

VAL6 Infrared Heater

KBE5S & KBE5L

(2-step)

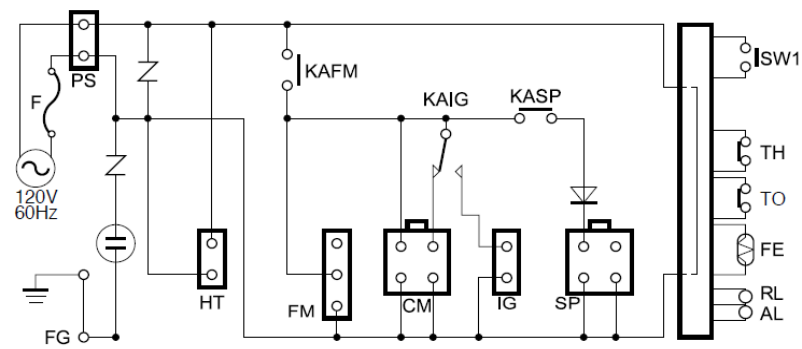
Maintenance Manual



Shizuoka Seiki Co., Ltd.

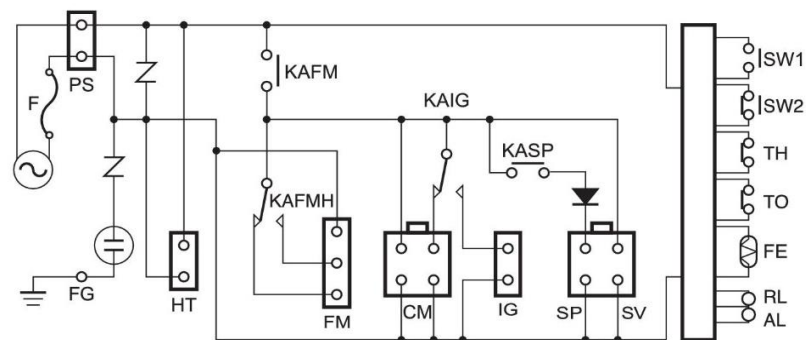
■ Wiring Diagram of Burner Control

● KBE5S



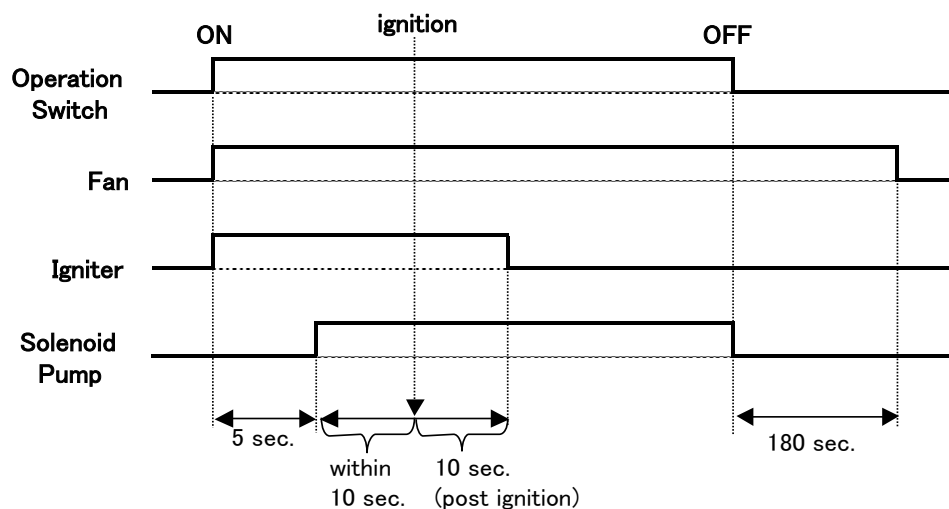
PS : Power Source	AL : Misfire Lamp	FM : Fan Motor
SW1 : Operation Switch	KA* : Control Relay	CM : (Open)
TH : Thermostat (Short)	F : Line Fuse	IG : Igniter
TO : Tip Over	Z : Surge Absorber	SP : Solenoid Pump
FE : Photo Cell	FG : Frame Ground	
RL : Running Lamp	HT : Open	

● KBE5L 2-step



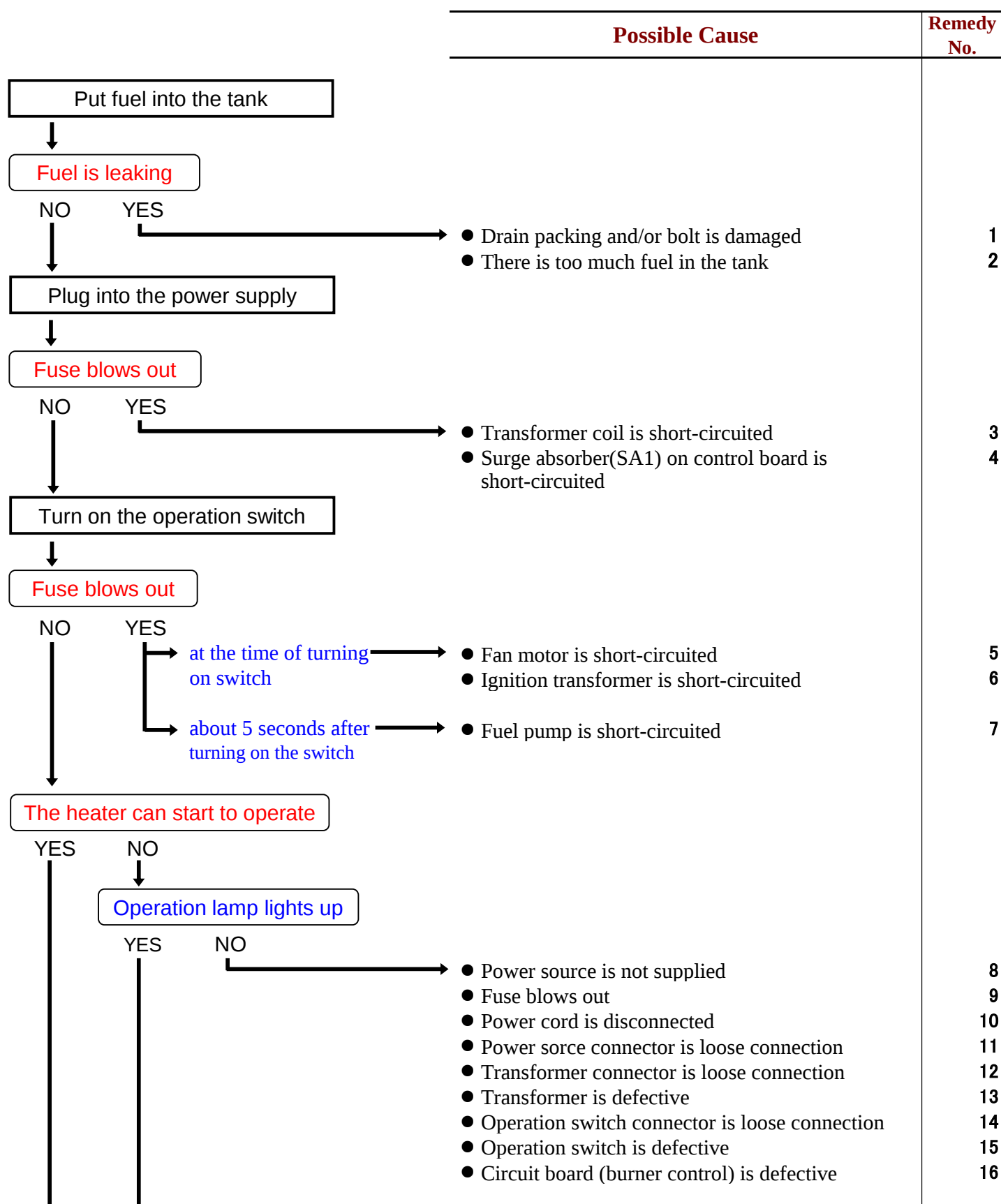
PS : Power Source	RL : Running Lamp	HT : Fuel Preheater
SW1 : Operation Switch	AL : Misfire Lamp	FM : Air Intake Motor
SW2 : Change Over Switch	KA* : Control Relay	CM : (Open)
TH : Thermostat (Short)	F : Line Fuse	IG : Igniter
TO : Tip Over	Z : Surge Absorber	SP : Solenoid Pump
FE : Photo Cell	FG : Frame Grand	SV : Solenoid Valve

■ Sequence Time Chart



Operation Flowchart

MODEL: KBE5S, KBE5L(2-step)



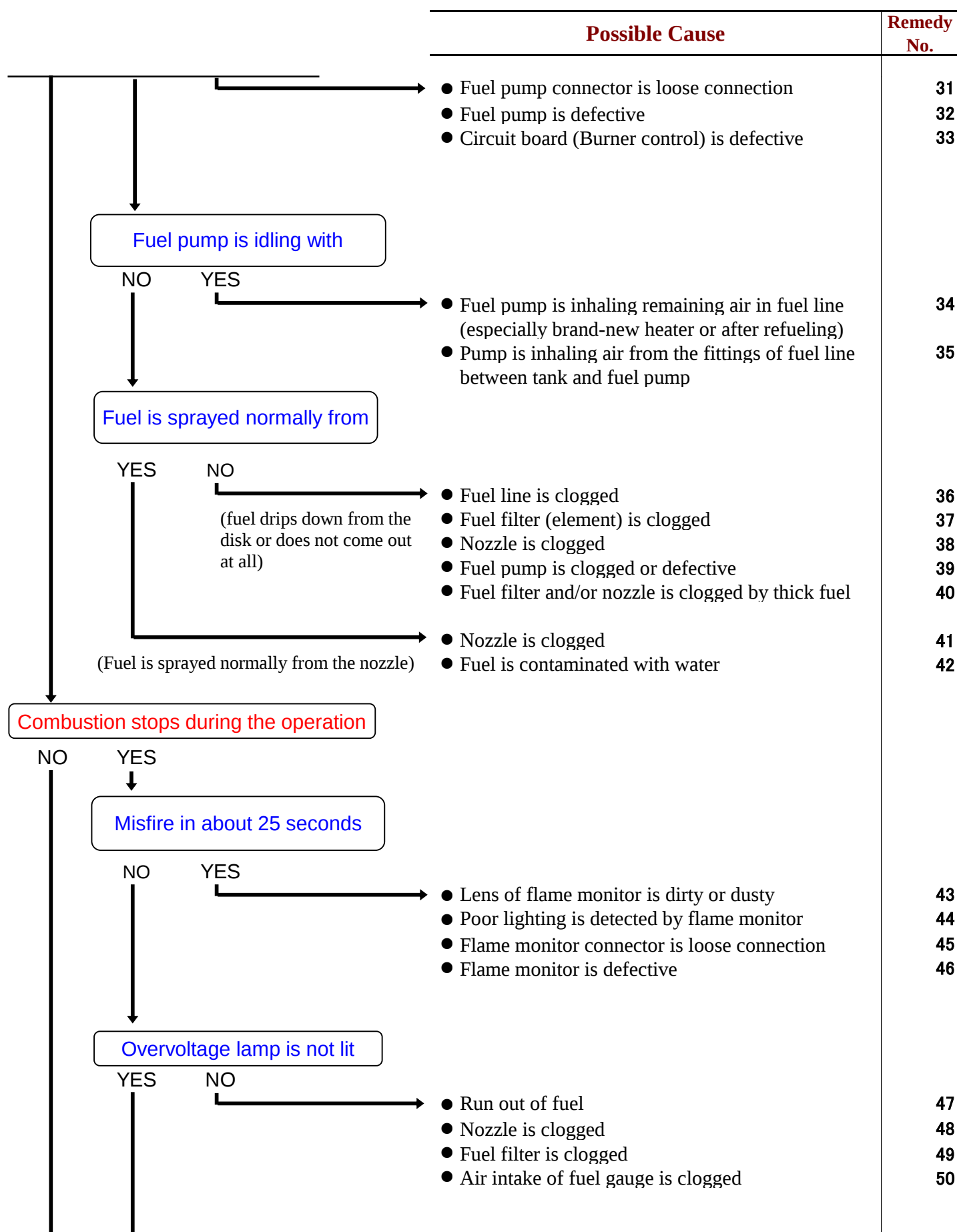
Operation Flowchart

MODEL: KBE5S, KBE5L(2-step)

		Possible Cause	Remedy No.
<pre> graph TD Start(()) --> Misfire{Misfire lamp lights up} Misfire -- YES --> Overvoltage{Overvoltage lamp lights up} Misfire -- NO --> Cause17[Terminals of control device is uncoupled] Overvoltage -- (for KBE5L) --> Cause18_22[Direct sunlight hits flame monitor Circuit board (burner control) is defective There is loose connection for tip-over switch There is breaking of wire for lines of tip-over Tip-over switch is defective.] Overvoltage -- (for KBE5S)*1 --> AllLamps{all three lamps light} AllLamps --> Cause23[Overvoltage is being detected] AllLamps --> Fan{Combustion fan is running} Fan -- YES --> Electrode{Electrode is sparking} Fan -- NO --> Cause24_26[Combustion fan connector is loose connection Combustion fan motor is clogged Combustion fan and/or circuit board (burner control) is defective] Electrode -- YES --> Heater{The heater ignites} Electrode -- NO --> Cause27_30[Ignition transformer connector or high-voltage cord is loose connection Electrode is defective Ignition transformer is defective (crack in high-voltage cord) Circuit board (Burner control) is defective] Heater -- YES --> End(()) Heater -- NO --> Fuel{Fuel pump does not turn on} Fuel -- YES --> End Fuel -- NO --> End </pre>		Terminals of control device is uncoupled	17
		*1 KBE5S manufactured from 2006 to 2013(Serial# J-04 to D-05)	
		- Direct sunlight hits flame monitor - Circuit board (burner control) is defective - There is loose connection for tip-over switch - There is breaking of wire for lines of tip-over - Tip-over switch is defective.	18 19 20 21 22
		Overvoltage is being detected	23
		- Combustion fan connector is loose connection - Combustion fan motor is clogged - Combustion fan and/or circuit board (burner control) is defective	24 25 26
		- Ignition transformer connector or high-voltage cord is loose connection - Electrode is defective - Ignition transformer is defective (crack in high-voltage cord) - Circuit board (Burner control) is defective	27 28 29 30

Operation Flowchart

MODEL: KBE5S, KBE5L(2-step)



Operation Flowchart

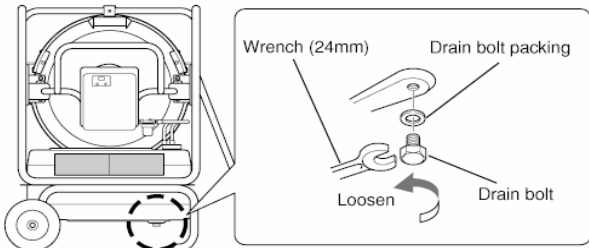
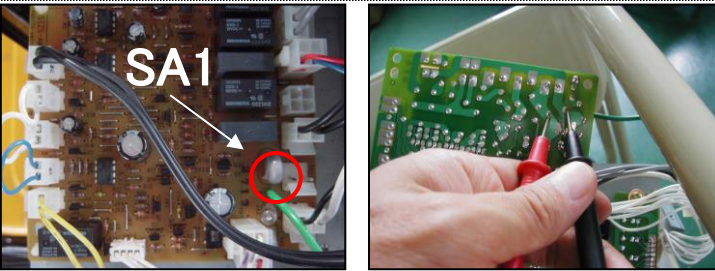
MODEL: KBE5S, KBE5L(2-step)

		Possible Cause	Remedy No.
	Overvoltage lamp is lit	● Overvoltage is being detected	51
	Combustion is stable		
YES			
NO		● Nozzle is clogged ● Fuel pump is clogged or defective	52 53
	Combustion level can switch into High/Low		
YES			
NO		● Change-over switch connector is loose connection ● Change-over switch is defective	54 55
	Smoke comes out		
NO			
YES	Smoke is continuous		
YES			
NO		● Fuel viscosity is increasing	56
	Which color is the smoke?		
Black		● Fuel viscosity is increasing ● Nozzle is clogged	57 58
White			
	Heater is using in high altitude		
YES			
NO	gives off black smoke	● Combustion air is insufficient	59
		● Oxygen for combustion is low because of high altitude	60

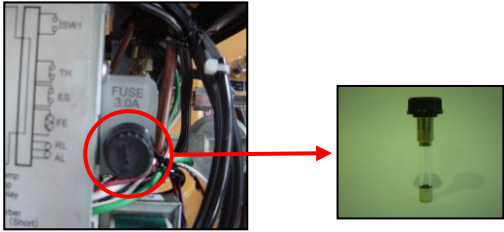
Operation Flowchart

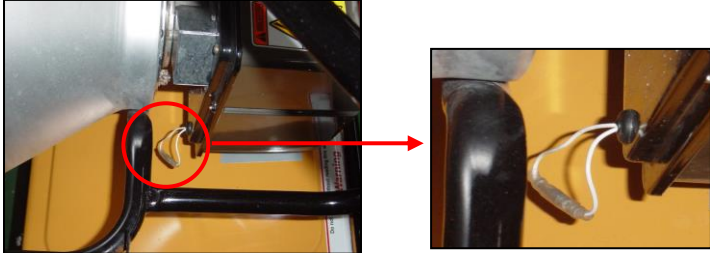
MODEL: KBE5S, KBE5L(2-step)

		Possible Cause	Remedy No.
<pre> graph TD Start(()) --> Q1{Smell of fuel comes out} Q1 -- NO --> Q2{Flame bounces out from the disk} Q1 -- YES --> C1[• Quantity of combustion air is too much • Nozzle is clogged • Fuel filter is clogged • The nozzle is incorrect] Q2 -- NO --> End[Normal Operation] Q2 -- YES --> Q3{Operating in high altitude} Q3 -- YES --> C2[• Oxygen for combustion is low because of high] Q3 -- NO --> C3[• Combustion air is insufficient] </pre>	The unburnt component may come out under the temperature of combustion chamber is low right after ignition. This unburnt component causes odor. However this may stop within 3 minutes because the temperature of combustion chamber will increase.	• Quantity of combustion air is too much • Nozzle is clogged • Fuel filter is clogged • The nozzle is incorrect	61 62 63 64
		• Combustion air is insufficient • Oxygen for combustion is low because of high	65 66

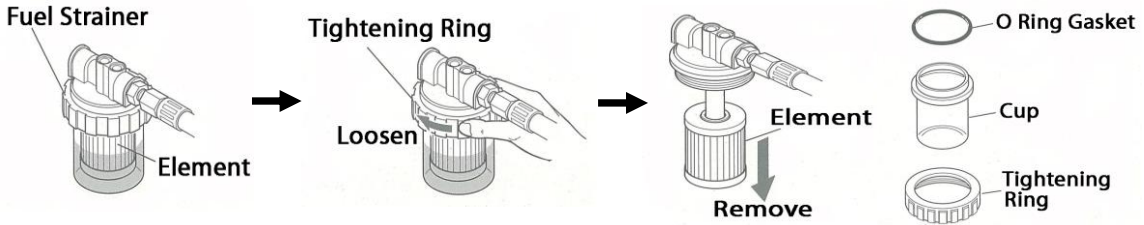
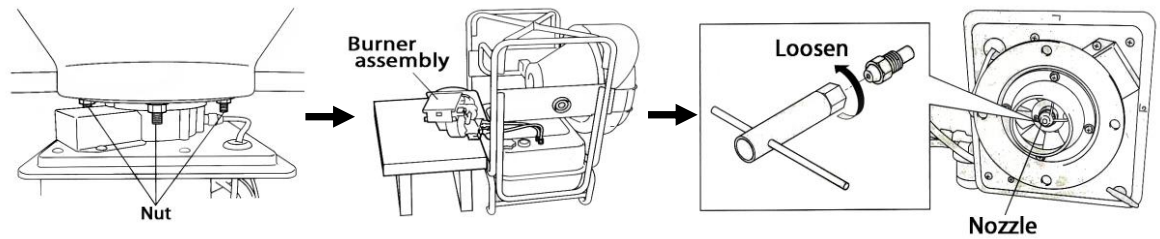
No.	Possible Cause	How to check	Result	Remedy
Fuel is leaking				
1	Drain packing and/or bolt is defective	Remove fuel from tank and take out a drain bolt. Then check whether the packing and bolt are damaged	Fuel leaks because of broken packing and/or bolt	Replace a drain packing and/or bolt
				
2	Too much fuel in the tank	Check the fuel level		Drain excess fuel
Fuse blows out				
At the time of plugging into the power supply				
3	Transformer coil is short-circuited	Disconnect transformer connector (CN 7) from circuit board, then measure coil resistance values of two leads Standard: about 350Ω (white-red) Standard: about 9Ω (purple-purple) •Without circuit tester Disconnect transformer connector (CN 7) from circuit board, then put plug into AC outlet	If either lead shows 0Ω, the transformer is short-circuited	Replace a transformer
			If the fuse is intact, the transformer is short-circuited	Replace a transformer
4	Surge absorber(SA1) on control board is short-circuited	Measure resistance at surge absorber (SA1)	If resistance value is 0Ω, surge absorber is short-circuited	Replace a circuit board (burner control)
				

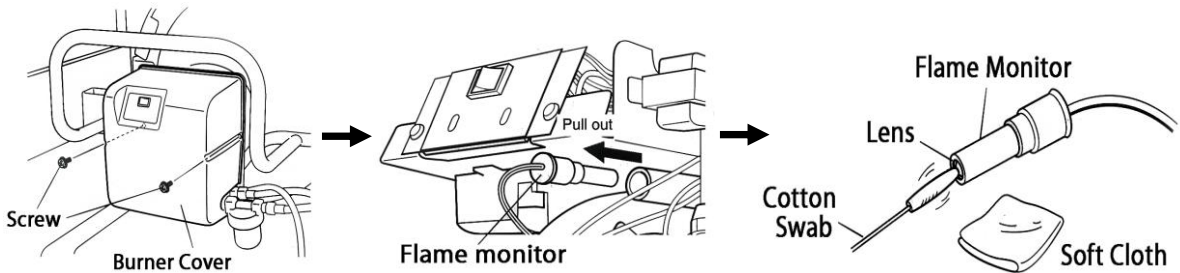
No.	Possible Cause	How to check	Result	Remedy
At the time of turning on operation switch				
5	Fan motor is short-circuited	Disconnect fan connector (CN 3) from circuit board, then measure resistance between terminals	If value leads 0Ω, the fan coil is short-circuited	Replace a fan motor
		•Without circuit tester Unplug fan connector (CN 3), and then start operation	If the fuse is intact, the fan coil is short-circuited	Replace a fan motor
6	Ignition transformer is short-circuited	Disconnect ignition connector(CN 4) from circuit board, then measure resistance between terminals	If the value shows 0Ω, the ignition coils is short-circuited	Replace an ignition transformer
		•Without circuit tester Disconnect ignition connector (CN 4), and then start operation	If the fuse is intact, the ignition coils is short-circuited	Replace an ignition transformer
About 5 seconds after turning on operation switch				
7	Fuel pump is short-circuited	Disconnect fuel pump connector (CN 6) from circuit board, then measure resistance between terminals	If the value shows 0Ω, the fuel pump coil is short-circuited	Replace a fuel pump
		•Without circuit tester Disconnect fuel pump connector (CN 6), then turn on	If fuse is intact, the fuel pump coil is short-circuited	Replace a fuel pump
Heater cannot start up (heater does not operate at all with switching on)				
Operation lamp doesn't light up (No lamp lights up)				
8	Power source is not supplied	Measure voltage of AC outlet. Standard: AC120V (or plug in another power tool and see if it	If the value shows 0V, power cable is not receiving electricity. (or if under 100V, could be power shortage)	Plug into a working outlet
9	Fuse blows out	Take fuse out from fuse box, and then check each conduction with circuit tester	If circuit tester reads ∞Ω, fuse blows out	Find a cause(s) of blown fuse and solve it,(refer to #3-7), then replace with a new one

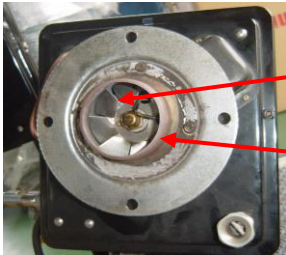
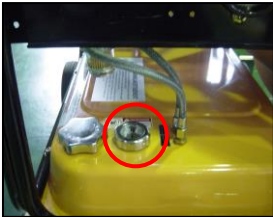
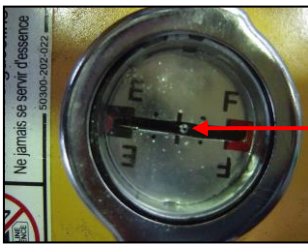
No.	Possible Cause	How to check	Result	Remedy
				
10	Power cord is disconnected	Take power source connector (CN 1) out from circuit board, then check each conduction with circuit tester	If either of the lead is broken, power cord is defective	Make sure the power cord is connected, or replace it
11	Power source connector is loose connection	Plug in power source connector (CN 1) again, then turn on	If it works normally, power source connector fails on contact	Plug in connector (CN 1) firmly
12	Transformer connector is loose connection	Plug in transformer connector (CN 7) again, and then turn on	If it works normally, transformer connector fails on contact	Plug in connector (CN 7) firmly
13	Transformer is defective	Measure voltage at output side of transformer connector (CN 7) Standard: input - AC120V (white-red) output - AC15V (purple-purple)	If tester reads normal voltage at input side, and reads 0V at output side, transformer is defective	Replace a transformer
14	Operation switch connector is loose connection	Plug in operation switch connector (CN 8) again, then turn on switch	If it works normally, operation switch connector fails in contact	Plug in connector (CN 8) firmly
15	Operation switch is defective	Take operation switch connector (CN 8) out, then check conduction with circuit tester Standard: Conducting (0Ω) when turned on switch	If it doesn't conduct when turned on switch, operation switch is defective	Replace an operation switch
16	Circuit board (Burner control) is defective	Measure voltage at input side of transformer connector (CN 7) Standard: AC120V (white-red)	If power source is normal and tester reads 0V at input side, circuit board is defective	Replace circuit board (burner control)

No.	Possible Cause	How to check	Result	Remedy
Misfire lamp doesn't light up (Only operation lamp lights up)				
17	Terminals of control device is uncoupled	Check whether the terminals for control device are connected firmly		Firmly connect terminals on control device
				
Overvoltage lamp doesn't light up (Operation lamp and misfire lamp light up)				
18	Direct sunlight hits flame monitor	Unplug flame monitor connector (CN11), then turn on switch	If it starts, sunlight is detected by flame monitor	Move disk away from direct sunlight or bright light
19	Circuit board (Burner control) is defective		If it doesn't start, circuit board is defective	Replace a circuit board
20	There is loose connection for tip-over switch	Plug tip-over switch (CN13) again, and then turn on	If it works normally, connector(s) fails on contact	Plug connectors firmly
21	There is breaking of wire for lines of tip-over switch	Check each lead with circuit tester	If circuit tester reads $\infty \Omega$, there is breaking wire for tip-over switch	Replace wire(s)
22	Tip-over switch is defective	Check the conduction of Tip-over switch (Standard value) Resistance value : 0Ω	If it doesn't conduct ($\infty\Omega$), Tip-over switch is defective	Replace Tip-over switch
All three(operation, misfire, over voltage) lamps light				
23	Over voltage is being detected	Change the power source or confirm whether the voltage of power source or		Find a cause of over voltage and take away them
Combustion fan does not run				
24	Combustion fan connector is loose connection	Plug combustion fan connector (CN 13) again, and then turn on	If it works normally, combustion fan connector fails on	Plug connector (CN13) firmly
25	Combustion fan motor is clogged	Try to rotate a vane by hand (*Be sure to plug off beforehand)	If a vane isn't rotated smoothly or completely, the combustion fan is clogged	Replace a combustion fan
26	Combustion fan and/or circuit board (Burner control) is defective	Refer to above #21 & 22	There is no cause in #21 & 22, combustion fan and/or circuit board are defective	Replace a combustion fan and/or circuit board

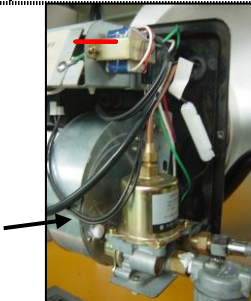
No.	Possible Cause	How to check	Result	Remedy
Electrode is not sparking				
27	Ignition transformer connector (CN4) or high-voltage cord is loose connection			Connect connection of ignition transformer connector (CN4) or high-voltage cord firmly
28	Electrode is defective			Replace an electrode
	(abnormal electrode)	Confirm that an electrode or a high-voltage cord are not wet or dirty by grime		Clean an electrode or a high-voltage cord
	(clearance is out of alignment)	Refer to drawing①		
29	Ignition transformer is defective	Measure voltage at ignition transformer connector (CN4) on	If it reads 120V, ignition transformer is	Replace an ignition transformer
30	Circuit board (Burner control) is defective	Standard: AC120V (black-black)	defective If it doesn't read 120V, circuit board is defective	Replace a circuit board
The heater does not ignite				
Fuel pump doesn't turn on (no vibration of fuel pump)				
31	Fuel pump connector (CN6) is loose connection	Plug fuel pump connector (CN6) again, and then turn on	If it works normally, fuel pump connector fails on contact	Plug connector (CN6) firmly
32	Fuel pump is defective	Measure voltage at output side of fuel pump connector on circuit	If the value shows standard voltage, the pump is defective	Replace a fuel pump
33	Circuit board (Burner control) is defective	board: Standard: AC60~96V (red-blue)	If the value does NOT show standard voltage, the circuit board is defective	Replace a circuit board
Fuel pump is idling with clicking sound				
34	Fuel pump is inhaling air which is remaining in fuel line (especially brand-new heater or after refueling)			Repeat start-operation 2 or 3 times in order to pump air out of fuel line * NEVER repeat more than 4 times in a row as fire may result

No.	Possible Cause	How to check	Result	Remedy
35	Pump is inhaling air from the fittings of fuel line between tank and fuel pump	Confirm no loose fitting in fuel line	If any loose fittings, tighten it	Tighten all fittings and repeat start-operation
Fuel is not sprayed normally from the nozzle				
36	Fuel line is clogged			Clear the clog in fuel line
37	Fuel filter (element) is clogged	Check with eyes whether or not the fuel filter is dirty or fouled		Replace a fuel filter
Replacing a fuel filter  The diagram illustrates the process of replacing a fuel filter. It starts with a 'Fuel Strainer' containing an 'Element'. An arrow points to the next step where the 'Tightening Ring' is being 'Loosen'. Another arrow points to the 'Element' being 'Remove' from the strainer. To the right, a legend identifies the components: 'O Ring Gasket', 'Cup', and 'Tightening Ring'.				
38	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
Replacing a nozzle  The diagram shows the steps to replace a nozzle. It begins with a 'Burner assembly' which has a 'Nut' on its side. An arrow points to the next step where the 'Nut' is being 'Loosen'. Another arrow points to the 'Nozzle' being removed from the burner assembly.				
unscrew three nuts and remove the burner				
39	Fuel pump is clogged or defective	Loose the brass nut, then switch on and check whether fuel comes out (place a pan under the pump)	If no fuel is pump up or fuel is not flowing at least 2" high, the fuel pump is clogged or defective (see exhibit "How to restore the fuel	Replace a fuel pump Clean and flush the tank with kerosene, alcohol or acetone

No.	Possible Cause	How to check	Result	Remedy
				
40	Fuel filter and/or nozzle is clogged by thick fuel		Because of low temperature, fuel viscosity increase and fuel filter and/or nozzle is clogged	Warm the fuel or mix kerosene with diesel. (Replace a filter and/or nozzle if
(Fuel is sprayed normally form the nozzle)				
41	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
42	Fuel is contaminated with water		Because of condensation, there is the dew condensation water in the tank	Replace a fuel thoroughly
Combustion stops during the operation				
Misfire in about 25 seconds after ignition				
43	Lens of flame monitor is dirty or dusty	Take a flame monitor out, and check whether its lens is clear or not	If it is dirty or dustiness, flame monitor cannot detect flame properly	Clean the lens of flame monitor with soft cloth
				
44	Poor lighting is detected by flame monitor	Remove a burner and check whether the whirl vane and inside of draft tube are clear or not	If they are dirty or dustiness, flame monitor cannot detect flame light properly *usually this will be happen with above #42 at once	Clean the whirl vane and inside of draft tube or replace a vane *clean the lens of flame monitor

No.	Possible Cause	How to check	Result	Remedy
	Cleaning the whirl vane and inside of	 whirl vane draft tube	Clean the whirl vane and inside of draft tube (especially behind whirl vane) till they are shining	
45	Flame monitor connector is loose connection	Plug flame monitor connector (CN11) again, and then turn on	If it works normally, flame monitor connector fails on contact	Plug connector (CN11) firmly
46	Flame monitor is defective	Disconnect flame monitor connector (CN11) from circuit board, then check transition of resistance by changing quantity of light into flame monitor	If the value of resistance is nonstandard, the flame monitor is defective Standard: black-black dark: over 2MΩ light: under 10KΩ	Replace a flame monitor
	till 2015/2016 from 2016/2017 serial# Z-01	Measure voltage at flame monitor connector on burner controller standard	If voltage doesn't change, flame monitor fails standard: White-White&red dark - about DC5V light - DC1.2V and under	Replace a flame monitor
Overvoltage lamp is NOT lit				
47	Run out of fuel	Check whether fuel is in tank		Refueling
48	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
49	Fuel filter (element) is clogged	Check with eyes whether or not the fuel filter is dirty or fouled		Replace a fuel filter
50	Air intake of fuel gauge is clogged	Check if air intake of fuel gauge is clogged with dust	If air intake of fuel gauge is clogged, fuel flow is insufficient by pressure drop in fuel	Clear an air intake of fuel gauge
	  air intake			

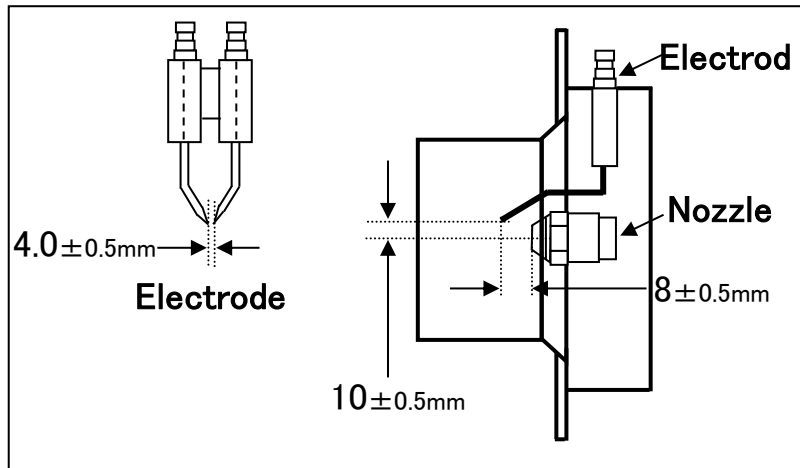
No.	Possible Cause	How to check	Result	Remedy
Overvoltage lamp is lit				
51	Over voltage is being detected	Change the power source or confirm whether the voltage of power source or		Find a cause of over voltage and take away them
Combustion is not stable				
52	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
53	Fuel pump is clogged or defective	Loose the brass nut, then switch on and check whether fuel comes out (place a pan under the pump)	If no fuel is pump up or fuel is not flowing at least 2" high, the fuel pump is clogged or defective (see Exhibit A "How to restore the fuel	Replace a fuel pump Clean and flush the tank with kerosene, alcohol or acetone
Combustion stage can switch (for KBE5L 2-step only)				
54	Change-over switch connector is loose connection	Plug change-over switch connector (CN8) again, and then turn on	If it works normally, change-over switch connector fails on	Plug in connector (CN8) firmly
55	Change-over switch is defective	Take change-over switch connector (CN 8) out, then check conduction with circuit tester Standard: Conducting (0Ω) when making the switch to "High"	If it doesn't conduct when turned on switch, change-over switch is defective	Replace a change-over switch
Smoke comes out				
Smoke is continuous for about 3 minutes				
56	Fuel viscosity is increased by low ambient temperature	Check whether ambient temperature is not under minus 4 dgree Fahrenheit (-20°C) and make sure winter fuel is used	If temperature is under minus 4 degree Fahrenheit or summer fuel is used, fuel is not sprayed normally from the nozzle because fuel viscosity is increased by low ambient temperature	Warming up fuel, refueling winter fuel or mixing kerosene with fuel in order to decrease fuel viscosity
Heater produces WHITE smoke				
57	Fuel viscosity is increased by low ambient temperature	Check whether ambient temperature is not under minus 4 dgree Fahrenheit (-20°C) and make sure winter fuel is used	If temperature is under minus 4 degree Fahrenheit or summer fuel is used, fuel is not sprayed normally from the nozzle because fuel viscosity is increased by low ambient temperature	Warming up fuel, refueling winter fuel or mixing kerosene with fuel in order to decrease fuel viscosity

No.	Possible Cause	How to check	Result	Remedy
58	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
Heater produces BLACK smoke				
59	Combustion air is insufficient	Check whether a combustion fan is run (refer to #21, 22, 23)	If the combustion fan does not run, imperfect combustion occurs by low oxygen	Replace a combustion fan and/or circuit board
		Check whether vanes of combustion fan are dusty	If vanes are dusty, imperfect combustion is occurs by low oxygen	Clean a vanes of combustion fan
		Check whether air inlet opening for combustion is appropriate	If opening is small, imperfect combustion occurs by low oxygen	Adjust a air inlet opening Normal scale : 5S 「3」、5L 「5」
		Check whether applied voltage is normal Standard: 120V±10%	If applied voltage is lower than 108V, imperfect combustion by decreasing of combustion fan rotation	Find a cause(s) of low voltage and solve it * or plug into another outlet
Heater is using in high altitude				
60	Oxygen for combustion is low because of high altitude	Check whether the heater is opearting in an altitude higher than 1000m	If its altitude is higher than 1000m, imperfect combustion occurs by low oxygen environment	Expand an air inlet opening gradually until smoke is clear away Normal scale : 5S 「3」、5L 「5」
Adjustment of air inlet expand an air inlet opening for combustion fan gradually (scale should be 4 or more) until smoke is clear away or flame doesn't protrude from the radiation disk.				
Smell of fuel comes out				
61	Combustion air is too much	Check whether air inlet opening for combustion is appropriate	If air inlet opening if too much, imperfect combustion occurs	Narrow an air inlet opening Normal scale : 5S 「3」、5L 「5」

No.	Possible Cause	How to check	Result	Remedy
62	Nozzle is clogged			Replace a nozzle Clean and flush the tank with kerosene, alcohol or acetone
63	Fuel filter (element) is clogged	Check with eyes whether or not the fuel filter is dirty or fouled		Replace a fuel filter
64	Nozzle is incorrect	Check whether correct nozzle is used Mark: 0.85USgal/h 60°H		Replace a correct nozzle
Flame bounces out from the disk				
65	Combustion air is insufficient	Check whether a combustion fan is run (refer to #21, 22, 23)	If the combustion fan does not run, imperfect combustion occurs by low oxygen	Replace a combustion fan and/or circuit board
		Check whether vanes of combustion fan are dusty	If vanes are dusty, imperfect combustion is occurs by low oxygen	Clean a vanes of combustion fan
		Check whether air inlet opening for combustion is appropriate	If opening is small, imperfect combustion occurs by low oxygen	Adjust a air inlet opening Normal scale: 5S「3」、5L「5」
		Check whether applied voltage is normal Standard: 120V±10%	If applied voltage is lower than 108V, imperfect combustion by decreasing of combustion fan rotation	Find a cause(s) of low voltage and solve it * or plug into another outlet
Heater is using in high altitude				
66	Oxygen for combustion is low because of high altitude	Check whether the heater is opearting in an altitude higher than 1000m	If its altitude is higher than 1000m, imperfect combustion occurs by low oxygen environment	Expand an air inlet opening gradually until smoke is clear away Normal scale: 5S「3」、5L「5」 (refer to No.57)

No.	Possible Cause	How to check	Result	Remedy
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Drawing①



Manufacturer does not recommend to fix electrode as they are very sensitive to

How to restore the fuel flow

If the heater produces a lot of black smoke, is difficult to fire or never ignites; please perform the following procedures before replacing the pump and/or nozzle.

- 1 Make sure that the pump turns on (you can feel and hear the vibration). This will occur approximately 5 seconds after the switch has been turned on.
- 2 Make sure that the electrode is sparking. You will hear the sparking and can see it through the front disk right after turning on the heater. (Take the heater to a dimly lit area for this spark check).

If the above items all check out properly and the unit is still not firing, place a pan under the pump to collect fuel during the next procedure. (If either 1 or 2 is the problem, please refer to the troubleshooting).

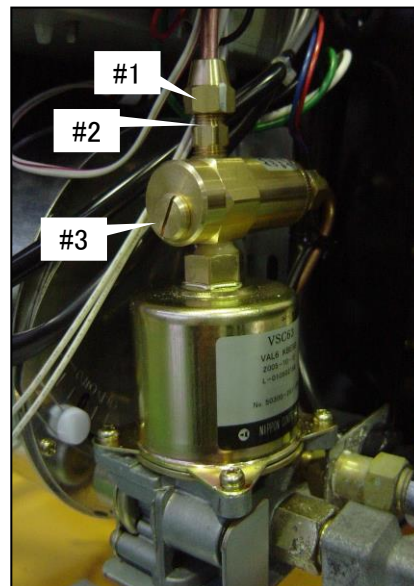
Procedure

Unscrew the brass fitting #1 completely and push it aside, so that the fuel outlet nipple #2 is visible. Turn on switch and look for fuel coming out of #2. The fuel flow must be at least 2" high. If the required fuel height is met, only the nozzle should be replaced and clean and flush the tank with kerosene, alcohol or acetone.

If no fuel is coming out or there is only a trickle, remove the #3 flat head screw, and turn on the switch.

After a few tries, fuel should squirt out of #3. It should shoot out about 12". If you only get a trickle, or no fuel, there may be several factors contributing to the clogging. Please replace a fuel

If you have a good flow at #3, reconnect the flat head screw and turn on the switch. The fuel will flow at #2 and if it is a constant flow with a minimum of 2" in height, turn off the switch and reconnect the fitting #1.



Note: Insufficient amounts of fuel at the nozzle may cause the unit not to ignite and the raw fuel that drips on the insulator will cause the black smoke when the heater does ignite.

Chart 1 Standard resistance of functional parts

Parts	Connector No	Lead	Condition	Resistance	Remarks
Operation Switch	CN8	Yellow—Yellow	on	0Ω	
			off	∞Ω	
Change-over Switch (KBE5L 2-step only)	CN8	Blue—Blue	High	0Ω	
			Low	∞Ω	
Photo Cell	CN11	Black—Black	dark light	over 2MΩ under 10KΩ	till 2015/2016 from 2016/2017(Z-01): refer to trouble shooting No.43
Transformer	CN7	Red-White Purple-Purple	input output	about 350Ω about 9Ω	
Igniter	CN4	Black—Black	input output	- about 4.5KΩ	
Solenoid Pump	CN6	Red-Blue	-	about 130Ω	
Solenoid Pump	CN6	Blue-Blue	-	about 100Ω	for 2-step
Solenoid Pump (solenoid valve)		Yellow-Yellow	-	about 740Ω	
Fan motor	CN3	Gray-Gray	—	about 10Ω	gate: Normal scale 5S「3」、5L「5」(60Hz)*
	CN3	White-Black	-	about 13Ω	gate: Normal scale 5L「5」(60Hz)* for 2-step

*When heater is used above 3,000ft sea level, adjust air inlet on fan motor for better combustion

Chart 2 Input & Output of Burner Control

Parts	Connector No	Lead	Condition	Voltage
Power code	CN1	Black-White	—	AC 120V (±10%)
Transformer	CN7	Red-White Purple-Purple	input output	AC 120V (±10%) about AC 15V
Igniter	CN4	Black-Black	input	AC 120V (±10%)
Solenoid Pump	CN6	Red-Blue	—	AC 60~96V
Solenoid Pump	CN6	Blue-Blue	-	AC 60~96V
Solenoid Pump (solenoid valve)		Yellow-Yellow	-	AC 120V (±10%)
Fan motor	CN3	Gray-Gray	60Hz 50Hz	AC 120V (±10%) -
Fan motor(for 2-step)	CN3	White-Black	60Hz 50Hz	AC 120V (±10%) -

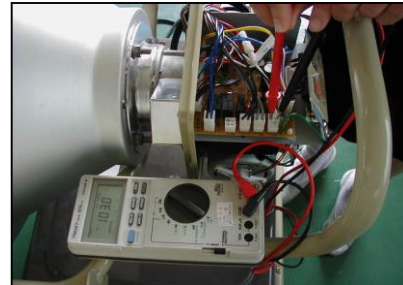
Picture 1 How to measure resistance

- ① Pull out a connector which you will measure from burner control
- ② Turn on the circuit tester and set resistor range
- ③ Insert the lead head of resistor to connector [lead wire side] and measure resistance



Picture 2 How to measure voltage

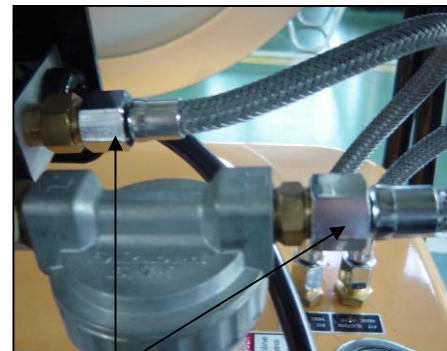
- ① Operate the heater
- ② Turn on the circuit tester and set AC voltage range
- ③ Insert the lead head of resistor to connector and measure voltage



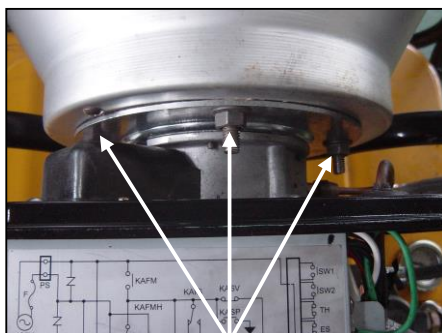
Picture 3 Removing a burner



screw
Unscrew two screws
and take burner
cover off



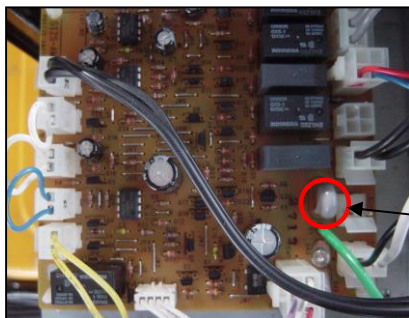
Unscrew two silver nuts with holding
gold nuts and remove two fuel hoses



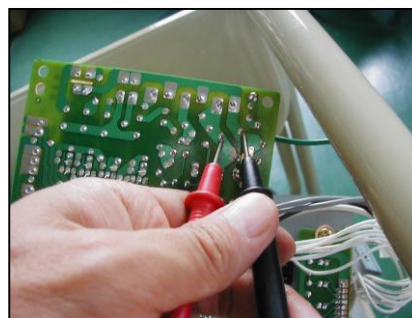
nut
Unscrew three nuts
and take the burner off



Picture 4 Inspection surge absorber (SA1)

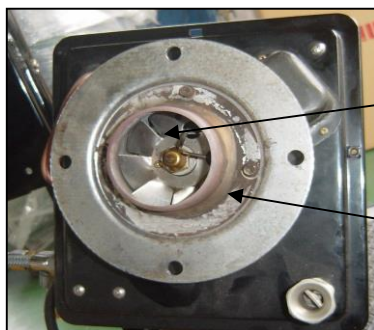


SA1



Take out the burner control, and point the lead head at solder part of SA1

Picture 5 Inspection draft tube and fan



whirl vane

draft tube

In case of draft tube and fan are dusty, please clean them up

Picture 6 Inspection fuse①

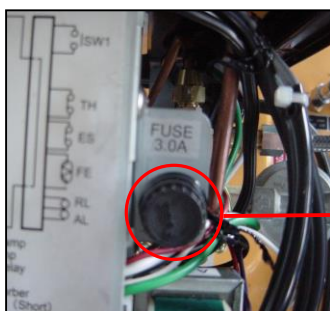
Object Serial Number : till 01Q-020000 (2003/2004 model)



Open the fuse box and check whether the fuse blows out

Picture 7 Inspection fuse②

Object Serial Number : from 01Q-030000 (2003/2004 model)

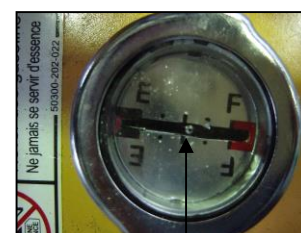


Open a screw cap and take out a fuse



Check whether fuse is blown out

Picture 8 Clean up fuel gauge



air intake

If air intake of fuel gauge is clogged, clean it up

Picture 9 Adjustment of air inlet for using the heater in high altitude

If dark smoke comes out or flame protrudes from the radiation disk in using the heater in an altitude higher than 3,000 ft, you need to expand combustion air inlet opening.



1. Unfasten a knob and expand combustion air inlet opening.

Standard Scale: KBE5S「3」、KBE5L「5」

You need to expand combustion air inlet opening gradually until smoke is clear away or flame doesn't protrude from the radiation disk. (scale should be 4 or more)

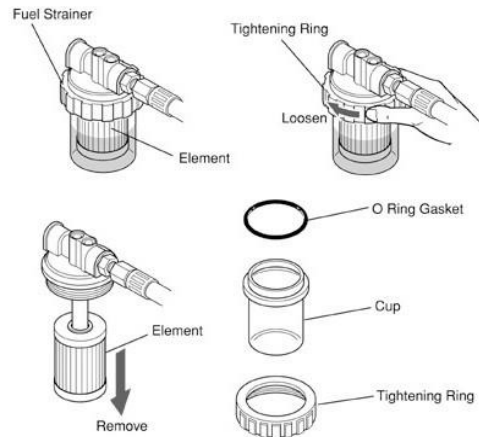
2. Fasten a knob of combustion fan and put a burner cover back.

..... Daily Inspection

■ Inspection of the filter and drainage of water from the fuel tank

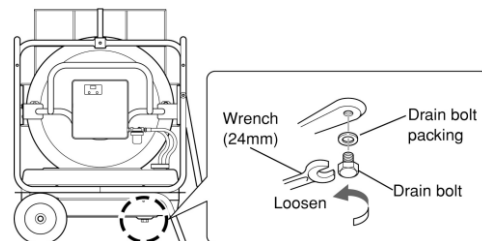
Checking the filter element

- 1 Check whether or not the filter element is dirt and foul.
- 2 In case the filter element is dirty or clogged, please replace it with a new one, and bind firmly the cup with the tightening ring.
- 3 If the dirt or water are found in the cup, eliminate them. Also, that means there are dirt or water in the tank as well. Follow the next instructions and eliminate the dirt or water from the fuel tank.



Drainage of water from the fuel tank

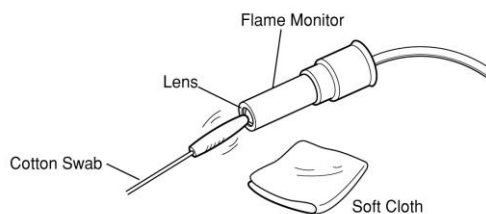
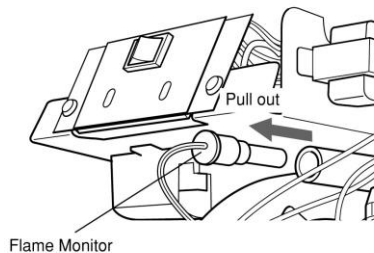
- 1 Remove the fuel cap, take out the tank inlet filter and insert a handy suction pump into the tank.
- 2 Remove as much fuel as possible (with the handy suction pump).
- 3 Restore the tank inlet filter and tighten firmly the fuel cap.
- 4 Prepare an empty container of about 3 liters (0.7gallons) capacity: to hold kerosene and water remaining in the fuel tank, place the container under the drain bolt (of the fuel tank).
- 5 Later on, please remove with wrench the drain bolt and tilt the fuel tank until the fuel is completely drained out of the tank. (At the same time, be careful not to lose the drain bolt packing)
- 6 Restore the drain bolt packing and tighten the drain bolt firmly so fuel cannot leak out (of the fuel tank).
- 7 Wipe off kerosene or water spilt over the tank.



■ Inspection and cleaning of the flame monitor

Observations – When removing the flame monitor, hold it by its main assembly; do not pull out the cord.

- 1 Remove the burner cover and pull out the flame monitor, and check whether or not its lens is dirty/foul.
- 2 If the lens is dirty/foul, please wipe the surface of the lens with a soft cloth, etc. until it becomes clear.
- 3 Restore the flame monitor, fix burner cover with screws



Inspection of "dirt/dusts" on main unit

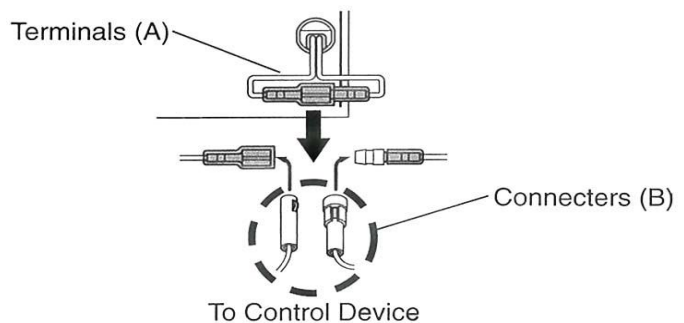
- 1 Check whether or not dirt/dusts is on or around the heater.
- 2 If dust is found, clean with a vacuum cleaner or wipe with a soft cloth, etc.

..... Periodic Inspection

- 1 The heater must be checked, if used for a long time. Please ask your dealer to inspect the heater every two (2) seasons.

..... How to connect the Control device

- 1 Uncouple the terminals (A) attached to the tip of white wires that come out of the burner base.
- 2 Connect both male and female terminals, which are uncoupled, to the connectors (B) of control device.



Observations

•When the heater is controlled by another device (such as a thermostat or a timer), the heater could turn itself on at any time.