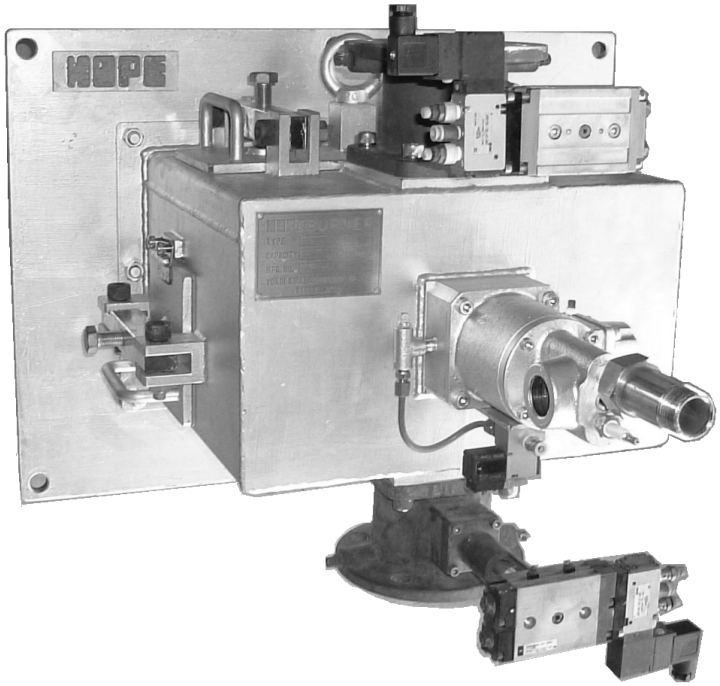
HG0T063E

HOPE C R U

CRUCIBLE SELF REGENERATIVE GAS BURNER

HANDLING MANURLS



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Thank you for your selection of CRUCIBLE SELF REGENERATIVE GAS BURNER Type CRU 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

Our CRU Crucible Self-Regenerative Gas Burner is a self-regenerative gas burner we have newly developed for crucibles.
To enable combustion in a ring-shaped narrow space, the direction of the combustion flame is alternately switched to clockwise/counterclockwise during the combustion. As the flame does not contact the crucible directly, the life of the crucible is extended and the temperature distribution is improved.
Although this burner was developed for crucibles, it can be also applicable to other crucible-shaped furnaces (e.g., pit-type furnaces, bell-type furnaces) with the expectations of the same effect.

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 CO_2 emission can be reduced substantially.
3) Since there is no portion of extremely high temperature within the flame, very favorable temperature distribution can be obtained.
4) Since highly luminous flame is obtained, the radiant heat transfer effect can be improved.
5) The replacement/cleaning of the regenerator can be conducted easily.
6) As the flame does not contact the crucible directly, the life of the crucible is extended.
7) As the flame direction is alternately switched to clockwise/counterclockwise, the local heat is prevented and therefore the temperature distribution is improved.
8) As the pressure loss of the burner is small, no exhaust fan is required, which leads to cost reduction.

Specification

Type	Main Cap kw	Pilot Cap. kw	Main Air Flow N ㎥/h	Pilot Air Flow N ㎥/h	Assist Air Flow N ㎥/h
CRU-10	100	7	200	7.3	2.7
CRU-20	180	7	320	7.3	5.0

Standard Pressure

Main air pressure	4kPa(CRU-10), 5kPa(CRU-20)
Gas pressure	10kPa
Pilot Gas pressure	6kPa
Air pressure for driving the actuator	0.3MPa
Assist Air	0.1MPa

Weight

Type	Burner Mass kg	Ceramics Ball Masskg	Ceramics Ball Size Inch
CRU-10	250	50	1/2
CRU-20	410	90	1/2

Ceramic balls are packaged in a paper bag, which weighs 25kg. Order placement is acceptable in units of 25kg.

Actuator

Burner Type	CRU-10	CRU-20
Actuator Type	CDRQ2B20－01	CDRQ2B40－01
Air consumption　l/min	0.2×2	0.6×2

Standard Pressure　0.3　MPa

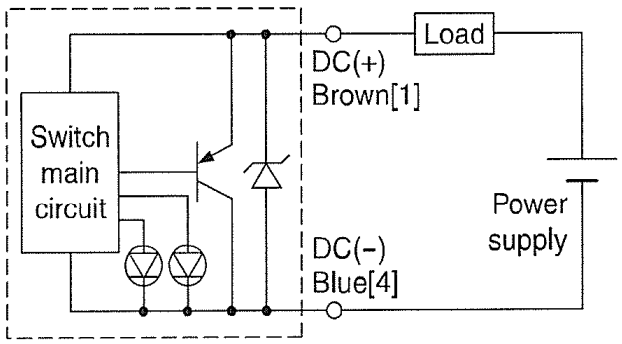
Auto Switch

Type	Special function	Electrical entry	Indicator light	Wiring type	Load voltage			Auto switch model	Applicable load
					DC		AC		
Solid State Auto Switch	—	Grommet	With indicator light	2-wire	24V	12V	—	D-M9BW	Relay,PLC

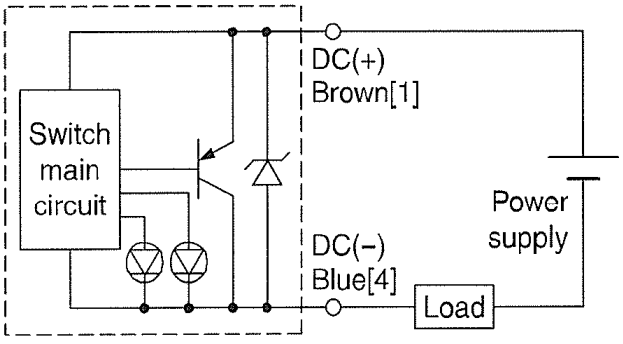
The auto switch is attached to the actuator for operational detection.
The length of the lead wire is 0.5m.

Auto switch Internal circuit

D-M9BW (V)（Sink input mode）



D-M9BW (V)　(Source input mode)



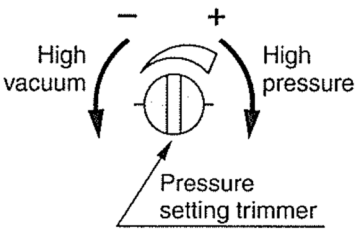
*: The number marked on each lead wire color shows the pin number of pre-wired connector.

Pressure switch for assist air

Set the pressure switch by using the following method so that it can be ON when assist air is supplied and OFF when assist air is not supplied:

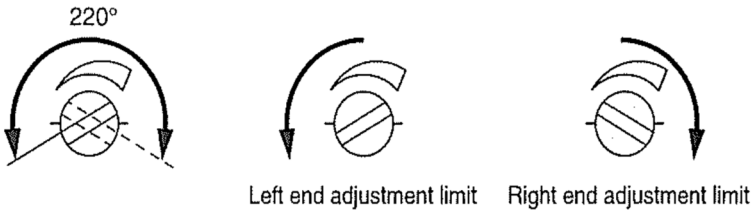
Pressure Switch Calibration

- Use the pressure setting trimmer to set ON pressure.
- Rotate clockwise to increase the set pressure. For setting vacuum, rotate counterclockwise.
- In the event of setting, use a flat head screwdriver suited for the groove of a trimmer, and rotate it lightly with a finger tip.



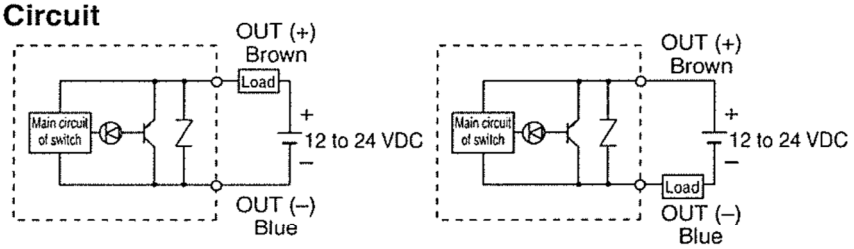
Trimmer

Rotation angle of the trimmer is 220°.
There is a stop provided to prevent the trimmer from rotating beyond its limits. Rotation beyond the limit can damage the trimmer. Adjust the trimmer gently within the rotation angle.

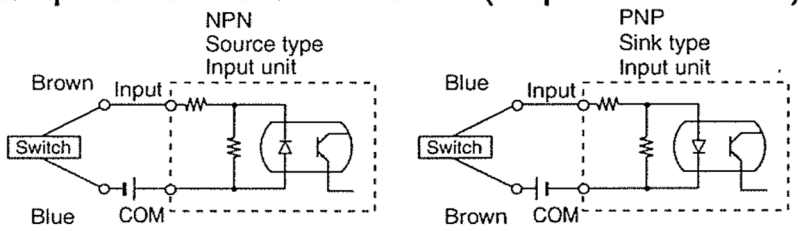


Internal Circuit/Wiring

Circuit

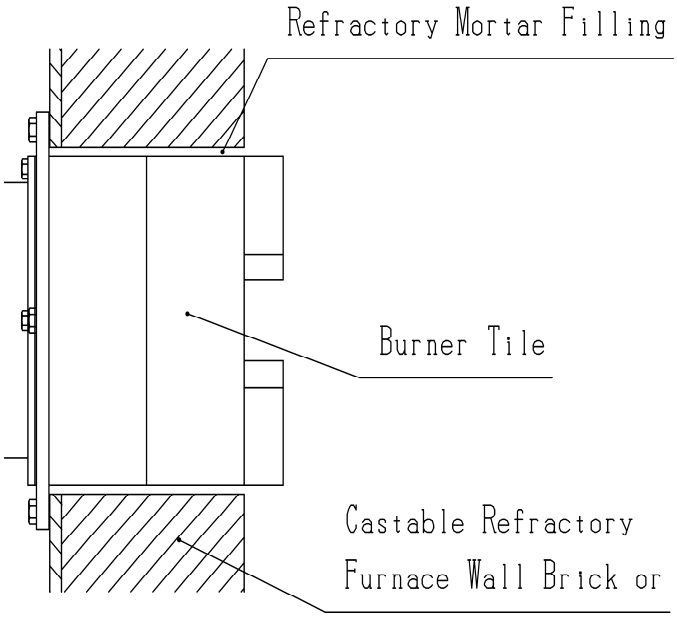


Example of connection with a PLC (Sequence controller)



Installation

1) When separating the burner tile from the pilot burner body, remove the body first.
2) To facilitate the replacement of the heat storage body, mount so that the selector valve is vertically.
3) 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.
4) 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.
5) Install the burner so that air can be taken in from below and air is exhausted from above.
6) Provide a space behind the burner enough for pulling out the burner gun from the burner for the maintenance purpose.

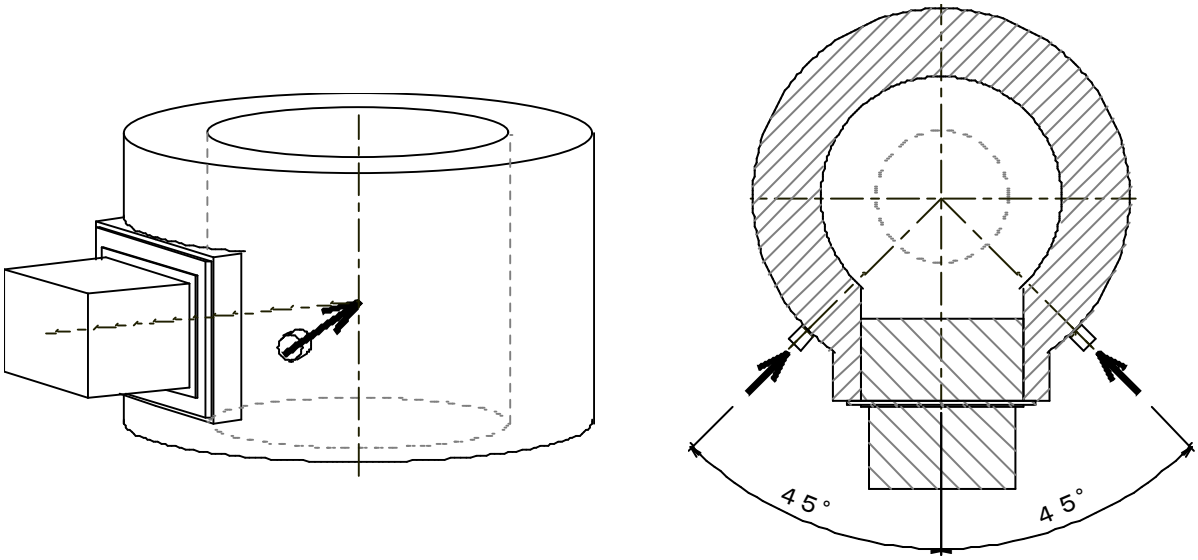


Piping

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 and assist air 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 gas 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 as close as possible to the burner inlet.

Main Flame Monitoring

In inspecting the main flame, view the flame in the arrow directions from the 2 inspection holes as shown in the below figure.



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.

Valve Operation Timing

●Selector valve

Operate the selector valve at every 15 sec. Be sure to turn ON/OFF the power supply to both the intake valve and the exhaust valve together. Normally, at the time of combustion, never turn the intake valve and the exhaust valve ON and OFF, respectively, or reversely OFF and ON, respectively. However, at the time of temperature control, this turning ON/OFF is not simultaneous for these two valves.

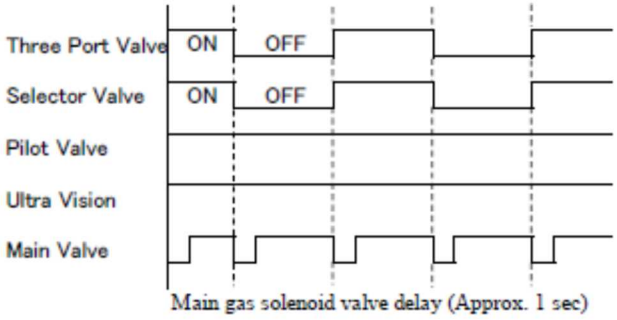
●3-port valve for assist air

Turn ON/OFF this valve at every 15 sec in the same way as the selector valve.

●Operation of the main gas solenoid valve when the crucible temperature is low

As a characteristic of the selector valve, when the selector valve is switched, the "gas-rich" phenomenon occurs, making the combustion unstable. To counter this problem, close the main gas solenoid valve at the same timing as that of the selector valve and 3-port valve, and open the valve with a delay of one sec **for the initial 10 min from combustion start or until the crucible temperature goes up to 500℃** only as a guide.

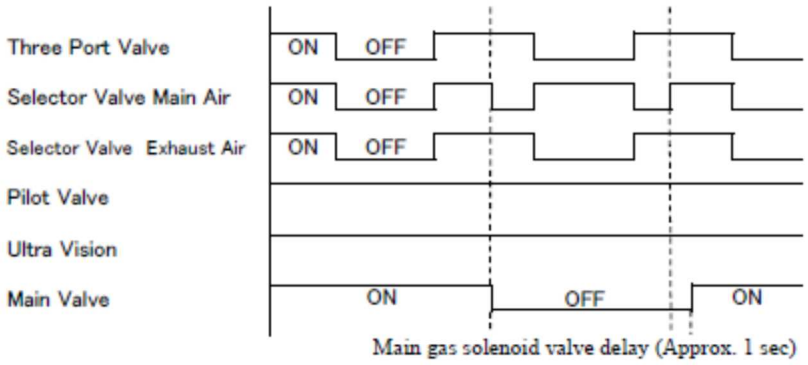
Thereafter, perform the normal main valve operation (always opened).



●Operation of the selector valve and main gas solenoid valve at the time of temperature control

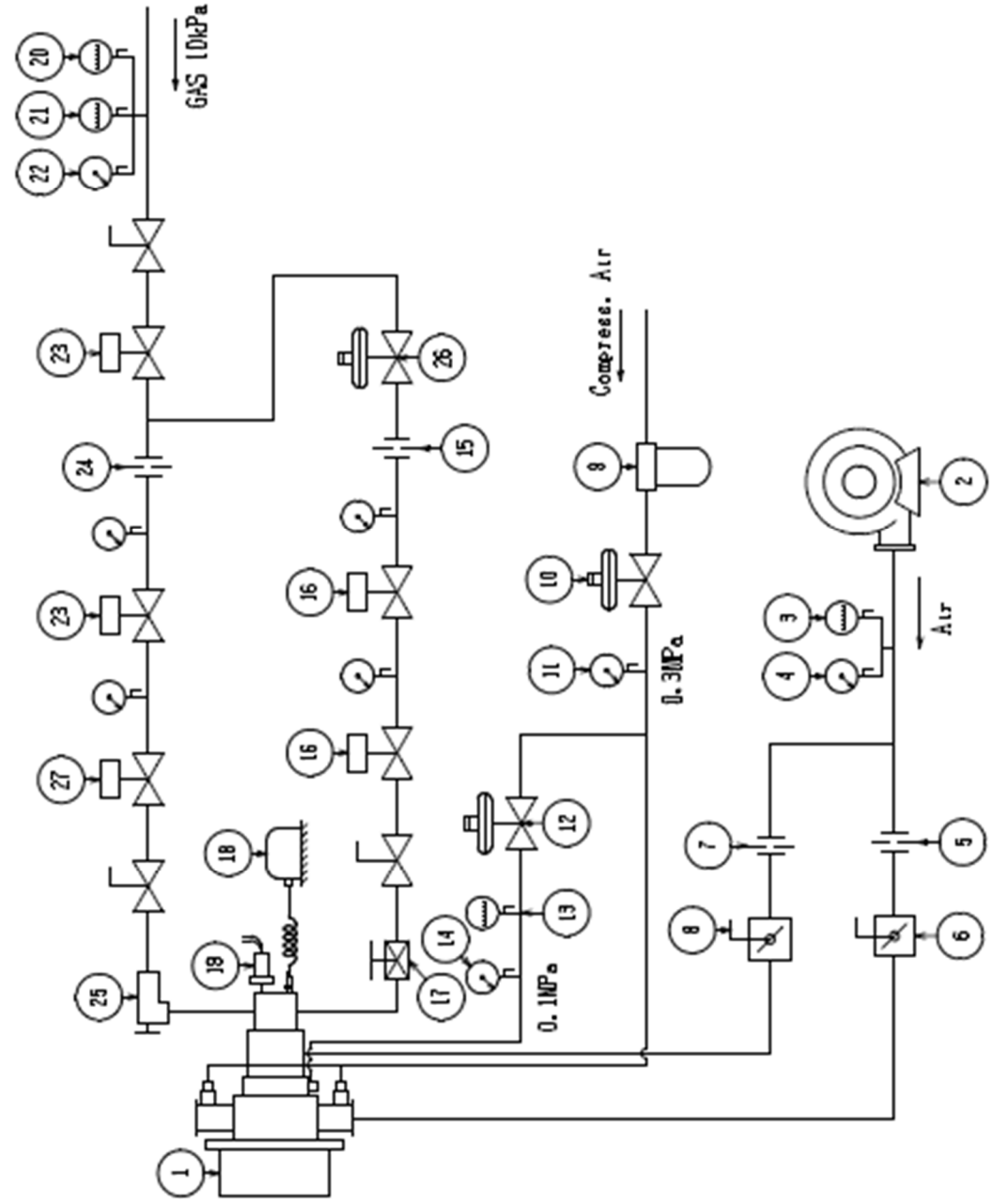
To minimize the fall of the crucible temperature when the main air enters the crucible at the time of temperature control (gas OFF), operate the intake valve alone in reverse to the exhaust valve and the 3-port valve (Set the intake valve OFF [ON] when the exhaust valve and the 3-port valve are ON [OFF]).

If the selector valve is switched upon the opening of the main gas solenoid valve, as this cause the "gas-rich" phenomenon, delay the timing of the main gas solenoid valve open by one sec.



Flow sheet

27	Solenoid valve (Slow-Open Type)
26	Pressure Reducing Valve
25	Limiting Valve
24	Orifice Flow Meter
23	Solenoid Valve
22	pressure Gauge
21	Pressure Switch HIGH
20	Pressure Switch LOW
19	Ultra Vision
18	Trans Fomer
17	Small Valve
16	Solenoid valve
15	Orifice Flow Meter
14	Pressure Gauge
13	Pressure Switch
12	Air Pressure Reducing Valve
11	Pressure Gauge
10	Air Pressure Reducing Valve
9	Filter
8	Damper
7	Orifice Flow Meter
6	Damper
5	Orifice Flow Meter
4	Pressure Gauge
3	Pressure Switch
2	Blower
1	CPU



Test Operation

Preparing

1） Confirm that all gas cocks are closed.
2） Check the gas piping for leak with air or nitrogen gas.
3） Confirm that all instruments in each line of air and gas can operate normally.
4） Confirm that gas 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 burner air pressure to 2.5kPa by using the air butterfly damper.
7） Supply high-pressure air and power to the selector valve actuator and the 3-port valve for assist air, and set the switching 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 2kPa.
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 gas is open. Then, ignite the main burner while gradually opening the limiting valve.

Adjusting

1） Set the excess air ration to approx. 1.6, and raise the temperature to the working temperature. (Measure the flow rate with the air and gas orifice flow meters, and set the flow rate accordingly with the limiting valve. As the furnace temperature rises, the excess air ratio lowers.)
2） When the temperature rises to near the operating temperature, adjust the excess air ratio to approx. 1.3. At the temperature near the operating temperature, set the burner pressure to 4 kPa (CRU-10) or 5kPa (CRU-20).
3） To measure the gas flow rate with the orifice flow rate in the same way as the measurement of the pilot gas flow rate, convert the specific gravity of the gas body.

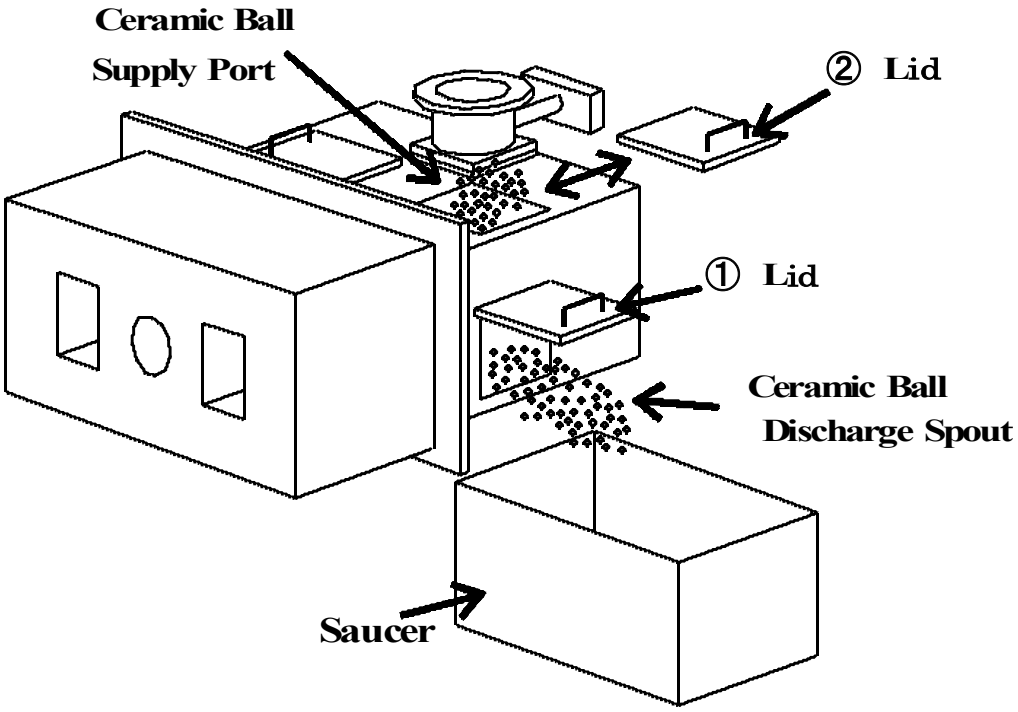
Inspection

1) Check the orifice differential pressure between air and gas, 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.

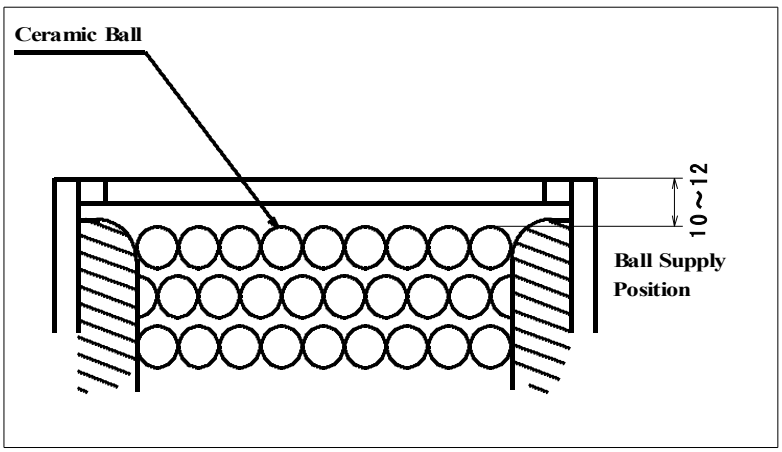
Precautions

1) When the in-furnace temperature is 500℃ or less, set the excess air ratio to 1.5 or more. (Otherwise, CO may be generated or accidental fire may be caused.)
2) Stop the combustion blower after the in-furnace temperature lowers to 500℃ or less to protect the nozzle. Also, when the blower is in operation, do not stop the actuator of the selector valve.
3) 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.
4) Design the piping with allowance enough to prevent pressure loss or drift.
5) Take countermeasures against noise, such as attaching a noise filter or the like, as need arises.

Ceramic Ball Replacement



1） Place 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） 4) Inspect the internal strainer from the ceramic ball discharge opening. If a significant crack is recognized in the strainer, replace it.
5） If no irregularity is found, close the lids ① 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.
6） Open the upper lid ② in the same way.
7） Supply new balls from the lid ②. 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.



8） Close the lid ② in the same way as closing the lids ①. Now, the ball replacement on one side is over.
9） Replace the balls on the other side in the same way.
10） If there are any removed balls cracked or broken, take them away. The remaining balls can be reused after washing and drying.
11） 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.

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 are closed.
3） Loosen the union, etc. of the gas piping.
4） Remove the bolts that fix the selector valve 6 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 6 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） Take out the UV tube from the ultra adapter ㉒.
8） Remove the plug cap from the spark plug.
9） Remove the spark plug while directing care to the spark plug not to break its insulator when extracting it.
10） Remove the bolt from the gas body ⑰, and extract the gas body, the main gas pile ⑳, the pilot gas pipe ⑱, etc.
11） Remove the bolt from the pilot air body ⑫, and extract the pilot air pipe ⑮, etc.
12） Extract the assist air body ⑦, the assist air pipe ⑩ and the assist air nozzle ⑪. These components come off upon the removal of the bolt from the pilot air body.
13） Take out the ceramic balls. For the method of taking them out, refer to “Replacement of Ceramic Balls” on P. 12. (When the burner body is removed, be sure to take out the ceramic balls first.)
14） Remove the burner body ④ from the burner plate tile①. When the burner body is removed, be sure to replace the seal packing ③. (Be sure to do this after removing the pilot burner unit.)
15） In reassembling, be sure to apply burn-in preventing agent to the bolts and the thread portions.

Pilot Nozzle Replacement

1） Remove the ignition plug 23. (Since this is vulnerable, it should be removed first.)
2） Remove the nozzle unit. (Refer to the drawing.)
3） Remove the gas nozzle 21.
4） Remove the pilot nozzle 19 and the pilot gas pipe 18. 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） Mount the ignition plug 23, and confirm the spark condition. Then, mount the nozzle unit. At this time, be careful not to damage the ignition plug.
7） Mount the nozzle unit. At this time, be careful not to damage the ignition plug.

Assist Air Nozzle Replacement

The assist air body ⑦, the assist air pile ⑩ and the assist air nozzle ⑪ are welded together into one unit. When the bolt is removed from the pilot air body, they come off. Replace them if it is necessary according to the extent of damage.

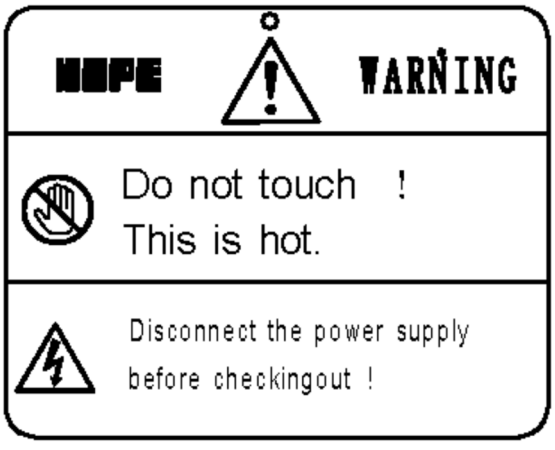
Spare Parts

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

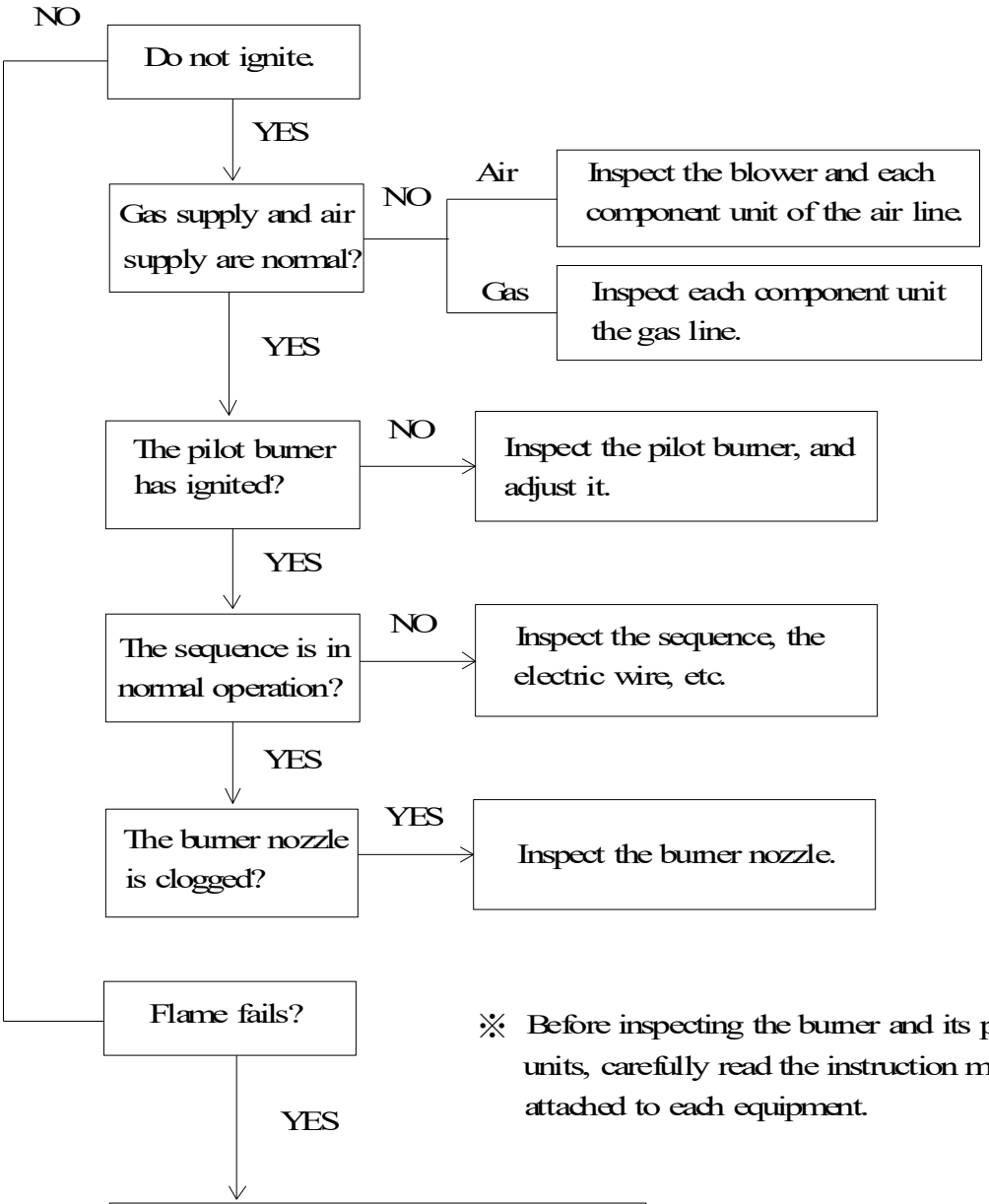
1） Ceramic Ball
2） Selector Valve (These are commonly used for both combustion air and exhaust.)
3） Ignition Plug
4） Packing of various types
5） Burner gun … 1 set
6） Assist air parts … 1 set

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.



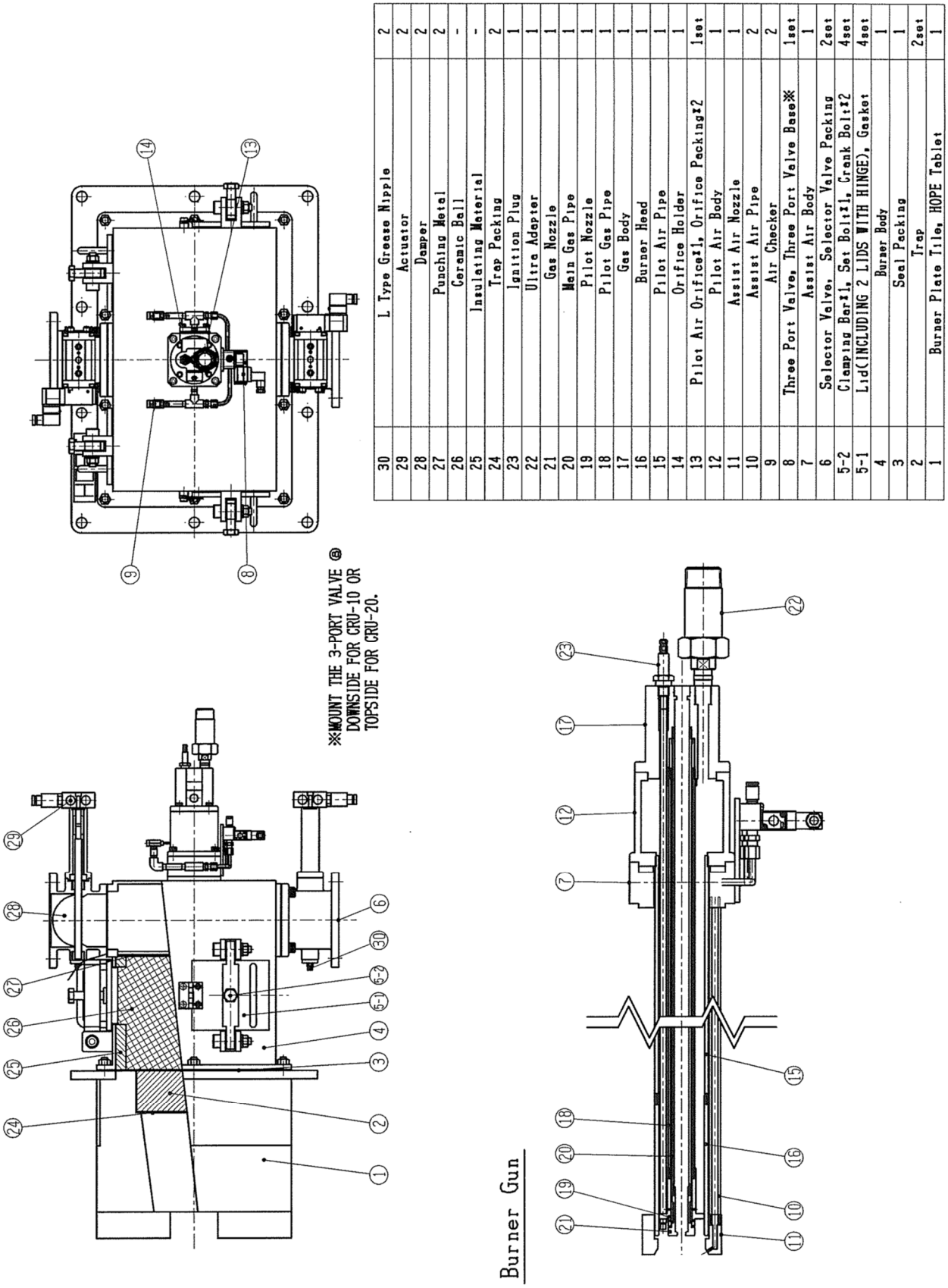
Troubleshooting



※ Before inspecting the burner and its peripheral units, carefully read the instruction manual attached to each equipment.

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

Structural drawing



30	L Type Grease Nipple	2
29	Actuator	2
28	Damper	2
27	Punching Metal	2
26	Ceramic Ball	-
25	Insulating Meterial	-
24	Trap Packing	2
23	Ignition Plug	1
22	Ultra Adapter	1
21	Gas Nozzle	1
20	Main Gas Pipe	1
19	Pilot Nozzle	1
18	Pilot Gas Pipe	1
17	Gas Body	1
16	Burner Head	1
15	Pilot Air Pipe	1
14	Orifice Holder	1
13	Pilot Air Orifice※1, Orifice Packing※2	1set
12	Pilot Air Body	1
11	Assist Air Nozzle	1
10	Assist Air Pipe	2
9	Air Checker	2
8	Three Port Valve, Three Port Valve Base※	1set
7	Assist Air Body	1
6	Selector Valve, Selector Valve Packing	2set
5-2	Clamping Bar※1, Set Bolt※1, Crank Bolt※2	4set
5-1	Lid(INCLUDING 2 LIDS WITH HINGE), Gasket	4set
4	Burner Body	1
3	Seal Packing	1
2	Trap	2set
1	Burner Plate Tile, HOPE Tablet	1