

## PART III SERVICE INSTRUCTIONS FOR ALL MODELS

### INTRODUCTION

CO-RAY-VAC burners are carburetor-like devices in which the vacuum developed by the flue exhauster (vacuum pump) induces a flow of fuel gas and air in the correct ratio for maximum combustion efficiency. The normal vacuum of 2" - 3" w.c. is therefore necessary for proper operation.

### CHECKING AND SETTING THE VACUUM. (See Diagram 33, page 36)

- A. Allow system to operate at least 1/2 hour.
- B. Check the vacuum at all end burners. Use a manometer or a vacuum gauge calibrated in inches w.c. (water column). All readings should be between 2" and 3" w.c.
- C. Vacuum is controlled by means of a damper in the vacuum pump inlet and in many systems, a damper in one or more of the branches of the system. Adjust as follows:
  1. If overall vacuum is too high, adjust the pump damper to get 2" - 3" w.c.
  2. If any branch is abnormally low or high, adjust the branch damper for proper vacuum.
  3. If a branch is too high and has no damper, it may be necessary to install one.
  4. If a branch that has no damper has low vacuum, and no apparent cause, it may be possible to open the pump damper to raise the system vacuum, then if necessary, reduce vacuum in other branches by closing branch dampers.
- D. If system vacuum is low, below 2" w.c., check the following:
  1. Branch dampers closed.
  2. Pump damper closed.
  3. Pump rotation wrong.
  4. Pump speed not 3450 RPM (incorrect wiring, wrong replacement motor)
  5. Pump impeller loose or defective.
  6. Blockage in pump discharge. (Bird's nest, etc.)
  7. Motor improperly wired for applied voltage.
  8. Air leaks in system at couplings, pump inlet boot, or end vent plate.
  9. Blockage in tubing system.
  10. Improper pitch, allowing water blockage.
  11. Condensate trap dry.
- E. If cause cannot be found above, consult the Roberts-Gordon representative. It may be necessary to check the system design for excess loading or insufficient tubing ahead of the vacuum pump to provide necessary cooling of flue gases.

### CONTROL PANEL OPERATION 013-123-01, 02 & 03

#### START-UP (SEE DIAGRAM 19A or 20A)

1. Thermostats make to complete circuit from transformer to zone relay coil.
2. Zone relay contacts 1-3 and 4-6 close, energizing vacuum pump motor (and combustion air blower if used).
3. When up to speed, motor interlock switch closes, energizing coil B2 which closes contacts 4-6 on relay B2 to start timing cycle. System is now in "pre-purge."
4. After 30-60 seconds in pre-purge mode, timer (904-262) energizes coil B1 which closes contacts 1-3 and 4-6 of relay B1.
5. — Contacts 1-3 of relay B1 close to provide an additional circuit to energize vacuum pump motor.  
— Contacts 4-5 of relay B1 supply power to all burners in the zones in which the thermostats are calling for heat.
6. When pilot thermal sensor is hot, the pilot switch closes and energizes the burner valve. Burner is now firing at rate and this flame is visible through the view port on the combustion chamber.

## SHUT-DOWN

1. When the last thermostat calling for heat is satisfied and opens, this de-energizes the zone relay and timer.
2. Zone relay contacts 1-3 and 4-6 open shutting down burner immediately. The vacuum pump motor is still energized through contacts 1-3 in relay B1.
3. Timer begins "post purge" count down of 30-60 seconds before de-energizing coil B1.
4. B1 relay contacts 4-6 open de-energizing motor. System now ready for next duty cycle.

With single fuel burners as shown in Diagram 19, the CO-RAY-VAC control panel has 4 zone relays, each controlled by a thermostat with all zone relay contacts 3-1 in parallel, and all 6-4 contacts in parallel, thus any thermostat calling for heat will start the vacuum pump, which will stay on until the last thermostat is satisfied. With dual fuel burners there are 2 or 3 zones available (See Diagram 20).

## OPERATION UNIQUE TO SINGLE FUEL WITH LIGHTS (01312302)

The operation of this control panel is identical to the single fuel models (01312301 and 01312303) except lights are provided to show the operational mode.

1. The "line power" light will be on whenever power is supplied to the panel.
2. The "pump power" light will be on when power is supplied to the pump motor. This includes operation during "pre-purge" burner firing, and "post-purge."
3. The "zone" lights (zone 1 through 4) will be on when power is supplied to the respective burner zone(s). This occurs when the thermostat is calling for heat except during "pre-purge."

## OPERATION UNIQUE TO DUAL FUEL (01312303)

Zone 3 and 4 controls are unavailable for burner zones; instead they are used to energize relays 3 and 4 as shown in Diagram 20, page 24.

1. When the selector switch\* is set to the natural position (Diagram 20) this initiates the conditions as follows:
  - a. The valves in the auxiliary portion of the gas train are energized and opened.
  - b. The L.P. Master valve is de-energized and closed.
  - c. The natural gas master valve is energized and opened.
2. When the selector switch is set to the L.P. position (Diagram 20) this initiates the conditions as follows:
  - a. The valves in the auxiliary portion of the gas train are de-energized and closed.
  - b. The L.P. master valve is energized and opened.
  - c. The natural master valve is de-energized and closed.

\*A SPDT selector switch with a minimum 2 amp/125V rating must be used in order to insure safe operation of the fuel master valves.

## **CHECKING ELECTRICAL CIRCUITS IN CONTROL PANEL**

### **01312301, 02, 03**

#### **WARNING — ELECTRICAL HAZARD**

Procedures outlined must be performed only by electricians or other individuals qualified to safely perform electrical tests.

#### **MOTOR RUN — NO CURRENT TO ANY BURNERS**

(Wait three minutes after thermostat makes before proceeding.)

1. Make sure the thermostat circuit is calling for heat by connecting a jumper wire to short-out from terminal "C 24V" to the terminal for the thermostat of the zone under test (i.e. "T<sub>1</sub>," "T<sub>2</sub>," "T<sub>3</sub>," or "T<sub>4</sub>"). If zone relay(s) actuate, thermostat(s) were not calling for heat, are defective, or wiring to the thermostats is open. (See Diagram 19A, page 23.)
2. If zone relay(s) operate, but burners are still not powered, put a jumper from terminal "C 24V" to "MBR" to bypass the interlock switch in the vacuum pump motor. Wait 1 minute, if burners become powered, end switch is defective or wiring is open. (See Diagram 19A or 20A.)
3. If burners are not powered, with zone relay in, check for current terminal 4, then terminal 6 of the zone relay. If powered at 4 but not at 6, zone relay is defective. (See Diagram 19 or 20.)
4. If no current at four, check for current at terminals 4 and 6 of relay B1. With coil actuated if not at 6 and not at 4, relay B1 is defective.
5. If relay B1 is not energized check terminals 4 and 6 of relay B2. If "hot" (24V) at 6 and not at 4, relay B2 is defective.
6. If "hot" at both terminal 4 and 6 on relay B2, timer is defective.

#### **PUMP MOTOR DOES NOT RUN**

1. Make sure thermostats are calling for heat.
2. Check fuses in main line.
3. Check for power to system with voltmeter or test lamp at terminal "H".
4. Check for power (24V) at "C 24V" to "T<sub>1</sub>" to "T<sub>2</sub>", etc. If power present, jump terminals "C 24V" to "T<sub>1</sub>". If relay operates, the thermostat is either satisfied, defective or wiring to thermostat is open. If relay does not actuate, either the relay or the wiring to the relay is defective.
5. If no power at "C 24V" transformer is defective, check for power at the pump motor terminal ("L<sub>1</sub>" and "L<sub>2</sub>") for operation with 115V.
6. If power is present, motor is defective or improperly wired.
7. If no power at MH (Motor Hot) check terminals 1 and 2 of actuated zone relay. If "Hot" at 1 and not 3, zone relay is defective.

#### **SPECIAL CONDITIONS**

1. If one thermostat is actuated and all zone relays close or partially close (clatter) #90426600 package with four rectifiers is defective or incorrectly wired.
2. If system operates without "post-purge" or "pre-purge," relay B1 is defective or improperly wired.

## PILOT IGNITION

### PILOT FAILS TO IGNITE

Check to make sure there is electric current at the control box. This can be done quickly by pulling the plug from the outlet receptacle and plugging it in again. If you hear a click of the solenoid valve, you know you have current.

Now look up through window in combustion chamber to see if there is spark at the spark plug. If there is no spark, then proceed to check out controls in the following order:

#### A. TRANSFORMER (Also called "Spark Generator")

1. Disconnect electric current by pulling plug.
2. Disconnect high tension lead from spark plug.
3. Replace plug in electrical outlet and holding high tension lead by insulated portion, bring metal connector close to burner casting and observe if you get a good spark. If there is no spark or a very weak spark, this would indicate the transformer is defective. Before changing transformer, you check the ground connection on the transformer (green wire) to make sure it is making a good contact at the grounding post and that the transformer is well grounded. A factory-installed tooth lock washer is used under one leg of the transformer in order to provide a well grounded connection to the control housing. Caution: Do not allow transformer to operate more than a few moments with more than a .130 gap to ground at the spark plug terminal because an external spark gap which is too large may cause the transformer to arc inside and ultimately short out.

If there is a good spark, then —

#### B. CHECK SPARK PLUG

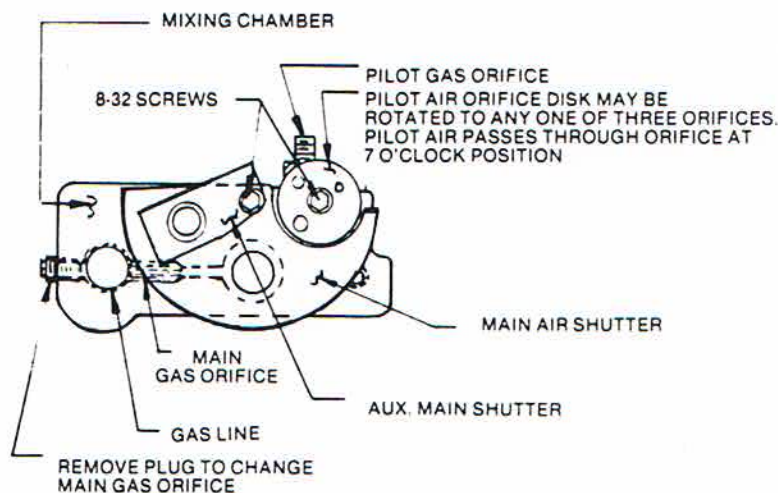
1. Pull electric plug to disconnect current.
2. Remove spark plug.
3. Connect high tension lead to the plug and allow plug to make contact with burner casting.
4. Replace electric plug in outlet and observe spark at the spark plug. If the spark is very weak or erratic, it would indicate either carbon or dirt at the points or clearance of points is improper. Clean plug and check clearance (approx. .130"). If there is no spark after cleaning, it must be assumed the plug is defective and requires replacement.

Having established the transformer and spark plug are O.K., proceed as follows:

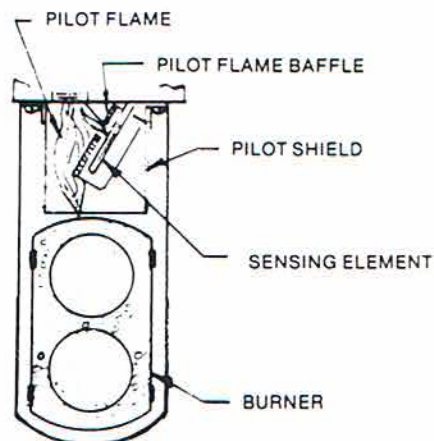
## PILOT COMBUSTION

### Air Adjustment:

Pilot air may be adjusted by loosening 8-32 screw holding pilot orifice disc in place and rotating the disc to one of the fixed openings provided. Use a 9/64" Allen wrench. (See Diagram 35.)



**Diagram No. 35**



**Diagram No. 36**

To aid in observing pilot flame, turn off main burner flame by unplugging pilot element switch at front end of burner box.

If you are unable to adjust pilot flame by using one of the fixed pilot air holes, then proceed as follows:

1. Check for air leaks at the burner flange, at the spark plug, at inspection windows, and where pilot element enters burner casting. Check for leaks at pilot tubing.
2. Remove pilot gas orifice (See Diagram 35) and make sure there are no stoppages due to chips or dirt, and that it is properly sized (No. 61 drill-natural gas, No. 68 drill-propane gas).

## MAIN BURNER IGNITION AND COMBUSTION

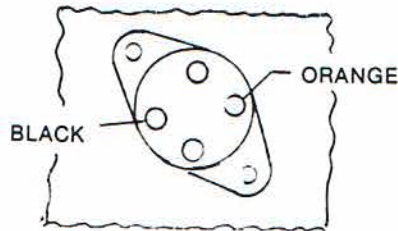
### MAIN BURNER FAILS TO IGNITE AND/OR BURN PROPERLY

Main burner fails to ignite and/or burn properly. Observe pilot flame which should be blue and contained in the pilot shield. If the pilot flame is ragged and extends outside the shield, check to see that pilot air orifice is properly aligned. Also try the other air orifices by rotating the orifice disc as described above under "PILOT COMBUSTION."

The pilot sensing element is heated by a portion of the pilot flame which is diverted through a small hole in the pilot flame baffle. When the flame is correctly adjusted, this baffle usually glows red, masking the glow of the sensing element. In most cases if the baffle glows, the sensing element will heat sufficiently to operate.

Check the pilot switch by shorting across the black and orange terminals at the pilot switch socket. (See Diagram 37, page 51.) If the main burner comes on it indicates that the pilot switch is defective and should be changed.

When shorting out the pilot switch you should hear a click indicating the main burner valve is energized. If there is no click, or gas is not passing to the main burner, check for broken wire or a faulty connection.



PILOT SWITCH SOCKET

**Diagram No. 37**

If it has been established the main burner solenoid valve is open and there is no visible flame, it may be assumed gas is flowing from the main burner but the gas-air mixture is improper and may be adjusted as follows: (Refer to Diagram 35, page 50.)

- a. Shut off burner by unplugging pilot element switch and unplug power cord(s) to burner.
- b. Loosen 8-32 screw holding main flame air shutter in place. Use a 9/64" Allen wrench.
- c. Turn auxiliary air shutter counter-clockwise to close fixed air opening in shutter.
- d. Rotate main flame shutter clockwise to allow full air opening in the shutter.
- e. Turn on main burner by plugging in pilot element switch and observe flame through observation window in combustion chamber.
- f. Slowly close the main flame shutter and then open shutter to the point where the flame changes from green to blue. The flame should be well defined and the flame cones should be about 3/8" long. Too much air will result in a "stringy" flame with a tendency to float away from the burner head.
- g. Tighten 8-32 screw, locking shutter in place.

If main burner flame cannot be adjusted as outlined above, check as follows:

- a. Turn burner off at shut-off cock.
- b. Remove 3/8" plug in mixing block and remove gas orifice with 3/16" Allen wrench.
- c. Check size of orifice (See Tables, Diagram 38, page 53.)
- d. Replace orifice and attach "U" gauge at 3/8" tapping.
- e. Turn off burner and take reading on "U" gauge. This will indicate vacuum in system at this point. If vacuum is less than 2", check out vacuum as described above. If vacuum in system is satisfactory and you cannot get reading of "0"  $\pm$  "0.3" w.c. with burner on and gas supply is normal, replace burner.

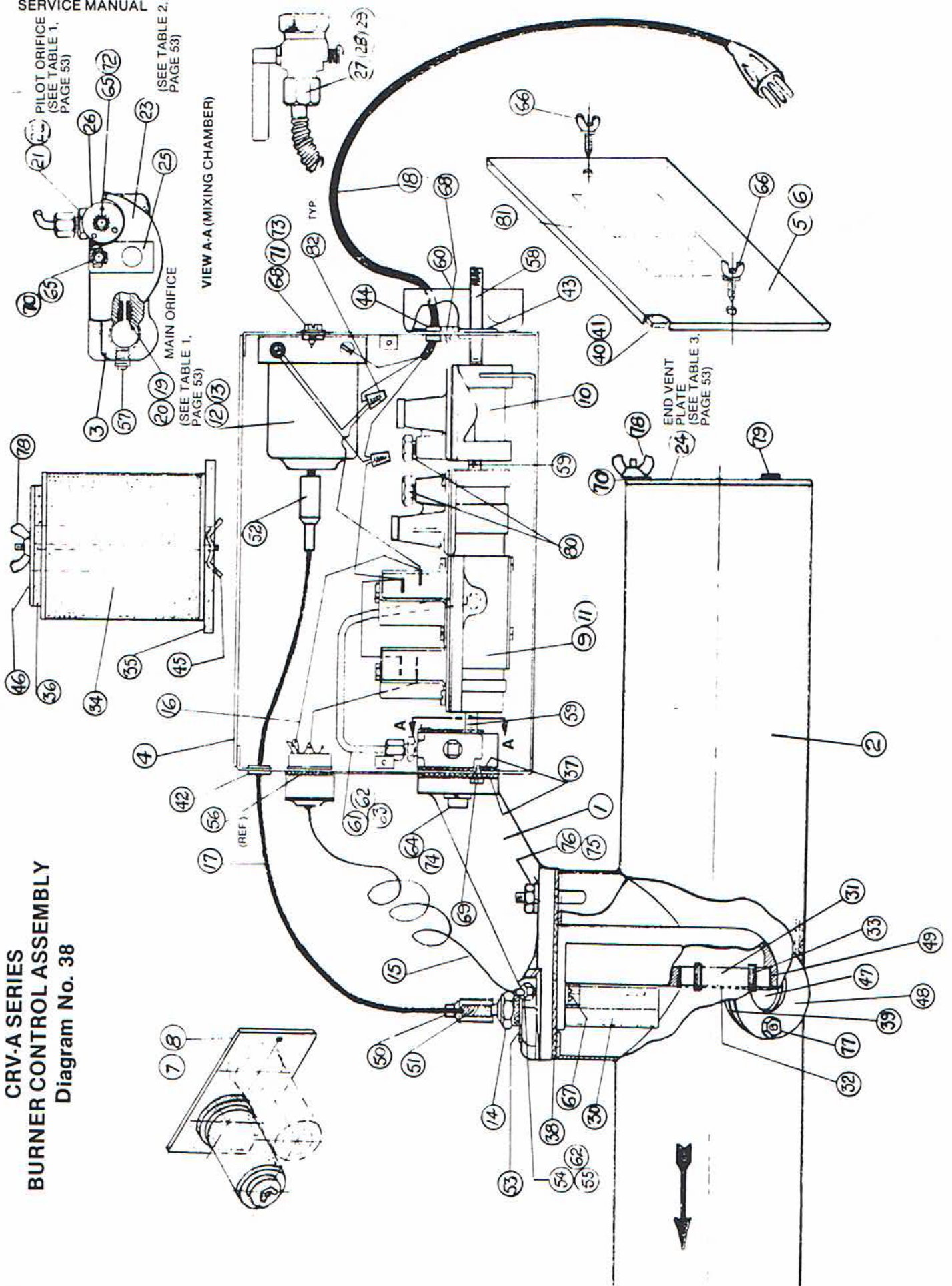
#### **BURNER FAILS TO OPERATE PROPERLY WHEN CONTROL HOUSING DOOR IS IN PLACE — FLAME SMALL — DIRTY FILTER**

A. When control housing doors are in place and securely fastened to burner and the main flame is smaller than normal, it is usually an indication that the air filter is very dirty and blocking the air supply for the burner. To check for this condition carefully observe the main flame while in operation. Then loosen the screws holding door in position and crack the door open slightly. If the flame is larger with the door cracked open, it is an indication that the filter is dirty and needs cleaning or replacing.

The filter might be cleaned by removing it from the burner and blowing it out with compressed air, however, this type of cleaning is effective probably only once, since much of the dirt particles become securely embedded in the filter media and cannot be easily removed. A new filter may be required.

Where severe dust problems exist, a special filter door capable of accepting two filters should be considered. Under these conditions it would be wise to install a ducted air supply system. Consult your Roberts-Gordon representative.

CRV-A SERIES  
BURNER CONTROL ASSEMBLY  
Diagram No. 38



# CRV-A SERIES BURNER CONTROL ASSEMBLY PARTS

See Diagram No. 38, page 52

ITEM	DESCRIPTION	QTY.	PART NO.	ITEM DESCRIPTION	PART NO.	QTY.
1	Burner Head, Machined					
2	Combustion Chamber Ass'y. W/Observ. Windows	1	01396000	Nipple 3/8 N.P.T.	91201608	1
3	Mixing Chamber, Machined	1	01330400	Nipple 3/8 N.P.T. X Close	91201600	2
4	Control Housing Assembly	1	01394100	Junction Box	91309300	1
5	Control Housing Door Ass'y. W/Name plate & Conn. Diag.	1	01325100	1/4 O.D. Alum. Tubing (Pilot Line)	91400105	1
6	Control Housing Door Ass'y. W/3" Opening For Filter	1	01325302	Ball Sleeve, 1/4 O.D. Tubing	00878300	3
7	Double Filter Door Ass'y. W/One Filter	1	01325301	Ball Sleeve Nut, 1/4 O.D. Tubing	00878400	2
8	Double Filter Door Ass'y. W/Two Filters	AS	01312600	Screw, Socket Hd. Cap., Cone, Point Not. 1/4-20	93713022	2
9	Gas Valve	REQ'D	01312601	Screw, Thumb, Cone Point, No. 8-32	93711408	2
10	Gas Regulator, Maxitrol RV-35A	1	70100600	Screw, STN. STL. No. 8-32 Rd. Hd. Slot'd.	91115100	4
11	Coils for Gas Valve (Replacement) (Eaton)	1	90201400	Screw Sheet Metal, No. 12 Type "A"	93531404	2
12	Coils for Gas Valve (Replacement) (White Rogers)	AS REQ'D	90031600	Screw Sheet Metal, No. 8, Type "A"	94211008	4
13	Spark Igniter Mounting Bracket	1	90031901	Spring Type Washer	91107800	1
14	Spark Igniter	1	01372400	Tinnerman Clip	91107600	2
15	Pilot Plug, 14 mm	1	90425600	External Tooth Lock Washer #8	96211500	2
16	Pilot Switch Ass'y. (W.R.)	1	91309000	External Tooth-Lock Washer #10	96210800	1
17	Wire Harness W/Socket	1	01313701	Washer, Lock, Spring No. 1/4	96411500	2
18	Ignition Cable	1	01326700	Washer, Lock, Spring No. 5/16	96411600	2
19	Cord 16/3 S. J. (3 wire)	1	91309116	Nut, Hex No. 5/16-18 Brass	92123900	2
20	Orifice - Main Gas, Nat.	USE 1	91306400	Nut, Hex No. 1/4-20	92113000	4
21	Orifice - Pilot Gas, Nat.	SEE SCHEDULE	013942--	Nut, Wing No. 10-24	92511601	2
22	Orifice - Pilot Gas, L.P.	SCHEDULE	008788--	Button, Bumper	91905400	1
23	Shutter-Air, Primary	"	008788--	Vent Limiting Device, Maxitrol 12A04	D-978	1
24	Plate, End Vent	"	013605--	Internal Connection Diagram (Std.)	D-979	1
25	Shutter-Air, Auxiliary	"	013676--	Internal Connection Diagram (Dual Fuel)	AS REQ'D	2
26	Orifice Disk - Pilot Primary Air	1	01360700			
27	Connector - Stop - Cock Assembly	1	01360600			
28	Flexible Tube With 3/8" NPT Female Adaptor	1	91410600			
29	Stop Cock with 1/2" NPT Male Connection	1	91410700*			
30	Pilot Shield Assembly	1	90101700*			
31	Ceramic Burner Port	1	01330000			
32	Grid, Retainer, Burner	1	01371300			
33	Clip, Support Grid, Burner	4	01371400			
34	Filter	1	01362300			
35	Gasket Filter Bottom	1	90707000			
36	Gasket Filter Top	1	order set			
37	Gasket, Burner and Mixing Chamber	2	01361300			
38	Gasket Combustion Chamber	1	01351100			
39	Gasket, Observ. Window Comb. Chamber	4	01367800			
40	Gasket, Door, Control Housing W/4" Dia. Hole	1	01351200			
41	Gasket Door Control Housing	1	01366300			
42	Flexible Grommet LMR No. 250	1	01366301			
43	Flexible Grommet, LMR No. 635	1	91309700			
44	SR6P3-4 Heycos	1	91309400			
45	Filter Support	1	91309600			
46	Disk, Filter Support	1	91905500			
47	MICA Window	1	01361200			
48	Ring, Viewer, Combustion Chamber	2	02553200			
49	Cement, Refractory	2	01390201			
50	Ignition Lead Cover	SET	91307100			
51	Rajah S-SOS No. 11 Ferrule	1	01352300			
52	Rajah S-SOS No. LL Extended Bakelite	1	91307900			
53	Washer, Flat, Brass	1	91302400			
54	Compression Fitting (Ref.)	1	91109300			
55	Alum. Sleeve (Ref.)	1	91211400			
56	Air Sealer, Pilot Switch (Ref.)	1	01356300			
57	Plug, Pipe 3/8 N.P.T. Sq. Hd.	1	90707200			
			91201003			

ITEMS: 19 - 20 MAIN ORIFICES: 21 - 22 PILOT ORIFICES:

INPUT	NAT.	PROP.	NAT.	PROP.
20,000	01394243	01394250	00878861	00878868
40,000	01394230	01394239	00878861	00878868
60,000	01394221	01394230	00878861	00878868
80,000	01394216	01394226	00878861	00878868

INPUT	PART NO.	HOLE DIA.
20,000	01360502	.328 (21/64)
40,000	01360504	.469 (15/32)
60,000	01360506	.593 (19/32)
80,000	01360508	.687 (11/16)

INPUT	PART NO.	HOLE DIA.
20,000	01367602	.359 (23/64)
40,000	01367604	.421 (27/64)
60,000	01367606	.593 (19/32)
80,000	01367608	.687 (11/16)

ITEM: 23  
SHUTTER AIR PRIMARY

ITEM: 24 PLATE, END VENT

\*THESE PARTS AS AN ASSEMBLY ARE PN 91410600 PER ITEM 27.