serious injury to the service person and a third party or the user due to improper service operations or defects in serviced products.

WARNING: There is a possibility of death or serious injury to the service person and a third party or the user due to improper service operations or defects in serviced products.

CAUTION: There is a possibility of injury to the service person and a third party or the user or damage to their property* due to improper service operations or defects in serviced products.

* The term “damage to their property” here refers to extensive damage to household effects, houses and pets.

WARNING

1. When there is no need to energize the unit during disassembly or cleaning, be sure to unplug the unit or disconnect the main power supply before servicing the unit to prevent electric shocks.

2. If the unit must be energized for inspection of the electric circuit, use rubber gloves to avoid contact with any live parts resulting in electric shocks.

3. Check for proper earth connections, and repair if necessary to prevent electric shocks.

4. Always use service parts intended for the applicable model for replacement of defective parts. Use proper tools to secure the wiring. Otherwise abnormal operation or trouble may occur and cause electric leaks or fire.

5. Check for proper part installations, wiring conditions and soldered or solderless terminal connections to prevent fire, heat or electric shocks.

6. Be sure to replace damaged or deteriorated power cords and lead wires to prevent fire, heat or electric shocks.

7. Lead wires terminated with closed end terminals or the like must be bound with their closed ends up to avoid entrance of moisture that could lead to electric leaks or fire.

8. After servicing, always use a megohmmeter (500V DC) to check for the insulation resistance of at least 1 megohm between the live part (attachment plug) and the dead metal part (grounding terminal). Otherwise electric leaks or shocks may occur.

9. Do not service the electrical parts with wet hands to prevent electric shocks.

10. Always ask the user to keep children away from the work area. They may be injured by tools or dissembled products.

11. Before carrying out inspections, drain the oil tank to prevent burn or malfunction of the unit.

12. Before carrying out inspections, let the fryer cool to prevent burns.

CAUTION

1. Always check the unit for proper operation before finishing services.

2. Do not drop anything into the oil tank. If any parts such as screws are dropped into the oil tank, they may be mixed into food.

3. Check for proper operation with oil inside the oil tank to avoid heater failure, burn or fire.

4. Be sure to reassemble the parts completely. Loose assembly of such parts as control box cover may cause entrance of vermins resulting in a short circuit between terminals and possible ignition.

5. Do not put oil into the oil tank if there is water inside the tank. Boiled water may cause oil splashes and burn.

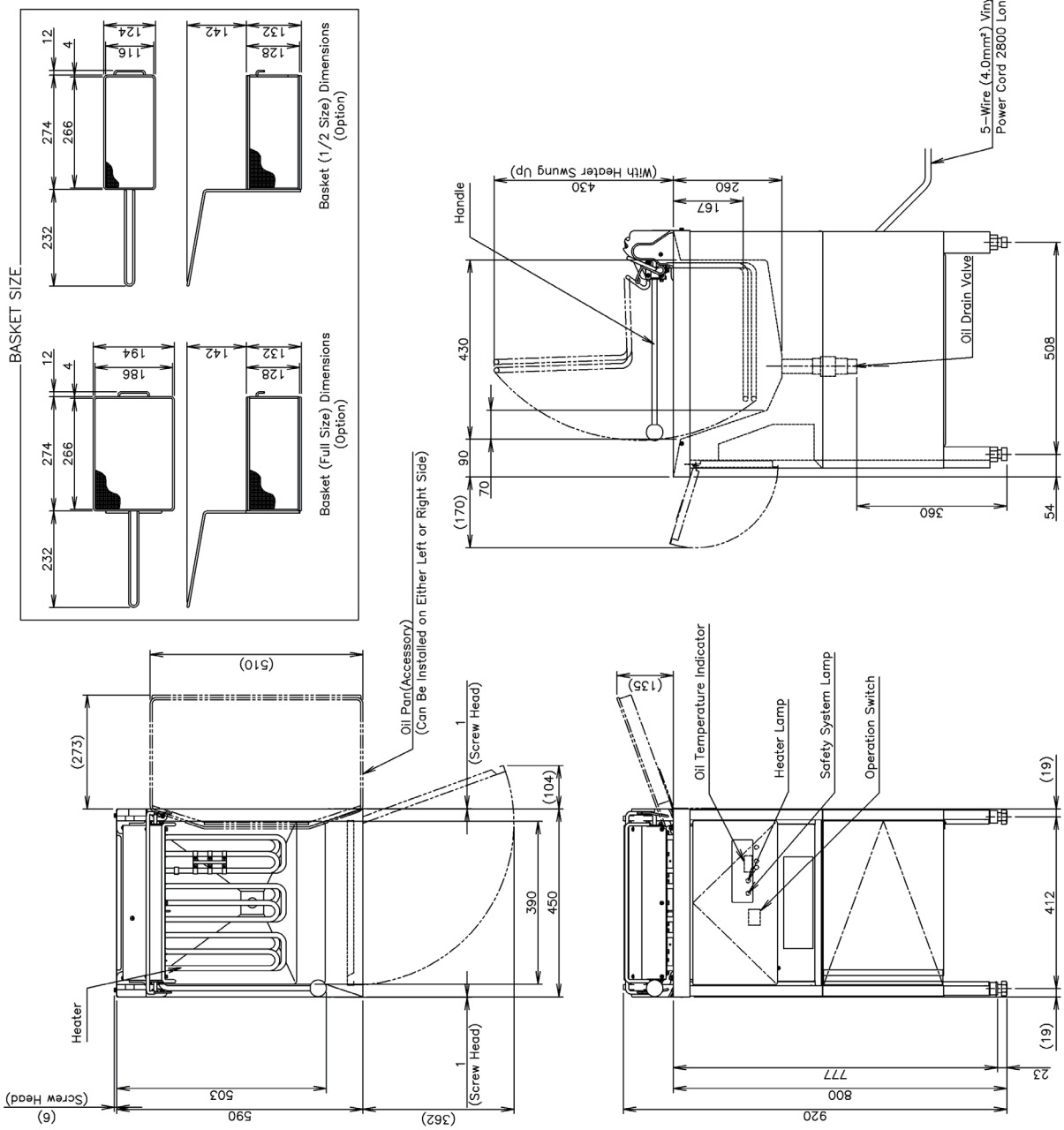
2. DIMENSIONS/SPECIFICATIONS

HOSHIZAKI

ITEM	Hoshizaki Commercial Electric Fryer
MODEL	FL-20B-SEA
POWER SUPPLY	3 Phase 4 Wire 380/400/415V 50Hz Capacity: 5.6kVA(8.5A)/6.2kVA(9.0A)/6.6kVA(9.2A)
AMPERAGE	8.5A/9.0A/9.2A
ELECTRIC CONSUMPTION	5.6kW/6.2kW/6.6kW
OIL HEATING TIME	Approx. 15min (415V, Ambient Temp. 30°C, Oil Amount 20L, Oil Temp. 20°C to 180°C)
OUTSIDE DIMENSIONS	450mm(W) x 590mm(D) x 800mm(H) (Overall Height 920mm)
CABINET	Stainless Steel
OIL TANK	Stainless Steel
HEATER	Immersion Sheathed Heater 6.6kW
OIL TANK SIZE	390mm(W) x 430mm(D) x Max. 260mm(H)
OIL AMOUNT	Standard 20L(Minimum 17L – Maximum 23L)
EFFECTIVE COOKING DIMENSIONS	390mm(W) x 376mm(D)
INSULATION	Super Wool Mat
LIFT SYSTEM	Manual Operation
OIL DRAIN SYSTEM	Valve (Rc1 Ball Valve)
OIL TEMPERATURE CONTROL	Microcomputer Control(50°C – 200°C) Standard Oil Temperature Setting 180°C
OIL TEMPERATURE DETECTOIN	Thermistor
HEATER LAMP	Neon Lamp (Red)
SAFETY SYSTEM LAMP	Neon Lamp (Red)
OIL DRAIN	Manual Drain with Oil Drain Valve
ELECTRIC CIRCUIT PROTECTION	Shutoff by Swinging Up Heater
OVERHEAT PROTECTION	Thermostat 280°C (Oil Temperature + Boil Dry) Bimetal Thermostat (One Shot Type)
LEG	Stainless Steel Adjustable 13 – 40mm
WEIGHT	53kg (Gross 60kg)
PACKAGE	Carton 518mm(W) x 662mm(D) x 994mm(H)
OPERATING CONDITIONS	Ambient Temperature: 40°C or less Voltage Range: 380V ± 10%, 400V + 8% / -10%, 415V + 4% / -10%
ACCESSORIES	Oil Can, Oil Strainer, Oil Pan, Oil Pan Strainer, Oil Tank Cover, Skimmer (small) , Separator
OPTIONAL PARTS	Basket (full size), Basket (1/2 size), Slider (for Tempura), Batter Scrap Tray, Filter, Adjustable Legs, Fall Prevention Plate, Connecting Fitting

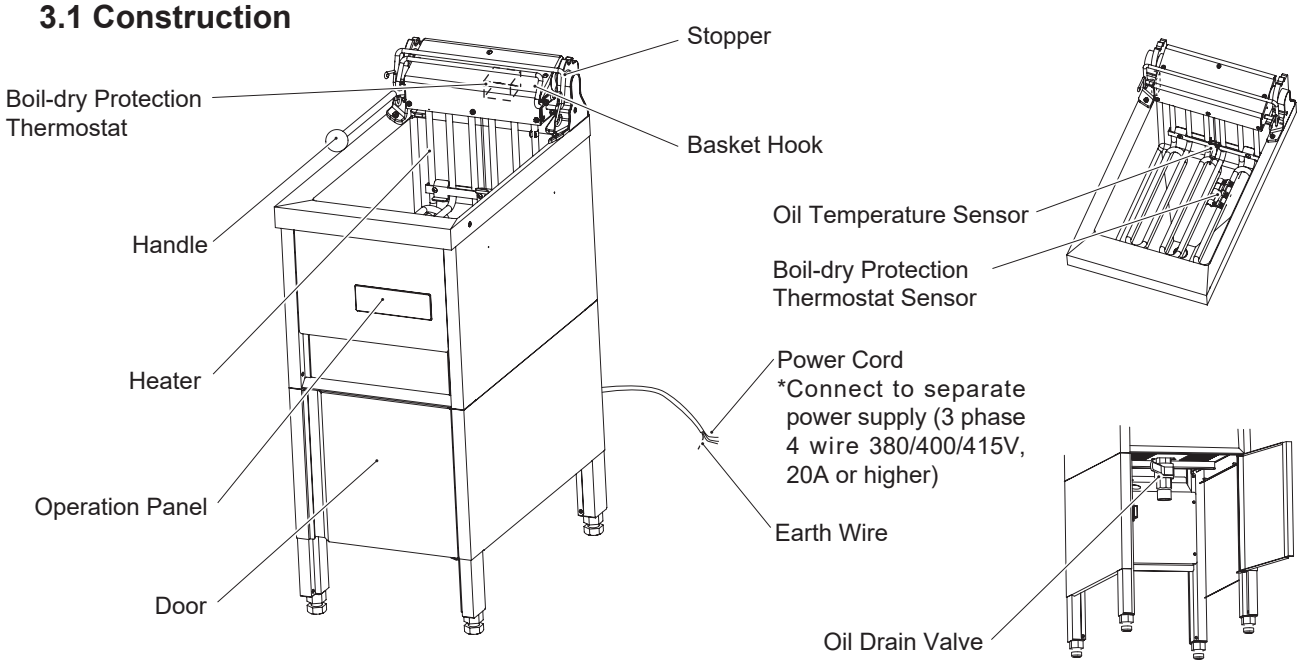
*We reserve the right to make changes in specifications and design without prior notice.

1. Install the product properly in accordance with the instructions on location water supply/drain connections and electrical connections stated in the instruction and installation manuals provided. Allow 10mm extra space at the installation site to meet any installation requirements.
2. Product Code: 78FE-D013

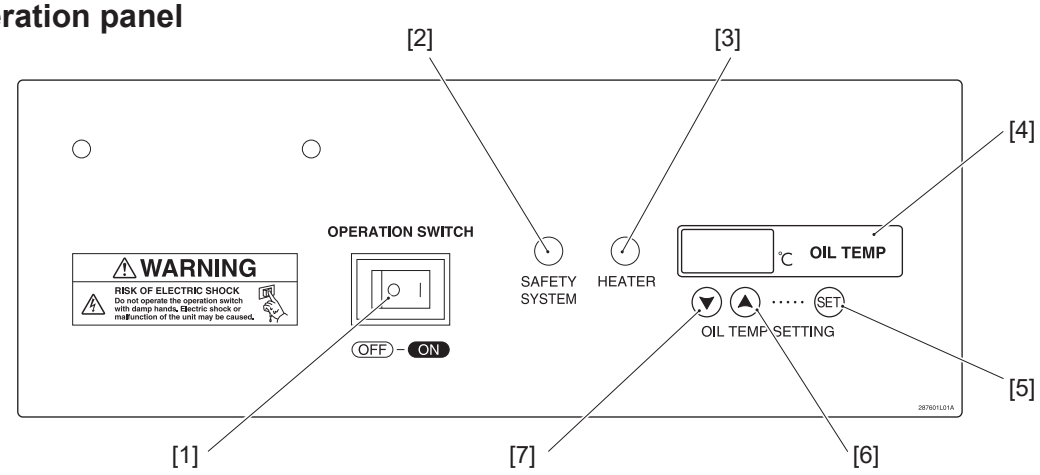


3. CONSTRUCTION

3.1 Construction



3.2 Operation panel



[1] Operation switch
Turns on/off the unit at the opening/closing time.

[2] Safety system lamp
Lights up when the boil-dry protection thermostat trips.

[3] Heater lamp
Lights up when the heater is energized.

[4] Oil temperature indicator
Indicates oil temperature. When the setting button is pressed, the display indicates the set temperature of oil.

[5] Setting button
Sets/changes the oil temperature.

[6] Up button
Increases the set temperature of oil.

[7] Down button
Decreases the set temperature of oil.

TECHNICAL INFORMATION

4. PERFORMANCE DATA

The performance data shown below are the test results with 3 phase 4 wire 50Hz using soybean oil.
The actual performance varies depending on the installation or use conditions. The values below are for reference only.

4.1 Heating performance (415V)

Ambient temperautre 5°C	20°C to 180°C
Oil amount 20L	14 min 44 sec

4.2 Control performance

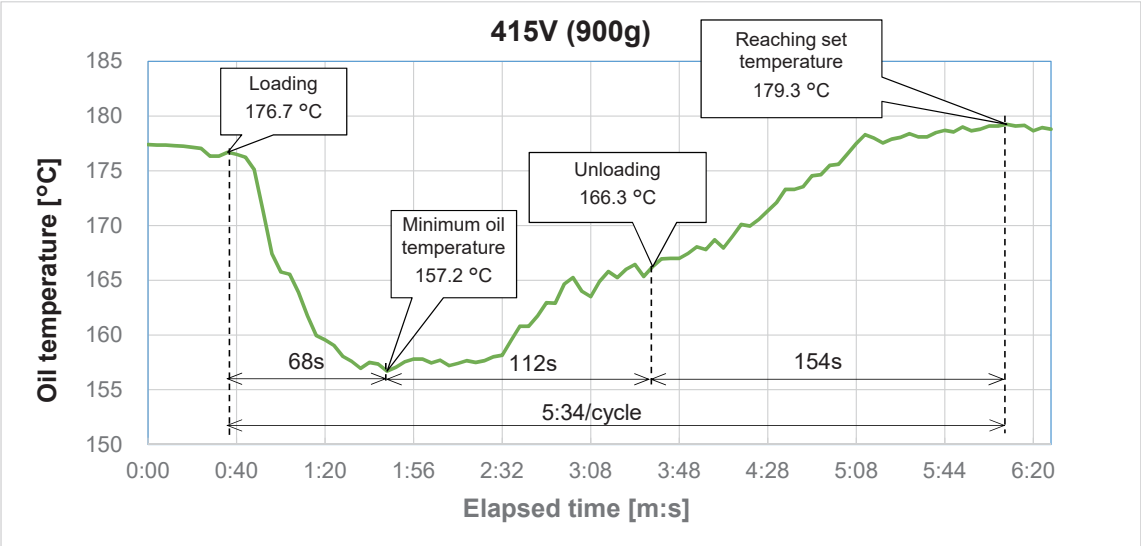
Oil amount (L)	20							
Ambient temperature (°C)	5		40					
Voltage (V)	415		380		400		415	
Set temperature (°C)	180	200	180	200	180	200	180	200
Maximun heater surface temperature (°C)	243.7	263.0	234.0	254.1	237.3	255.2	244.6	257.9
Minimum heater surface temperature (°C)	179.1	199.6	178.2	200.7	178.3	200.7	178.4	198.2
Heater surface temperature difference (K)	64.6	63.4	55.8	53.4	59.0	54.5	66.2	59.7
Average heater surface temperature (°C)	211.4	231.3	206.1	227.4	207.8	228.0	211.5	228.1
Oil temperature difference (K)	**9.9**	**8.4**	**7.8**	**8.4**	**6.8**	**7.8**	**10.0**	**9.2**
Average oil temperature (°C)	**178.9**	**199.2**	**234.0**	**254.1**	**237.3**	**255.2**	**244.6**	**257.9**
Heater ON time (m : s)	00:41	00:35	00:46	00:40	00:39	00:33	00:40	00:37
Heater OFF time (m : s)	05:37	04:01	06:55	04:52	06:32	04:38	07:35	05:30
Cycle time (m : s)	06:18	04:36	07:41	05:32	07:11	05:11	08:15	06:07
Operation rate (%)	10.8	12.7	10.0	12.0	9.1	10.6	8.1	10.1

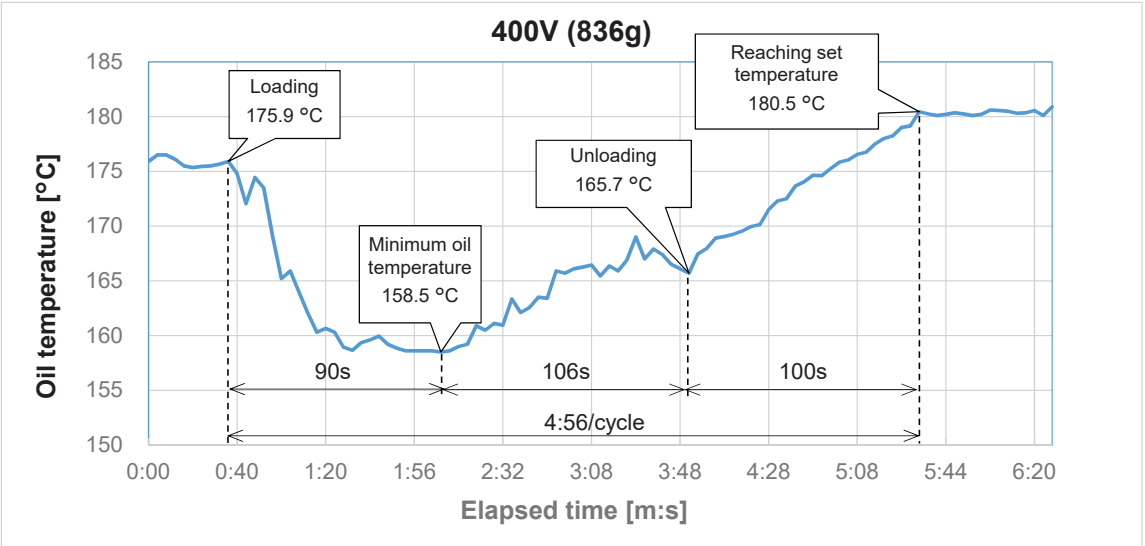
4.3 Boil-dry protection (415 + 4%V)

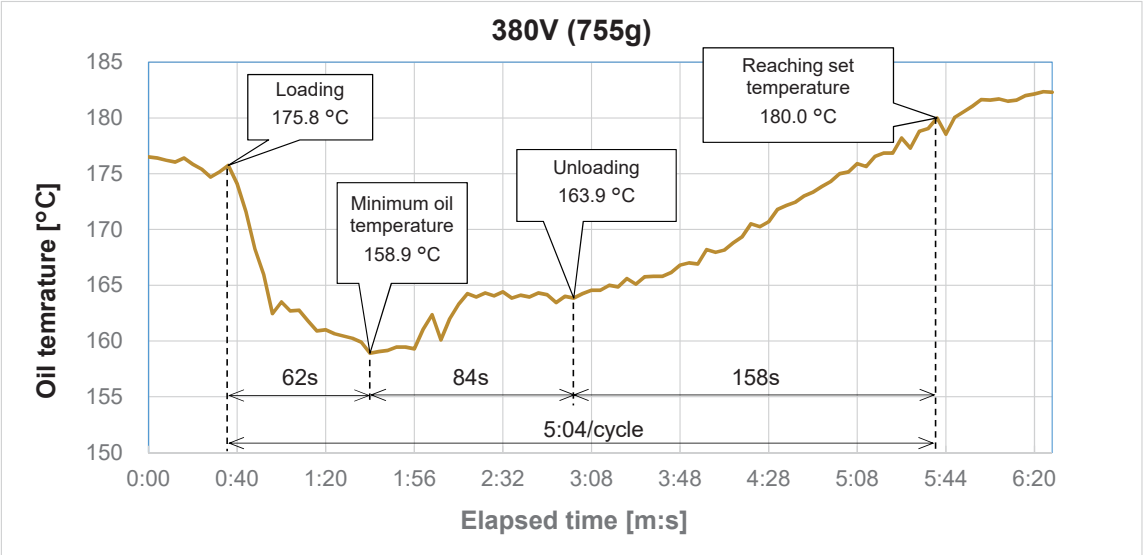
Ambient temperature (°C)	5	40
Maximum heater surface temperature when boil-dry protection thermostat trips (°C)	404.4	382.8

4.4 Actual load performance

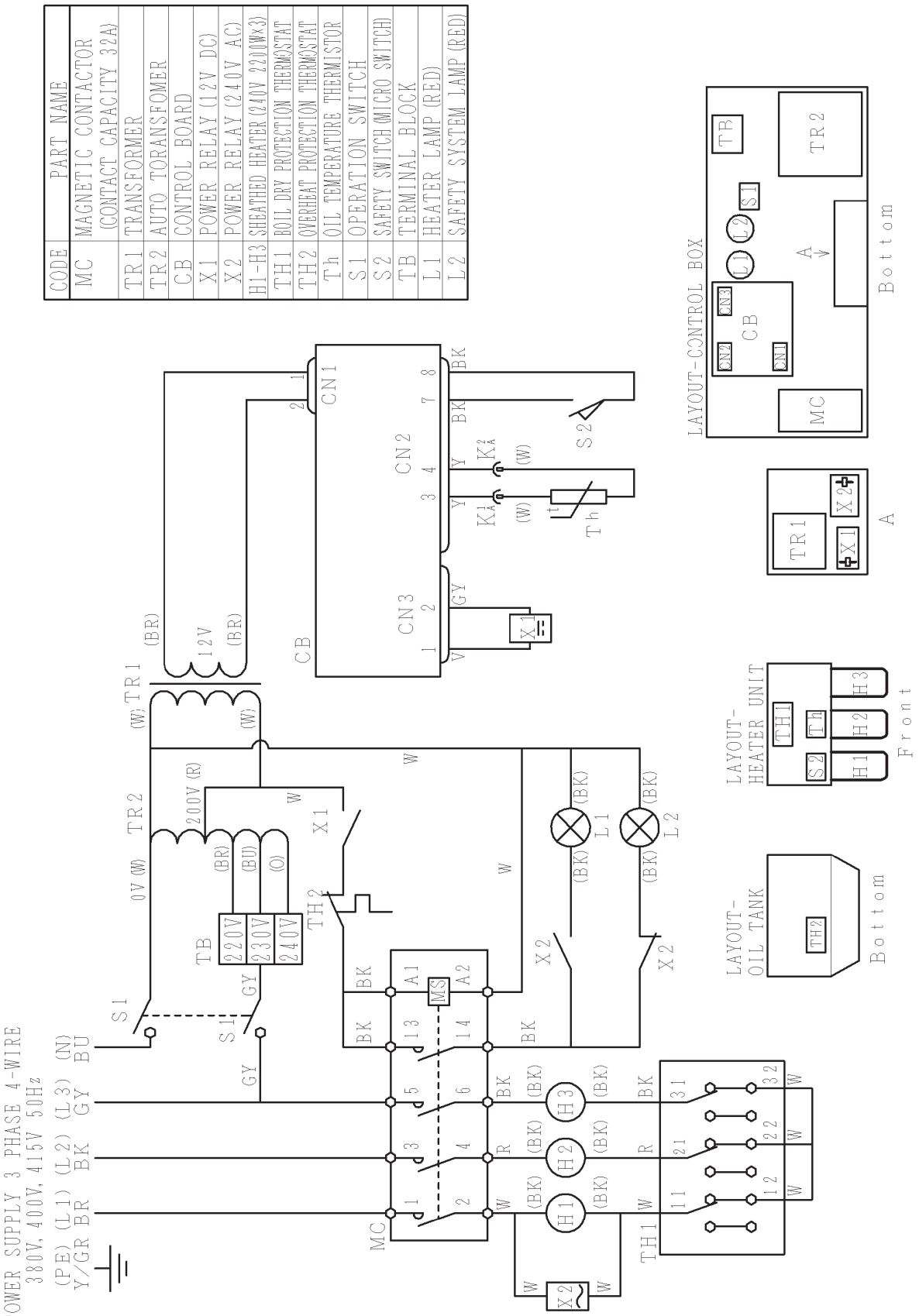
Voltage:	415/400/380 V	Load:	Frozen french fries
Ambient temperature:	20°C	Load amount:	900/836/755 g
Oil temperature setting:	180°C	Load temperature:	-20°C
Oil amount:	Standard (20L)	Number of loading:	1 time


415V (900g)
Loading
176.7 °C
Minimum oil
temperature
157.2 °C
Unloading
166.3 °C
Reaching set
temperature
179.3 °C
68s
112s
154s
5:34/cycle
Oil temperature [°C]
Elapsed time [m:s]


400V (836g)
Loading
175.9 °C
Minimum oil
temperature
158.5 °C
Unloading
165.7 °C
Reaching set
temperature
180.5 °C
90s
106s
100s
4:56/cycle
Oil temperature [°C]
Elapsed time [m:s]


380V (755g)
Loading
175.8 °C
Minimum oil
temperature
158.9 °C
Unloading
163.9 °C
Reaching set
temperature
180.0 °C
62s
84s
158s
5:04/cycle
Oil temrature [°C]
Elapsed time [m:s]

5. WIRING DIAGRAM



SERVICE INFORMATION

6. ERROR CODES

6.1 Error codes

Error code	Error	Operation
E1	Oil temperature too high	Heater turns off
E2	Open circuit of oil temperature thermistor	
E3	Short circuit of oil temperature thermistor	
EEE	Defective EEPROM	
Safety system lamp lights up	Tripped safety system	Heater turns off

6.2 Errors and remedies

6.2.1 Oil temperature too high: E1

[Description]

If the thermistor detects that the oil temperature is above 220°C, the display indicates “E1”, and the unit stops (the heater turns off).

[Possible cause]

- The magnetic contactor sticks closed and the heater is energized continuously.
- The control board fails and the heater is energized continuously.
- The thermistor fails and the heater is energized continuously.

[Remedy]

- Replace the magnetic contactor, control board or thermistor.

6.2.2 Open circuit of oil temperature thermistor: E2

[Description]

If an open circuit of oil temperature thermistor is detected, the display indicates “E2”, and the unit stops (the heater turns off).

[Possible cause]

- The thermistor is open-circuited.
- A connector or pin of the thermistor is disconnected.
- The heater is swung up after the unit is turned on while the ambient temperature is low. (If the ambient temperature is below 0°C 5 minutes after the unit is turned on, the thermistor is assumed to be open-circuited (low temperature prevention control).)

[Remedy]

- Replace the thermistor.
- Reconnect the connector or pin.
- If the low temperature prevention control operates, remove the cause.

6.2.3 Short circuit of oil temperature thermistor: E3

[Description]

If a short circuit of the oil temperature thermistor is detected, the display indicates “E3” and the unit stops (the heater turns off).

[Possible cause]

- The thermistor is short-circuited.

[Remedy]

Replace the thermistor.

6.2.4 Defective EEPROM: EEE

[Description]

Control board fails.

[Remedy]

Replace the control board.

7. SAFETY SYSTEM

7.1 Safety switch

[Purpose]

Avoid boil dry by de-energizing the heater when it is swung up.

[Possible cause]

The heater is swung up.

[Remedy]

Swing down the heater to the normal position.

7.2 Boil-dry protection thermostat

[Purpose]

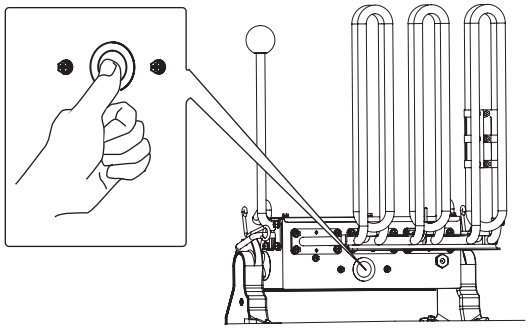
1. Avoid boil dry when there is no cooking oil inside the oil tank.
2. Avoid overheating of cooking oil caused by a magnetic contactor failure or the like when there is cooking oil inside the oil tank.

[Possible cause]

1. The unit is turned on and the oil tank is boiled dry when there is no oil inside the oil tank.
2. The heater is swung up during operation.
3. The heater is overheated when the magnetic contactor is stuck.
4. Foreign matter is attached to the boil-dry protection thermostat bulb.
5. The ambient temperature is too low before operation in a winter morning.

[How to reset]

1. Swing up the heater.
2. Press and hold the reset button with your thumb until the button clicks. The reset button is stiff to prevent oil from getting into the unit.
3. If the reset has been successful, normal operation starts without the safety system lamp lighting up.



7.3 Overheat protection thermostat

[Purpose]

Avoid overheating of cooking oil when the boil-dry protection thermostat fails while cooking oil is inside the oil tank.

[Possible cause]

The magnetic contactor sticks closed, and the boil-dry protection thermostat also fails.

[How to reset]

Replace the overheat protection thermostat.

8. CONTROL

8.1 Temperature indication

After the unit is turned on, the display indicates the oil temperature.
The display indicates “Lo” if the oil temperature is below 50°C.

8.2 Oil temperature control

The heater turns on if the oil temperature data for control sent from thermistor is below the lower limit of the oil temperature setting. The heater turns off if the oil temperature data is above the upper limit. The oil temperature control repeats the above steps to control the oil temperature.
The heater turns off immediately if an error is detected or the heater is swung up during the oil temperature control. The oil temperature control resumes after the error is resolved or the heater is swung down.

8.3 Control data

The oil temperature is read 10 times every 0.1 seconds and the average of 8 temperature data excluding the maximum and minimum values is used (for noise suppression). The averaged data is recalled every second and used as data for control. This data is rounded to the first decimal place when displayed.

8.4 Oil temperature setting

8.4.1 Changing setting

1) Press and hold the setting button for 2 seconds.
   The oil temperature indicator flashes and indicates the current set temperature.

2) Adjust the set temperature by pressing the up/down button while the indicator is flashing.
   The oil temperature is adjustable from 50 to 200°C. The default oil temperature setting is 180°C.

8.4.2 Storing setting

1) After 5 seconds without any operation while the indicator is flashing, the indicator goes back to the current set temperature indication and the setting is stored.
   However, if the unit is turned off while the indicator is flashing, no setting is stored.

9. MAINTENANCE MODE

9.1 Entering maintenance mode and changing setting

1) Turn on the operation switch while pressing and holding the setting button.
   The unit enters the maintenance mode and the display indicates “n 1” (setting code 1).
   The oil temperature control stops during this mode.

2) Use the up/down button until the display indicates the desired setting code.

3) Press the setting button, and the display indicates the setting value.

4) Press the up/down button to adjust the setting value.
   If the up/down button is pressed and held, the setting value increases/decreases every 0.2 seconds automatically.

9.2 Storing setting and cancelling setting mode

1) Press the setting button while the setting value is indicated. The setting value is stored and the indicator goes back to the setting code indication.
   Also, after 5 seconds without any operation, the setting value is stored, and the indicator goes back to the setting code indication.
   However, if the unit is turned off within 5 seconds before the setting completes, no setting value is stored.

2) This mode is cancelled after the unit is turned off.

9.3 Settings

Setting code	Item	Setting range	Step	Default
n 1	Heater on/off temperature difference	0.5 to 5.0 K	0.5 K	1.0 K
n 2	Correction temperature	-10 to +10 K	1 K	0 K
n 3	Correction method	1 (new method), 2 (conventional method)	1	1
n 4	Chattering prevention timer for magnetic contactor	0 to 4 seconds	1 second	2 seconds
n 5	Replacement period (number of operations) of magnetic contactor	100,000 to 500,000 times	10,000 times	150,000 times
n 6	Indication showing total number of operations of magnetic contactor	0 to 999,990 times		0 times
n 7	Resetting total number of operations of magnetic contactor			

9.4 Detailed descriptions of settings

(1) Heater on/off temperature difference [n 1]

[Description]

Set the temperature difference at which the heater turns on/off.
Oil temperature setting = upper limit
Oil temperature setting - temperature difference at which the heater turns on/off = lower limit

[Setting range]

0.5 to 5.0 K (indication: “ 5” to “50”)

[Default]

1.0 K (indication “10”)

(2) Correction temperature [n 2]

[Description]

Correct the temperature difference between the temperature measurement point and the center of the oil tank.

[Setting range]

-10 to +10 K (indication: “-10” to “10”)

[Default]

0 K (indication: “ 0”)

(3) Correction method [n 3]

[Description]

Set the method of temperature correction.

New method

Correct the temperature at which the heater turns on/off.

Correction value (K)	0	2
Current temperature (°C)	180	180
Temperature difference at which heater turns on/off (K)	1	1
Temperature at which heater turns on (°C)	179	176
Temperature at which heater turns off (°C)	180	178

Conventional method

Correct the measured oil temperature (control data).

Correction value (K)	0	2
Current temperature (°C)	180	178
Temperature difference at which heater turns on/off (K)	1	1
Temperature at which heater turns on (°C)	179	179
Temperature at which heater turns off (°C)	180	180

[Setting range]

1: new method, 2: conventional method

[Default]

1: new method (indication: “1”)

(4) Chattering prevention timer for magnetic contactor [n 4]

[Description]

Prevent chattering by keeping the on/off state of the magnetic contactor for the desired period of time during the oil temperature control. However, if abnormalities are found or the heater is swung up, the magnetic contactor (heater) will be turned off immediately.

[Setting range]

0 to 4 seconds (indication: “ 0” to “ 4”)

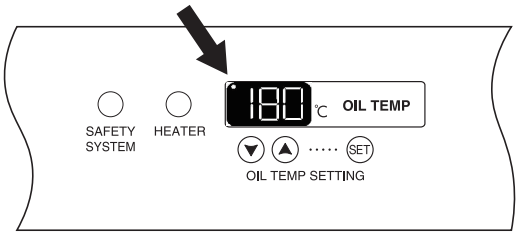
[Default]

2 seconds (indication: “2”)

(5) Replacement period (number of operations) of magnetic contactor [n 5]

[Description]

Store the number of times that the magnetic contactor (heater) operates by the oil temperature control.
When the number of operations exceeds the set number of times, a dot is indicated in the upper left of the display. The number is stored once every 10 times.



[Setting range]

100,000 to 500,000 times (indication: “100” to “500”)

[Default]

150,000 times (indication: “150”)

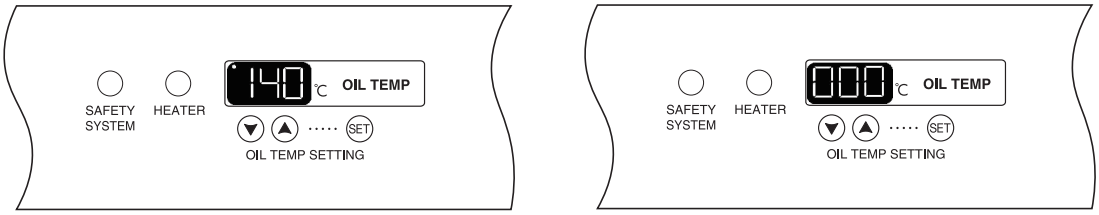
(6) Indication of total number of operations of magnetic contactor [n 6]

[Description]

Indicate the total number of operations of the magnetic contactor.
Use this code when checking the replacement period of the magnetic contactor.

[Indication]

e.g. 140,000 times
Select “n 6” and press the setting button. The display indicates the upper 3 digits “˙140” (a dot is indicated in the upper left for upper digits) for 2 seconds, and the indication goes off for 1 second. Then, the display indicates the lower 3 digits “000”, and the indicator goes back to the setting code automatically. The indicator also goes back to the setting code if the setting button is pressed while the number of operations is indicated.



(7) Resetting total number of operations of magnetic contactor [n 7]

[Description]

Reset the total number of operations of the magnetic contactor.
Use this code after replacing the magnetic contactor.

[How to reset]

Select “n 7”. Press and hold the setting button for 5 seconds. The display indicates “C L” for 2 seconds, and the total number of operations of magnetic contactor is reset to “0”. The indicator goes back to the setting code.

9.5 Other mode

9.5.1 Forced indication mode

[Description]

Use this mode to check the oil temperature when the oil temperature is below 50°C and the display indicates “Lo”.

[Indication]

Press and hold the down button for 2 seconds during the temperature control. The display indicates the oil temperature while the button is pressed.
After the button is released, the indicator goes back to the normal oil temperature indication.

10. INSPECTIONS

10.1 Inspections by user (daily)

When servicing, instruct the user as needed on the daily inspections.

10.2 Inspections by user and service engineer (annually/biannually)

In addition to the inspections of the power cord, earth wire and magnetic contactor by the user, check the items below when servicing. They have a high possibility of causing complaints.

10.2.1 Power cord

Replace the power cord if:
- the power cord is overheated, damaged, weighed down or caught in, or
- the power cord is melted or damaged inside/outside the mechanical compartment.

10.2.2 Earth wire

Check for disconnection or loose connection of the earth wire.

10.2.3 Magnetic contactor ([important]: periodic replacement part)

Replace the magnetic contactor if it has expired.
The replacement is required when the number of operations reaches the specified value or every 5 years.
Check the number of operations of the magnetic contactor by entering the maintenance mode.
If a dot is indicated in the upper left of the display, replace the magnetic contactor.
After the replacement, reset the number of operations of the magnetic contactor.

10.2.4 Boil-dry protection thermostat

Replace the boil-dry protection thermostat or bracket if:
- the capillary tube is bent or cut off, or
- the bracket is damaged and the thermostat bulb is exposed.

Clean the boil-dry protection thermostat bracket if:
- the sensor of the boil-dry protection thermostat is dirty.

10.2.5 Sheathed heater

Clean the sheathed heater if:
- the sheathed heater is dirty.

10.2.6 Oil temperature thermistor

Clean or adjust the oil temperature thermistor if:
- the oil temperature thermistor is dirty, or
- the end of the oil temperature thermistor is deformed.

10.2.7 Safety switch

Swing up the sheathed heater and adjust the safety switch if:
- the heater does not turn on after the unit is turned on, or
- the switch in the heater box does not click when the heater is swung up.

10.2.8 Heater lock mechanism

Check if the heater is locked smoothly.
If not, make an adjustment.

10.2.9 Labels

If labels attached to the unit have come off or letters on labels have faded away, replace them.

11. SERVICE DIAGNOSIS

No	Problem	Possible cause		Remedy
		Item	Description	
1	Oil temperature indicator will not light up (the unit will not start)	Power supply line	Open circuit	Replace
		Power supply	Insufficient power supply	Adjust and rework as needed
		Operation switch	Off	Turn on
			Defective	Replace
		Earth leakage breaker (on-site arrangement)	Off	Turn on If it turns off again, check for electric leakage
			Defective	Replace
		Control board	Defective	Replace
2	Heater lamp will not light up	Boil-dry protection thermostat	Tripped (safety system lamp lights up)	See No. 4 and remove cause
			Damaged capillary tube	Replace
		Safety switch	Adjustment fault	Adjust
			Bad contacts	Replace
		Power relay (X1)	Defective	Replace
		Power relay (X2)	Defective	Replace
		Control board	Defective	Replace
		Heater lamp	Defective	Replace
		Overheat protection thermostat	Tripped	Replace
3	Heater will not heat	See No. 1		
		See No. 2		
		Setting	Not set to desired oil temperautre	Check set temperature
		Overheat protection thermostat	Tripped	Replace
4	Boil-dry prtection thermostat trips	Boil-dry protection thermostat	Malfunction	Replace
		Bulb	Dirty	Clean
		Magnetic contactor	Contact sticking	Replace
		Boil dry	-	Instruct user
		Ambient temperature	Below 0°C	Press reset button

No	Problem	Possible cause		Remedy
		Item	Description	
5	Oil temperature rises abnormally	Control board	Defective	Replace
		Oil temperature thermistor	Defective	Replace
		Magnetic contactor	Contact sticking	Replace
6	Oil temperature rises extremely slowly	Power supply	Open phase	Repair
		Sheathed heater	Open circuit	Replace
		Overheat protection thermostat	Tripped	Replace
		Magnetic contactor	Bad contacts	Replace
7	"E1" (oil temperature too high)	See “6.2 Errors and remedies”.		
8	"E2" (open circuit of oil temperature thermistor)			
9	"E3" (short circuit of oil temperature thermistor)			
10	"EEE" (defective EEPROM)			

12. PARTS REPLACEMENT

Turn off the power supply before replacing parts.

12.1 Opening heater box

*Applicable parts: boil-dry protection thermostat, sheathed heater, oil temperature thermistor and safety switch

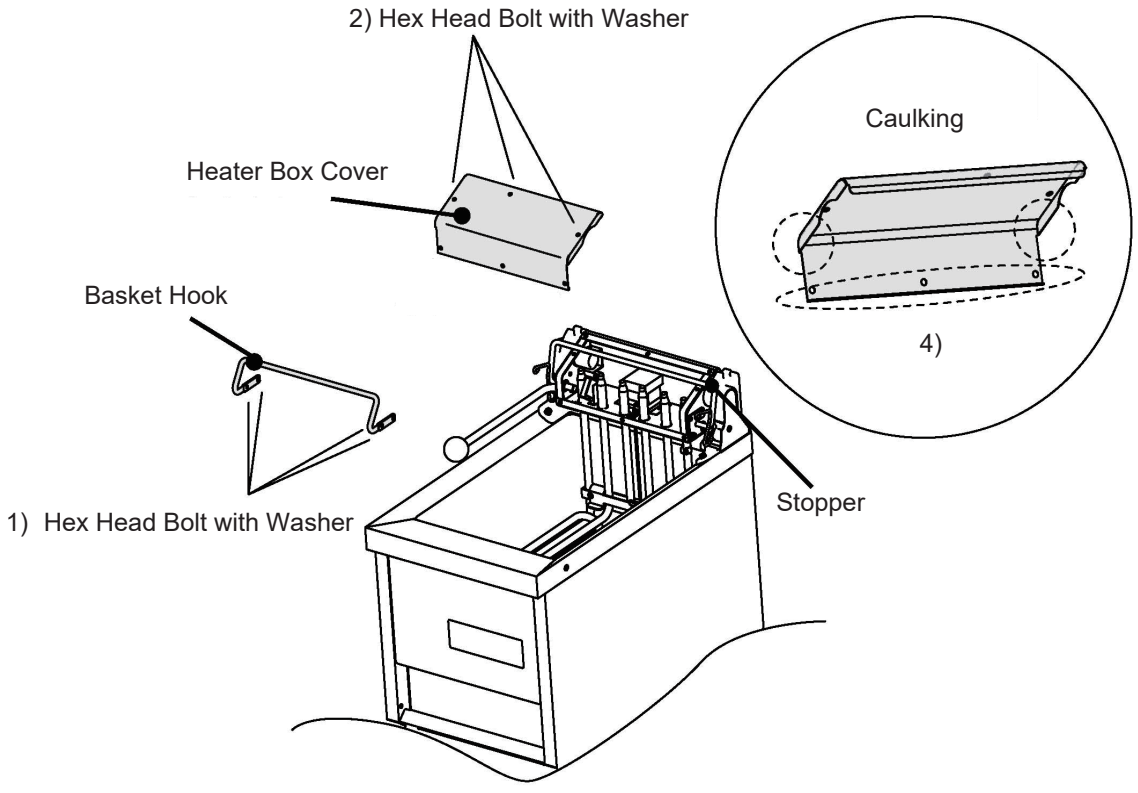
1) Remove the hex head bolts with washers (two bolts each on the left and right) to remove the basket hook. (The heater box cover is removable without removing the stopper.)

2) Remove the six hex head bolts with washers to remove the heater box cover. The lower front part of the heater box cover is caulked with a sealant. Cut the sealant using a cutter knife to remove the cover.

3) Remove the fixings and wires of the applicable part to replace it. For details, see the procedure of each part.

4) Remove the sealant attached to the heater box and heater box cover. Then use a silicone sealant (Momentive Performance Materials, Inc TSE392-C). Fix the heater box cover with the six hex head bolts with washers. Wipe off any excess sealant.

5) Fix the basket hook with the hex head bolts with washers (two bolts each on the left and right).



12.2 Replacing boil-dry protection thermostat

To remove:

1) Remove the connecting terminal (wires) of the boil-dry protection thermostat.

2) Remove the two hex head bolts with washers for the bracket of the boil-dry protection thermostat.
   - Be careful not to lose the O-ring and thermostat spring.

3) Remove the two truss head machine screws (SUS 4 x 6) to remove the boil-dry protection thermostat.

4) Loosen the six U-nuts and six truss head machine screws on the thermostat bulb bracket fixed to the sheathed heater.
   - Do not drop the U-nuts, truss head machine screws and bracket into the oil tank.
   - If those parts are left in the oil tank, they may be mixed into food.

5) Remove the thermostat bulb from the thermostat bulb bracket fixed to the sheathed heater.

6) Remove the capillary clip and stuffing box from the heater box.

To attach:

7) Insert the thermostat bulb into the heater box.

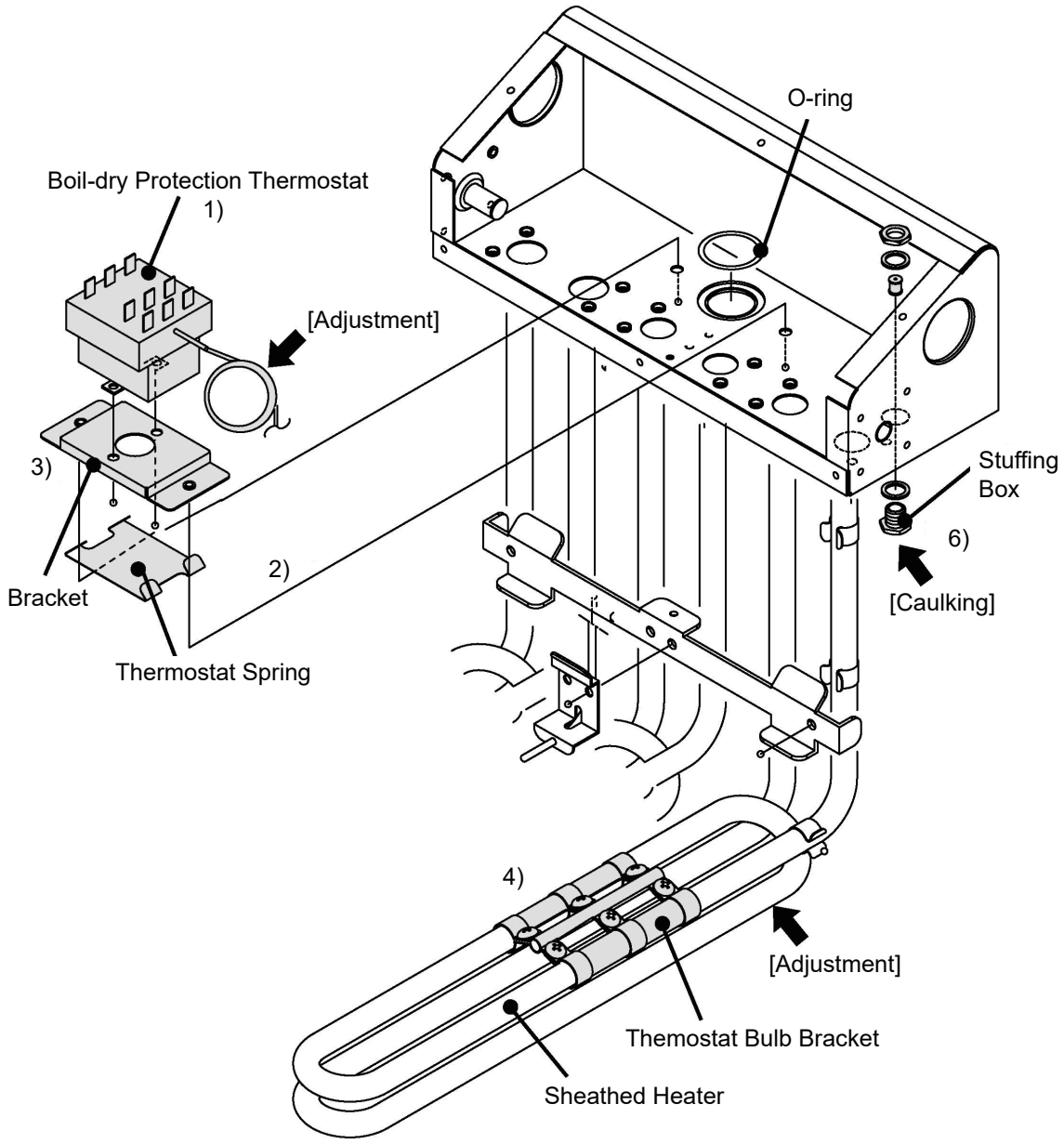
8) Attach the thermostat bulb bracket to its original position and fix the thermostat bulb.
   - Use the two 4 x 6 truss head machine screws to attach the boil-dry protection thermostat to the bracket.
   - If batter scraps or carbide is attached to the bracket, remove it, or replace the bracket with the new one.
   - If the thermostat bulb is not tightly fixed (out of position, loose, attached with deformed bracket, or dirty with batter scraps), the boil-dry protection thermostat may malfunction or fail to detect the risk of fire.

9) Attach the capillary clip to tighten and fix the stuffing box.
   - Lay out and fix the capillary tube at the rear of the heater. [Adjustment]
   - Bend radius of the capillary tube must be more than 5 mm.
   - When fixing the stuffing box to the heater box, caulk the center of the stuffing box using a sealant (Cemedine Bathcaulk N HJ-146).

10) Attach the bracket for the boil-dry protection thermostat.
   - If hex head bolts with washers or screws with wrong length are used, the reset button cannot be pressed.

11) Install the boil-dry protection thermostat to the heater box.
- The O-ring must be securely fit in the groove.
- When attaching the bracket of the boil-dry protection thermostat, do not pinch the thermostat spring or wires.
- Lay out the capillary tube as it was, and fix it with the capillary clip. Do not bend the capillary tube tightly. Bundle the excess of the capillary tube into a loop inside the heater box. [Adjustment]
- Make sure to fix/connect every part/wire.

12) Install the connecting terminal (wires) of the boil-dry protection thermostat.
- See the wiring label for proper connection.



12.3 Replacing sheathed heater and oil temperature thermistor

1) Remove the sheathed heater bracket, the six fixing screws of the thermistor bracket inside the oil tank and the six U-nuts at the rear of the thermistor bracket.

2) Remove the two pan head screws with washers of the oil temperature thermistor bracket inside the heater box.

3) Remove the oil temperature thermistor.
   - If deteriorated or deformed, replace the O-ring on the oil temperature thermistor. Otherwise, oil may get into the heater box and cause a part failure.

4) Loosen the six U-nuts and six truss head machine screws on the thermostat bulb bracket of the boil-dry protection thermostat fixed to the sheathed heater.
   - Do not drop the U-nuts, truss head machine screws and bracket into the oil tank.
   - If those parts are left in the oil tank, they may be mixed into food.

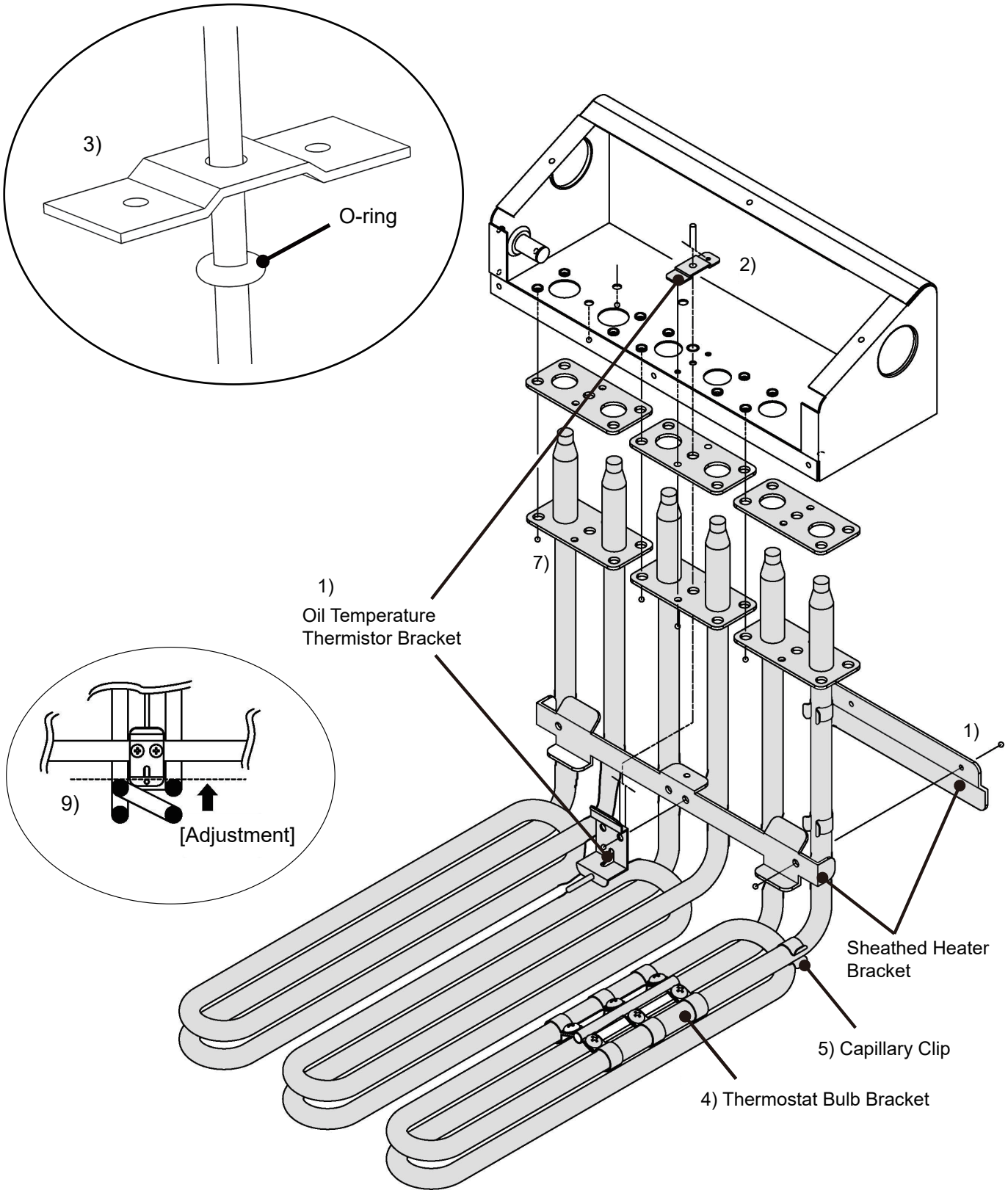
5) Remove the thermostat bulb from the thermostat bulb bracket to remove the capillary clip.

6) Disconnect the heater line inside the heater box.

7) Remove the hex head bolts with washers on the sheathed heater to remove the heater.

8) Install the new sheathed heater in the reverse order of the removal procedure.
   - Adjust the position of the oil temperature thermistor so that its end is at the same height with the upper end of the sheathed heater. [Adjustment]
     Otherwise, the separator will not be in the proper position, or the temperature detection will not work properly.

9) To replace the oil temperature thermistor, cut the tie on the waterproof bag to disconnect the connector.
   - Adjust the position of the new oil temperature thermistor so that its end is at the same height with the upper end of the sheathed heater. [Adjustment]
     Otherwise, the separator will not be in the proper position, or the temperature detection will not work properly.


3)
O-ring
2)
7)
1)
Oil Temperature
Thermistor Bracket
1)
9)
[Adjustment]
Sheathed Heater
Bracket
5) Capillary Clip
4) Thermostat Bulb Bracket

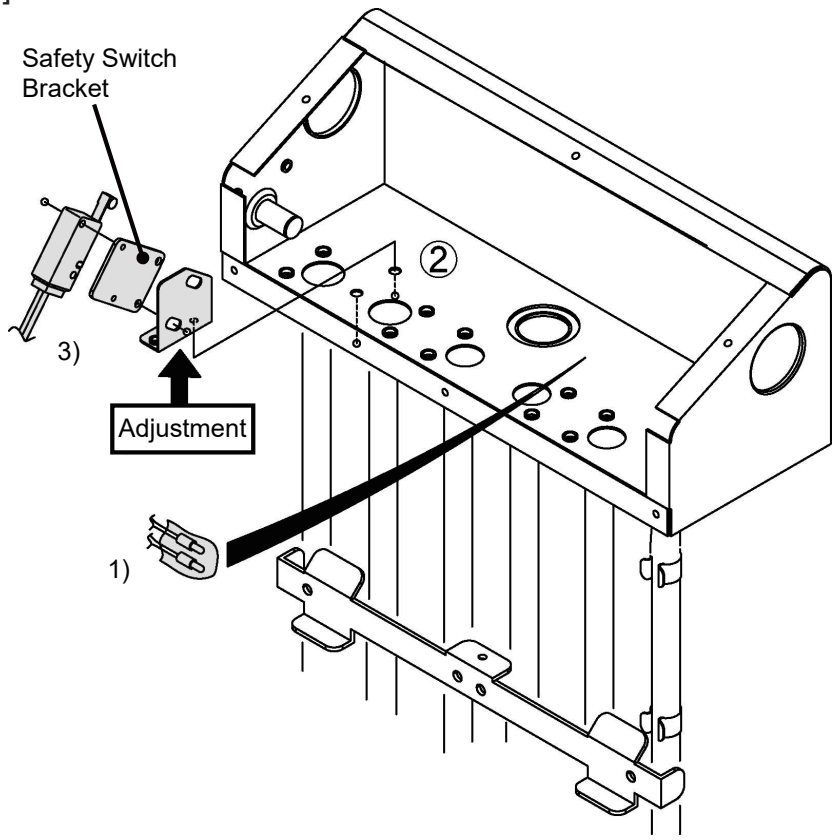
12.4 Replacing safety switch

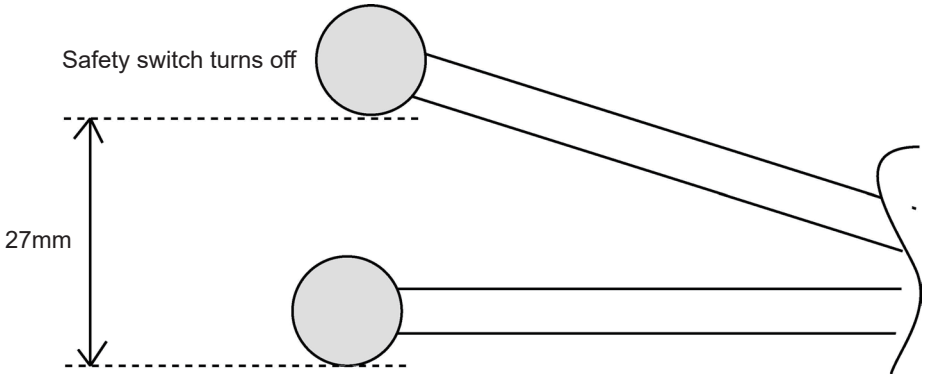
1) Cut the tie on the waterproof bag to disconnect the closed-end connector.

2) Remove the hex head bolts with washers fixing the safety switch bracket.

3) Install the new safety switch in the reverse order of the removal procedure.
   - Tightly fix the safety switch bracket.
     Otherwise, the safety switch will not be in the proper position, and the heater will not turn on.
   - Make sure to fix the fixing screws tightly.
   - Make sure to use the waterproof bag.

4) When fixing the safety switch, adjust the distance from the handle grip position with the heater swung down to the specified position where the switch turns off.
   [Adjustment]





12.5 Removing control box

Applicable parts: earth leakage breaker, magnetic contactor, control board, transformer, relay, lamp and overheat protection thermostat

1) Remove the front panel.
   - Be careful not to lose the plastic washers.

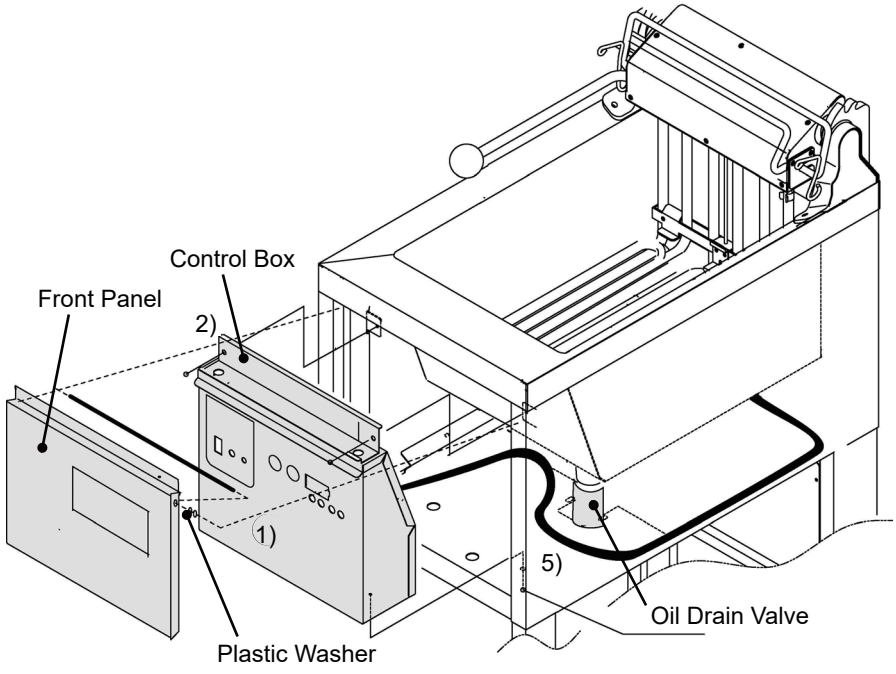
2) Remove the two fixing screws at the front of the control box.

3) Remove the two fixing screws at the bottom of the control box.

4) Replace the applicable part with the new one. Attach the removed parts in the reverse order of the removal procedure.

5) The power cord must be away from the oil drain valve and oil tank. If the user drains hot oil by mistake, the power cord may melt.

6) Make sure to use the plastic washers when attaching the front panel.



12.6 Replacing overheat protection thermostat

1) Remove the overheat protection thermostat cover.

2) Disconnect the wires to remove the overheat protection thermostat.

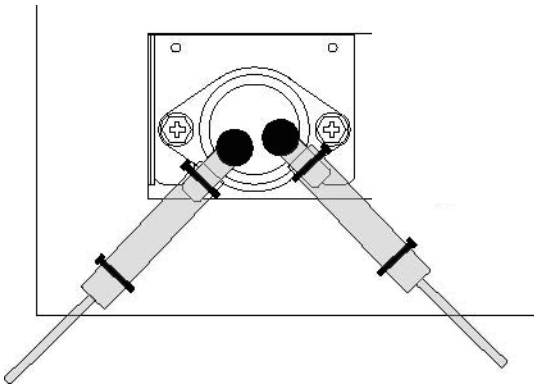
3) Apply 2g of thermal conductive grease paste (Shin-Etsu Silicones KS612) to the sensing surface of the overheat protection thermostat bulb.

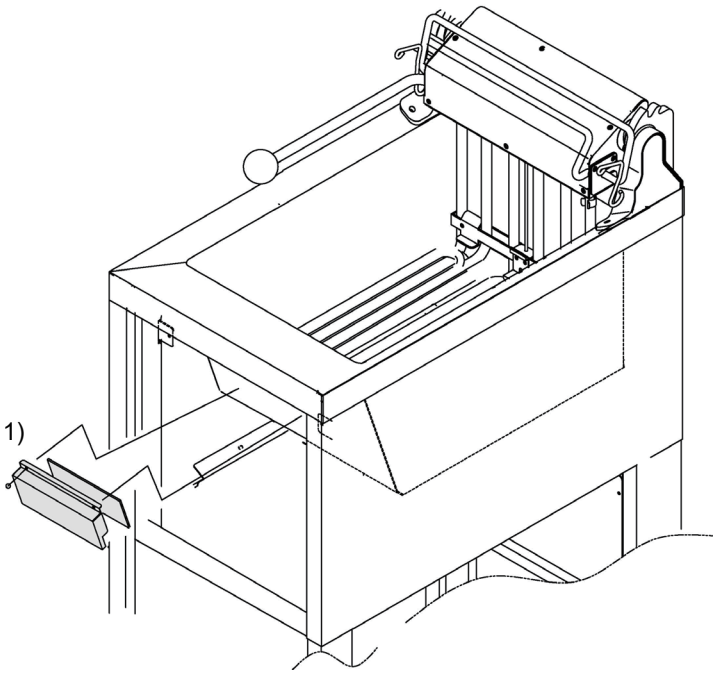
4) Connect the wires and cover the terminal with the glass tube.

5) Apply heat resistant silicone adhesive (Shin-Etsu Silicones KE3417).
   - Cover the whole terminal with the heat resistant silicone adhesive.
   - If the heat resistant silicone adhesive is not applied, short circuit may be caused.

6) Attach the overheat protection thermostat bracket.

* The thermal conductive grease paste and heat resistant silicone adhesive must be prepared separately.





12.7 Opening control box

Applicable parts: magnetic contactor, control board, transformer, relay and lamp

- When wiring, separate the high voltage (380/400/415V AC) and low voltage (12V DC) wires to avoid noise influence.

- Keep the high voltage wires away from the control board to avoid noise influence.

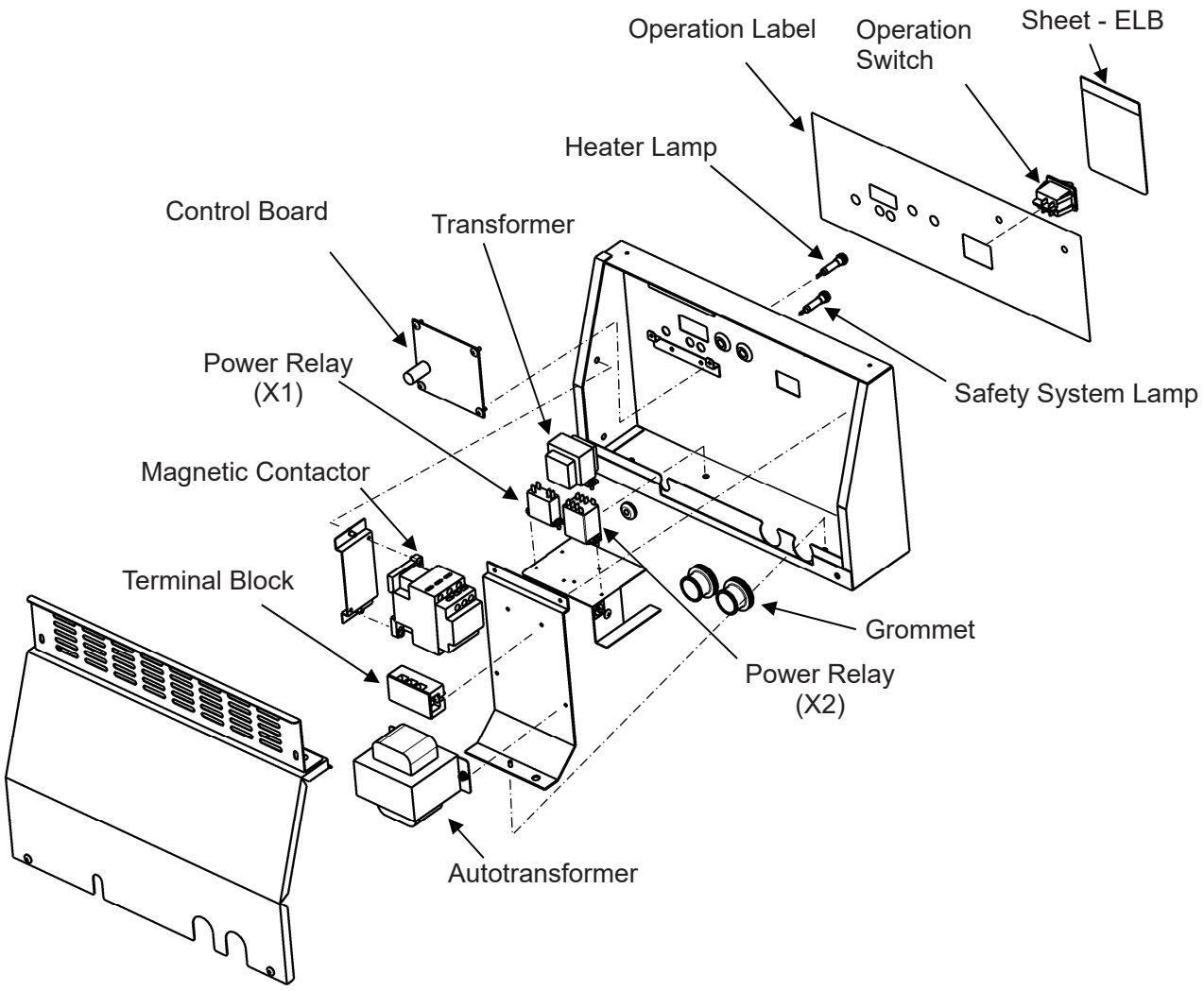
- The wires must not be caught in a bracket or the like.

- Tightly fix the wires to the unit. A loose connection may cause fire.

- When replacing the lamps, remove the operation label.

- The grommets or any other sealed parts must be sealed as they were to prevent oil from getting into the control box.

- Reset the number of operations after replacing the magnetic contactor.



12.8 Instructions for handling control board

Check by user

If receiving a service call, ask the user to turn off the power to the unit and turn it on again. When the unit is malfunctioning for some reasons, normal operation may resume once the power is turned off.

Requirements when servicing

1) Check that the unit has been earthed properly. If not, the control board will not work properly.

2) To get static free, always touch the metal part of the unit before servicing. Electrostatic discharge will cause severe damage to the control board. Also, keep things that produce static electricity (e.g. plastic bag or product) away from the control board.

3) Do not touch the electronic devices on the control board or the back of the control board.

4) Handle the control board by the edges only. Do not touch the electronic parts and wiring.

5) Do not drop the control board on the floor. The control board is fragile.

6) Do not short the relay output terminal.

7) Put the control board on a flat surface and prevent damage to the electronic parts and devices.

8) Do not pull wires with thin insulations (e.g. thermistor) to prevent damage.

9) Do not pull connectors connected to thin wires for relay control to prevent disconnection at the connectors, pins or crimped parts. After servicing, check that the connectors are fixed properly and the wires are not under tension.

10) Do not bend or stretch the thermistor's single wire.

11) Do not get the thermistor and lead wires caught in. The insulations may be damaged, resulting in a short circuit.

12) When wiring, keep the thermistor's wires at least 30mm away from the high voltage (380/400/415V AC) wires.

13) After the control board is replaced, the number of operations of magnetic contactor resets. Replace the magnetic contactor as needed.
The replacement of the magnetic contactor is required when the number of operations reaches the specified value or every 5 years.