

INTRODUCTION

The CO-RAY-VAC[®] System consists of a network of combustion chambers connected with standard lengths of black steel pipe. The combustion chambers are usually connected in series with a limit of three in line. A vacuum pump maintains a vacuum in the piping system. A gas burner is installed in each combustion chamber and is rated at 40,000 BTU/hr. input. The firing device is a carburetor-like mechanism which utilizes the vacuum system to control both the flow of gas as well as the air for combustion. Vacuum in the system at the correct level is therefore most important for proper operation. Before attempting to adjust or regulate the burners, you must make sure that the vacuum in the system is within the limits prescribed.

I. CHECKING VACUUM

- A. Allow system to operate at least ~~1/2-hour~~ ^{10 min. OK}
- B. Starting at the burner farthest from the pump, use a manometer or gauge calibrated in inches of water and check vacuum by inserting tube attached to manometer about 6" into the vacuum test hole at the end vent pipe. See Diagram #1.
- C. With all burners on, vacuum should be at least 2" W.C. and not over 3" W.C.
NOTE: There are two means provided for adjusting the amount of vacuum in the system. The vacuum pump is equipped with a turn damper in the inlet of the pump casting and the end vents have individual slide dampers. When pump is installed, be sure to lock damper of the vacuum adjuster in full open position with wing nut and lock washer. With the end vent slide dampers set at the minimum opening, adjust the vacuum at the turn damper on the pump so that the end vent vacuum farthest from the pump is between 2" and 3" W.C. Securely lock this damper in place. Adjust the vacuum at other end vents by moving and then securing the end vent slide dampers.
- D. If vacuum is over 3", open end vent damper; if less than 2", close end vent damper.
- E. If vacuum cannot be maintained above 2" by adjusting end vent damper, check the following:
 1. Pump turn damper closed.
 2. Check pump rotation.
 3. Impeller in pump loose on shaft or defective.
 4. Blockage in outlet of pump or in flue exhaust pipe.
 5. Motor improperly wired for applied voltage.
 6. Air leaks in system and at inlet boot to pump.
 7. Blockage in piping system.
 8. Traps in radiant or tail pipe. (See Installation Manual)
 9. Too many end vents. (See Design Manual)
 10. Condensate traps dry. Fill with water and seal.
 11. Vacuum pump too small. (See Design Manual)
 12. Insufficient tail pipe. (See Design Manual)
 13. If cause of low vacuum condition cannot be determined above, consult R-G Representative.

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II. CHECKING ELECTRIC CIRCUITS

A. DESCRIPTION OF OPERATION (See Wiring Diagrams)

A line voltage 2-circuit thermostat is used for direct control of the system. When a low voltage thermostat is used, it operates a line voltage 2-circuit relay. These 2-circuit controls permit multiple-thermostat control of the system, with the vacuum pump energized when any thermostat is calling for heat. One switching circuit of each control, "C" to "B" of the thermostat in Diagram #2, "1" to "4" of the relay in Diagram #3, or the 24 Volt relay in Diagram #4 of Pre-wired Panel Box, operates the vacuum pump through the pump overrun relay. Parallel connection of the output of these controls ("B" to "B" to "B", etc.), ("4" to "4" to "4", etc.), provides pump operation at the call of any thermostat. Current from the thermostat is delivered to heater "H" and the normally closed contact "3" of the overrun relay. Cold contacts "1" to "3" of the overrun relay start the pump motor. When heater action switches the relay, the motor is powered from normally open contact "2". Thus, the motor will continue to run until the heater cools and

A. DESCRIPTION OF OPERATION (Cont'd.)

the relay switches back from "2" to "3". This delayed action will occur after the last thermostat is satisfied.

In a similar manner, the burner circuits are energized through the circuit timer's normally open contact "2", which throws as a result of the operation of the circuit timer's heat motor.

B. NO CURRENT AT BURNER RECEPTACLES

1. Make sure thermostats are calling for heat.
2. Check fuses in main line.
3. (Refer to Diagram #2) Put jumper on "C" and "A" (230-15 thermostat). Put jumper on "Blue" to "Red" (176-12 thermostat). If current is established, thermostat is not calling for heat or is defective.

(Refer to Diagram #3) Put jumper on "T" to "T" in relay. If relay does not pull in, it is defective or thermostat is not calling for heat or is defective.

(Refer to Diagram #4) Put jumper on "C" and "T1". If relay does not pull in, it is defective or thermostat is not calling for heat or it is defective.

C. 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:

(Refer to Diagram #2) Where 230-15 thermostat is used: At line voltage terminal "B" to ground -- if there is power at terminal "C" but not at B, thermostat is either satisfied or defective.

Where 176-12 thermostat is used: At line voltage terminal "White" to ground -- if there is power at terminal "Blue" but not at "White", thermostat is either satisfied or defective.

(Refer to Diagram #3) At relay, terminals "L-L"; if power is present, jump terminals "T" to "T". If relay operates, thermostat is either satisfied or defective, or wiring to thermostat is open. If relay does not pull in, it is defective. (Pump motor should run when the relay is manually operated.)

(Refer to Diagram #4) On terminal strip at terminal "H", check for power (24V) at "C" to "T1", "C" to "T2", etc. If power is present, jump terminals "C" to "T1". If relay operates, the thermostat is either satisfied or defective or the wiring to the thermostat is open. If relay does not pull in, it may be assumed to be defective. (Pump motor should run when the relay is manually operated.)

4. Check for current at the pump motor terminals. If power is present, motor is defective or impeller of pump might be jammed. If there is no power, jump terminals "1" and "3" of pump overrun relay. If pump motor runs, overrun relay is defective. If pump motor does not run, leave jumper on terminals "1" and "3" and recheck motor for power to determine if wiring from overrun relay to thermostat or thermostat relay is open.

III. PILOT FAILS TO IGNITE AND/OR BURN PROPERLY

Note: On some Co-Ray-Vac units, the color coding of wiring, as described below, does not hold true. However, terminal designation is always correct.

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.

A. TRANSFORMER (Cont'd.)

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, it is suggested 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 case 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

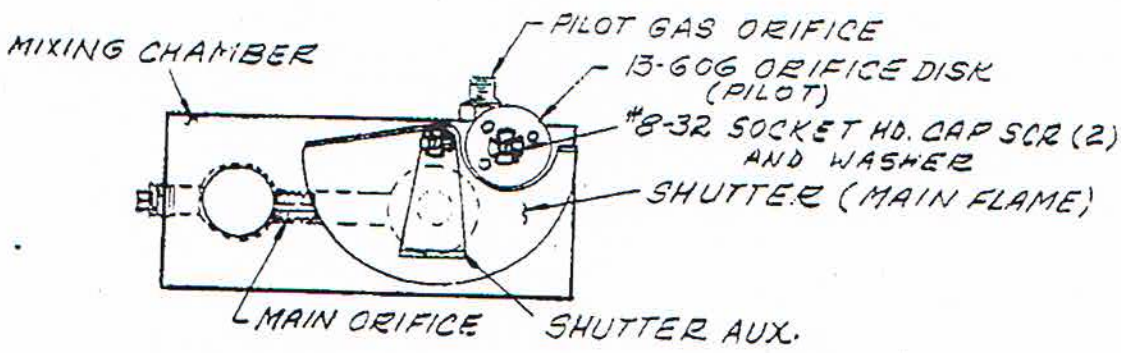
1. Pull electric plug to disconnect current.
2. Remove spark plug.
3. Connect high tension lead to the plug and allow plug to make contact with burner casting.
4. Replace electric plug in outlet and observe spark at the spark plug. If the spark is very weak or erratic, it would indicate either carbon 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:

C. HAVING ESTABLISHED SPARK, NEXT CHECK TO MAKE SURE PILOT IS BURNING PROPERLY

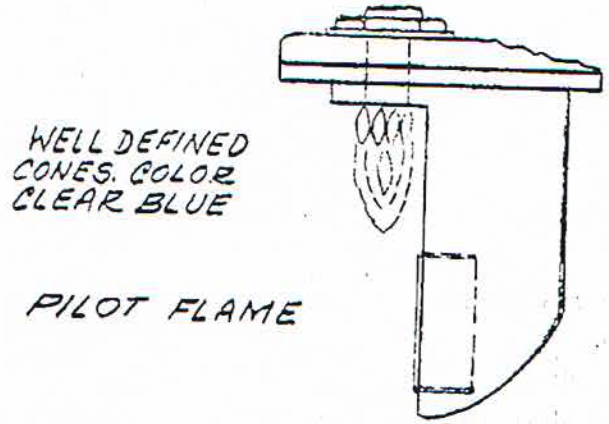
Air Adjustment:

- a. 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. (See Diagram #5)



(Diagram #5)

Pilot flame should be stable and burn with well defined cones at the pilot ports. See Diagram #6.

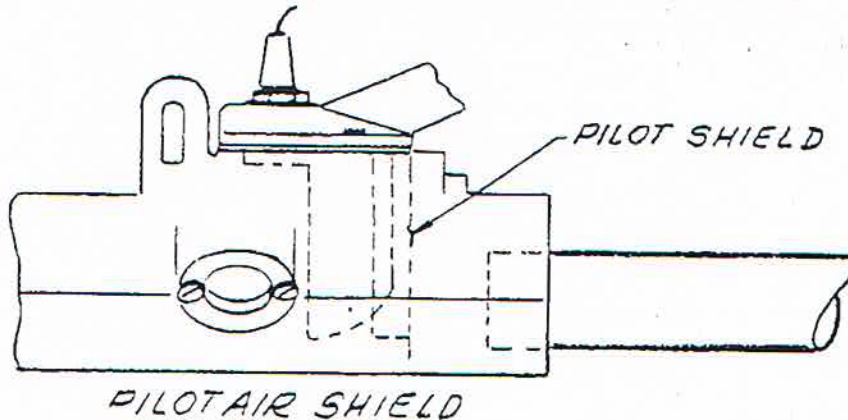


(Diagram #6)

C. HAVING ESTABLISHED SPARK, etc. (Cont'd.)

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

- b. If you are unable to adjust pilot flame as illustrated in Diagram #6 by using one of the fixed pilot air holes, then proceed as follows:
 1. Check pilot air shield (Diagram #7) to make sure it is in proper position.



(Diagram #7)

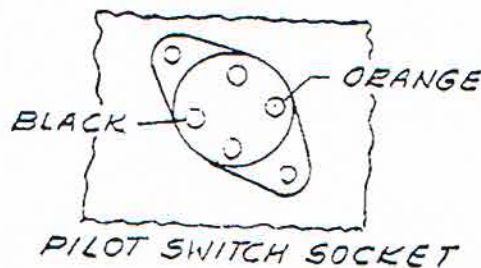
2. Check for air leaks at the burner flange, at the spark plug, at inspection windows, and where pilot element enters burner casting. Check for leaks at pilot tubing.
3. Remove pilot orifice (See Diagram #5) and make sure there are no stoppages due to chips or dirt, and that it is properly sized (No. 61 drill - natural gas, No. 68 drill - propane gas).

IV. MAIN BURNER FAILS TO IGNITE AND/OR BURN PROPERLY

- A. Observe pilot flame after burning for a minute or two. The bulb of the pilot sensing capillary in the flame should be glowing a dull cherry-red. If it is not glowing and is dark in color, it would indicate the pilot flame is not heating the sensing device sufficiently to close pilot switch. Check as follows:

- a. Make sure pilot is properly adjusted as outlined in C above.
- b. Make sure bulb is properly positioned in flame. The capillary is held in position with a compression fitting. By loosening the nut, the bulb location may be adjusted in relation to pilot flame.
- c. With the pilot element glowing red as described above, check pilot switch by shorting across the black and orange terminals at the pilot switch socket (See Diagram #8). If the main burner comes on, it is an indication the pilot sensing device or pilot switch is defective and should be changed.

When shorting out the pilot switch, you should hear a click indicating the main burner solenoid is energized. If there is no click or gas is not passing to main burner, check for broken wire or short in control box.



(Diagram #8)

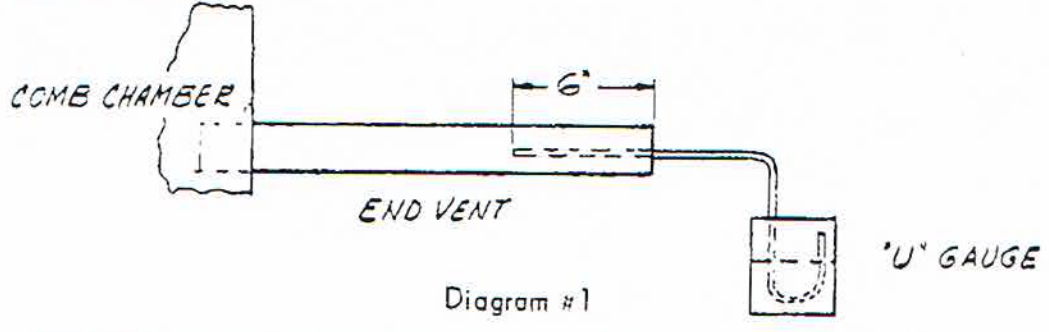
- B. If it has been established the main burner solenoid valve is open and there is still no visible flame, it may be assumed gas is flowing from the main burner but the gas-air mixture is improper and may be adjusted as follows: (Refer to Diagram #5).
 - a. Shut off burner by unplugging pilot element switch.
 - b. Loosen 8-32 screw holding primary air shutter in place.

B. (Cont'd.)

- 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 turn primary air shutter towards closure to obtain a greenish color flame 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 stringy flame and a tendency to float away from the burner head.
- g. Tighten 8-32 screw, locking shutter in place.

C. If the 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 Allen wrench.
- c. Check size of orifice (No. 30-natural gas, No. 38-propane gas).
- 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" ± 0.3" W.C. with burner on and gas supply is normal, change unit.



* NOTE: IF THE MOTOR IS NOT EQUIPPED WITH TWO BROWN LEAD WIRES, CONNECT WHITE WIRE, WHICH EXITS FROM FAN OVERRUN RELAY, TO THE GROUND WIRE.

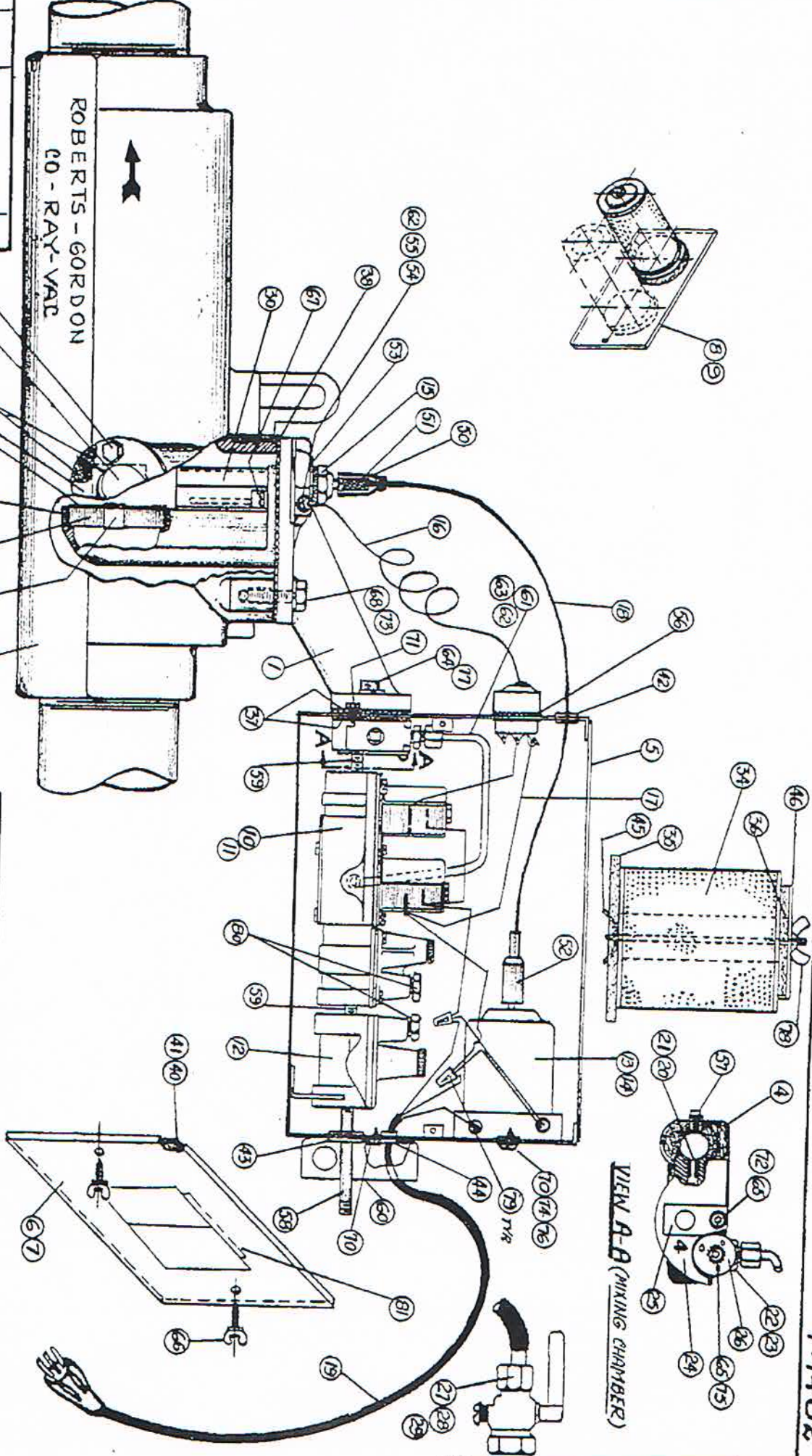
BURNER FAILS TO OPERATE PROPERLY WHEN CONTROL HOUSING DOOR IS IN PLACE - FLAME SMALL - DIRTY FILTER

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. Such a construction would about double the time required to plug up the filters. Since two such doors could be used the filter area could be quadrupled.



DATE	CHANGE	BY

<p>NAME CO-RAY-VAC BURNER ASSEMBLY REV 5-40</p>		<p>DATE</p>	
<p>MATERIAL</p>		<p>MANUFACTURED BY</p>	
<p>FINISH</p>		<p>DATE</p>	
<p>ROBERTS-GORDON APPLIANCE CORP. BUFFALO, N. Y.</p>		<p>APPROVED BY</p>	
<p>F-1482</p>		<p>DATE</p>	

Item	Description	Part No.	Qty.	Item	Description	Part No.	Qty.
1	Burner Head, Machined	13-960	1	42	Flexible Grommet, LMR No. 250	913-097	1
2	Combustion Chamber, Ass'y (w/ Observation Windows)	13-055	1	43	Flexible Grommet, LMR No. 635	913-095	1
3	Combustion Chamber, Machined	13-909-1	1	44	SR6P3-4 Heycos	913-096	1
4	Mixing Chamber, Machined	13-941	1	45	Filter Support	919-055	1
5	Control Housing Assembly	13-251	1	46	Dick, Filter Support	13-612	1
6	Control Housing Door w/ Name Plate & Conn. Diagram	13-253	1	47	Mica Window	25-532	2
7	Control Housing Door w/ 3" Opening for Filter	13-253-1	1	48	Ring, Viewer, Comb. Chamber	13-902	2
8	Double Filter Door w/ One Filter	13-126	As Reqd	49	Cement, Refractory	913-071	Set
9	Double Filter Door w/ Two Filters	13-126-1		50	Ignition Lead Cover	13-523	1
10	Gas Valve, Eaton NCI-1181-IF 3/8 NPT	900-268	1	51	Rajah S-SOS No. 11 Ferrule	913-079	1
11	Coils for Gas Valve (Replacement)	900-149	As Reqd	52	Rajah S-SOS No. 11 Ext'd Bakelite	913-024	1
12	Gas Regulator, Maxitrol RV-35A	902-014	1	53	Washer Flat, Brass	911-093	1
13	Spark Igniter (Honeywell)	904-171	Use	54	Compression Fitting (Ref.)	912-114	1
14	Spark Igniter (W.R.)	904-174		55	Alum. Sleeve (Ref.)	13-563	1
15	Spark Plug, 14 mm	913-090		56	Air Sealer, Pilot Switch (Ref.)	907-072	1
16	Pilot Switch Ass'y (W.R.)	13-137	1	57	Plug, Pipe 3/8 N.P.T. Sq. Hd.	912-018-3/8	1
17	Wire Harness w/Socket	13-267	1	58	Nipple 3/8 N.P.T. x 4" Lg.	912-016-4	1
18	Ignition Cable	913-091-16	1	59	Nipple 3/8 N.P.T. x Close	912-016-C	2
19	Cord 16/3 S.J. (3 Wire)	913-064	1	60	Junction Box	913-093	1
20	Orifice, Main Gas, Nat.	13-942#30	Use	61	1/4 O.D. Alum. Tubing (Pilot Line)	914-001-7/8	1
21	Orifice, Main Gas, L.P.	13-942#39		62	Ball Sleeve, 1/4 O.D. Tubing	8-783	3
22	Orifice, Pilot Gas, Nat.	8-788#61	Use	63	Ball Sleeve Nut, 1/4 O.D. Tubing	8-784	2
23	Orifice, Pilot Gas, L.P.	8-788#68		64	Screw, Socket Hd. Cap Conepoint No. 1/4-20 x 1 3/8	911-122 -13/8	2
24	Shutter, Air, Primary	13-605-4	1	65	Screw, Socket Hd. Cap No. 8-32x1/2	911-117-1/2	2
25	Shutter, Air, Auxiliary	13-607	1	66	Screw, Thumb, Conepoint No. 10-24 9/16	911-151	4
26	Orifice Disk, Pilot Primary Air	13-606	1	67	Screw, Stainless Steel Round Head Slotted No. 8-32 x 1/4	911-157-1/4	2
27	Propane Fueled Burners Including Dual Fuel or (LPN)			68	Screw, Hex Hd. No. 5/16-18x1 1/8	911-026-1 1/8	2
	Bundy Steel Tube	13-615	1	69	Screw, Hex Hd. No. 1/4 - 20 x 1/2	911-025-1/2	4
	Flared Brass Elbow	912-138	1	70	Screw, Sht. Metal Type A, No. 12x1/2	911-052-1/2	4
	Shut-Off Cock	901-012	1	71	Screw, Sht. Metal Type A No. 8x 1/4	911-050-1/4	1
28	Instruction Tag (Yellow)	910-067	1	72	Washer, Spring Type	911-078	1
29	Natural Fueled Burners			73	Washer, Lock, Spring No. 5/16	911-061-5/16	2
	Flexible Connector w/ 3/8" Adaptor	914-107	1	74	Tinnerman Clip	911-076	2
	Shut-Off Cock	901-017	1	75	External Tooth Lock Washer No. 8	911-094-8	1
	Instruction Tag	910-065	1	76	External Tooth Lock Washer No.10	911-094-10	2
30	Pilot Shield Assembly	13-300	1	77	Washer, Lock, Spring No. 1/4	911-061-1/4	2
31	Ceramic, Burner Port	13-713	1	78	Nut, Wing No. 10-24	911-005-10-24	1
32	Grid, Retainer, Burner	13-714	1	79	Nut, Wire	913-129	2
33	Clip, Support Grid, Burner	13-623	2	80	Vent Limiting Device Maxitrol 12 A 04	902-025 D-995	2
34	Filter	907-070	1	81	Internal Connection Diagram		
35	Gasket, Filter Bottom	Order Set 13-613	13-613-1	1			
36	Gasket, Filter Top		13-613-2	1			
37	Gasket, Burner & Mixing Chamber		13-511	2			
38	Gasket, Combustion Chamber	13-678	1				
39	Gasket, Ob. Window, Comb. Chamber	13-512	4				
40	Gasket, Door, Control Housing w/ 4" Diameter Hole	13-663	1				
41	Gasket, Door, Control Housing	13-663-1	1				