INSTALLATION and OPERATING INSTRUCTIONS

For Use By Qualified Service Technicians Only

CARLIN OIL BURNERS Models 501CRD and 601CRD (60-Hz)

DESCRIPTION

"CRD" burners feature a combustion head incorporating a new design concept which provides a means to control the air pattern to match the nozzle requirements. The aerodynamics for optimum combustion are easily adjusted for any nozzle size without changing the air-handling hardware. The flame front is initiated inside the air tube so that no erratic recirculating gasses from the main chamber area can quench the flame at the retention ring.

The letters "CRD" stand for "Controlled Retention—Double Speed."

Use of a small blower wheel (fan) operating at 3450 rpm provides a more positive, yet quiet, air flow which does not yield to normal draft variations and therefore assures a more constant air-fuel ratio for dependably clean combustion day after day.

SPECIFICATIONS

ITEMS	MODEL NUMBER 501CRD	601CRD
Fuel Specification	No. 2 CS12	No. 2 CS12
Firing Range	6.00–12.00*	6.00–13.20*
Motor HP, rpm	⅓, 3450 rpm	½, 3450 rpm
Motor Phase, Hz	Single, 60-Hz	Single, 60-Hz
Motor Amps	5.7 (approx.)	6.4 (approx.)
Motor Volts, Standard	120V	120V
Motor Volts, Optional	—	230V**
Motor Contactor	—	DPST-Optional**
Standard Control Type	R8184G	R8184G
Control Volts, Hz	120V, 60-Hz	120V, 60-Hz
Ignition Transformer	120/12,000	120/12,000
Burner Housing	Rugged Casting	Rugged Casting
Blower Wheel Diam. × Width	5¾" × 4"	6⅝" × 4"
2-Stage Fuel Unit Pressure	150 psi	150 psi
Oil Valve Volts, Hz	120V, 60-Hz	120V, 60-Hz
Oil Nozzle Specs.	45° SS	45° SS
Approximate Shipping Weight	65 lbs.	65 lbs.

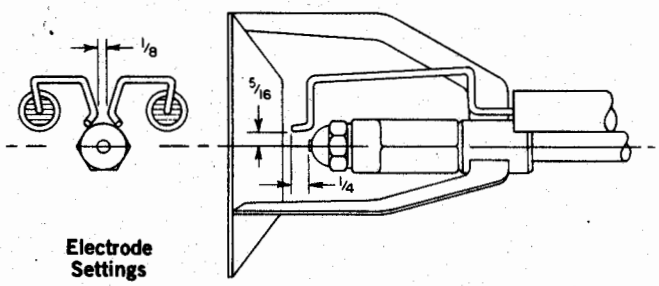
*The maximum high-fire capability shown is for natural draft. With forced draft the maximum firing rate is reduced.
**Motor contactor optional on Model 601CRD at an additional cost. Required when motor is for 230 volts.

ASSEMBLING THE BURNER (TWO-PAK)

1. Remove the air tube and nozzle line assembly from the smaller carton. If nozzles are not installed, see instructions under (4).
2. Remove the main housing assembly from the larger carton.
3. Install air tube assembly in housing using set screws provided.
4. Install and tighten the proper nozzles (45° SS Hago) in the adapter. Be careful not to damage the electrode insulators or to bend the wires.
5. Check the electrode settings specified as follows: ⅛-inch to 3/16-inch gap, 5/16-inch above the nozzle centerline and ¼-inch ahead of the nozzle tips. See Fig. 1.

It is important that the installation of the oil burner, piping and fittings, safety devices, controls, electrical wiring and equipment be done in accordance with national and/or local regulations of the authorities having jurisdiction over such installation.

Fig. 1.



Electrode Settings

6. Swing open the transformer, and slide the nozzle line assembly into the air tube.
7. Place the nozzle line yoke in the groove in the adjusting screw.
8. Fasten the high tension leads to the transformer terminals.
9. Swing the transformer to the closed position and fasten.
10. Connect the flared fitting on the copper oil line to the nozzle line and tighten.

ABOUT COMBUSTION CHAMBERS

Models 501CRD and 601CRD operate with superior efficiency and cleanliness in properly designed refractory-type combustion chambers. Very wide tolerance to burner adjustments and other variables is found when these chambers are used. Noise levels are also reduced.

Tables 1 and 2, page 2 shows the recommended *minimum* inside dimensions for refractory brick, refractory pre-cast and pre-formed refractory fiber chambers. Due to their quick warm-up properties, the lightweight insulating-type materials are slightly preferable although these burners show less dependence upon refractory temperature than previous models. Refractory materials in boilers and furnaces should be capable of withstanding 2600°F (1427°C) or higher.

The notes accompanying Tables 1 and 2 provide further details relative to variations in dimensions and geometry. Refer to Fig. 3, page 2.

FIRING BOILERS WITHOUT REFRACTORY CHAMBERS

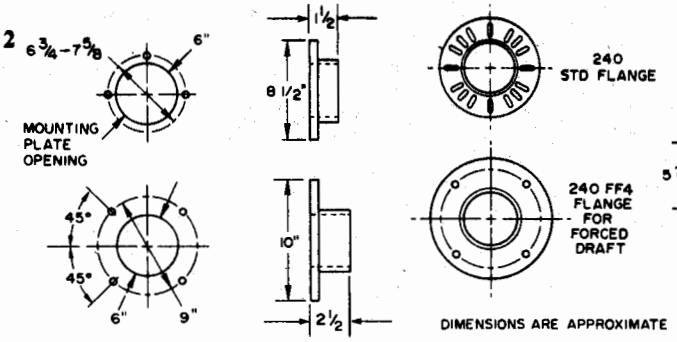
Depending upon the geometry of the combustion space some units perform better than others without refractory. When the back wall of the unit coincides approximately with the end of the flame, a target of refractory material is essential. Zero smoke readings are made easier if a refractory fiber "rug" or fill material is used on the base under the flame.

Tables 1 and 2, together with their footnotes, give the essential dimensions and information needed to provide conditions for satisfactory operation without complete chambers. Refer to Figs. 4 and 5, page 2.

INSTALLING THE BURNER: FLANGE MOUNTED

1. Measure, in the burner opening, the distance from the inside of the combustion chamber to the outside of the mounting plate to find the insertion length of air tube needed. Position flange on air tube at a point from end of burner corresponding to this measurement. Tighten set screws to anchor flange. The flange is now located so that the end of the burner will be flush, or almost flush, with the inside of the combustion chamber. See Fig. 3 (side view) page 2, and Fig. 6, page 2.
2. Slide the end of the air tube into the opening and secure the flange to the front plate.

Fig. 2



INSTALLING THE BURNER: PEDESTAL MOUNTED

1. Adjust the pedestal so that the height of the air tube matches the location of the burner opening.
2. Slide the end of the air tube into the opening so that it is flush or nearly flush with the inside of the combustion chamber. See Fig. 7.
3. From the outside of the unit, seal the space around the air tube with asbestos cement or equivalent.

Table 1. RECOMMENDED MINIMUM DIMENSIONS OF COMBUSTION CHAMBER FOR MODEL 501CRD (Inches)

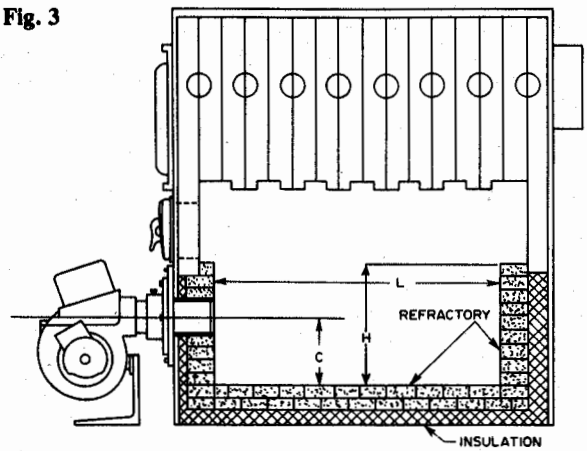
		Minimum Inside Dimensions In Refractory Type Combustion Chambers (Ins.)					Minimum Dimensions In Boilers Fired Without Refractory Chambers (Ins.)				
1 Nozzle Size	2 Firing Rate (GPH) At 150 psi	3 Length (L)	4 Width (W)	5 Dimension (C)	6 Height (H)	7 Vertical CYL.	8 Length (L) with Target	9 Length (L) without Target	10 Width (W)	11 Dimension (C)	12 Dimension (D)
5.00	6.00	18	16	7.5	15	16	18	22	18	8.5	10.5
5.50	6.60	19	16	7.5	15	17	19	23	18	8.5	10.5
6.00	7.20	20	17	8.0	16	18	20	24	19	9.0	11.0
6.50	7.80	22	17	8.0	16	20	22	27	19	9.0	11.0
7.00	8.40	24	18	8.5	17	22	24	29	20	9.5	11.5
7.50	9.00	27	18	8.5	17	25	27	33	20	9.5	11.5
8.00	9.60	30	20	9.5	19	28	30	36	22	10.5	12.5
8.50	10.20	33	21	10.0	20	31	33	40	23	11.0	13.0
9.00	10.80	36	22	10.5	21	34	36	43	24	11.5	13.5
9.50	11.40	40	22	10.5	21	38	40	48	24	11.5	13.5
10.00	12.00	44	23	11.0	22	42	44	52	25	12.0	14.0

Table 2. RECOMMENDED MINIMUM DIMENSIONS OF COMBUSTION CHAMBER FOR MODEL 601CRD (Inches)

		Minimum Inside Dimensions In Refractory Type Combustion Chambers (Ins.)					Minimum Dimensions In Boilers Fired Without Refractory Chambers (Ins.)				
1 Nozzle Size	2 Firing Rate (GPH) At 150 psi	3 Length (L)	4 Width (W)	5 Dimension (C)	6 Height (H)	7 Vertical CYL.	8 Length (L) with Target	9 Length (L) without Target	10 Width (W)	11 Dimension (C)	12 Dimension (D)
5.00	6.00	18	16	7.5	15	16	18	22	18	8.5	10.5
5.50	6.60	19	16	7.5	15	17	19	23	18	8.5	10.5
6.00	7.20	20	17	8.0	16	18	20	24	19	9.0	11.0
6.50	7.80	22	17	8.0	16	20	22	27	19	9.0	11.0
7.00	8.40	24	17	8.0	16	22	24	29	19	9.0	11.0
7.50	9.00	27	17	8.0	16	25	27	33	19	9.0	11.0
8.00	9.60	30	17	8.0	16	28	30	36	19	9.0	11.0
8.50	10.20	31	17	8.0	16	29	31	38	19	9.0	11.0
9.00	10.80	33	17	8.0	16	31	33	40	19	9.0	11.0
9.50	11.40	35	17	8.0	16	33	35	42	19	9.0	11.0
10.00	12.00	38	18	8.5	17	36	38	46	20	9.5	11.5
11.00	13.20	42	18	8.5	17	40	42	50	20	9.5	11.5

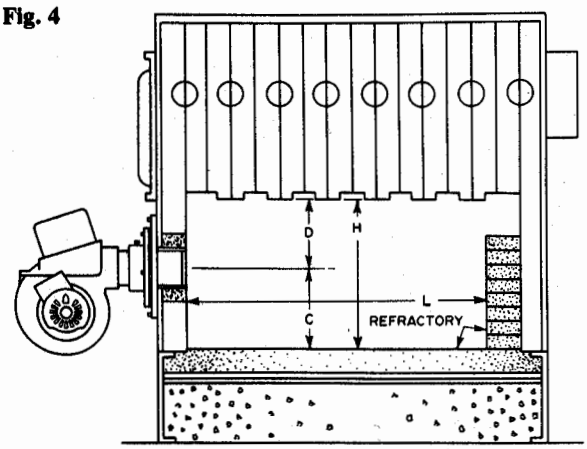
1. Flame lengths are approximately as shown in column (3) when using 45° SS nozzles. Flames approximately 10% shorter are attainable with 45° H nozzles. Often, tested boilers or furnaces will operate well with chamber shorter than the lengths shown in column (3).
2. As a general practice any of these dimensions can be exceeded without much effect on combustion.
3. Chambers in the form of horizontal cylinders should be at least as large in diameter as the dimension in column (4). Horizontal stainless steel cylindrical chambers should be 1 to 4 inches larger in diameter than the figures in column (4).
4. Wing walls are not recommended. Corbels are not necessary although they might be of benefit to good heat distribution in certain boiler or furnace designs.
5. A fiber-type refractory "rug" or fill material to cover the floor area of the combustion space in boilers fired without refractory chambers is recommended for cleaner combustion and to protect the base.
6. When a refractory or refractory fiber target is used the lengths in column (8) apply. If the lengths are equal to or longer than in column (9) no target material is needed unless recommended by the boiler manufacturer.

Fig. 3



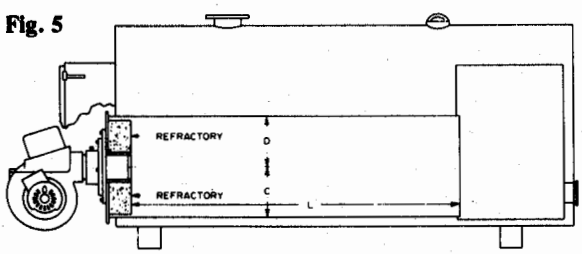
Brick combustion chamber, side view.

Fig. 4



Wet leg boiler. No combustion chamber, side view.

Fig. 5



Scotch Marine boiler. No combustion chamber.

Fig. 6.

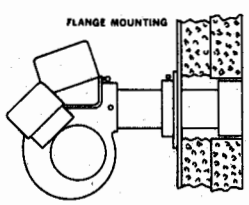
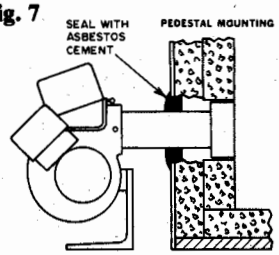


Fig. 7



WIRING

When the burner is furnished with a burner-mounted primary control, field connections are to be made in the 4" × 4" junction box under the control. The motor, transformer, oil valve, and flame detector are pre-wired. High limit, low water cut-off, fusible link switch, emergency and service switches are wired in series between the hot supply lead and the unwired black lead in the control. The thermostat or operating control, if used, is wired to "T" and "T." Otherwise, jumper "T" and "T."

When the primary control is mounted on the boiler or furnace, the motor, transformer, and oil valve connections are joined in the junction box mounted on the motor.

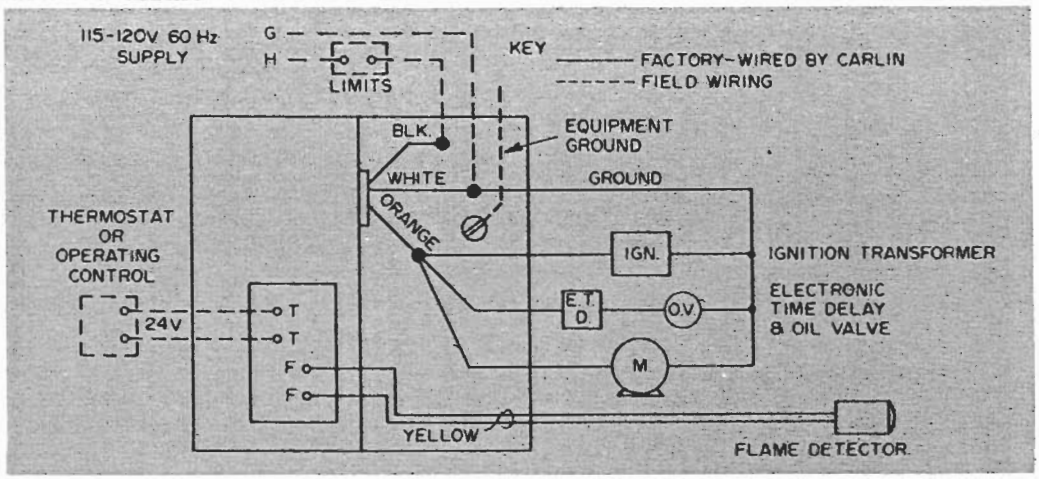


Fig. 8

HONEYWELL TYPE R8184G
CONSTANT IGNITION

NOTE: CONSTANT IGNITION= Spark "ON" during entire burning cycle.

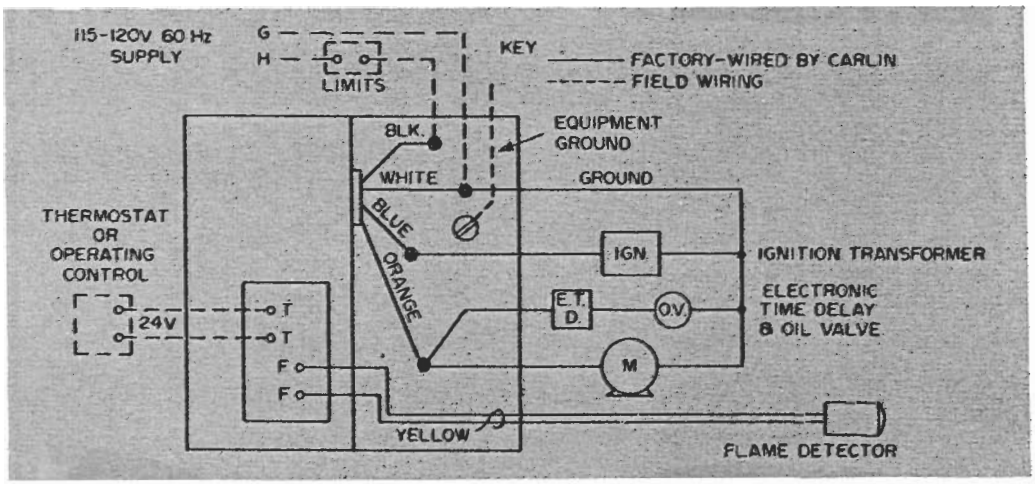


Fig. 9

HONEYWELL TYPE R8404A
OR WHITE-RODGERS TYPE 669

NOTE: INTERMITTENT IGNITION= Spark "ON" only at burner start.

Burners also available with electronic controls. Appropriate wiring diagram is shipped with each burner.

HOW TO ADJUST THE COMBUSTION HEAD

The retention ring position ahead of the throttle ring is adjustable from zero (flush) to 1 1/8-inches (Dimension "A," Figs. 10 and 11). Turning the adjustable screw in (clockwise) increases the distance "A" ahead. This distance is indicated by reading the scale on the nozzle line across the corners on sides of the channel guiding the nozzle line. Each division is 1/16-inch.

Fig. 10

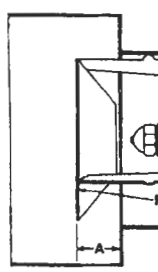
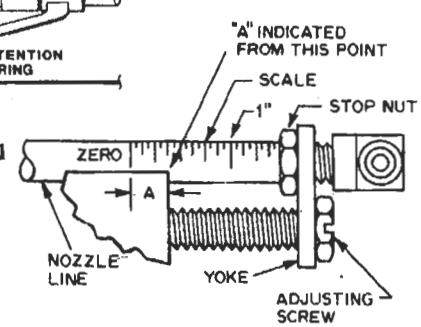


Fig. 11



RETENTION RING AND AIR SHUTTER ADJUSTMENTS

Tables 3 and 4 show for each firing rate the approximate recommended positions of the flame retention ring with the corresponding amounts of air shutter opening. Tables 3 and 4 are provided as a guide only. Final adjustments must be made to suit the conditions of the installation.

Table 3. APPROXIMATE SETTINGS FOR MODEL 501CRD (5¾" × 4" Blower Wheel)

Nozzle Size	Firing Rate (GPH) at 150 psi	Retention Ring Setting, Inches on Scale, Dimension "A"	Initial Air Shutter Opening (Percent)
5.00	6.00	3/16	50
5.50	6.60	1/4	65
6.00	7.20	5/16	75
6.50	7.80	3/8	80
7.00	8.40	7/16	90
7.50	9.00	1/2	100
8.00	9.60	5/8	100
8.50	10.20	3/4	100
9.00	10.80	7/8	100
9.50	11.40	1	100
10.00	12.00	1 1/4	100

Table 4. APPROXIMATE SETTINGS FOR MODEL 601CRD (6 5/16" × 4" Blower Wheel)

Nozzle Size	Firing Rate (GPH) at 150 psi	Retention Ring Setting, Inches on Scale, Dimension "A"	Initial Air Shutter Opening (Percent)
5.00	6.00	1/8	35
5.50	6.60	3/16	45
6.00	7.20	1/4	50
6.50	7.80	5/16	55
7.00	8.40	3/8	60
7.50	9.00	7/16	65
8.00	9.60	1/2	70
8.50	10.20	9/16	85
9.00	10.80	5/8	100
9.50	11.40	3/4	100
10.00	12.00	7/8	100
11.00	13.20	1 1/4	100

NOZZLE SPECIFICATIONS: 45° SS or 45° H HAGO

45 ° H (hollow cone spray) nozzles provide approximately 10% shorter flame than 45 ° SS nozzles.

Other makes of nozzles may or may not prove satisfactory. Sufficient test data is not available to make other recommendations. The correlation of nozzle sprays between different manufacturers is not consistent.

For special applications, other specifications might provide a more desirable pattern.

FUEL UNITS AND OIL LINES

Standard burners are provided with a two-stage 3450 rpm fuel unit *set at 150 psi*.

A *single-pipe system* is recommended whenever the bottom of the fuel tank is above the burner or is at the same level as the burner. This includes outdoor fuel tanks that are at such levels.

A *two-pipe system* is recommended when the fuel tank is below the level of the burner, and the fuel unit must pull (lift) the fuel up to the burner. For two-pipe installations the by-pass plug must be installed. Maximum recommended vacuum is 12 inches of mercury.

Table 5 shows, for the standard two-stage fuel unit, the allowable lift and lengths of 1/2" and 5/8" OD tubing for both suction and return lines in two-pipe systems.

Be sure that all oil line connections are absolutely airtight. Check all connections and joints. Flared fittings are recommended. *Do not* use compression fittings.

Open the air-bleed valve and start the burner. For clean bleed, slip a 3/16" ID hose over the end of the bleed valve and bleed into a container. Continue to bleed for 15 seconds after oil is free of air bubbles. Stop the burner and close the bleed valve.

Table 5. TWO-STAGE UNITS—TWO-PIPE SYSTEMS SUNTEC H3PB-B100 (150 PSI) WEBSTER 22R22OD-5EC3 (150 PSI)

Lift (feet)	Length of Tubing (feet) ½" OD	⅝" OD
0	100	100
2	88	100
4	78	100
6	69	100
8	59	100
10	49	100
12	39	100
14	29	82
15	24	68

LIGHT-OFF AND ADJUSTMENT

Before re-starting the burner, preset the air shutter and the retention ring position for the particular firing rate according to Table 3, page 3 for 501CRD or Table 4, page 4, for 601CRD.

If the fire is a little too rich, open the air shutter or move the combustion head forward by increasing dimension "A," Fig. 10, page 3. At the lower inputs, a very slight change is usually enough.

Adjust draft to 0.02 to 0.04 inches W. C. over the fire for natural draft units.

Run a smoke test. Strive for zero or a trace. Each time further adjustment of air or retention ring is made, reset the draft to 0.02 to 0.04 inches W. C. over the fire.

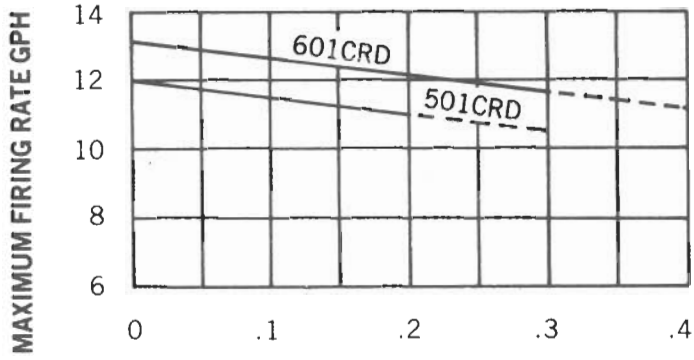
Check CO_2. This should be over 10 percent, and will often be over 13 percent, in a well-sealed unit.

Check for good ignition and clean cut-off. If cut-off continues to be poor, look for air leaks in the suction line and correct them.

FORCED DRAFT FIRING

Due to the back pressure in forced draft units the maximum firing rate of a burner is reduced. The greater the pressure, the lower the maximum GPH capability becomes. Note that the graph below stops at 0.20 inches W. C. for Model 501CRD and at 0.30 inches W. C. for Model 601CRD; the maximum recommended back pressure for these models.

The combustion head settings for forced draft firing would be somewhat greater than those shown in Table 3, page 3, and Table 4, page 4, which are for zero pressure or natural draft.



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