

CoRayVac®

INSTALLATION-OPERATION & SERVICE INSTRUCTION CRV 2-40, 3-40, 4-40, 6-60 SYSTEMS

This manual contains instruction for several different models of CoRayVac Systems. Refer to your packing slip and the outside of delivered cartons to verify models received. Follow appropriate Instructions

INSTALLER- Please take the time to read and understand these instructions prior to any installation.

OWNER- Keep this manual in a safe place to provides your serviceman with helpful information in the need arrises.



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Quality in any Language™

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CRV 2-40 63 MODEL

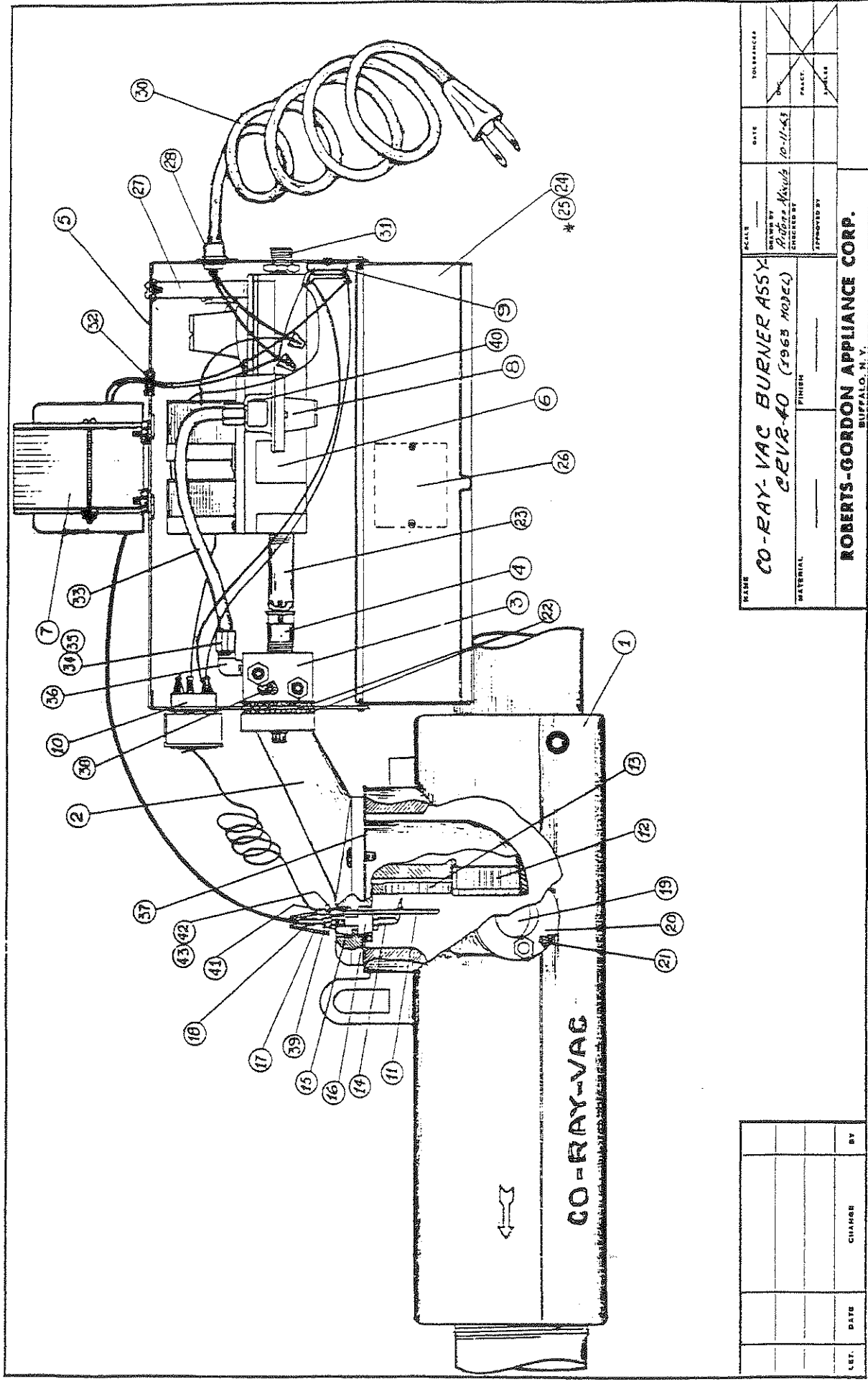
CRV 2-40 64 MODEL

CRV 4-40

CRV 6-60

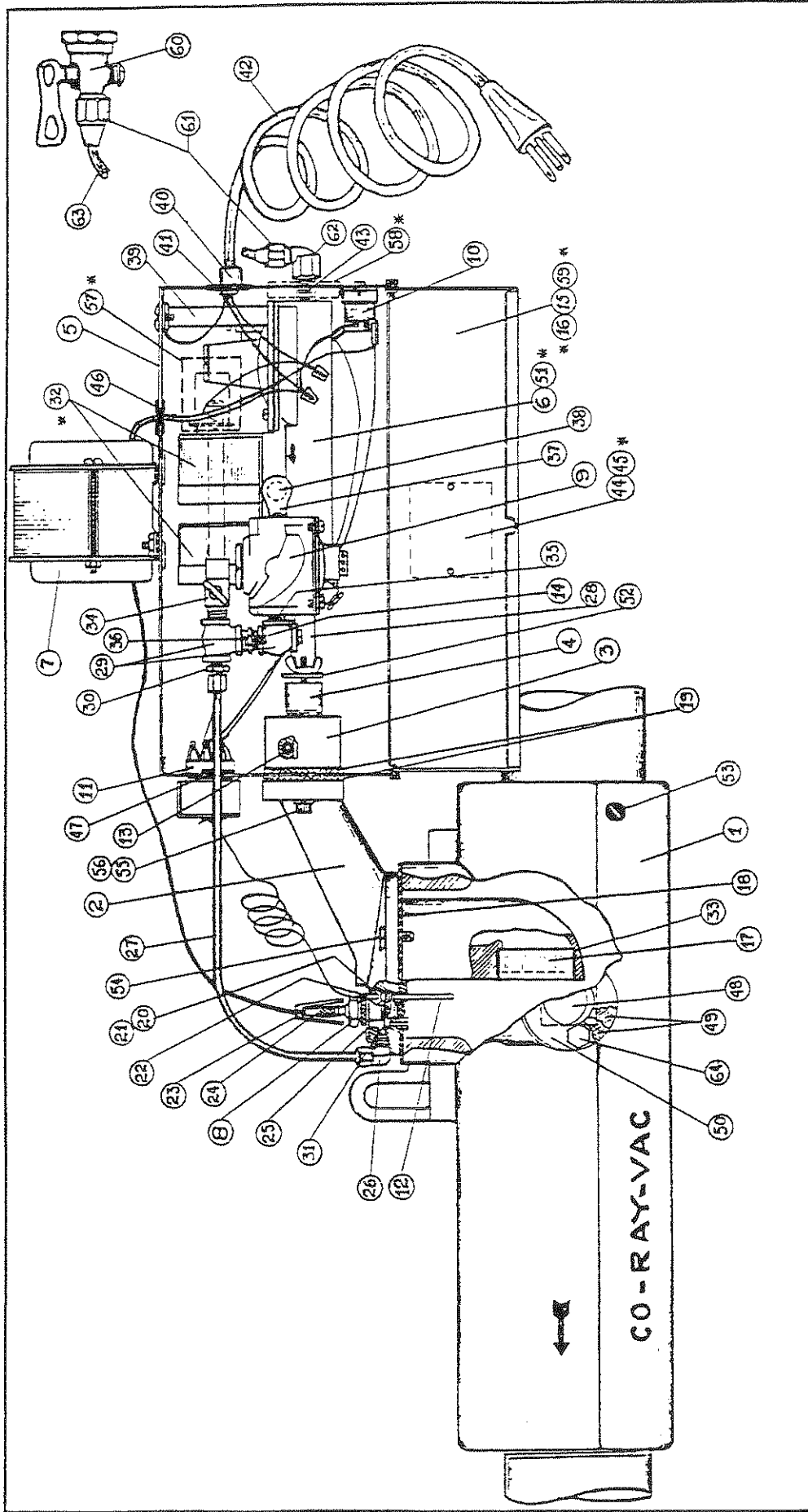
DUAL FUEL CONTROL PANEL

Note:For servicing information on CRV 3-40 series use CRV 4-40 instruction .



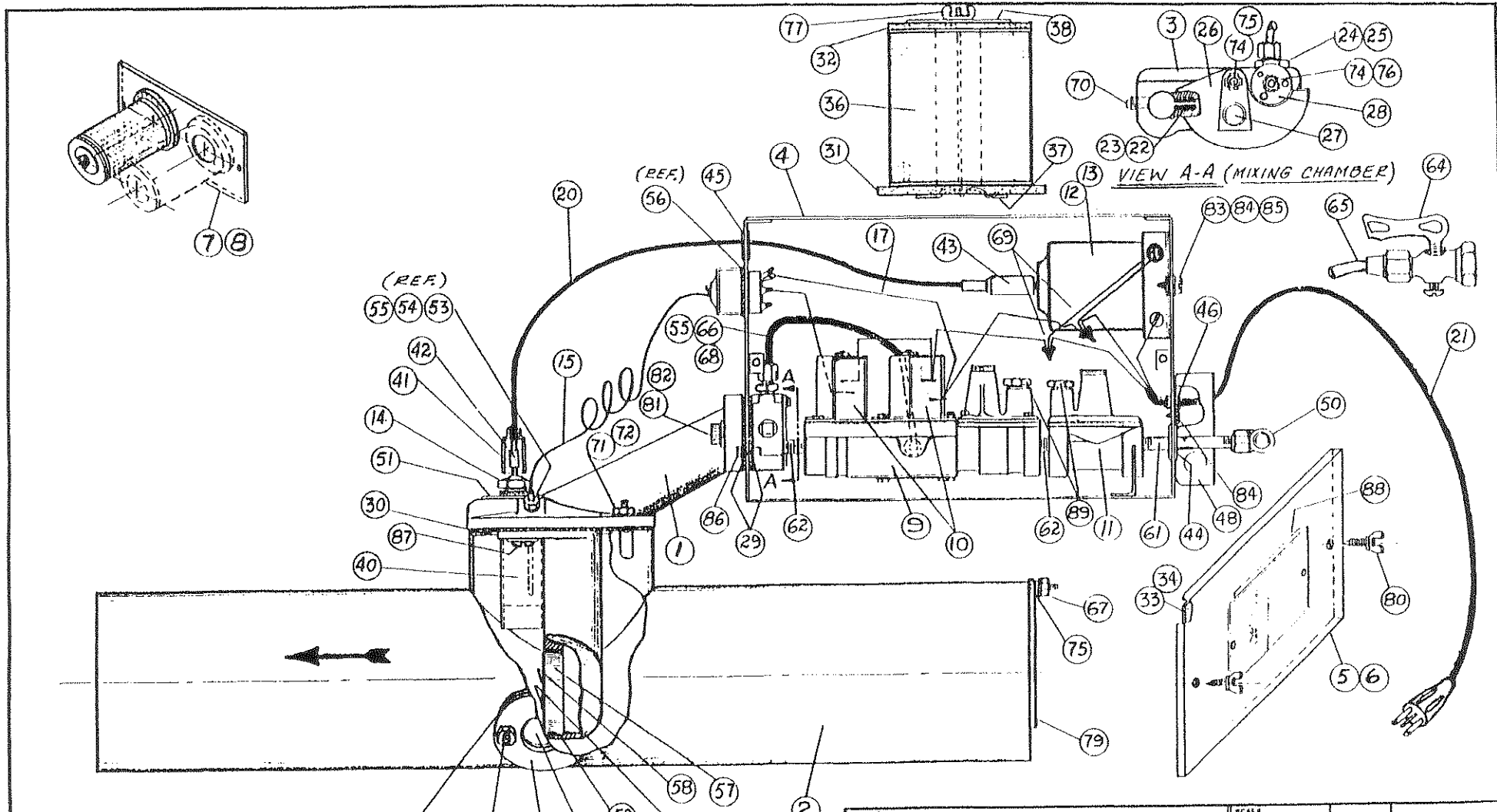
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ROBERTS-GORDON APPLIANCE CORP.			
BUFFALO, N. Y.			

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NAME	CO-RAY-VAC BUENER ASSY.	DATE		TOLERANCES
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BUFFALO, N. Y.				

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NAME CO-RAY-VAC BURNER ASS'Y- CRV6-60		SCALE _____	DATE 4-20-78	TOLEDRAGER _____
MATERIAL _____		DRAWN BY <i>Auton's Studio</i>		DFC _____
FINISH _____		CHECKED BY _____		PALET. _____
ROBERTS-GORDON APPLIANCE CORP. BUFFALO, N. Y.		APPROVED BY _____		AMBLED _____
				F-1351

CO-RAY-VAC[®] SERVICE MANUAL
MODEL CRV4-40

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 $\frac{1}{2}$ hour.
- 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.

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. 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

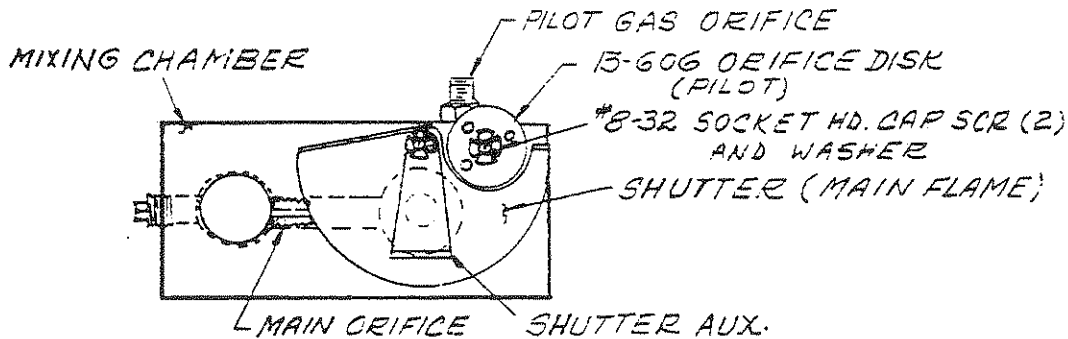
1. Pull electric plug to disconnect current.
2. Remove spark plug.
3. Connect high tension lead to the plug and allow plug to make contact with burner casting.
4. Replace electric plug in outlet and observe spark at the spark plug. If the spark is very weak or erratic, it would indicate either carbon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

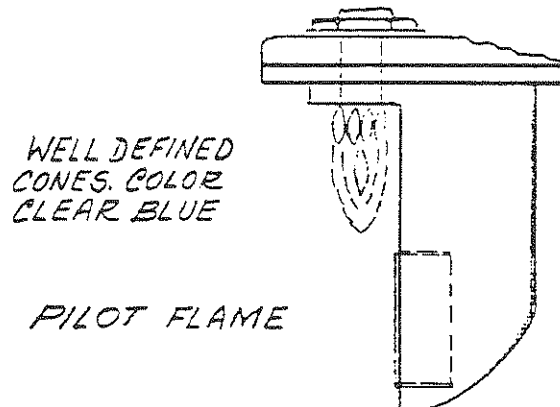
Air Adjustment:

- 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.

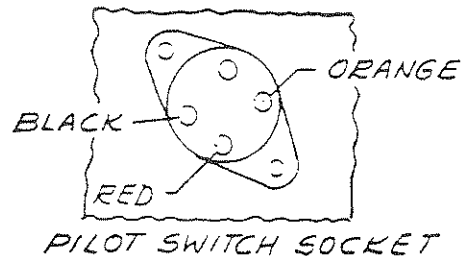


(Diagram #6)

A. (Cont'd)

- 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 #5). 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 5-32 screw holding primary air shutter in place.
- 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 5-32 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. 21-natural gas, No. 31-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" ± 0.8" W.C. with burner on and gas supply is normal, change unit.

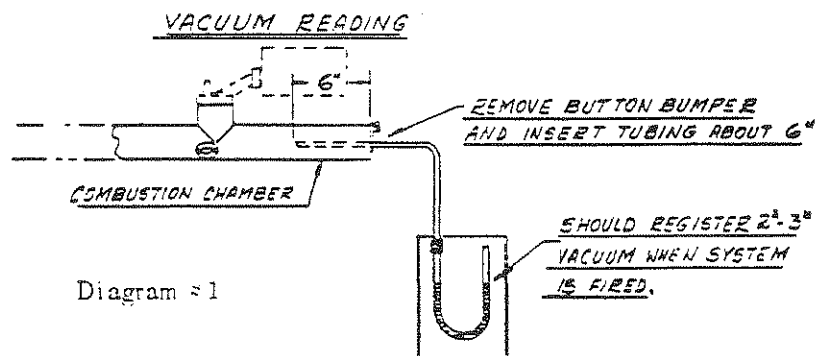


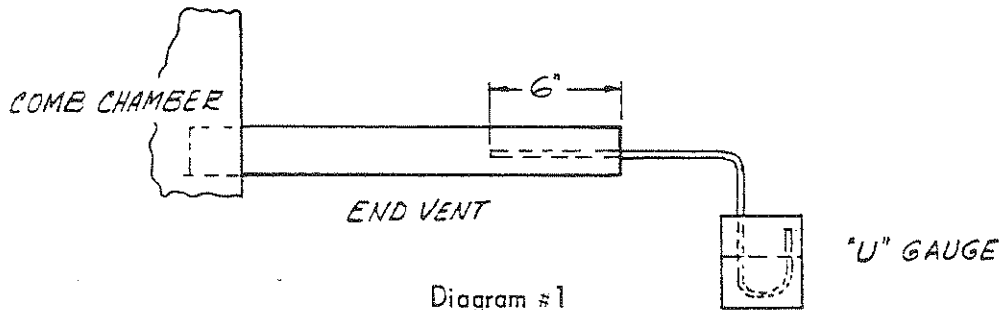
Diagram #1

B. (Cont'd.)

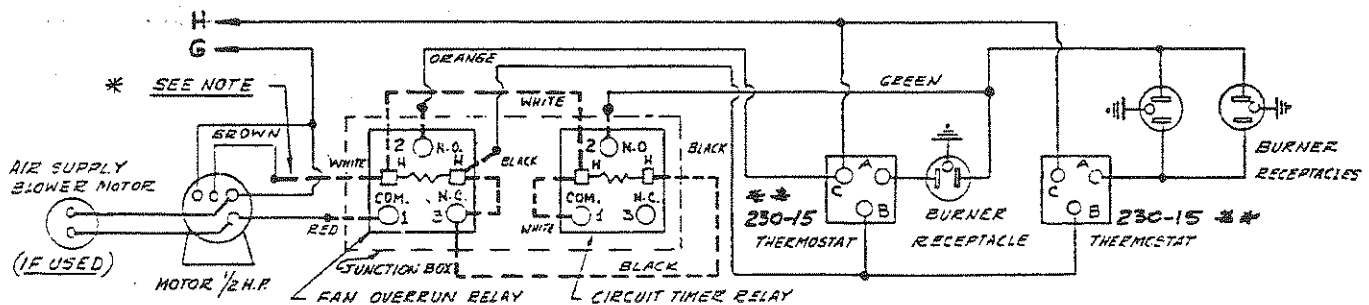
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- g. Tighten 8-32 screw, locking shutter in place.

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.



** NOTE: LETTERS "A" "B" & "C" REFER TO W-R. 230-15 THERMOSTAT. WHERE W-R. 176-12 IS USED, "A"=RED, "B"=WHITE, "C"=BLUE.

Diagram #2

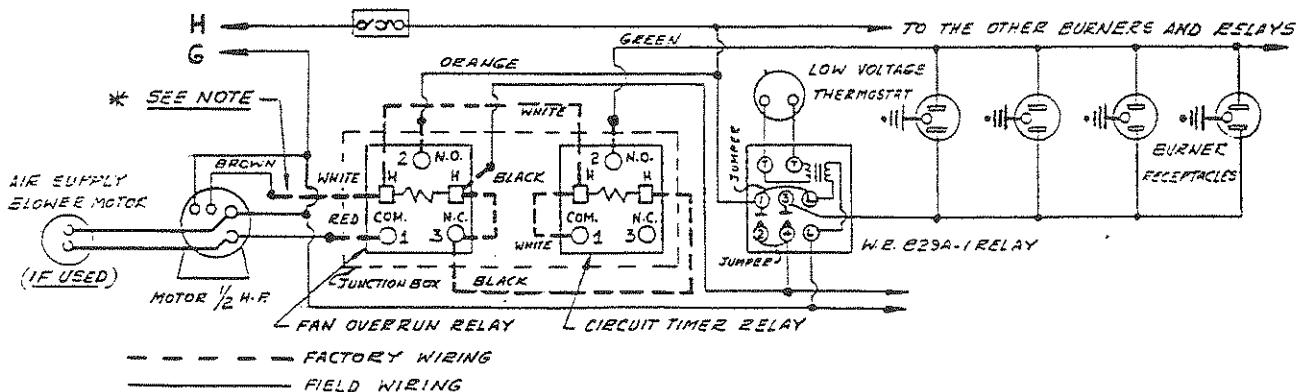


Diagram #3

B. NO CURRENT AT BURNER RECEPTACLES

1. Make sure thermostats are calling for heat.
2. Check fuses in main line.

(Refer to Diagram # 4) Put jumper on "C" and "T1". If relay does not pull in, it is defective. If it does not pull in thermostat was 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 # 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 "1". 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.

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 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.
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:

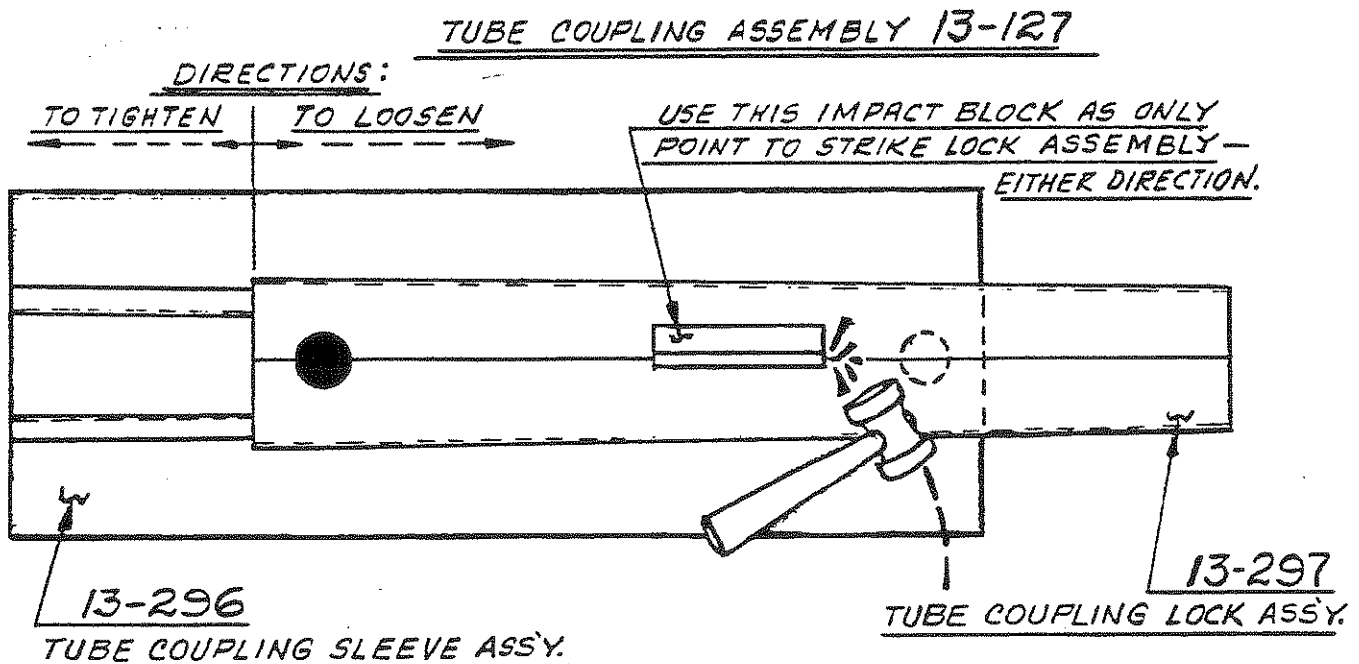
**BURNER FAILS TO OPERATE PROPERLY WHEN CONTROL HOUSING DOOR IS IN PLACE –
FLAME SMALL – DIRTY FILTER**

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.



TO ASSEMBLE 13-127 TUBE COUPLING OVER THE 4" O.D. TUBING:

- 1.) Line up ends of 4" O.D. tubing, leaving approx. $\frac{1}{4}$ " space between ends.
- 2.) Wrap coupling sleeve assembly 13-296 around ends of the aligned 4" tubing, positioning the pins in 13-296 between the ends of the tubing.
- 3.) Squeeze and hold sleeve assembly in place, and engage the end of 13-297, which has a $\frac{1}{4}$ hole through it, on the end of 13-296, which has a hole through it.
- 4.) Slide 13-297 approx. 6" onto 13-296. Push both ends of tube together against the pins, centering sleeve assembly.
- 5.) Drive 13-297 until the whole coupling assembly fits tightly on the tubing.

See Illustration Above.

MODEL: CRV 4 - 40 NAT. OR L.P.

ITEM	DESCRIPTION	PART NO.	QTY.	ITEM	DESCRIPTION	PART NO.	QTY.
1	Burner Casting - Machined	13-940	1	53	Air Sealer, Pilot Switch	907-072	1
2	Combustion Chamber - Machined	13-909	1	54	Screw, Hex Hd. 1/4-20	911-025-1/2	4
3	Mixing Chamber - Machined	13-941	1	55	Screw, Hex Hd. 5/16-18	911-026-3/4	2
4	Control Housing Assembly	13-251	1	56	Washer, Lock, Spring 5/16	911-061-5/16	2
5	Control Housing Door Assy. w/name Plate and Wiring Diagram	13-253	1	57	Washer, Lock, Spring 1/4	911-061-1/4	2
6	Control Housing Door Assy. w/3" Opening for Filter	13-253-1	1	58	Screw, Socket Hd. Cap., Cone Point 1/4-20	911-122-1-3/8	2
7	Valve, Combination, & "Zero" Governor	900-119	1	59	Screw, Thumb, Cone Point 10-24-9/16	911-151	4
8	Gas Regulator, RV-35 A	902-014	1	60	SR6P3-4 Heycos	913-096	1
9	Spark Igniter	904-171	Use	61	Washer, Flat, Brass	911-093	1
10	Spark Igniter (W.R.)	904-174		1	62	Nut, Wing, No. 10-24	911-005-10-24
11	Spark Plug - 14mm	913-090	1	63	Plug, Pipe, 3/8" N.P.T.	912-010-3/8	1
12	Pilot Switch Assy. (W.R.)	13-109	1	64	Screw, Socket Hd. Cap. No. 8-32	911-117-1/2	2
13	Socket with Wire Harness	13-267	1	65	Washer, Special	911-078	1
14	Orifice, Main Gas, Natural No. 30	13-942-30	Use	66	Screw, Sheet Metal, Type "A" No. 12	911-052-1/2	4
15	Orifice, Main Gas, L.P. No. 39	13-942-39		1	67	Tinnerman Clip	911-076
16	Orifice, Pilot Gas, Natural No. 61	8-788-61	Use	68	Washer External Tooth No. 10	911-094-10	1
17	Orifice, Pilot Gas, L.P. No. 68	8-788-68		1	69	Gasket, Door, Control Housing	13-663-1
18	Shutter, Air, Primary Main Air	13-605	1	70	Gasket, Door, Control Housing w/ 4" Dia. Hole	13-663	1
19	Orifice Disk - Pilot Primary Air	13-606	1	71	Connection Diagram	D-926	1
20	Shutter, Air, Auxiliary	13-607	1	72	Nut, Wire	913-129	2
21	Gasket, Burner	13-564	1	73	Washer, External Tooth No. 8	911-094-8	1
22	Gasket, Burner and Mixing Chamber	13-511	2	74	Shut-off Valve	901-012	1
23	Gasket, Observation Window Combustion Chamber	13-512	4	75	Screw, Sheet Metal, Type "A" No. 8	911-050-1/4	1
24	Gasket, Filter, Bottom 13-613-1	Order Set 13-613	1	76	Double Filter Door w/ One Filter	13-126	As Req'd
25	Gasket, Filter, Top 13-613-2			77	Double Filter Door w/ Two Filters	13-126-1	
26	Filter	907-070	1	78	Junction Box	913-093	1
27	Filter Support Assembly	919-055	1	79	Coils For Gas Valve (Replacement)	900-149	As Req'd
28	Disk, Filter Support	13-612	1	80	Cement, Refractory	913-071	
29	Pilot Air Shield Assembly	13-247	1	81	Vent Limiting Device, Maxitrol 12A04	902-025	2
30	Ignition Lead Cover	13-523	1				
31	Rajah S-SOS No. 11 Ferrule	913-079	1				
32	Ignition Cable	913-091-16	1				
33	Rajah S-SOS No. 11 Extended, Bakelite	913-024	1				
34	Spark Plug Restrictor - Washer	13-570	1				
35	Compression Fitting	912-114	1				
36	Aluminum Sleeve	13-563	1				
37	Ball Sleeve 1/4 O.D. Tubing	8-783	3				
38	Ball Sleeve Nut 1/4 O.D. Tubing	8-784	2				
39	Connector	8-782	1				
40	Aluminum Tubing 1/4 O.D.	914-001-7.5	1				
41	Cord, 16/3 S.J. (3 Wire)	913-064	1				
42	Elbow, Flare 3/8" Tubing	912-138	1				
43	3/8" O.D. Tubing w/ Flare Nuts, "U" Shape	13-615	1				
44	Flexible Vinyl Grommet LMR-250	913-097	1				
45	Flexible Vinyl Grommet LMR-635	913-094	1				
46	Nipple 3/8" N.P.T.	912-016-4	1				
47	Nipple 3/8" N.P.T. x Close	912-016-C	2				
48	Mica Window	25-532	2				
49	Ring, Viewer	13-902	2				
50	Ceramic Block 1	908-014	1				
51	Clip, Support, Grid	13-623	4				
52	Grid, Retainer, Burner,	13-621	1				

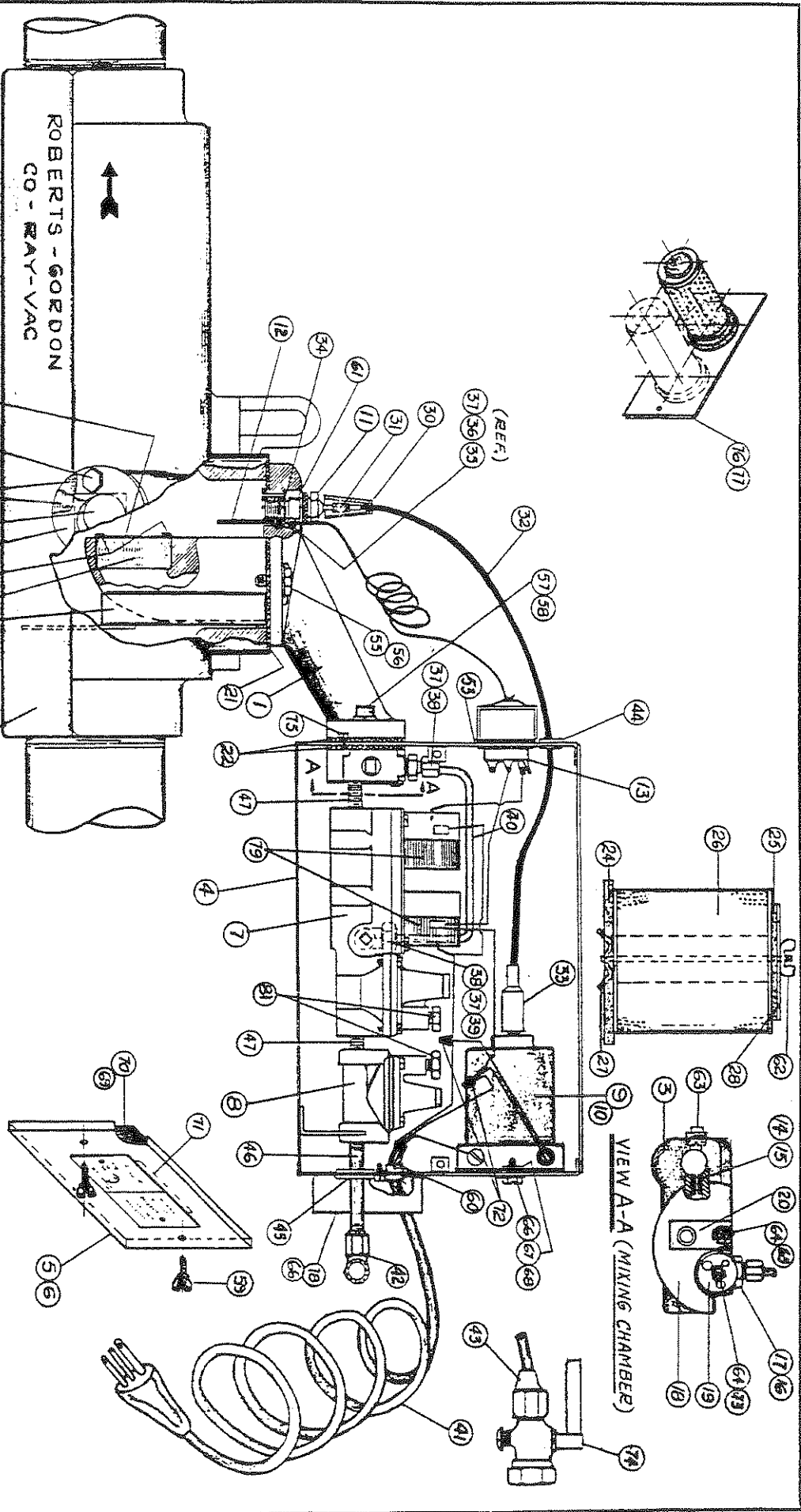
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ROBERTS - GORDON APPLIANCE CORP.
 BUFFALO, N. Y.

CO-RAY-VAC BURNER ASSY
 GRV 4-40

NONE
 APPROVED BY: *Amvns/Mvch*
 DATE: 4-18-68
 PART:

F-1285

CO-RAY-VAC[®] SERVICE MANUAL

MODEL CRV 6-60

INTRODUCTION

The CO-RAY-VAC[®] System consists of a network of combustion chambers connected with standard lengths of black steel tubing. The combustion chambers are usually connected in series with a limit of three in line. A vacuum pump maintains a vacuum in the tubing system. A gas burner is installed in each combustion chamber and is rated at 60,000 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 $\frac{1}{2}$ hour.
- 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. 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 tubing 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.

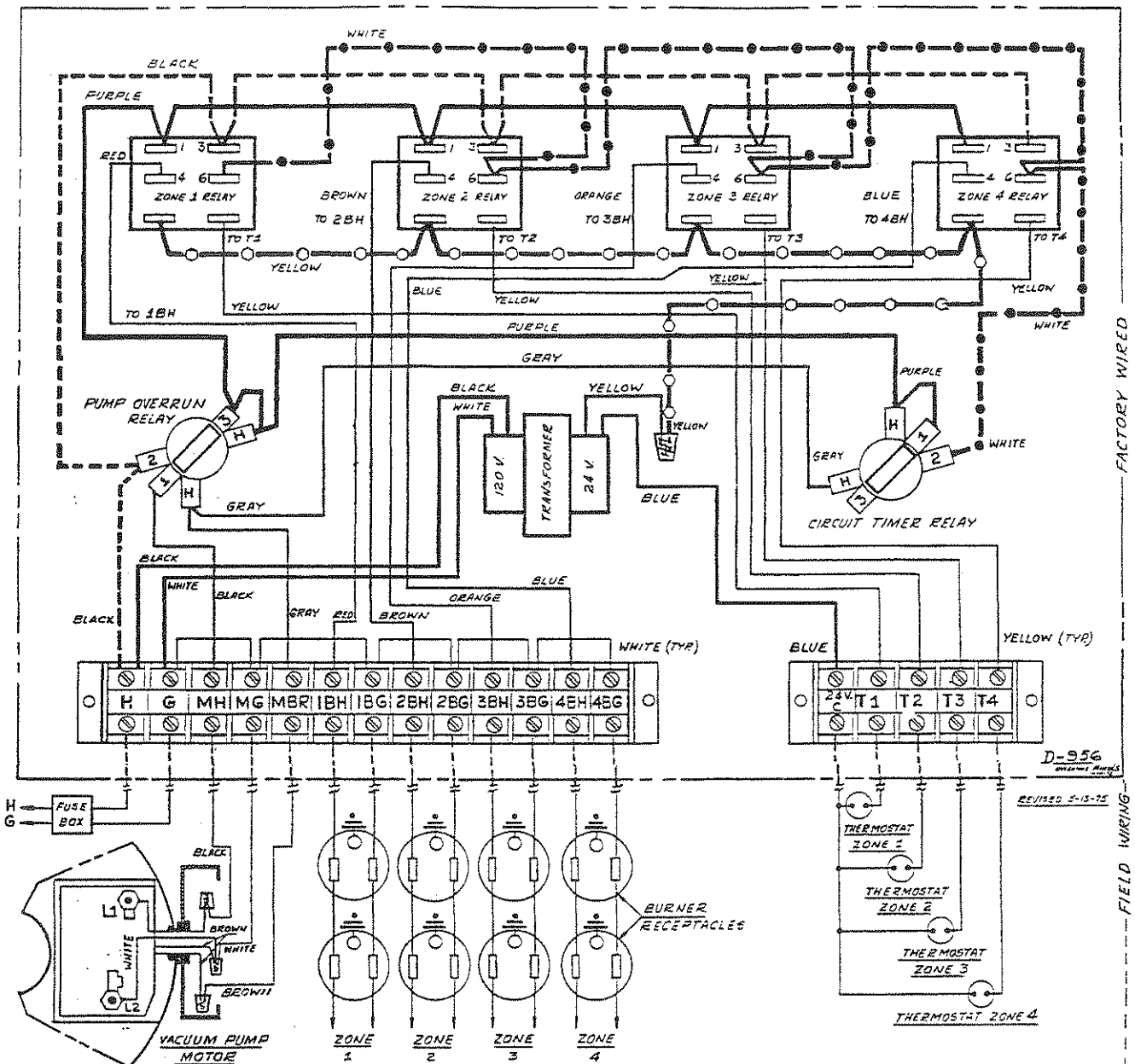
II. CHECKING ELECTRIC CIRCUITS

A. DESCRIPTION OF OPERATION (See Wiring Diagrams)

Either a line or low voltage thermostat is used for direct control of the system. The thermostats, operating in a low voltage circuit, operate zone relays in the control panel. These zone relays permit multiple thermostat control of the system, with the vacuum pump energized when any thermostat is calling for heat. One set of contacts (all in parallel with each other) in the relays operate the vacuum pump through the pump overrun relay. Thus any one relay-thermostat combination provides pump operation on a call for heat from any thermostat. Current from zone relay contact "3" flows to relay contact "1"; to pump overrun relay heater "H" and to the normally closed contact "3". Current passes through pump overrun relay contact "1" to terminal board "MH" to power the motor. When heater action switches the pump overrun relay, the motor is powered from normally open contact "2". Thus, the motor will continue to run until the heater cools and the relay switches back from "2" to "3". This delayed action will occur after the last thermostat is satisfied.

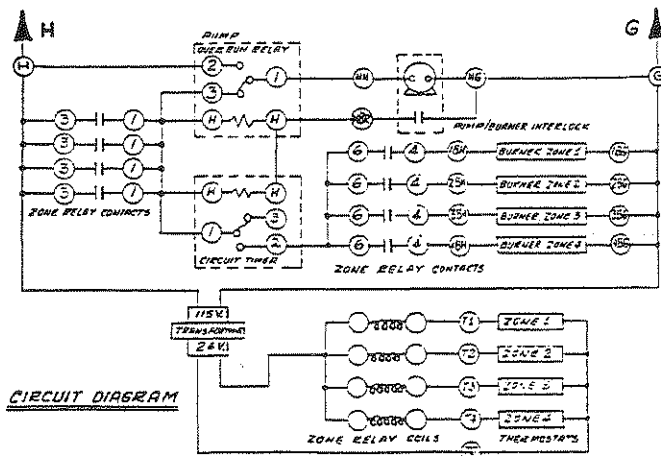
When pump overrun relay was powered, circuit timer relay contacts "1" and "H" were energized. When the heater action switches this relay contact, "2" is powered from contact "1" which energizes zone relay contact "6". If that zone is calling for heat current passes from contact "6" to contact "4" to terminal board (zone) BH and to the receptacles for that zone and energizing the burners in the system.

CO-RAY-VAC FIELD WIRING WHERE PANEL BOX #13-123-B IS USED



NOTES: CONNECTION SHOWN FOR WESTINGHOUSE MOTOR ONLY FOR OTHER MOTORS SEE CONFL DIAGRAMS
 IF THE MOTOR IS NOT EQUIPPED WITH TWO (2) BROWN LEAD WIRES
 INSTALL JUMPER WIRE FROM TERMINAL MG TO TERMINAL MBZ IN THE PANEL BOX.

IMPORTANT:
 MAKE SURE THAT
 BLOWER ROTATION
 IS IN ACCORDANCE
 WITH ARROW CAST
 ON SCROLL.

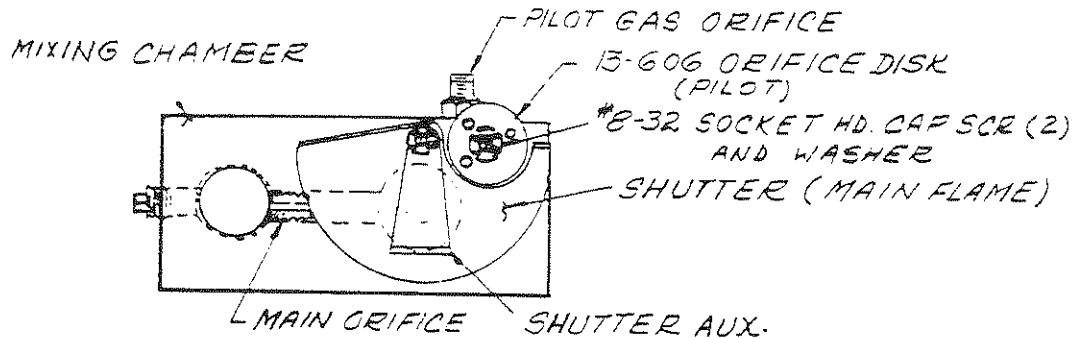


CIRCUIT DIAGRAM

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

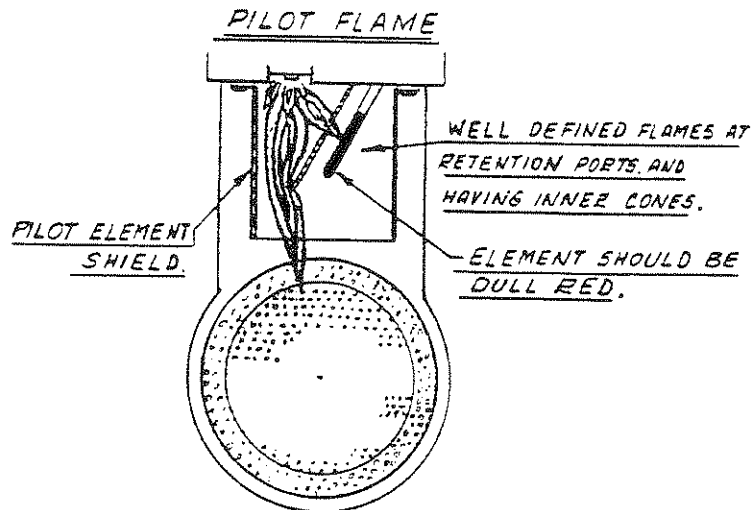
Air Adjustment:

- a. Pilot air may be adjusted by loosening 5-32 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 well defined cones at the pilot ports. See Diagram #6.



(Diagram #6)

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 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 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).

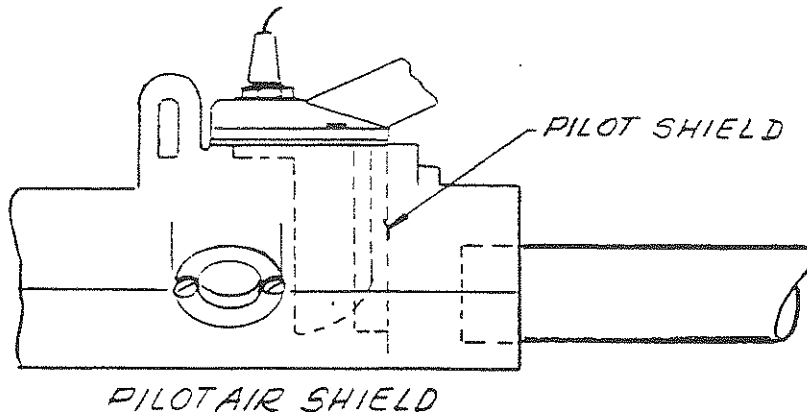
IV. MAIN BURNER FAILS TO IGNITE AND/OR BURN PROPERLY

- 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. 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)

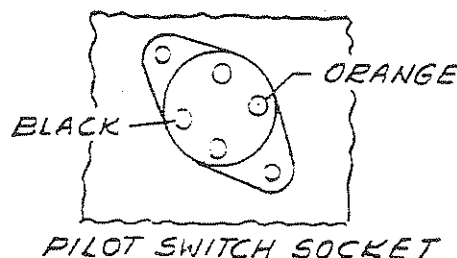
2. Check for air leaks at the burner flange, at the spark plug, at inspection windows, and where pilot element enters burner casting. Check for leaks at pilot tubing.
3. Remove pilot orifice (See Diagram #5) and make sure there are no stoppages due to chips or dirt, and that it is properly sized (No.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

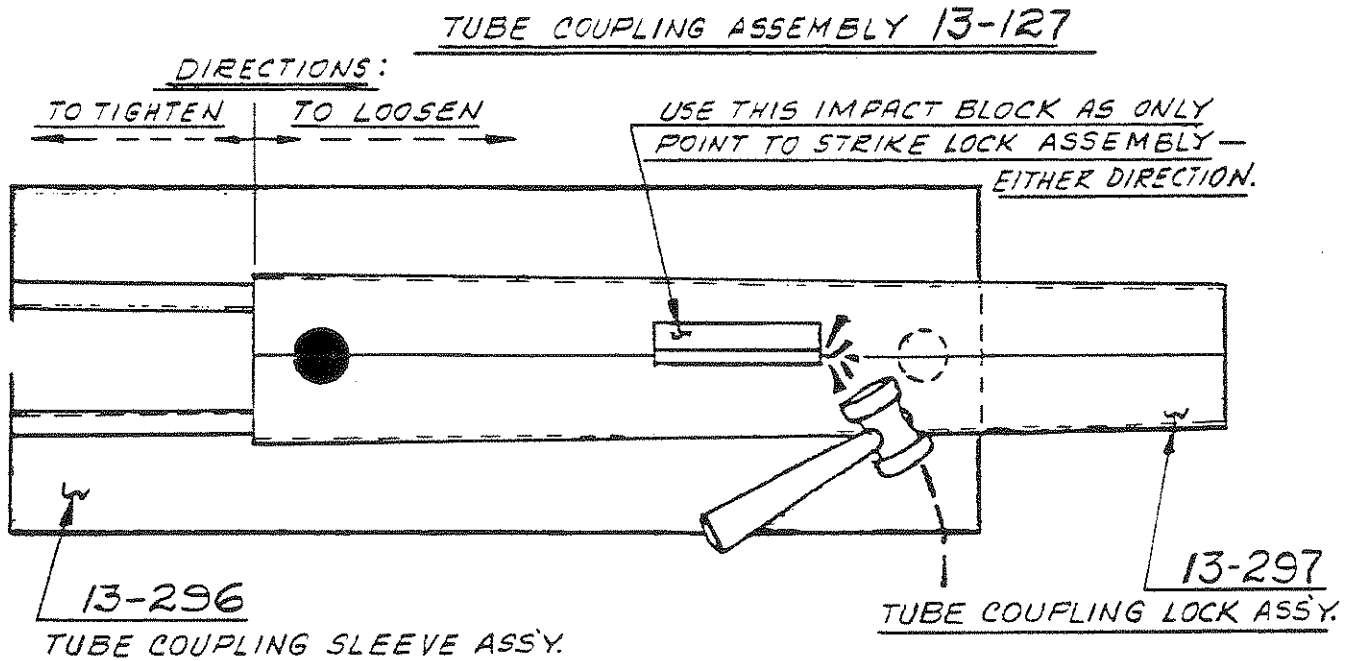
**BURNER FAILS TO OPERATE PROPERLY WHEN CONTROL HOUSING DOOR IS IN PLACE –
FLAME SMALL – DIRTY FILTER**

A. When control housing doors are in place and securely factened 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.



TO ASSEMBLE 13-127 TUBE COUPLING OVER THE 4" O.D. TUBING:

- 1.) Line up ends of 4" O.D. tubing, leaving approx. $\frac{1}{4}$ " space between ends.
- 2.) Wrap coupling sleeve assembly 13-296 around ends of the aligned 4" tubing, positioning the pins in 13-296 between the ends of the tubing.
- 3.) Squeeze and hold sleeve assembly in place, and engage the end of 13-297, which has a $\frac{1}{4}$ " hole through it, on the end of 13-296, which has a hole through it.
- 4.) Slide 13-297 approx. 6" onto 13-296. Push both ends of tube together against the pins, centering sleeve assembly.
- 5.) Drive 13-297 until the whole coupling assembly fits tightly on the tubing.

See Illustration Above.

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 "1". 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.

MODEL CRV6 - 60

ITEM	DESCRIPTION	PART NO.	QTY.	ITEM	DESCRIPTION	PART NO.	QTY.
1	Burner Casting Machined	13-955	1	46	SH6P3-4 Heycos	913-096	1
2	Combustion Chamber Assembled w/Obser. Windows	13-304	1	47			
3	Mixing Chamber - Machined	13-941	1	48	Junction Box	913-093	1
4	Control Housing Assembly	13-251	1	49			
5	Control Housing Door Ass'y w/Name Plate and Wiring Diagram	13-253-2	1	50	Elbow, Flare 3/8" Tubing	912-138	1
6	Control Housing Door Ass'y w/3" Opening for Filter	13-253-1	1	51	Washer, Flat, Brass	911-093	1
7	Double Filter Door Ass'y w/One Filter	13-126	As	52	Mica Window	25-532	2
8	Double Filter Door Ass'y w/Two Filters	13-126-1	Req.	53	Compression Fitting (Ref.)	912-114	1
9	Gas Valve - Main Flame, Eaton NCI-1181-1F	900-268	1	54	Alum. Sleeve (Ref.)	13-563	1
10	Coils for Gas Valve (Replacement)	900-149	As Req.	55	Ball Sleeve	8-783	3
11	Gas Regulator (Maxitrol RV 35A, Class I & II)	902-014	1	56	Air Sealer, Pilot Switch (Ref.)	907-072	1
12	Spark Igniter (Honeywell)	904-171	Use	57	Ceramic, Burner Port	13-688	1
13	Spark Igniter (W. R.)	904-174	1	58	Grid, Retainer, Burner	13-687	1
14	Spark Plug 14 mm	913-090	1	59	Cement, Refractory	913-071	Set
15	Pilot Switch Ass'y (W. R.)	13-137	1	60	Chip, Support Grid, Burner	13-673	3
16				61	Nipple 3/8 N. P. T.	912-016-4	1
17	Wire Harness w/Socket	13-267	1	62	Nipple 3/8 N. P. T. x Close	912-016-C	2
18				63			
19				64	Shot-off Valve (3/8 Tube x 1/2 N. P. T.)	901-012	1
20	Ignition Cable	913-091-1B	1	65	3/8" O. D. Tubing w/Flare Nuts, "U" Shape	13-615	1
21	Cord 16/3 S. J. (3 Wire)	913-064	1	66	1/4 O. D. Alum. Tubing (Pilot Line)	914-001-7 1/2	1
22	Orifice - Main Gas, Natural No. 71	13-942-21	Use	67	"KEPS" Nut No. 10-24	911-105-10-24	1
23	Orifice - Main Gas, L. P. No. 31	13-942-31	1	68	Ball Sleeve Nut 1/4 O. D. Tubing	8-784	2
24	Orifice - Pilot Gas, Natural No. 61	8-788-61	Use	69	Wire Nut	913-129	2
25	Orifice - Pilot Gas, L. P. No. 68	8-788-68	1	70	Plug, Pipe, 3/8 N. P. T. Sq. Hd.	912-018-3/8	1
26	Shutter - Air, Primary Main Air	13-605-1	1	71	Nut, Hex No. 5/16-18, Brass	911-003-5/16-18	2
27	Shutter - Air, Auxiliary	13-607	1	72	Washer, Lock, Spring No. 5/16	911-061-5/16	2
28	Orifice Disk - Pilot Primary Air	13-606	1	73	Nut, Hex No. 1/4-20	911-001-1/4-20	4
29	Gasket, Burner and Mixing Chamber	13-511	2	74	Screw, Socket Hd. Cap No. 8-32	911-117-1/2	2
30	Gasket, Combustion Chamber	13-678	1	75	Tinnerman, Special, Washer	911-078	2
31	Gasket, Filter, Bottom 13-613-1	13-613	1	76	Ext. Tooth Lock Washer No. 8	911-094-8	1
32	Gasket, Filter, Top 13-613-2			77	Nut, Wing, No. 10-24	911-005-10-24	1
33	Gasket - Door Control Housing	13-663-1	1	78			
34	Gasket, Door - Control Housing w/4" Dia. Hole	13-663	1	79	Shutter, End Vent	13-676	1
35	Gasket, Observation Window, Comb. Chamber	13-512	4	80	Screw, Thumb, Cone Point No. 10-24 x 9/16	911-151	4
36	Filter	907-070	1	81	Screw, Socket Hd. Cap, Cone Point No. 1/4-20	911-122-1 3/8	2
37	Filter Support	919-055	1	82	Washer, Lock Spring No. 1/4	911-061-1/4	2
38	Disk, Filter Support	13-612	1	83	Tinnerman Clip	911-076	2
39	Ring, Viewer, Comb. Chamber	13-902-1	2	84	Screw Sheet Mtl. No. 10, Type "A" Ind. Washer Hd.	911-121-1/2	4
40	Pilot Element Shield Ass'y	13-300	1	85	Washer, Ext. Tooth No. 10	911-094-10	1
41	Ignition Lead Cover	13-523	1	86	Screw, Sheet Mtl. No. 8, Type "A"	911-050-1/4	1
42	Rajah S-SOS No. 11 Ferrule	913-079	1	87	Screw, Stn. Stl. No. 8-32 Rd. Hd. Slot'd	911-157-1/4	2
43	Rajah S-SOS No. 11 Extended Bakelite	913-024	1	88	Internal Connection Diagram	D-960	1
44	Flexible Grommet, LMR No. 635	913-094	1	89	Vent Limiting Device, Maxitrol 12A04	902-025	2
45	Flexible Grommet, LMR No. 250	913-097	1				

PARTS LIST

CRV 2-40 1964 MODEL

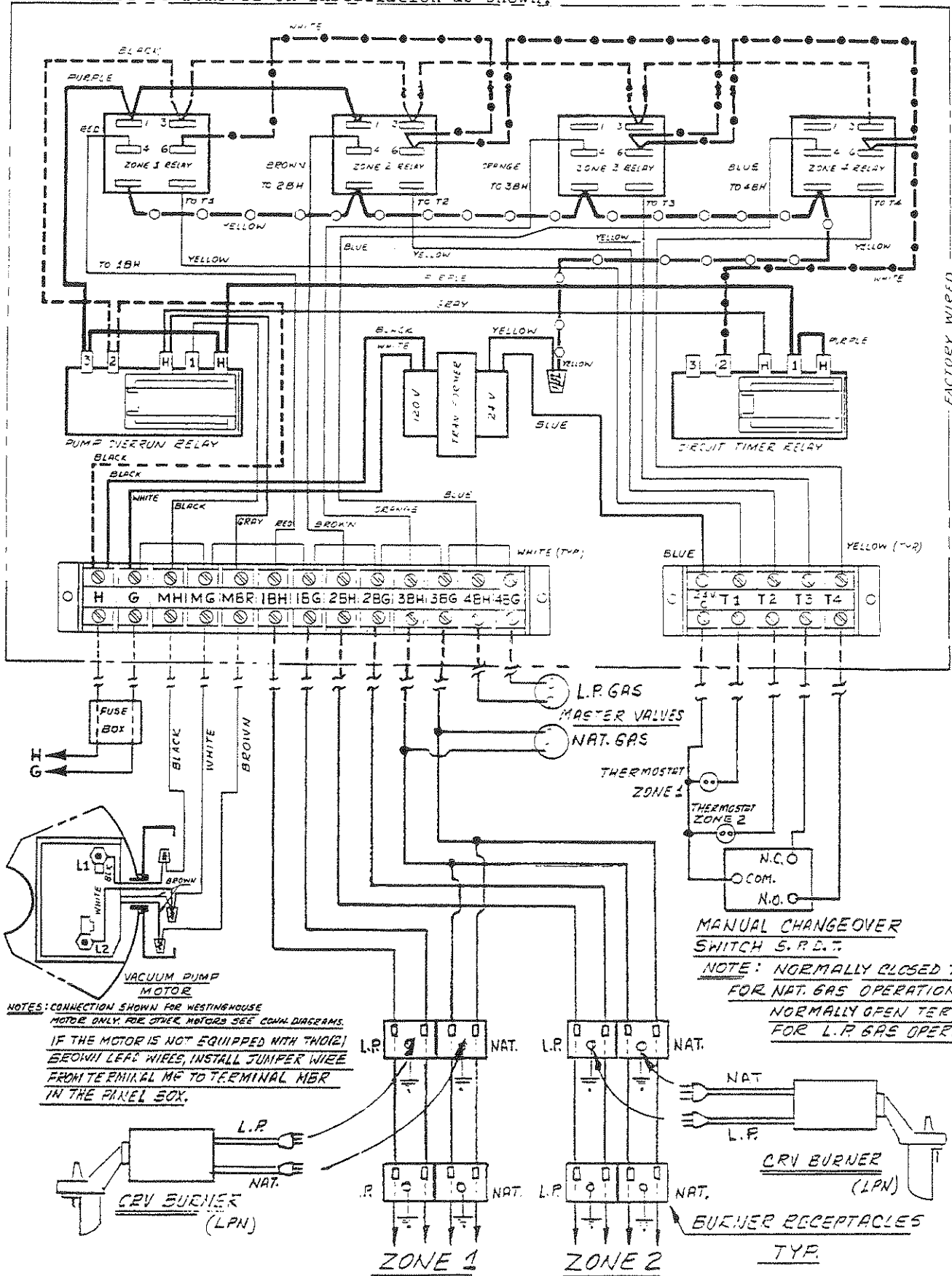
ITEM NO.		PART NO.	QUANTITY
1	COMBUSTION CHAMBER	13-909	1
2	BURNER CASTING	13-934	1
3	MIXER CHAMBER	13-921	1
4	AIR SHUTTER ASSEMBLY	13-224	1
5	CONTROL HOUSING SUB-ASSEMBLY	13-215	1
6	VALVE, COMBINATION	900-119	1
7	TRANSFORMER HRT 1-140	900-133	1
8	SPARK PLUG 14MM, SPECIAL	913-070	1
9	PILOT GAS REGULATOR	13-935	1
10	DELAY RELAY	904-133	1
11	SOCKET WITH WIRE HARNESS	13-230	1
12	PILOT SENSING ELEMENT AND SWITCH	903-002-52	1
13	ORIFICE - MAIN GAS	919-102	1
14	ORIFICE - PILOT GAS	919-094	1
15	CONTROL HOUSING DOOR	13-554	1
16	*FILTER DOOR ASSEMBLY	13-227	AS REQ'D.
17	CERAMIC BLOCK	908-014	1
18	BURNER GASKET	13-564	1
19	GASKET	13-511	2
20	COMPRESSION FITTING	912-114	1
21	BALL SLEEVE 1/4"	8-783	1
22	ALUMINUM SLEEVE	13-563	1
23	IGNITION LEAD COVER	13-523	1
24	RAJAH FERRULE #8-SOS11	913-079	1
25	SPARK PLUG GASKET, BRASS	911-093	1
26	ELBOW 1/8 N.P.T. & 3/8 TUBE, SPECIAL	912-136	1
27	ALUMINUM TUBING 3/8 O.D. x 11-1/4 LONG	13-571	1
28	NIPPLE PIPE 3/8 N.P.T.	912-016-4.5	1
29	TEE, BRASS 1/8 N.P.T.	912-073-1/8	2
30	CONNECTOR 1/8 N.P.T. & 3/8 TUBE	912-005	1
31	RESTRICTOR, PILOT	13-570	1
32	SOLENOID 115V (FOR REPLACEMENT ONLY)	900-149	AS REQ'D.
33	MARCOSET HIGH TEMPERATURE CEMENT	913-071	AS REQ'D.
34	SHUT-OFF VALVE 1/8 N.P.T.	3-762	1
35	NIPPLE PIPE 1/8 N.P.T. CLOSE	912-014 x C	1
36	PILOT ORIFICE ADAPTOR	13-937	1
37	ELBOW, STREET 1/8 N.P.T.	912-036-1/8	1
38	NIPPLE, PIPE 1/8 N.P.T. x 1.5	912-014-1.5	1
39	VALVE SUPPORT BRACKET	13-553	1
40	SRM HEYCOS	913-063	1
41	ADAPTOR CLIP 7/8	913-052	1
42	CORD, CORNISH #17460 (3 WIRE)	913-064-36	1
43	NIPPLE, PIPE 3/8 N.P.T. x 1.5	912-016-1.5	1
44	BURNER NAME PLATE, NATURAL GAS	910-013	1
45	*BURNER NAME PLATE, LP GAS	910-020	1
46	GROMMET, TRNS. PRIMARY	913-075	1
47	GROMMET, PILOT TUBE	913-043	1
48	MICA WINDOW	13-513	2
49	GASKET	13-512	4
50	RING, VIEWER	13-902	2
51	*LP GAS CONVERSION KIT	900-132	
52	AIR SHUTTER	13-928	1
53	ALLEN SET SCREW HALF DO6 #1/4-20	911-111-1/2	2
54	#5/16-18 HEX HEAD SCREW PLATED	911-026-3/4	2
55	SCREW SOCKET HEAD CAP #1/4-20	911-091-1 1/2	2
56	LOCK WASHER, SPRING #1/4	911-061-1/2	2
57	*PILOT AIR FILTER ASSEMBLY	13-229	AS REQ'D.
58	*FILTER PLUG	13-567	AS REQ'D.
59	*DOOR WITH 3" OPENING	13-554-2	AS REQ'D.
60	SHUT-OFF VALVE	901-012	1
61	NUT, FLARE 3/8 O.D. TUBE	912-139	2
62	ELBOW, FLARE 3/8 N.P.T. & 3/8 TUBE	912-138	1
63	3/8 O.D. ALUMINUM TUBING x 36 LONG	914-003-36	1
64	#1/4-20 HEX HEAD SCREW	911-025-1/2	4

*OPTIONAL

FOR COMBINATION L.P./NAT. GAS EURNERS FOR LPN SEMI AUTOMATIC CHANGEOVER.

CO-RAY-VAC FIELD WIRING WHERE PANEL BOX #13-123-A IS USED:

NOTE: Purple wire from Zone Relay 2, Terminal 1; to Zone Relay 3, Terminal 1 must be removed on installation as shown.



NOTES: CONNECTION SHOWN FOR WESTINGHOUSE MOTOR ONLY. FOR OTHER MOTORS SEE COWM DIAGRAMS. IF THE MOTOR IS NOT EQUIPPED WITH TWO(2) BROWN LEAD WIRES, INSTALL JUMPER WIRE FROM TERMINAL MH TO TERMINAL MBR IN THE PANEL BOX.

MANUAL CHANGEOVER SWITCH S.R.T.

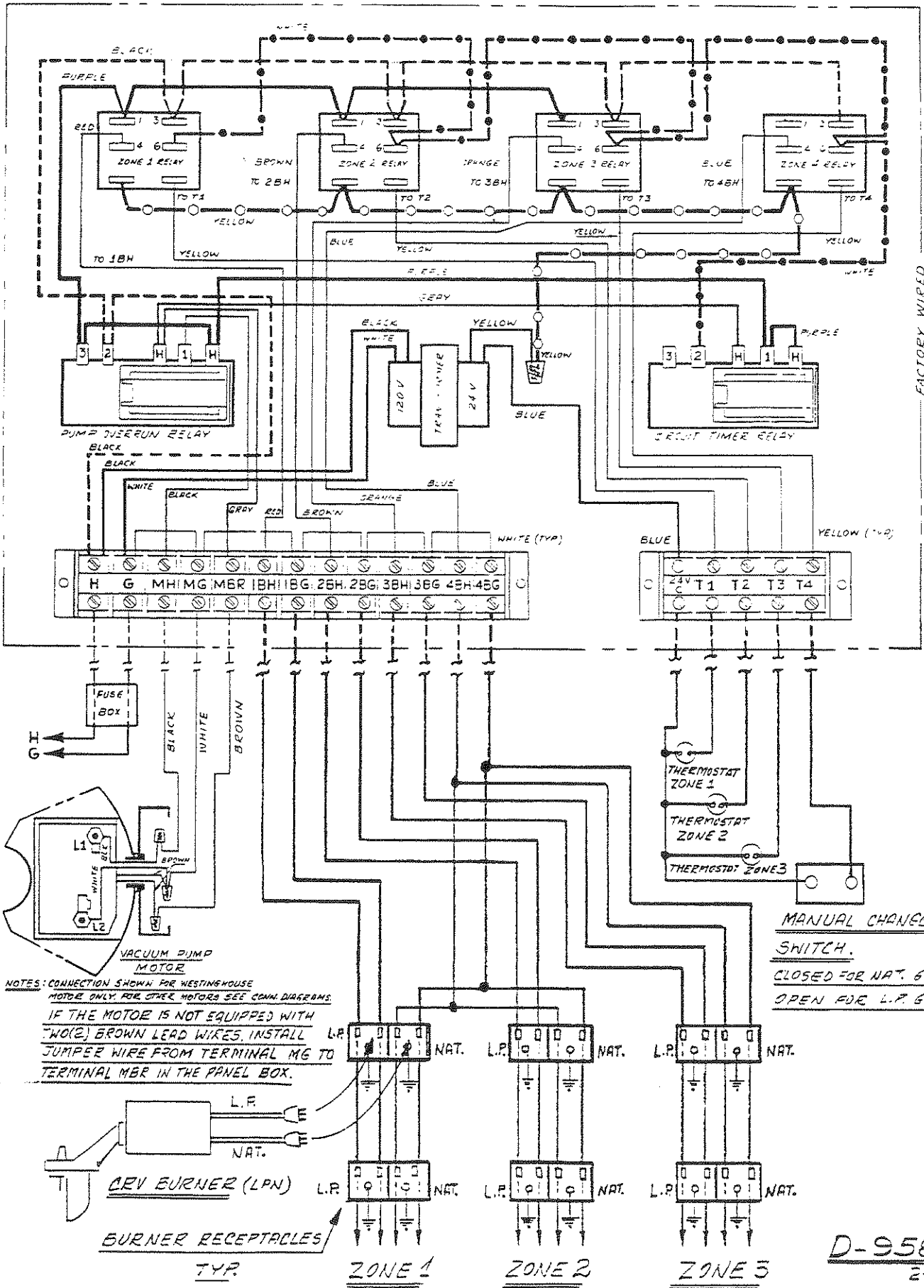
NOTE: NORMALLY CLOSED TERMINAL FOR NAT. GAS OPERATION, AND NORMALLY OPEN TERMINAL FOR L.P. GAS OPERATION.

BILL OF MATERIALS
CRV 2-40 1963 MODEL

NO.	PART DESCRIPTION	PART NO.	QTY.
1	COMBUSTION CHAMBER (MACH.)	13-909	1
2	BURNER CASTING (MACHINED)	13-925	1
3	MIXING CHAMBER (MACHINED)	13-921	1
4	AIR SHUTTER ASS'Y	13-224	1
5	CONTROL HOUSING SUB'ASS'Y	13-215	1
6	VALVE COMBINATION	900-119	1
7	TRANSFORMER HRT-140	900-133	1
8	REGULATOR - PILOT	13-923	1
9	DELAY RELAY	904-133	1
10	SOCKET WITH WIRE HARNESS	13-222	1
11	PILOT SENSING ELEMENT & SWITCH ASS'Y 30A46-52	903-002-52	1
12	BURNER CERAMIC	908-014	1
13	GRID - PILOT	13-562	1
14	SPARK ELECTRODE PLUG	13-926	1
15	INSULATOR - CERAMIC TOP	908-003	1
16	INSULATOR - CERAMIC BOTTOM	908-004	1
17	IGNITION LEAD COVER	13-523	1
18	RAJAH SPRING TERMINAL	913-025	1
19	MICA WINDOW	13-513	2
20	RING VIEWER	13-902	2
21	GASKET - RING VIEWER	13-512	4
22	GASKET - MIXING CHAMBER	13-511	2
23	PIPE NIPPLE 3/8 N.P.T.	912-016-4.5	1
24	CONTROL HOUSING DOOR	13-554	2
25	*FILTER DOOR ASS'Y	13-227	AS REQ'D
26	BURNER NAME PLATE	910-013	1
27	VALVE SUPPORT BRKT.	13-553	1
28	SR-16-1 RIGHT ANGLE HEYCOS	913-051	1
29			
30	CORD BELDEN #17826B	913-050-36	1
31	MALE CONNECTOR 3/8 N.P.T. 3/8 S.A.E.	912-111	1
32	GROMMET	913-015	1
33	1/4 O.D. ALUM. TUBING 7.5 LG.	914-001-7.5	1
34	BALL SLEEVE	8-783	2
35	BALL SLEEVE NUT	8-784	2
36	ELBOW BRASS	8-163	2
37	GASKET	13-564	1
38	REVERSE PLUG #36 DRILL	919-102-36	1
39	RAJAH BASE STUD #10-32	913-026	1
40	PIPE NIPPLE 1/8 x CLOSE	912-014xC	1
41	ALUM. SLEEVE	13-563	1
42	COMPRESSION FITING	912-114	1
43	BALL SLEEVE	8-783	1

*OPTIONAL

FOR COMBINATION L.P./NAT. GAS BURNERS
CO-RAY-VAC FIELD WIRING WHERE PANEL BOX #13-123-A IS USED:
FOR LPN MANUAL CHANGEOVER



NOTES: CONNECTION SHOWN FOR WESTINGHOUSE MOTOR ONLY. FOR OTHER MOTORS SEE COMM. DIAGRAMS.
 IF THE MOTOR IS NOT EQUIPPED WITH TWO (2) BROWN LEAD WIRES, INSTALL JUMPER WIRE FROM TERMINAL MG TO TERMINAL MR IN THE PANEL BOX.

MANUAL CHANGEOVER SWITCH.
 CLOSED FOR NAT. GAS
 OPEN FOR L.P. GAS

