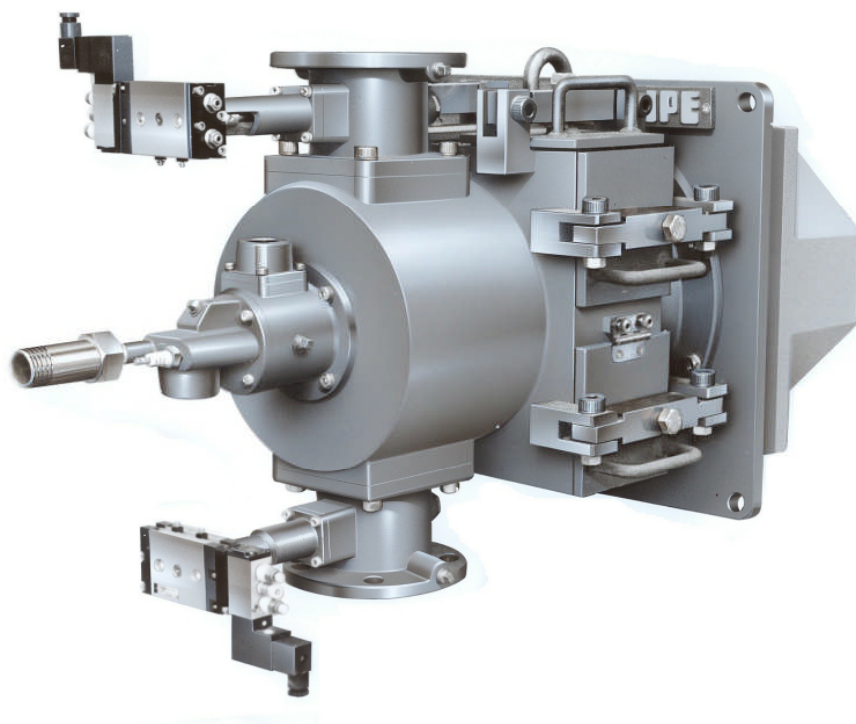


HOPE

HO48083E

HOPE S R B O
SELF REGENERATIVE OIL BURNER
HANDLING MANUALS



YOKOI KIKAI KOSAKUSHO CO., LTD.

Head Office:

**2720-1, Oboraguchi, Nakashidami, Moriyama-ku
Nagoya 463, Japan**

Tel: +81-52-736-0773 Fax: +81-52-736-0

TABLE OF CONTENTS

1. TBLE OF CONTENTS	• • • • 1
2. Inspection of Product and Accessories, and Outline and • Features	• • • • 2
3. Specification	• • • • 3
4. Actuator Auto Switch	• • • • 4
5. Installation	• • • • 6
6. Piping	• • • • 7
7. Flow sheet	• • • • 8
8. Monitoring of Main Flame	• • • • 9
9. Test Operation	• • • 10
10. Inspection	• • • 11
11. Structural drawing	• • • 12
12. Overhaul Burner	• • • 13
13. Replacement of Ceramic Balls	• • • 14
14. Spare Parts • Warning Plate	• • • 15
15. Troubleshooting	• • • 16

Thank you for your selection of SELF REGENERATIVE OIL BURNER Type SRBO Please carefully read this instruction manual in order for you to be fully satisfied with the performance of this burner and to secure the safety in operation, maintenance and inspection. Also, please be sure to deliver this instruction manual to the end user, as well as to the constructor.

Inspection

Check the model and type of the burner, the voltage of the solenoid valve, the part No. of the auto switch, etc. to confirm that they are exactly what you have ordered. Also, check for damage, etc, due to transportation.

Outline

SRBO Type Self-Regenerative Oil Burner aims at a departure from the twin burner type, the basic concept of the regenerative combustion system.

This burner is epoch-making in that it alone enables regenerative combustion by employing the unique combustion and switching methods.

We are confident that this burner is indispensable for the protection of the earth environment in the future.

Features

- 1) Since the regenerative combustion system is integrated into one burner, cost can be reduced.
- 2) The energy-saving effect is so large that CO₂ emission can be reduced substantially.
- 3) With exhaust gas recirculation effect and multistage combustion, NO_x emission can be controlled to a low level.
- 4) Since the conventional control system can be used as it is, the existing burner can be replaced easily.
- 5) Since the combustion is continuous, the in-furnace temperature and the in-furnace atmosphere are not disturbed.
- 6) Since there is no portion of extremely high temperature within the flame, very favorable temperature distribution can be obtained.
- 7) Since highly luminous flame is obtained, the radiant heat transfer effect can be improved.
- 8) The heat storage body can be replaced easily.

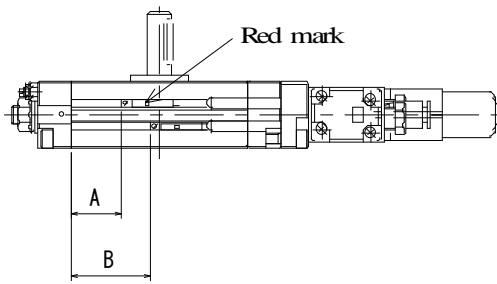
Actuator

Standard Pressure 0.3 MPa

	Type	Air consumption l/min
SRBO-15	CDRQ2B20-01	0.2×2
SRBO-25	CDRQ2B40-01	0.6×2
SRBO-40	CDVRA1B50-01	0.9×2
SRBO-60	CDVRA1B63-01	1.8×2
SRBO-100	CDVRA1BS80-106	3.2×2

Setting position of the auto switch of the actuator

SRBO-15,25



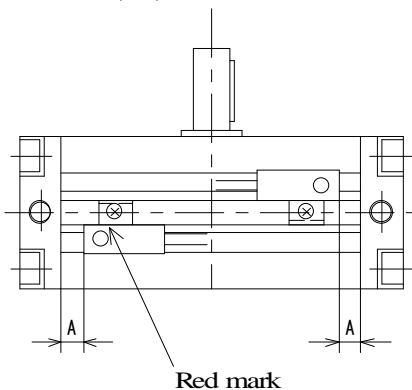
● SRBO-15

Reed Auto Switch		Solid State Auto Switch	
A	B	A	B
22	34.5	26	38.5

● SRBO-25

Reed Auto Switch		Solid State Auto Switch	
A	B	A	B
34	53	38	57

SRBO-40,60,100



● SRBO-40

Reed Auto Switch		Solid State Auto Switch	
D- A59W	9	D- F59F	19.5
—	—	D- F5N1L	20.5
Other than the above	13	Other than the above	15.5

● SRBO-60

Reed Auto Switch		Solid State Auto Switch	
D- A59W	15	D- F59F	21.5
—	—	D- F5N1L	22.5
Other than the above	11	Other than the above	17.5

● SRBO-100

Reed Auto Switch		Solid State Auto Switch	
D- A59W	19	D- F59F	25.5
—	—	D- F5N1L	26.5
Other than the above	15	Other than the above	21.5

※As of shipping, the auto switch on the detection side of the inactive solenoid valve is red-marked, which matches the red mark of the yoke (connecting the valve body to the actuator) and shaft. The auto switch is set in the dimensional positions A and B in the drawing. When the auto switch is used, fine adjustment is required. Adjust the auto switch to ensure that it can detect without fail.

Auto Switch

The auto switch is attached to the actuator for operational detection. Select one from the below table. The length of the lead wire is 0.5m.

SRBO—15 SRBO—25

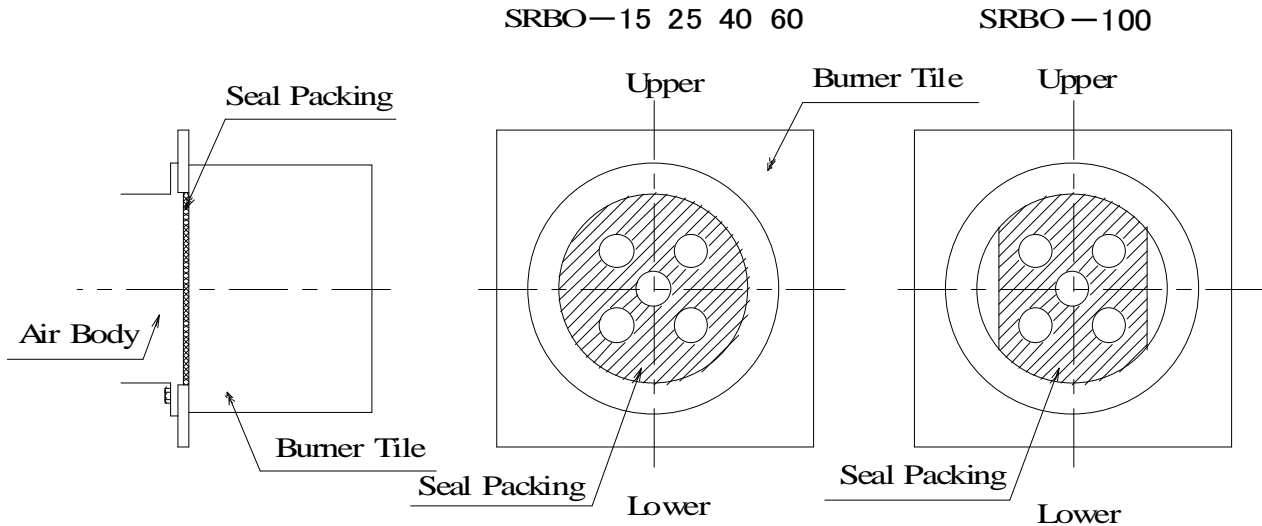
Type	Special Function	Electrical Entry	Indicator light	Wiring Type	Load Voltage		Auto Switch Model		Applicable load		
					DC	AC	Perpendicular	In-line			
Solid State Auto Switch	—	Grommet	With light	3-wire(NPN)	24V	5V,12V	—	D-M9NV	D-M9N	IC Circuit	Relay, PLC
				3-wire (PNP)				D-M9PV	D-M9P		
				2-wire				D-M9BV	D-M9B		
	2-color indication with diagnostic			3-wire (NPN)	24V	5V,12V	—	D-M9NWV	D-M9NW	IC	
				3-wire (PNP)				D-M9PWV	D-M9PW	Circuit	
				2-wire				D-M9BWV	D-M9BW	—	
	2-color indication with Water-resistant			3-wire (NPN)	24V	5V,12V	—	D-M9NAV	D-M9NA	IC	
				3-wire (PNP)				D-M9PAV	D-M9PA	Circuit	
				2-wire				D-M9BAV	D-M9BA	—	
Reed Auto Switch	—	Grommet	With light	3-wire (NPN)	—	5V	—	D-A96V	D-A96	IC Circuit	Relay, PLC
				2-wire	24V	12V	100V	D-A93V	D-A93	—	
			100V or less				D-A90V	D-A90	IC Circuit		
			Without light	—	—	—	—	—	—	—	

SRBO—40 SRBO—60 SRBO—100

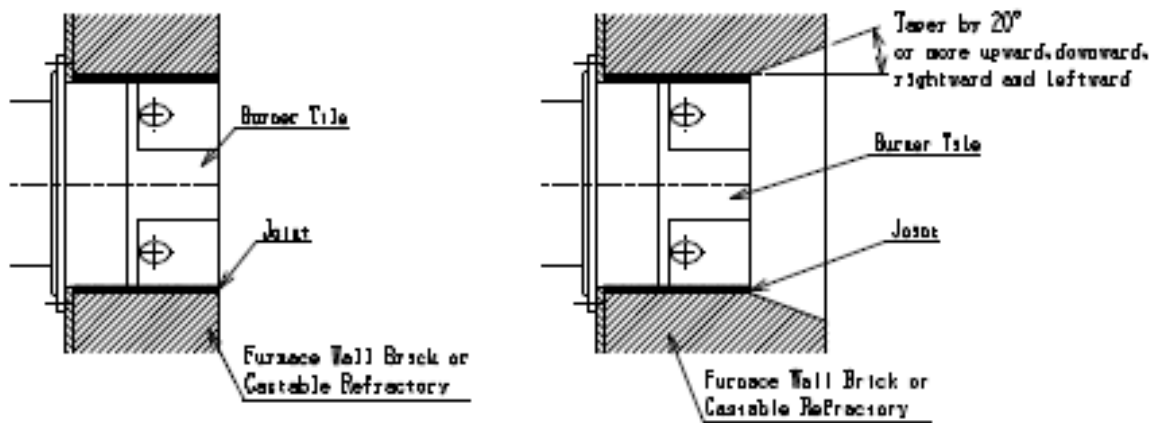
Type	Special Function	Electrical Entry	Indicator light	Wiring Type	Load Voltage		Auto Switch Model	Applicable load		
					DC	AC				
Solid State Auto Switch	—	Grommet	With light	3-wire(NPN)	24V	5V,12V	—	D-F59	IC Circuit	Relay, PLC
				3-wire(PNP)				D-F5P		
				2-wire				D-J59		
	2-color indication with diagnostic			3-wire(NPN)	24V	5V,12V	—	D-F59W	IC Circuit	
				3-wire(PNP)				D-F5PW		
				2-wire				D-J59W		
	With timer			4-wire(NPN)	—	5V,12V	—	D-F59F	IC Circuit	
Reed Auto Switch	—	Grommet	With light	3-wire(NPN)	—	5V	—	D-A56	IC Circuit	Relay, PLC
				2-wire	24V	12V	100V,200V	D-A54	—	
			200V or less				D-A64			
			—				D-A67	IC Circuit		
			2-color indication with diagnostic	With light	—	—	—	D-A59W	—	

Installation

- 1) When separating the burner tile from the pilot burner body, remove the body first.
- 2) When mounting the burner tile to the pilot burner body, confirm that the seal packing has been attached. Also, pay attention to the attachment direction of the seal packing. Note with care that the seal packing shape is different only for SRBO-100.



- 3) To facilitate the replacement of the heat storage body, mount so that the selector valve is vertically.
- 4) Back up the outer surface of the burner tile, particularly the lower portion of the outer surface, with fire brick, castable refractory or the like to prevent the burner tile from dropping.
- 5) When mounting the burner to the furnace body, fill the gap between the mounting port and the burner tile with fire mortar or the like for fixing.
- 6) Align the front surface of the burner tile with the wall surface of the furnace to be the same level. If the furnace wall is too thick, taper the burner tile from the front surface by 20° or more upward, downward, rightward and leftward.



- 7) The air inlet and exhaust gas outlet may be provided in the upper or lower position.
- 8) Provide a space behind the burner enough for pulling out the burner gun from the burner for the maintenance purpose.

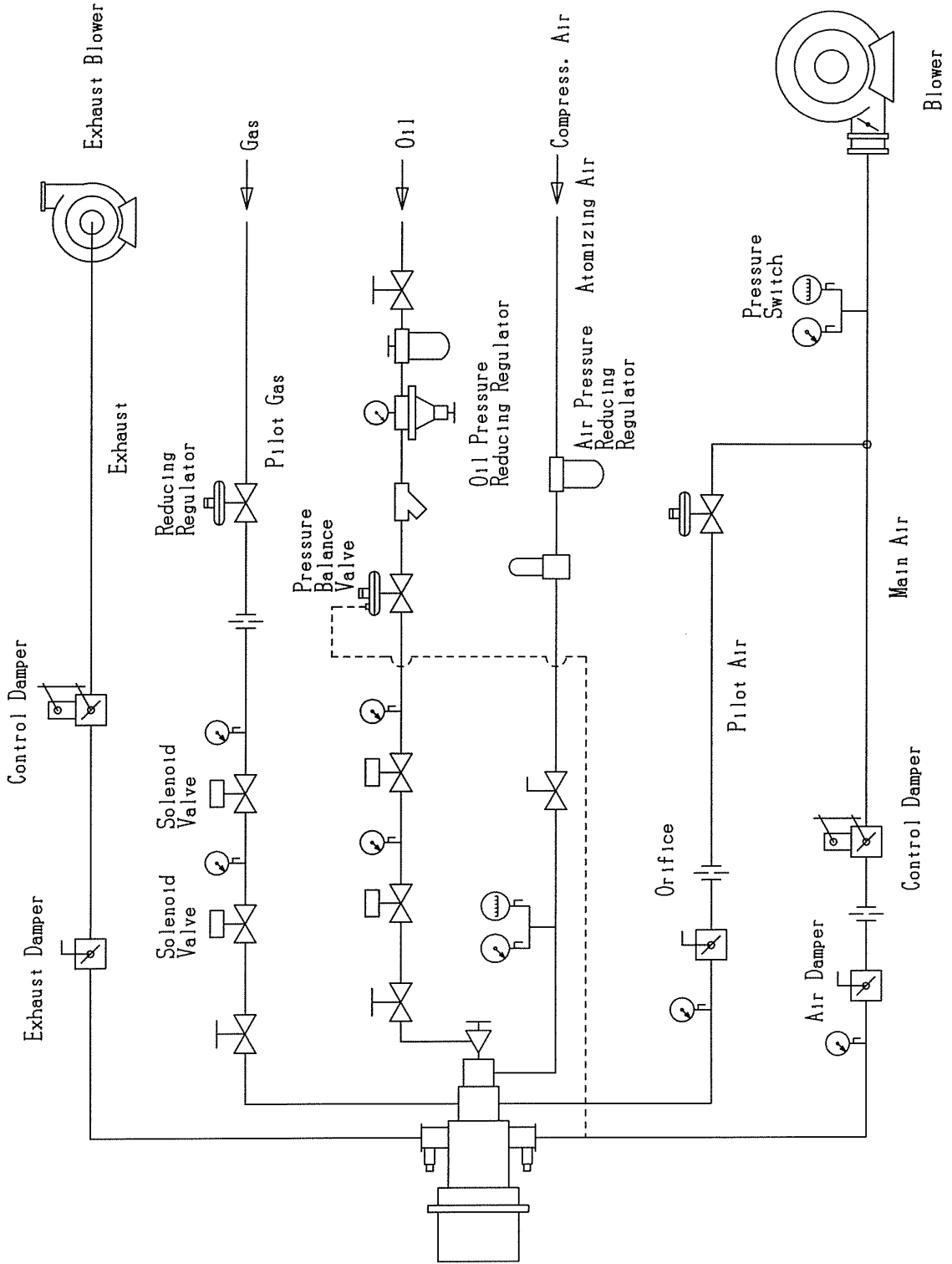
Piping

- 1) Direct good care to the inside of the pipe not to leave seal tape fractions, bond, cutting chips, etc. there which may cause malfunction of the solenoid valve, governor, valve, etc.
- 2) In connecting the pipes, provide pipe support in proper positions to prevent the application of any excess force.
- 3) Attach an MO type orifice flow meter to each piping. Also, provide a straight pipe segment that is as long as 5 times or more of the pipe diameter before and behind each orifice flow meter.
- 4) Use the air free from drain, mist, etc. for driving the actuator of the selector valve.
- 5) Since high-temperature gas containing a large amount of moisture passes through the exhaust side piping, it is advisable to take countermeasures against corrosion, such as draining.
- 6) Since the exhaust side piping is held at a high temperature, seclude the piping from the direct contact by human bodies.
- 7) In mounting the oil regulating valve, the butterfly damper, the orifice flow meter, etc., position them to be easy for adjustment.
- 8) The gas regulating valve and the butterfly damper should be lockable.
- 9) The flow direction of the orifice flow meter is fixed. Be careful not to turn around IN and OUT directions
- 10) Mount the gas solenoid valve and oil solenoid valve as close as possible to the burner inlet.

Valve Operation Timing

- 1) Selector valve
Set the selector valve to change over the valve operation timing at every 15 sec. For the air valve and the exhaust valve, be sure to turn ON/OFF them together, and never turn ON the air valve and turn OFF the outlet valve or vice versa.
- 2) Control valve
Control the valve operation timings of the air control valve and exhaust control valve so that they can synchronize with each other.

Flow sheet

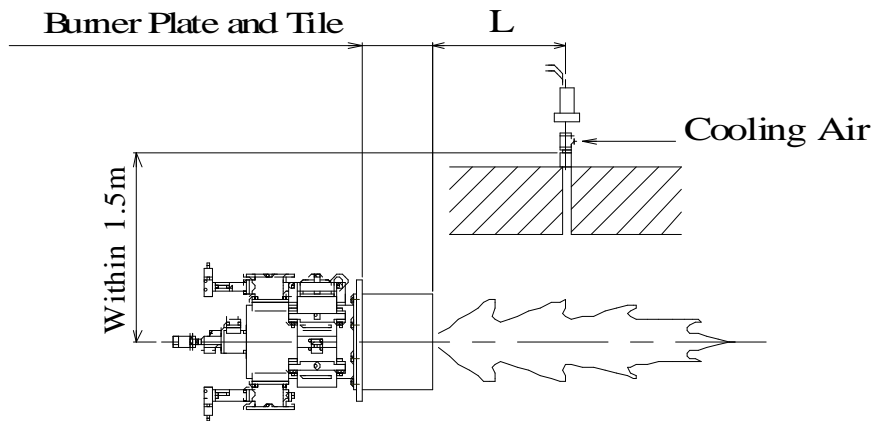


Main Flame Monitoring

Monitor the main flame from the below-specified position by using a high-sensitivity monitor.

Type	Distance of Burner Plate and Tile mm	Distance from the Tile End mm
SRBO-15	260	400
SRBO-25	300	400
SRBO-40	350	400
SRBO-60	384	400
SRBO-100	450	400

To prevent heat transfer from the furnace wall, air-purge from the mounting part of Ultra Vision. Set the distance from Ultra Vision to the flame monitoring position to within 1.5m.



Test Operation

Preparing

- 1) Confirm that all gas cocks and oil cocks are closed.
- 2) Check the gas piping and oil piping for leak with air or nitrogen gas.
- 3) Confirm that all instruments in each line of air and oil and gas can operate normally.
- 4) Confirm that gas and oil is in supply under the specified pressure and that the inside of the piping is being substituted.
- 5) Start the blower, and confirm that the pressure at the outlet is as specified.
- 6) Set the control damper to the maximum combustion position (6kPa) and the minimum combustion position (0.1 – 0.5kPa).
- 7) Adjust the exhaust damper to make the exhaust pressure to be negative equal to the air pressure for synchronization.
- 8) Fully open the control damper, and air-purge the inside of the furnace (aiming at approx. 3 times the volume of the furnace).
- 9) Set the control damper to the minimum combustion position.
- 10) Supply high-pressure air and electricity to the actuator of the selector valve, and set the changeover time to 15 sec.

Igniting

- 1) Confirm that the cock, solenoid valve and limiting valve in front of the burner are fully closed.
- 2) Fully open the pilot air cock, and adjust the regulating valve to set the pressure to 4kPa.
- 3) Measure the flow rate of the pilot air with the orifice flow meter.
- 4) Fully open the pilot gas cock, press the ignition button and ignite the pilot gas while gradually opening the gas regulating valve.
- 5) After the ignition is achieved, calculate the gas flow rate from the air flow rate to make the excess air ratio to 1.1, obtain the differential pressure of the orifice flow meter and set the gas regulating valve to the differential pressure. At this time, be sure to convert the specific gravity of the gas body.
- 6) Confirm the ignition behavior 2 or 3 times. Also, confirm the value of the flame detector.
- 7) Confirm that the solenoid valve of the main oil is open. Then, ignite the main burner while gradually opening the regurating cock.

Adjusting

- 1) After the ignition is achieved, fully open the control damper to the maximum combustion position.
- 2) Set the excess air ration to approx. 1.5, and raise the temperature to the working temperature. (Measure the flow rate with the air and oil flow meters, and set the flow rate accordingly with the regurating cock. As the furnace temperature rises, the excess air ratio lowers.)
- 3) When the temperature rises to near the working temperature, adjust the excess air ration to 1.2 to 1.3. (At this time, switch the temperature gauge mode from auto to manual and set the combustion to the maximum position.)
- 4) After the excess air ratio is set, set the control damper to the minimum combustion position and confirm the minimum combustion.

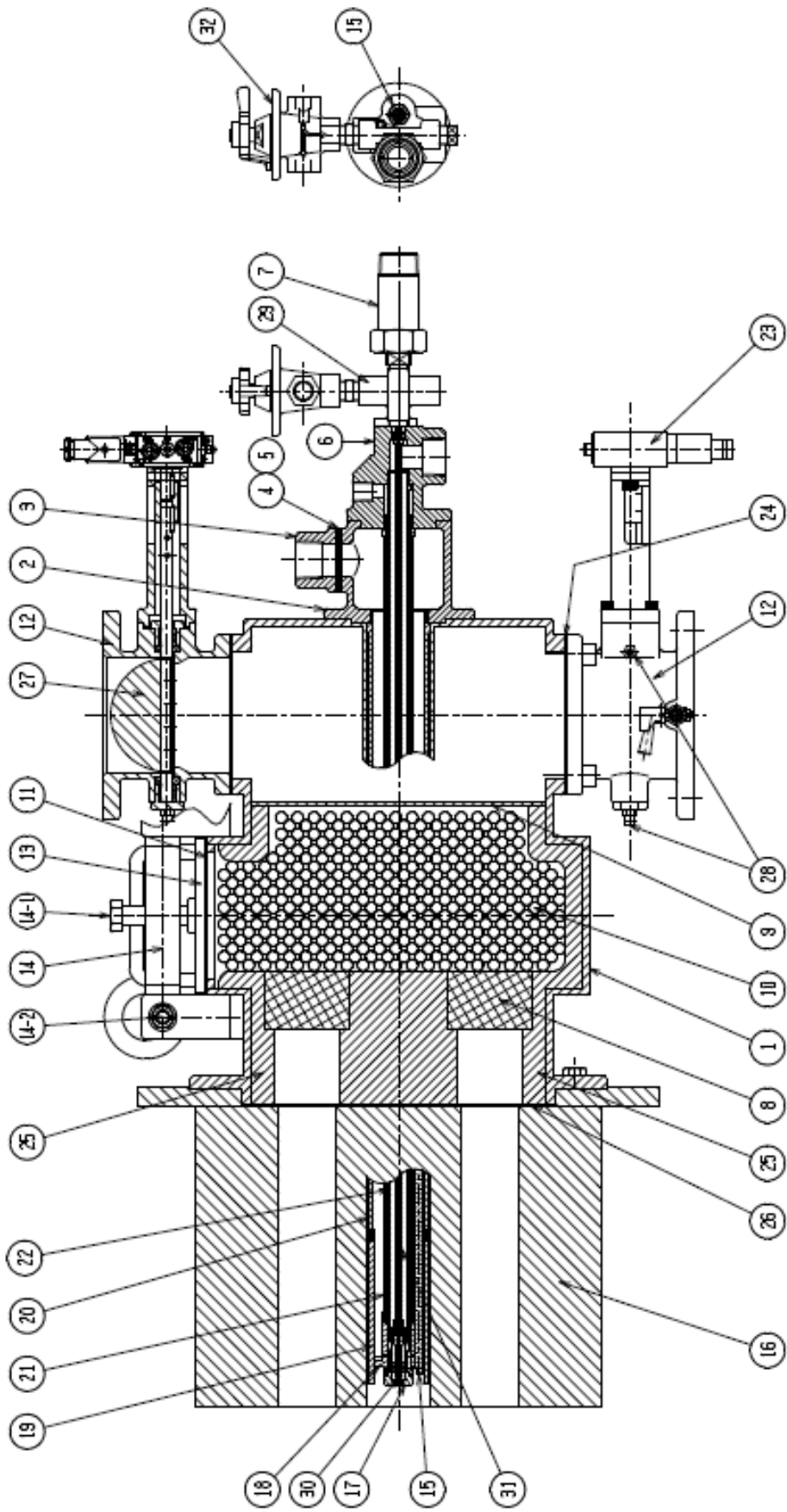
Inspection

- 1) Check the orifice differential pressure between air and oil flow, and if there is any deviation, readjust the differential pressure (semiannually or on a timely basis according to the status of use).
- 2) In starting the operation (with the furnace at a cold temperature), set the reference burner pressure appropriately, and record the combustion air differential pressure under that pressure. If the differential pressure lowers to 80% or less clean or replace the heat storage body. If the differential pressure rises to 110% or more, check or replace the selector valve.
- 3) Periodically check the flame condition and the glowing of the front panel, and check the sight hole for crack, etc. If any defect is found, immediately remedy the defect by replacing the defective parts or taking other measures.
- 4) Check Ultra Vision for contamination, signal, etc. (semiannually or so).
- 5) Check the bolts and nuts for looseness.
- 6) Check, clean or replace the filter of the combustion blower (weekly or so).
- 7) Check and clean the filter, mist separator, auto drain, etc, of the high-pressure air (semiannually or so).
- 8) Lubricate the selector valve with grease (periodically).
Use SUMICO LUBRICANTCO.,LTD.Sumitemp Grease NO.2 or an equivalent
- 9) Periodically check the movement and condition of the selector valve. If any defect is detected, replace the valve.
- 10) When replacing the ceramic balls of the heat storage body, be sure to check the trap. If a substantial crack or break is found, since the ceramic balls may escape through the trap, replace or repair the heat storage body.
- 11) If the pilot burner fails to ignite, check the spark plug. If the insulator is cracked or the insulator end portion is damaged or contaminated with carbon, clean the insulator or replace the spark plug.
- 12) Periodically check the manual valve and control valve of the exhaust line. Since exhaust gas contains a large quantity of moisture, corrosion due to moisture and resultant malfunction may be caused.
- 13) Periodically check the ceramic balls for clogging and the number of balls. If the balls are contaminated, clean them. If the balls are deficient, supply balls to cover the deficits.

Precautions

- 1) When the in-furnace temperature is 500°C or less, set the excess air ratio to 1.5 or more. (Otherwise, CO may be generated or accidental fire may be caused.)
- 2) Since about 20% of the exhaust is discharged from the furnace, be sure to provide a gas flue and a damper to the furnace.
- 3) Stop the combustion blower after the in-furnace temperature lowers to 500°C or less to protect the nozzle. Also, when the blower is in operation, do not stop the actuator of the selector valve.
- 4) When you have to come close to the burner or its periphery or touch the burner or the piping for the purpose of checking, etc., since their temperatures are high, be sure to wear protective gloves, a protective cap, protective glasses, etc.
- 5) Design the piping with allowance enough to prevent pressure loss or drift.
- 6) Take countermeasures against noise, such as attaching a noise filter or the like, as need arises.

Structural drawing



1	Burner Body	1	13	Lid	6	23	Air Actuator	2
2	Pilot Air Body	1	14	Clamping Bar	6	24	Selector Valve Packing	2
3	Orifice Holder	1	14-1	Set Bolt	6	25	Insulating Materials	-
4	Pilot Orifice	1	14-2	Crank Bolt	12	26	Seal Packing	1
5	Orifice Packing	2	15	Ignition Plug	1	27	Damper	2
6	Atomizing-Air Body	1	16	Burner Plate Tile	1	28	Grease Nipple	4
7	Ultra Adapter	1	17	Atomizer	1	29	Valve Joint	1
8	Trap	1	18	Pilot Nozzle	1	30	Oil Nozzle	1
9	Punching Metal	2	19	Burner Head	1	31	Oil Pipe	1
10	Ceramic Ball	-	20	Pilot Air Pipe	1	32	Oil Regulating Cock	1
11	Gasket	6	21	Pilot Gas Pipe	1			
12	Selector Valve	2	22	Atomize Pipe	1			

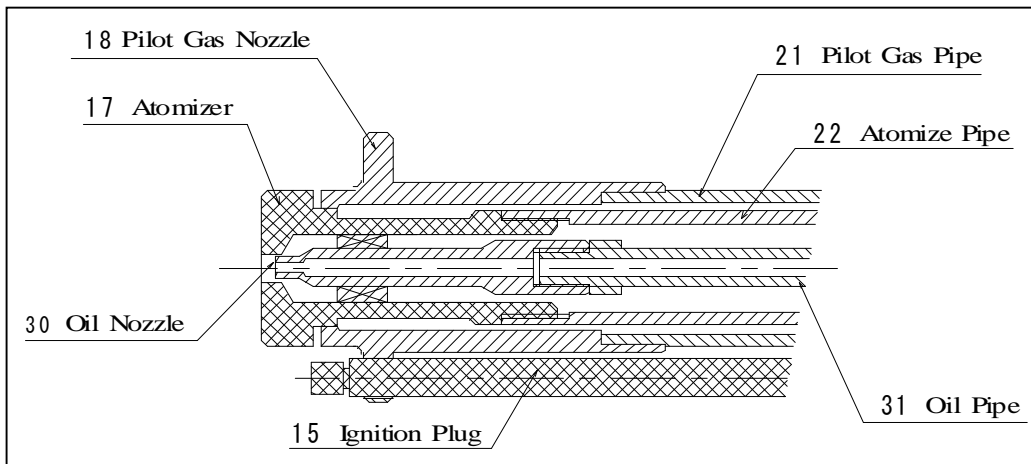
Disassembly

※When disassemble is made, wait until the furnace cools down. Also, be sure to wear protective gloves.

- 1) Confirm that the power supply to the combustion blower and other power supplies are OFF.
- 2) Confirm that all gas cocks and oil cocks are closed.
- 3) Loosen the union, etc. of the gas piping.
- 4) Remove the bolts that fix the selector valve 12 to the air flange, and remove the air flange. At this time, be careful not to lose the packing.
- 5) Remove the air tube of the air actuator 23 and the DIN terminal of the solenoid valve.
- 6) Remove the bolts of the selector valve, and remove the selector valve and the packing.
- 7) Remove the gas body 6, and pull out the gas body, the atomize pipe 22, the pilot gas pipe 21, etc. At this time, be careful not to break the insulator of the spark plug.
- 8) Remove the bolts of the pilot air body 2, and pull out the pilot air pile 20, etc.
- 9) Remove the burner body from the burner plate 16. After the removal, be sure to replace the seal packing 26. (Be sure to do this after removing the pilot burner unit.)
- 10) In reassembling, be sure to apply burn-in preventing agent to the bolts and the thread portions.

Nozzle Replacement

- 1) Remove the ignition plug 15. (Since this is vulnerable, it should be removed first.)



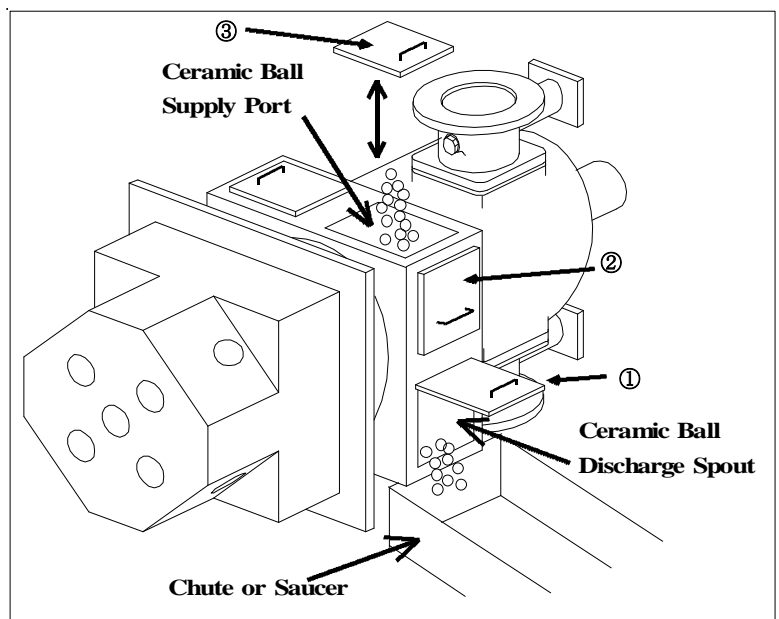
- 2) Loosen the valve joint 29, and pull out the oil nozzle 30 and the oil pipe 31
- 3) Remove the Atomizer 17.
- 4) Remove the pilot nozzle 18 and the pilot gas pipe 21. These two have been welded into an integrated component.
- 5) When reassemble is made, use the disassembly procedures by reversing the order. Be sure to apply burn-in preventive agent to the threaded portions.

- 6) When reassembling the Atomizer 17 and the pilot nozzle 18, confirm that the ignition plug mounting positions of the gas body 6 and pilot nozzle 18 are aligned straight along the axial line. (Be careful not to slant them.)
- 7) Mount the ignition plug 15, and confirm the spark condition. Then, mount the nozzle unit. At this time, be careful not to damage the ignition plug.
- 8) Mount the nozzle unit. At this time, be careful not to damage the ignition plug.

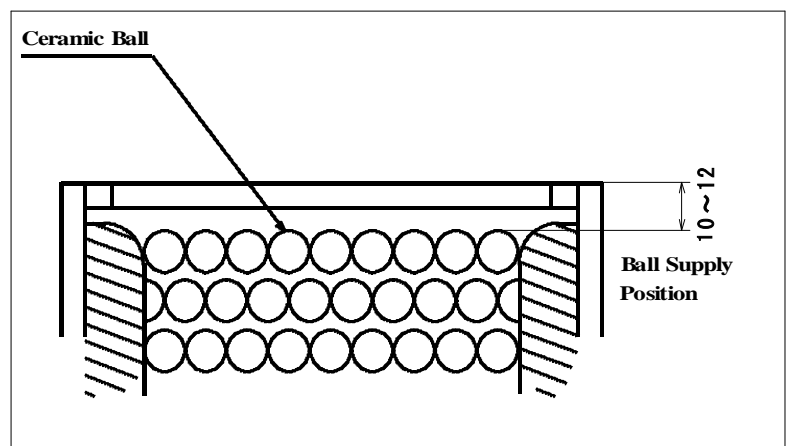
Ceramic Ball Replacement

Replacement Instruction Drawings

- 1) Place a chute or a saucer under the lid ①.
- 2) Loosen the tap bolt that fixes the lid ①, and remove one of the 2 crank bolts.
- 3) Pull out the crank bar to open the lid, and the balls will come out. At this time, beware of the ball temperature that may be very high.
- 4) Then, open the lid ② in the same way, and remove the remaining balls.
- 5) Check the trap from the inspection windows of the lids ① and ②. If an excessive crack or break is found, since the ceramic balls may escape through the trap, replace or repair the heat storage body.



- 6) If no irregularity is found, close the lids ① and ② to the original positions and firmly fix them with the crank bars and the tap bolts. At this time, do not forget about inserting the packing.
- 7) Open the upper lid ③ in the same way.
- 8) Supply new balls from the lid ③. Supply balls up to 10 to 12mm from the top surface as shown on the right figure. If the lid is floating, never press it.
- 9) Close the lid ③ in the same way as closing the lids ① and ②. Now, the ball replacement on one side is over.



- 10) Replace the balls on the other side in the same way.
- 11) If there are any removed balls cracked or broken, take them away. The remaining balls can be reused after washing and drying.
- 12) After 2 weeks or one month after the ball replacement, check the number of balls again. If the number of balls is deficient, supply balls to cover the deficits.

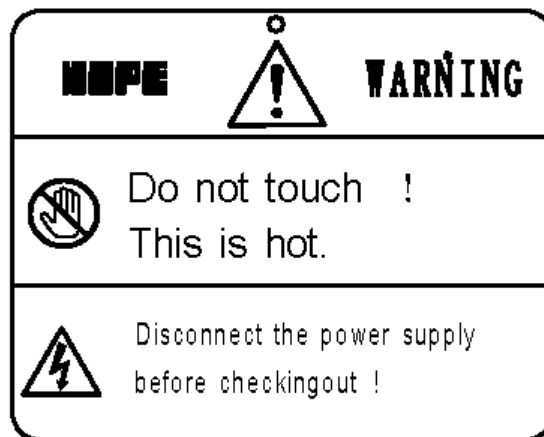
Spare Parts

There are consumables and replacements as listed below. It is recommended to make them ready as spare parts for use on site.

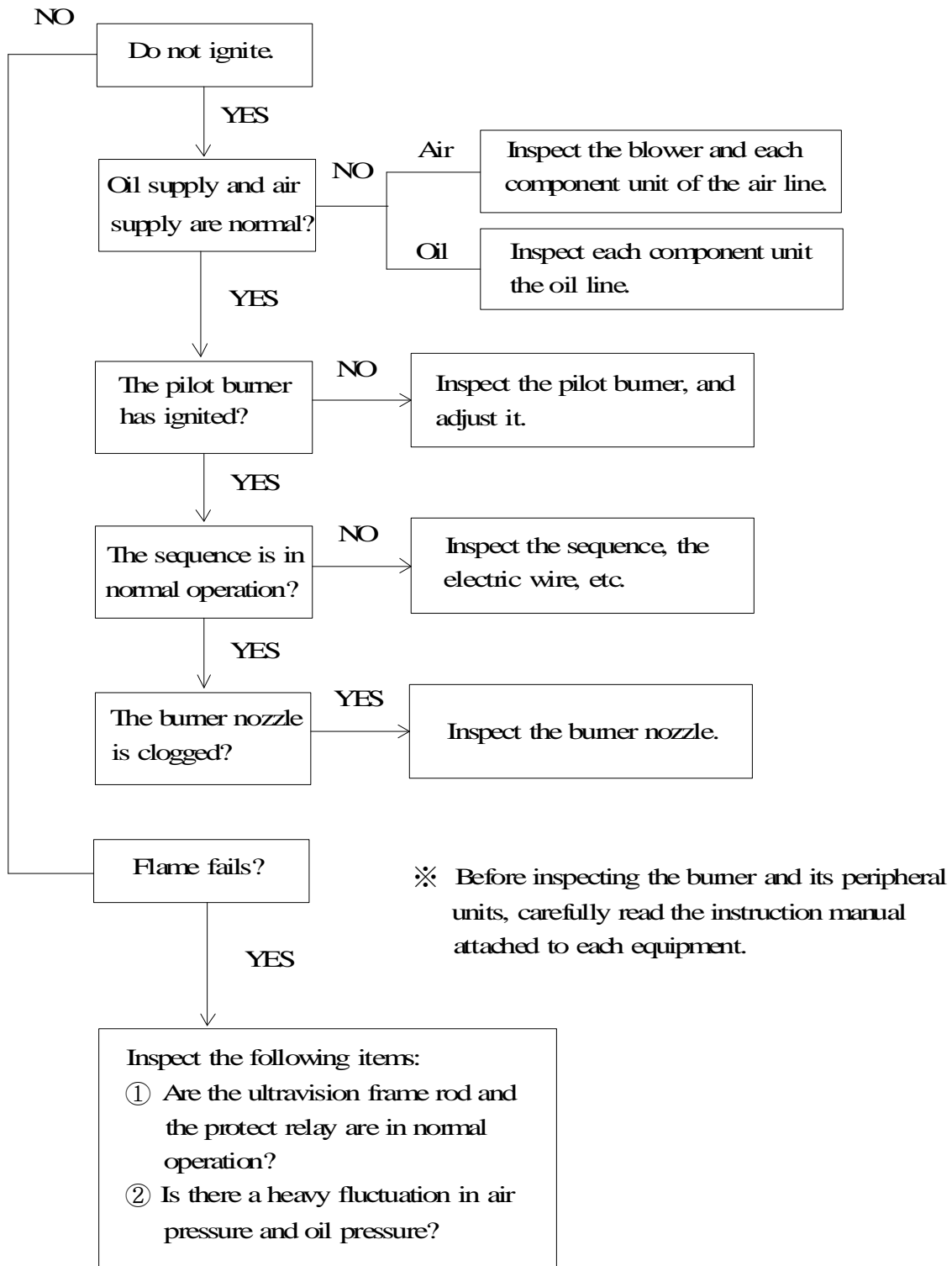
- 1) Ceramic Ball
- 2) Selector Valve (These are commonly used for both combustion air and exhaust.)
- 3) Ignition Plug
- 4) Packing of various types
- 5) Oil Nozzle • Pilot Nozzle Atomizer
- 6) Pipes including Oil pipes

Warning Plate

When the installation construction has been completed, check to confirm that the warning plate shown below is firmly attached to the burner body. If the warning plate is lost, immediately contact our sales department for instructions.



Troubleshooting



※ If there is any questions, contact our sale department.