



Residential Oil Burner Guide

EZ/EZ-Pro

EZ-1 (0.50 to 1.65 GPH)

EZ-2 (1.50 to 2.25 GPH)

EZ-3 (2.00 to 2.60 GPH)

99FRD/100CRD/ 102CRD

99FRD (0.50 to 3.00 GPH)

100CRD (0.50 to 2.25 GPH)

102CRD (2.00 to 4.50 GPH)

CARLIN. THE TECHNOLOGY LEADER.



CARLIN. THE TECHNOLOGY LEADER.

Contents

EZ / EZ-Pro

EZ-Pro Data Sheet

EZ-1/2/3 Burner Manual

99FRD / 100CRD / 102CRD

99/100/102 Data Sheet

99/100/102 Burner Manual

Burner Components

48245, 40200, 50200, 60200 Control

41000 Electronic ignitor

98022 PSC Motor

98289 SVC Oil valve & kit

98435 Kool Kit cooling interface

90000 EZ-Temp control

90200 EZ-Temp control

90524 EZ-Temp control





MODEL **EZ-Pro™** Advanced Oil Burner

0.5 TO 2.6 GPH

The **Quiet REVOLUTION**

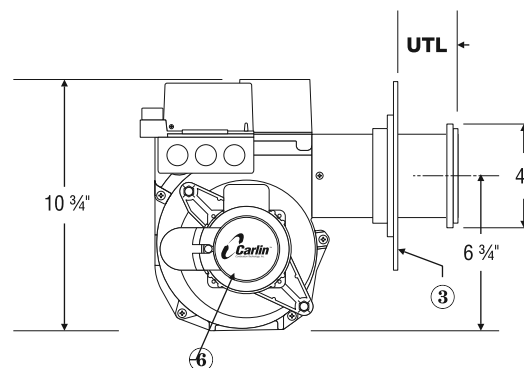
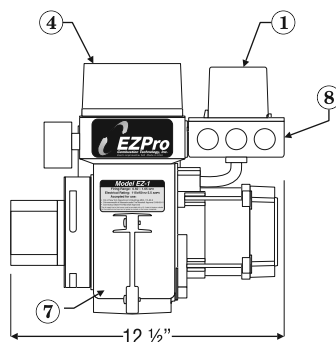
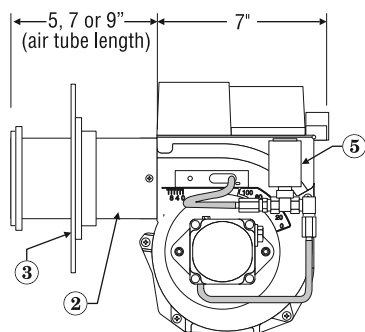
- Ultra-quiet operation . . .
- Electronic reliability . . .
- Unmatched performance
- Plus a **5**-year warranty



CARLIN. THE TECHNOLOGY LEADER.



Carlin EZ-Pro Advanced Oil Burner



- ① Carlin 60200 microprocessor control
⑤ Carlin SVC instant oil valve

- ② Air tube
⑥ Carlin PSC motor

- ③ Universal flange (welded flange optional)
⑦ Cast aluminum blower housing

- ④ Carlin 41000 solid state ignitor
⑧ Junction box

Features

The **EZ-Pro** advanced oil burner combines the proven range and reliability of the EZ burner with Carlin's line of electronic controls and high efficiency components. Purchase the EZ-Pro in any of three configurations — EZ-1, EZ-2 or EZ-3. Specify tube length when ordering.

Quiet operation

- Unique blower design nearly eliminates fan noise
- The smooth ignition and combustion of the EZ burner design yield virtually silent burning

Electronic reliability

- Comes standard with time-tested solid state ignition and state-of-the-art microprocessor control technology:
 - Carlin **60200-02** microprocessor control (with 10-second prepurge and postpurge and interrupted ignition) — Diagnostic LED lights announce operating mode: Self-check, Flame-on, Recycle, Lockout and Latch-up
 - Carlin **41000** electronic ignitor, constant-duty rated for long life and reliability
 - Cad cell flame sensor

Unmatched performance

- Carlin **PSC** high-efficiency motor
- EZ burner design yields exceptional fuel/air mixing for wide range of operation
- Nozzle line heater for clean burning and reliable ignition
- 5, 7 or 9-inch air tube and combustion head, with stainless steel nose cone
- Single-stage oil pump with integral oil valve
- Aluminum flange and gasket (welded flange optional)

Specifications

Input

..... **0.5 to 2.6 GPH**
..... **70,000 to 364,000 Btu/h**

Fuels

U. S. No. 1 or No. 2 Fuel oil
Canada No. 1 Stove oil or No. 2 Furnace oil

Electrical

Power 120 VAC/60 HZ/1-PHASE
Current Approximately 5.8 AMPS
Limit circuit input 120 VAC/60 HZ
Motor (PSC) 1/6 HP, 3450 RPM
Oil valve power 120 VAC/60 HZ
Nozzle line heater 120 VAC/60 HZ
Alarm contacts (isolated) 24 VAC/VDC, 2 AMPS

Ignition

Carlin Model 41000 solid state electronic ignitor
Ignition voltage 14,000 VOLTS

Control

Carlin Model 60200 microprocessor control

- 15-sec. Trial for ignition (TFI)
- 1.3-sec. FFRT
- Pre-purge and post-purge (10 seconds)
- Serviceman reset protection (Latch-up after three consecutive lockouts)
- Interrupted duty ignition
- Recycle on flame failure

Operating temperature limits

Maximum ambient 104 °F (40 °C)

Agencies

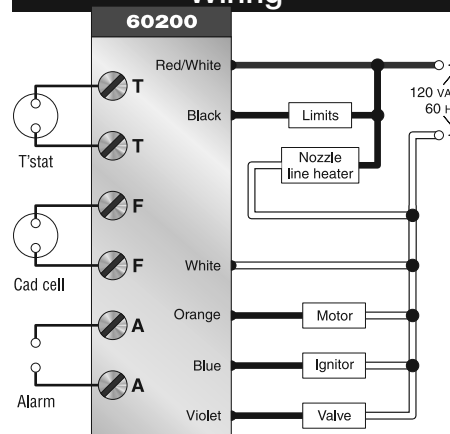
UL Listed (US & Canada)

Firing rate ranges

Model	Range GPH	Head bar selections (Note 1)
EZ-1	0.50 – 1.65	7 options: 0.5 / 0.6-0.65 / 0.75 / 0.85-1.00 / 1.10-1.25 / 1.10-1.25 / 1.35-1.50 / 1.65 GPH
EZ-2	1.50 – 2.25	4 options: 1.50 / 1.65-1.75 / 2.00 / 2.25 GPH
EZ-3	2.00 – 2.60	3 options: 2.00 / 2.25 / 2.60 GPH

Note 1: Head bars, supplied in kits with each burner, position the flame retention ring assembly correctly in the air tube for the given firing range. See burner manual for more detail.

Wiring



Warning — For use only by a qualified service technician.

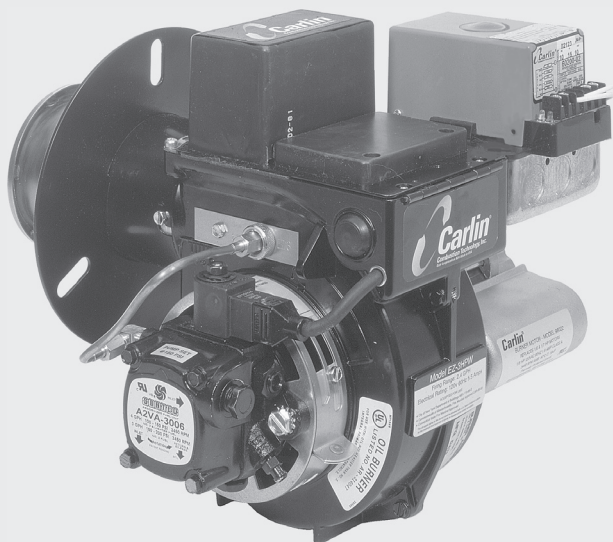
- Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
- Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.
- Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.

TECH SUPPORT HOTLINE 800-989-2275



Carlin Combustion Technology, Inc.

70 Maple Street East Longmeadow, MA 01028 Phone 413-525-7700 Fax 413-525-8306
e-mail us at: info@carlincombustion.com visit our website: www.carlincombustion.com



Ratings

Input:	EZ-1, EZ-1-HP	0.50 to 1.65 GPH
	EZ-2, EZ-2-HP	1.50 to 2.25 GPH
	EZ-3, EZ-3-HP	2.00 to 2.60 GPH
Fuels:	.....No. 1 or No. 2 heating oil (ASTM D396)	
Fuel unit:	.....	Suntec
	EZ-1,-2 or -3	100 PSIG NOZZLE PRESSURE
	EZ-1,-2 or -3-HP	130 to 150 PSIG NOZZLE PRESSURE
Electrical:	Power	120V/60 Hz/1-PHASE
	Motor	Carlin PSC, 1/6 HP, 3450 RPM
	Current	Approx. 2.5 AMPS
Ignition:	..... Carlin Model 41000 electronic — 14,000 VOLTS	
Control:	..... U.L. Group I or II primary safety control	
Agencies:	..... UL Listed (US and Canada)	

WARNING

Installer/servicer — Except where specifically stated otherwise, this manual must be used only by a *qualified service technician*. Failure to comply with this or other requirements in this manual could result in severe personal injury, death or substantial property damage.

WARNING

User — Refer only to User's Information booklet for information regarding operation of this burner. The burner Instruction Manual is intended only for your service technician. The burner and heat exchanger must be inspected and started at least annually by your service technician.

MODEL **EZ-1/2/3**TM Oil burners

Instruction manual

Contents

PLEASE read this first.....	2
Codes and standards.....	2
EZ-1/2/3 application information	3
Prepare site • assemble burner • mount burner	5
Prepare burner	10
Wire burner • start burner — 48245 primary control ...	14
Wire burner • start burner — 40200/42230 primary	16
Wire burner • start burner — 50200 primary control ...	18
Wire burner • start burner — 60200 primary control ...	20
Adjustment and verification	22
Annual start-up and service.....	23
Repair parts.....	24
Maintenance procedures.....	26
Limited warranty	27
User care and maintenance	Rear cover

© Copyright 2008 — Carlin Combustion Technology, Inc.

70 Maple Street
Ph 413-525-7700

East Longmeadow, MA 01028
Fx 413-525-8306

TECH SUPPORT 800-989-2275

carlincombustion.com

PLEASE read this first . . .

Special attention flags

Please pay particular attention to the following when you see them throughout this manual.

DANGER Notifies you of hazards that *WILL* cause severe personal injury, death or substantial property damage.

WARNING Notifies you of hazards that *CAN* cause severe personal injury, death or substantial property damage.

CAUTION Notifies you of hazards that *WILL or CAN* cause minor personal injury or property damage.

NOTICE Notifies you of special instructions on installation, operation or maintenance that are important, but are not normally related to injury or property damage hazards.

General information

Burner applications

Follow all instructions in this manual, the primary control data sheet and the appliance manual. Verify the burner is correct for the appliance being used and for all applicable codes/standards.

Damage or shortage claims

The consignee of the shipment must file damage or shortage claims immediately against the transportation company.

When calling or writing about the burner . . .

Please provide us with the UL serial number and burner model number to assist us in locating information. This information can be helpful when troubleshooting or obtaining replacement parts.

WARNING **Should overheating occur:**

- (1) shut off the oil supply to the burner.
- (2) do not shut off the control switch to the circulator or

WARNING

Follow the guidelines below to avoid potential severe personal injury, death or substantial property damage.

Installer/service technician . . .

- Read all instructions before proceeding. Perform all procedures, and in the order given to avoid potential of severe personal injury, death or substantial property damage.
- Before leaving the site after startup or service, review the *User's information* page with the user. Make the user aware of all potential hazards and perform the training outlined below.

Train the user . . .

- To properly operate the burner/appliance per this manual and the appliance instructions see *User's information*.
- To keep this manual at or near the burner/appliance for ready access by the user and service technician.
- To contact the service technician or oil dealer if he encounters problems with the burner/appliance.
- To keep the appliance space free of flammable liquids or vapors and other combustible materials.
- Do not use laundry products, paints, varnishes or other chemicals in the room occupied by the burner/appliance.
- To contact the service technician at least annually for startup and burner/appliance service.

When servicing the burner . . .

- Disconnect the electrical supply to the burner before attempting to service to avoid electrical shock or possible injury from moving parts.
- Burner and appliance components can be extremely hot. Allow all parts to cool before attempting to handle or service to avoid

1. EZ-1/2/3 application information

Codes and standards

Certification

EZ-1/2/3 burners are U.L. listed for the U.S. and Canada, certified to comply with ANSI/UL 296, for use with #1 or #2 heating oil (per standard ASTM D396).

Burner labels list compliance, when required, with special local, state or provincial approvals.

NOTICE

Install this burner in accordance with all local codes and authorities having jurisdiction. Regulations of these authorities take precedence over the general instructions provided in this manual.

United States installations

Burner/appliance installations in the United States must comply with the latest editions of NFPA 31 (Standard for the Installation of Oil-Burning Equipment), ANSI/NFPA 70 (National Electrical Code), and all applicable local codes.

Canadian installations

Burner/appliance installations in Canada must comply with the latest editions of CSA B139 (Installation Code for Oil Burning Equipment), CSA standard C22, Part 1 (Canadian Electrical Code), and all applicable local codes.

Conversion burners

General information — conversion burners

Carlin Elite burners are shipped for general distribution, with fuel units set for 100 PSIG. Burners are usually shipped assembled, with a universal slip-on flange. Air tubes and housings will be installed or shipped in separate boxes for field assembly.

Before installing the burner, follow guidelines in this manual to ensure you are using the correct nozzle, head-positioning bar and air tube length.

Oil nozzle selection — conversion burners

If oil nozzle selection information for the application is not available from appliance documents, you can use Table 1, page 4, for an initial nozzle selection for the application. Specific applications may require testing more than one nozzle to obtain both clean combustion and a good match of flame shape to the combustion chamber.

OEM burners

General information — OEM burners

Elite burners manufactured for heating appliance manufacturers (OEM's) are generally identical to conversion burners (distributed through supply houses) with one or more of the following differences:

- Burners may be fully assembled, with a welded flange set at the proper insertion depth and pitch for the appliance.
- Burners may be installed on the appliance or shipped in a separate carton.
- Burner nozzles may be installed in the burner, bagged or tied onto the burner chassis, or located in the appliance packaging.
- Head positioning bars may be installed or bagged to the burner chassis. Up to seven bars may be supplied. Use the bar with a range that includes the nozzle size used.

Elite burners with the “-HP” suffix are only supplied through the heating appliance manufacturer (OEM) market. These burners differ from standard models as follows:

- Fuel unit pressure is factory-set between 130 and 150 PSIG. Check heating appliance manufacturer's specifications for the correct pressure setting.
- The air band scale is calibrated for the fuel unit pressure. Set the air band to match the nozzle size installed. See page 11 in this manual for further information.

Installing OEM burners

- Burner flanges are welded to the air tube to ensure the correct pitch. Do not attempt to adjust the pitch using the air tube locking screws.
- Burners shipped installed on the heating appliance are supplied with four extra shipping screws in the air tube. These screws do not need to be removed, and can remain in the air tube for the life of the burner.

Oil nozzle selection — OEM burners

- Use only the nozzle specified in the heating appliance manufacturer's manual or burner supplement.

1. EZ-1/2/3 application information *(continued)*

Table 1 Apply the guidelines below to select a nozzle when appliance-specific nozzle data is not available from the manufacturer (see notes at end of table for application tips). DO NOT apply for EZ-1-HP, EZ-2-HP or EZ-3-HP models — see information supplied with appliance/burner.

EZ-1 Burner nozzle selections														
Brand	Spray	Angle & pattern	Head positioning bars (GPH)											Flame length needed
			0.50	.60 to .65		0.75	0.85 to 1.00		1.10 to 1.25		1.35 to 1.50		1.65	
			Nozzle rating, GPH											
			0.50	0.60	0.65	0.75	0.85	1.00	1.10	1.25	1.35	1.50	1.65	
Delavan	Hollow	60°A				•	•	•	•					Medium
	Hollow	70°A	•	•	•	•	•	•						Short
	Semi-solid	60°SS	•	•	•	•	•							Short
	Solid	60°B						•	•	•	•	•	•	Very long
	Solid	70°B						•	•	•	•	•	•	Long
Hago	Hollow	60°H	•	•	•	•	•	•						Short
	Hollow	70°H	•	•	•	•	•							Short
	Semi-solid	60°SS	•	•	•	•	•	•	•	•	•	•		Short
	Solid	60°ES	•	•	•	•	•	•	•	•	•	•	•	Medium
	Solid	70°ES	•	•	•	•	•	•						Medium
	Solid	60°B						•	•	•	•	•	•	Long
	Solid	70°B						•	•	•	•	•	•	Long
Monarch	Hollow	60°NS	•		•	•	•	•	•					Short
	Hollow	70°NS	•	•	•									Short
	Semi-solid	60°AR			•	•	•	•	•	•	•			Medium
	Semi-solid	70°AR				•	•							Short
	Solid	60°R			•	•	•	•	•	•	•	•	•	Medium
	Solid	70°R		•	•	•	•	•						Medium
Danfoss	Hollow	60°AH	•	•	•	•	•	•	•					Short
	Semi-solid	60°AB				•	•	•	•	•	•	•	•	Medium
	Solid	60°AS		•	•	•	•	•	•	•	•	•	•	Medium

EZ-2 Burner nozzle selections							
Brand	Spray	Angle & pattern	Head positioning bars (GPH)				
			1.50	1.65 to 1.75		2.00	2.25
			Nozzle rating, GPH				
			1.50	1.65	1.75	2.00	2.25
Delavan	Hollow	60°A	•	•	•	•	•
	Solid	60°B	•	•	•	•	•
	Semi-solid	60°SS	•	•	•	•	•
Hago	Semi-solid	60°SS	•	•	•	•	•
	Solid	60°B	•	•	•	•	
	Solid	60°ES	•	•	•		
	Solid	60°P				•	•
Monarch	Solid	60°R	•	•	•	•	•
	Semi-solid	60°AR	•	•	•	•	•
	Hollow	60°AS	•	•	•		
Danfoss	Hollow	60°AH	•	•	•	•	•
	Semi-solid	60°AB	•	•	•	•	•
	Solid	60°AS	•	•	•	•	•

EZ-3 Burner nozzle selections						
Brand	Spray	Angle & pattern	Head positioning bars (GPH)			Flame length needed
			2.00	2.25	2.50	
			Nozzle rating, GPH			
			2.00	2.25	2.50	
Delavan	Hollow	60°A	•	•	•	Medium
	Solid	60°B	•	•	•	Long
	Semi-solid	60°SS	•	•	•	Medium
Hago	Semi-solid	60°SS	•	•	•	Medium
	Solid	60°P	•	•	•	Long
	Solid	60°B	•			Long
						Long
Monarch	Solid	60°R	•	•	•	Medium
	Semi-solid	60°AR	•	•	•	Medium
Danfoss			•	•	•	Medium
	Hollow	60°AH	•	•	•	Short
	Semi-solid	60°AB	•	•	•	Medium
	Solid	60°AS	•	•	•	Long

- In general, all the nozzles shown above will burn well. However, in short combustion chambers, solid nozzles are not recommended because the flame may impinge on the back wall.
- If the nozzle selected for a retrofit application results in a smoky fire, you can sometimes determine the best nozzle to use by observing the flame. To do this, slowly cover the air band slots with your fingers while the burner is firing. The flame will begin to smoke in the area where there is more fuel than air. If the smoke begins on the outer edges, try a narrower or more solid nozzle spray pattern. If the flame begins to smoke at the tips, try a wider or more hollow nozzle spray pattern.
- For a packaged appliance application on which the burner has been tested, use the nozzle given in the appliance manufacturer's instructions or supplement for the best results.

2. Prepare site • assemble burner • mount burner

Inspect/repair/replace vent system

WARNING

Do not install this burner unless you have verified the entire vent system and the appliance are in good condition and comply with all applicable codes. And ...

- The vent and chimney must be sized and constructed in accordance with all applicable codes.
- Do not install or use an existing manual damper in the breeching (vent connector) or chimney.
- Do not connect the appliance vent connector to a chimney or vent serving a fireplace, incinerator or solid-fuel-burning apparatus.
- In a cold climate, do not vent into a masonry chimney that has one or more sides exposed to the outside. Install a listed stainless steel liner to vent the flue products.
- A defective vent system could result in severe personal injury, death or substantial property damage.

Prepare vent/chimney

- Secure all metal vent joints with screws, following the vent manufacturer's instructions. Seal all joints in the vent system and chimney. Repair masonry chimney lining and repair all mortar joints as needed.
- Install a double-acting barometric draft regulator in the vent piping if specified in the appliance manual. (The damper must be located in the same space as the appliance.)
- Provide support for the vent piping. Do not rest the weight of any of the vent piping on the appliance flue outlet.

Combustion/ventilation air openings

Check appliance manual and applicable codes for required sizing/design/ placement of combustion/ventilation air openings. You can use the following general guidelines, taken from NFPA 31, provided they meet all local requirements.

Louvers/screens

- Air opening sizes are always given in free area. This means after deduction for louver obstruction. If you can't find the louver reduction for the grilles used, assume free area is 20% of total for wood louvers, or 60% of total for metal louvers.
- Screens can be no finer than ¼-inch mesh, and must be accessible for cleaning.

Residential installations

Unconfined spaces (at least 7,000 cubic feet per GPH)

- An unconfined space means a room with at least 7,000 cubic feet volume for each GPH input (or 50 cubic feet per MBH) of all appliances in the room. Example: For each 1 GPH oil input, the room must have 7,000 cubic feet (875 square feet with an 8-foot ceiling height.)
- Open basements and crawl spaces are usually large enough, and will generally allow enough air infiltration so special provisions will seldom be required.
- If the building is tightly constructed, you will have to provide outside air openings into the building. The total free area of the openings must be

at least 1 square inch per 5,000 Btuh (28 square inches per GPH) of all appliances in the space.

- See Table 2 for summary.

Confined spaces (less than 7,000 cubic feet per GPH)

- Air taken from inside building only —
 - Provide two openings — one near floor, the other near ceiling. Provide free area of 140 square inches per GPH input. If building is tightly constructed, provide air opening(s) into building providing 30 square inches per GPH as well.
- Air taken from outside —
 - Direct through outside wall or vertical ducts: Provide two openings — one near floor, the other near ceiling. Provide free area of 35 square inches per GPH input.
 - Through horizontal ducts: Provide two openings — one near floor, the other near ceiling. Provide free area of 70 square inches per GPH input.
- Ventilation air from inside/combustion air from outside
 - Size openings to interior to provide 140 square inches free area per GPH input. Size outside air duct to provide 28 square inches free area per GPH.
- See Table 2 for summary.

Table 2 Minimum combustion/ventilation air openings

Source of air	Minimum free area of opening(s)	Total grill area, typical (sq. in.) for firing rates of:					
		1 GPH		2 GPH		3 GPH	
		Wood	Metai	Wood	Metai	Wood	Metai
Residential installations, unconfined spaces (7,000 cu. ft. volume per GPH)							
From inside building, typical construction	No special openings required if natural infiltration is sufficient.						
From inside building, tight construction	1 or more grilles 30 Sq. in./ GPH	150	50	300	100	450	150
Residential installations, confined spaces							
From inside building through interior walls	2 openings, each 140 Sq. in./ GPH	700	234	1400	467	2100	700
From outside building direct through outside wall	2 openings, each 35 Sq. In./ GPH	175	59	350	117	525	175
From outside building through vertical ducts	2 openings, each 35 Sq. In./ GPH	175	59	350	117	525	175
From outside building through horizontal ducts	2 openings, each 70 Sq. In./ GPH	350	117	700	234	1050	350
Ventilation through interior walls, with an opening to outside	2 Int. openings, each 140 Sq. In./ GPH	700	234	1400	467	2100	700
	1 Exterior opening 28 Sq. In./ GPH	140	47	280	94	420	140
Commercial installations							
From outside building direct through adjacent outside wall	One opening through outside wall, providing free area of at least 28 Square inches per GPH input						
Other conditions	Size openings per local codes/jurisdictions						

2. Prepare site • assemble burner • mount burner *(continued)*

Combustion/ventilation air checklist

WARNING

The burner may operate successfully under momentary downdraft conditions, but sustained downdraft is unsafe. This can occur with an inadequate or incorrectly installed chimney/vent. It can also occur in rooms/buildings equipped with exhaust fans or unsealed return air ducts. Always check operation of the burner under all conditions to verify vent system operates correctly. You may have to install ducted air (using Intake Air System); interlock the burner with exhaust fans to shut burner off when fan operates; or provide make-up air to the appliance room sufficient to prevent any negative pressure in the space. Failure to correct downdraft or negative room pressure operation could result in severe personal injury, death or substantial property damage.

- ❑ Verify that openings are unobstructed.
- ❑ Verify that appliance space and air source spaces are free of:
 - Gasoline or other flammable liquids or vapors.
 - Combustible materials.
 - Air contaminants and chemicals, such as laundry products, paint, thinner, varnish, etc.
- ❑ Confirm with the building owner that the area will be kept free of these materials at all times and that air openings will be kept unobstructed.
- ❑ EZ-1 burner applications only: For spaces not fitted with large enough air openings, you may be able to apply the optional Air Intake System, with air ducted directly to the burner from outside. You must use the combustion air/exhaust components specified in the Air Intake System installation instructions (this page) and appliance manual.

Optional Air Intake System (EZ-1 burners only)

- Apply this option when desired or for EZ-1 burner applications if the appliance space may contain corrosive contaminants, such as laundry products, paints, varnishes or other chemicals.
- Use only Carlin part number 97406 Combustion Air Intake System. Follow instructions on this page, the appliance manual and instructions supplied with the air intake system.

WARNING

Even when using the Air Intake System, make sure the space provides enough ventilation to prevent overheating of the appliance, burner and controls. If there is risk of overheating, you must install ventilation air openings sized large enough to provide air for cooling the equipment. Failure to provide ventilation can result in severe personal injury, death or substantial property damage.

Installing optional Air Intake System (EZ-1 burners only)

1. Install the optional Air Intake System only on Carlin EZ-1 burners.
2. Disconnect oil lines and nozzle lines from burner.
3. Remove fuel unit from burner housing.
4. Remove air shutter and air band from housing.
5. Mount gasket on burner as shown in figure.
6. Using the mounting bolts for the fuel unit, install the air box and fuel unit on burner housing.
7. Reconnect oil lines and nozzle line to the burner.
8. Connect the combustion air supply duct to the air box and secure. (Use Field Controls Model CAS-1 Combustion Air Supply Duct Kit and install as per Field Controls' instructions.)

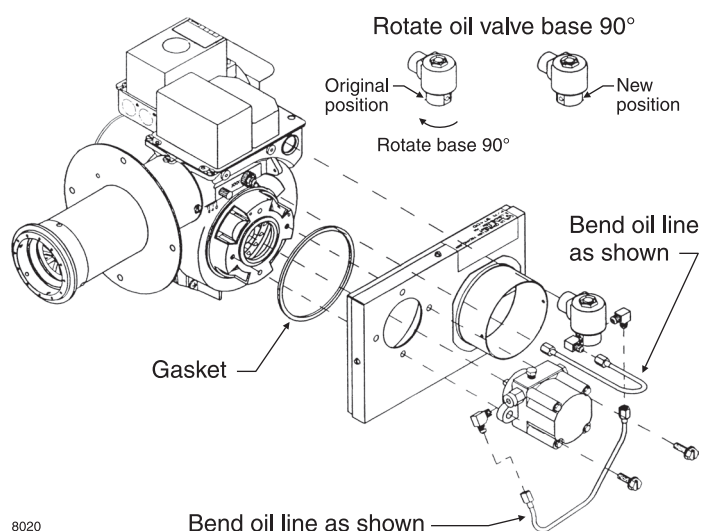
Burner adjustments with optional Air Intake System

1. After installing the air intake system, set the air box damper to the burner firing rate. Firing rate will be higher than nozzle size for “-HP” models because oil pump pressure is higher than 100 PSIG.
2. Follow the instructions in this manual for final adjustments to the burner using combustion test instruments.
3. After completing combustion testing, tighten the locking screw on the air box to avoid accidental changes in the damper adjustment setting.

WARNING

Follow all manufacturers' instructions carefully when installing the air intake duct assembly. Failure to carefully follow all instructions can result in hazardous operating conditions.

Figure 1 Installing optional air intake system (used only on EZ-1 burners)



8020

2. Prepare site • assemble burner • mount burner *(continued)*

Verify clearances

Verify that the burner/appliance will maintain all clearances from combustible construction and clearances for service/maintenance as required in the appliance manual and applicable codes.

Verify that the vent system components maintain all necessary clearances to combustible construction, including the correct design of thimbles and insulation where penetrating combustible walls.

Verify combustion chamber

General guidelines

- If retrofitting the burner to an appliance, install the burner in accordance with the appliance instruction manual, when available. If no specific application data is available from the appliance manufacturer, apply the guidelines in Table 3 to check whether the burner is likely to work acceptably in the application.
- Clean all appliance flues and heating surfaces thoroughly, removing all soot and scale.
- Seal all joints and gaps using furnace cement to prevent excess air infiltration.

Minimum combustion chamber dimensions

- Illustrations A to C in Table 3 show different chamber configurations.

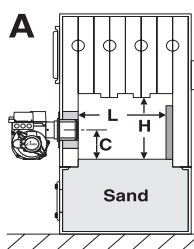
- Do not attempt to fire the burner in a chamber with dimensions smaller than shown in Table 3 unless the application has been specifically tested and listed by the appliance manufacturer and/or Carlin.
- Please notice the special requirements given in Table 3 notes.

Using chamber linings and lightweight chambers

- When using refractory liners or lightweight chambers, use insulating-type refractory rated 2300°F minimum.
- You must install a target wall liner if flame length is close to the length of the chamber.
- Use a floor liner when possible. The floor liner will improve firing in most applications. Extend floor liner 3 to 4 inches up side wall.
- Target wall liners — Corbel the top of target wall liners 1½ to 2½ inches deep and extend at least 3 to 4 inches above the center of the flame.
- Use pre-formed chamber liners when available.
- For firing rates below 0.75 GPH, it is best to apply in a refractory-lined or stainless tube (designed for application) chamber. Lining the floor and target wall of the chamber with lightweight insulating refractory will accomplish the same.
- When conversion firing coal-fired units, install a combustion chamber in the ashpit area, or fill ashpit with sand up to 2 inches above the “mud ring” of a boiler (firing through the door). Install a lightweight refractory liner on the target wall as in Table 3, Figure C. Make sure the minimum dimensions comply with those listed.

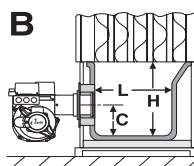
Table 3 Burner retrofit applications — guidelines and minimum dimensions for combustion chambers

1 Firing rate	2 L	3 W	4 C	5 H	6 DV
GPH	Inches	Inches (3)	Inches	Inches	Inches (5)
0.50	7	6	3	8	7
0.65	7.5	7	3.5	9	7.5
0.75	8	7	3.5	9	8
0.85	9	7	3.5	9	8.5
1.00	10	8	4	10	9
1.10	11	8	4	10	9.5
1.25	12	8	4	10	10
1.35	13	8	4	10	11
1.50	14	8	4.5	11	12
1.65	15	9	4.5	11	13
1.75	16	9	4.5	11	14
2.00	17	9	4.5	11	15
2.25	18	10	5	12	16
2.50	19	10	5	12	17
Notes					
1 Some tested appliances operate well with dimensions other than above.					
2 Generally, the application should be acceptable for dimensions as large as 50% greater than the above.					
3 Horizontal cylinder chambers should have a diameter at least as large as the dimension in column 3. Horizontal steel cylinder chambers should have diameters at least 1 to 4 inches larger than the dimension in column 3.					
4 Wing walls are not recommended. Corbels can be beneficial to heat distribution in some appliances.					
5 DV is the minimum diameter for vertical cylinder chambers.					



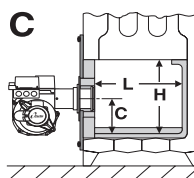
A. Conversion firing coal-fired units

1. Install a combustion chamber in the ashpit area, or fill ashpit with sand up to 2 inches above the “mud ring” of a boiler (firing through door).
2. When firing through door, install a lightweight refractory “target” on the rear wall, as shown.



B. Conversion firing dry-base units

1. Applies to brick, refractory, precast and preformed refractory fiber chambers. Lightweight, insulating-type materials are preferred because of their quick warm-up. Use material rated at least 2300°F.
2. Dimensions in the table can be exceeded without much effect for dry-base units.



C. Conversion firing wet-base units

1. Apply recommendations here to prevent flame from impinging on surfaces or being cooled too much by the cool walls of the heat exchanger. Do not exceed dimensions of table more than 50% to avoid flame chilling.
2. Install a ceramic fiber floor liner (extended 3 to 4 inches up the side walls) and a ceramic fiber rear target the full width of the back wall as well. Corbel the top of the target 1½ to 2½ inches deep and extend at least 3 to 4 inches above the center of the flame. Use preformed chambers and/or target walls if available.
3. Set the fuel unit pressure for approximately 150 PSIG and use a nozzle rated about 20% less than the firing rate to compensate for the higher pressure. This will improve atomization, making the flame more intense, shorter and hotter. Use a head bar matched for the nozzle size, but set the air band to match the firing rate.

2. Prepare site • assemble burner • mount burner (continued)

Inspect burner and components

- Check the air tube length. Verify the usable length of the tube UTL will be long enough (see "Mount burner in appliance").
- Visually inspect all burner components and wiring.
- Verify that wiring is intact and leads are securely connected.

- Verify that all burner components are in good condition.

WARNING

Do not install or operate the burner if any component is damaged or if burner does not comply with the specifications of Table 1, page 3, and other guidelines of this manual and the appliance manual.

Assemble burner (when required)

Welded-flange burners

1. Verify the bolt pattern on the appliance chamber matches the flange pattern.
2. Verify the insertion depth (UTL) matches the depth of the appliance opening (so the end of the air tube is flush with, or slightly short of, the inside surface of the combustion chamber).

4. Level the air tube using a spirit level.
5. Mark the air tube position with a pen or pencil around the circumference of the tube.
6. Remove air tube from the opening.

Universal (adjustable) flange burners

1. Verify the flange mounting slots line up with the appliance bolts. See Figure 2.
2. Slip the adjustable flange onto the air tube.
3. Measure the distance from the inside of the combustion chamber to the outside of the appliance mounting plate.
4. Position the universal flange at this distance from the end of the air tube.
5. Tighten the locking screws finger tight.
6. Insert the air tube/flange assembly into the appliance opening and level the air tube with a spirit level. Adjust flange if needed.
7. The end of the air tube should be flush, or almost flush, with the inside of the combustion chamber wall.
8. Verify the air tube is level and inserted the corrected depth. Adjust if necessary. Then tighten the flange locking screws securely.
9. Remove the flange/air tube assembly from the opening.

Figure 2 Universal flange mounting dimensions

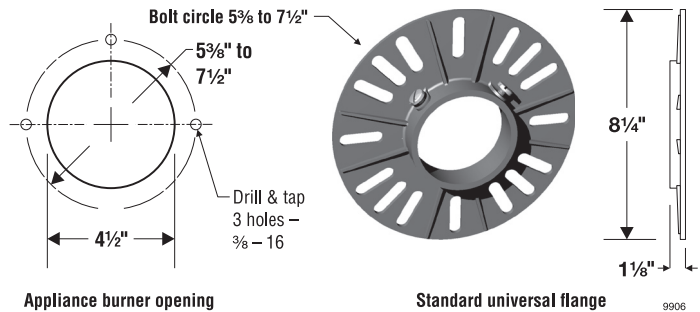
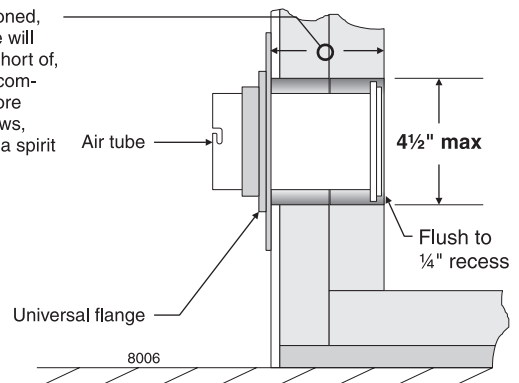


Figure 3 Mark insertion depth on air tube when using universal flange mounting

When correctly positioned, the end of the air tube will be flush with, or just short of, the inside wall of the combustion chamber. Before tightening flange screws, level the air tube with a spirit level.



Pedestal-mounted burners

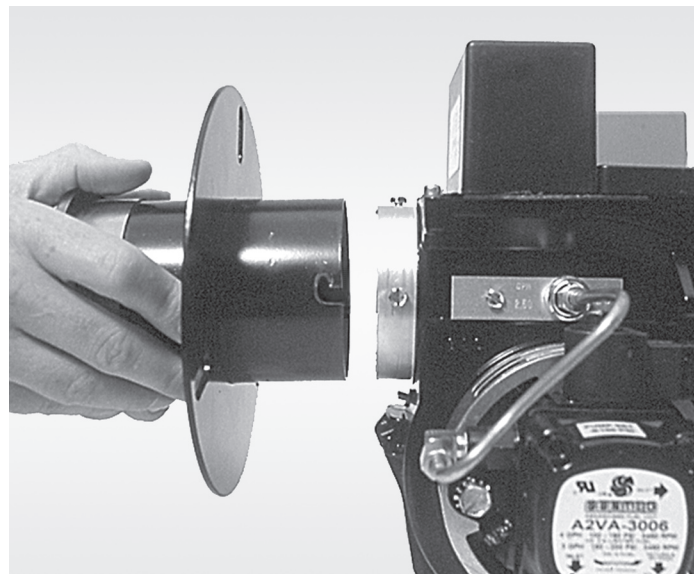
1. Check the diameter of the appliance opening. If larger than 4 1/2 inches, rebuild the opening so the open is reduced to 4 1/2 inches maximum.
2. Insert the air tube into the appliance opening as in Figure 3. Do not attach air tube to housing yet.
3. Slide the tube in until the end of the tube is flush with, or up to 1/4 inch short of, the inside of the combustion chamber.

2. Prepare site • assemble burner • mount burner *(continued)*

Attach air tube to housing

1. The burner chassis is supplied with three screws mounted into the housing.
2. Loosen these screws about three turns.
3. Slide the air tube onto the housing, aligning the J-notches in the tube with the housing screws (Figure 4).
4. Turn the tube to engage the J-notches.
5. Tighten the screws.

Figure 4 Attaching air tube to burner chassis



Mount burner in appliance

Welded flange-mounted burner

1. Place gasket over burner air tube and insert burner into appliance opening. Secure in place with hardware supplied with appliance.

WARNING

Universal flange or pedestal mount — these insertion methods are intended only for negative overfire pressure. For pressurized firing, you must obtain a burner with a welded flange, designed for use with the specific appliance. Failure to comply could result in severe personal injury, death or substantial property damage.

Universal flange-mounted burner

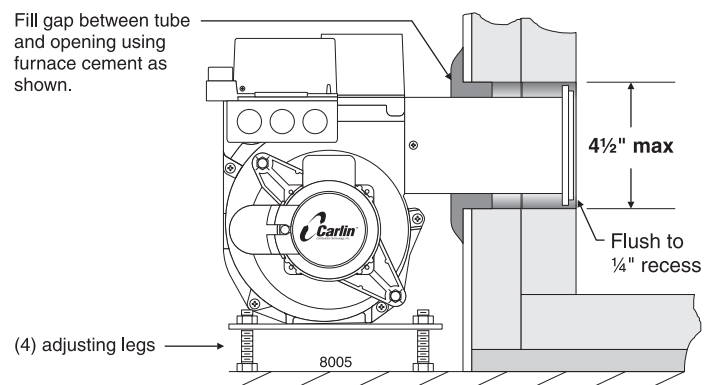
1. Place gasket over burner air tube.
2. Insert burner into appliance.
3. Verify burner is seated level and straight. Adjust flange slightly if necessary.
4. Secure flange to appliance with hardware supplied with appliance.

Pedestal mounted burner

1. Adjust the pedestal legs so the air tube is level and the center of the tube is at the same height as the center of the appliance opening.
2. Tighten the pedestal leg jam nuts.

3. Insert the burner/air tube into the appliance opening until pen/pencil line is even with appliance front (so end of air tube is flush with, or slightly short of, the inside of the chamber).
4. Seal the space around the air tube with furnace cement or equivalent (Figure 5).

Figure 5 Seal opening around burner air tube when pedestal mounting (burner shown with tube attached to housing and installed)



3. Prepare burner

Removing/installing head assembly

WARNING

Use care when handling burner components after the burner has been firing. Components can be hot and could cause severe personal injury.

You will need to remove the combustion head assembly for inspection of the assembly, replacement of the oil nozzle or adjustment of electrodes.

To remove the assembly:

1. Loosen, and then rotate the two screw clamps securing the ignitor in place. Swing the ignitor plate open.
2. Disconnect the nozzle line heater harness.
3. Unscrew the oil line fitting and thumb nut at the burner housing.
4. Pull the threaded end of the oil tube into the blower housing (Figure 6).
5. Rotate the assembly 180° so the electrodes are upside down. This places the electrode insulators out of the way for easy removal.
6. Remove the combustion head assembly, as shown in Figure 6, by pulling the assembly up and out of the housing.
7. Handle the assembly with care to avoid bending/moving the electrodes, or damaging the electrode ceramic insulators.
8. Inspect the gasket on the bottom of the ignitor plate. The gasket prevents air from escaping from the housing. Replace the gasket if not in good condition.
9. Inspect the ignitor contact clips. Clean or replace if necessary to ensure reliable contact with the electrodes.

To replace the combustion head assembly, reverse the sequence above.

- Remember to put the assembly in upside down, so the electrode insulators are out of the way.
- See Figure 7. You will have to lift the end of the assembly to guide it through the reduced diameter throttle cone at the end of the air tube. **DO NOT FORCE.**

CAUTION

Use care when tightening the oil line fitting to oil tube extension. Tighten securely, but do not cross-thread or over-tighten.

Figure 6 Inserting/removing combustion head assembly

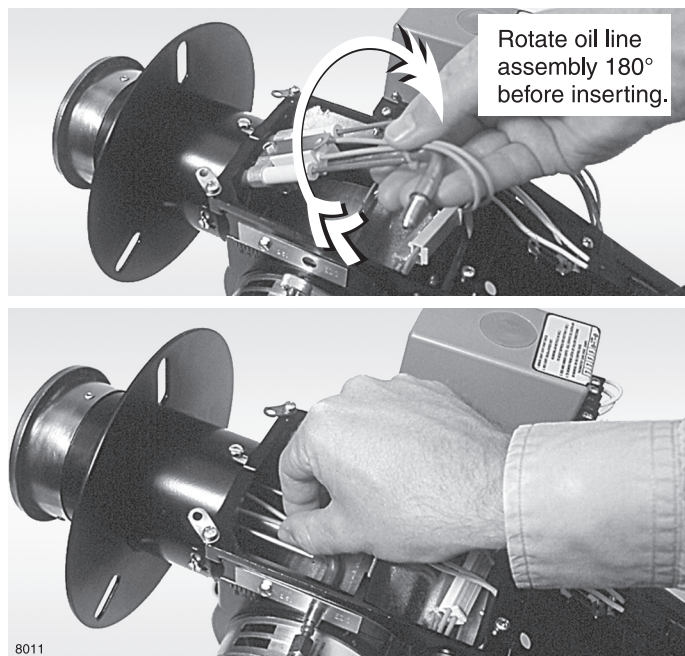
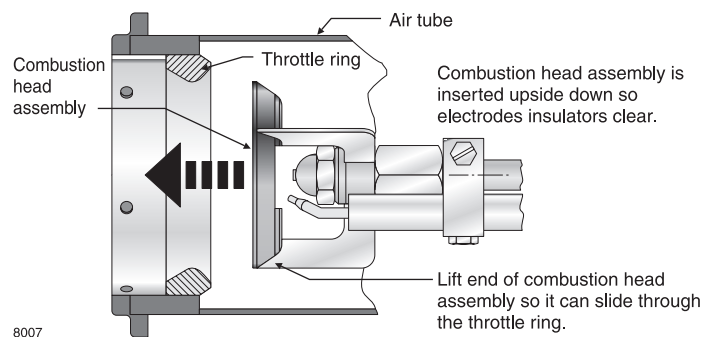


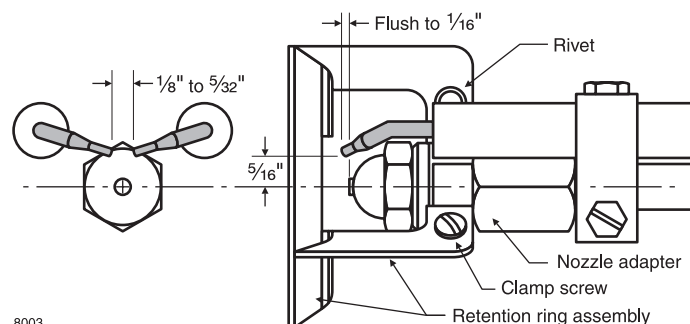
Figure 7 Inserting combustion head assembly



Install nozzle/check electrodes

1. Loosen the clamp screw on the retention ring assembly (see Figure 8). Slide the retention ring assembly off of the nozzle adapter.
2. Install and tighten the nozzle shown in Table 1, page 4, for retrofit applications. Install the nozzle given in the appliance manual when application information for the EZ-1/2/3 oil burner is given.
3. Hold the nozzle adapter securely when removing or replacing the nozzle (Figure 9). Take care not to damage the electrode insulators or to bend the electrodes in the process.

Figure 8 Electrode placement, retention ring assembly and nozzle adapter



3. Prepare burner *(continued)*

WARNING Inspect the nozzle adapter before replacing the nozzle. If the threads have been damaged or shows score marks, replace the nozzle line/adapter assembly.

4. Replace the retention ring assembly by slipping one of the riveted arms through the gap between the electrode tips. Align this arm straight up, with the ring clamp firmly against the nozzle adapter shoulder. Then tighten the clamping screw.
5. Check the electrode settings. Position the electrodes as shown in Figure 8. These settings are critical in ensuring a reliable ignition. Once the electrodes are set, check all clamps to be sure they are securely

Figure 9 Carefully support the nozzle adapter when removing or installing nozzle



Install head positioning bar

1. The burner is supplied with up to seven calibrated bars that properly position the head in the air tube. See the table below for head positioning bars available.
2. The head positioning bars are stamped with a nozzle size range. Use a positioning bar with the range that includes the nozzle size installed.
3. See Figure 10. Remove the existing bar (if installed) and replace with the correct one.
4. Store any remaining bars in the rear of the burner to allow future nozzle size change, if desired.

Model	Range	Head positioning bars available
EZ-1, EZ-1-HP	0.50 – 1.65 GPH	7 options: 0.5 / 0.6-0.65 / 0.75 / 0.85-1.00 / 1.10-1.25 / 1.10-1.25 / 1.35-1.50 / 1.65
EZ-2, EZ-2-HP	1.50 – 2.25 GPH	4 options: 1.50 / 1.65-1.75 / 2.00 / 2.25
EZ-3, EZ-3-HP	2.00 – 2.50 GPH	3 options: 2.00 / 2.25 / 2.50

Figure 10 Installing head positioning bar



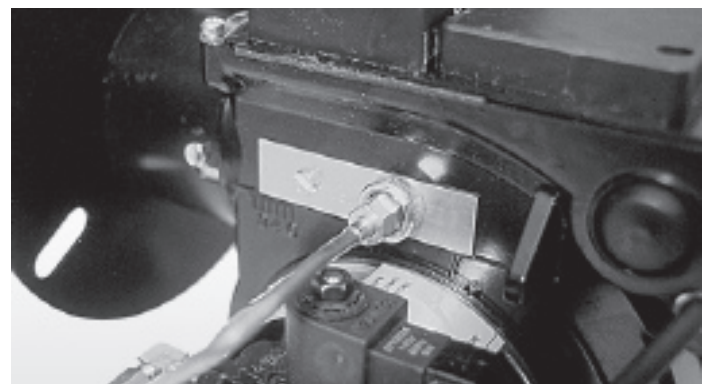
Adjust air band (initial setting)

1. The air band is marked in GPH oil (initially set to the burner nozzle size). Loosen the locking screw and move the air band until the pointers line up with the burner nozzle size (GPH). See Figure 11.

NOTE: For high altitude installations above 2,000 feet, increase the air supply setting 4% for each 1,000 feet above 2,000 feet above sea level.

2. The burner is now adjusted to the approximate air band setting for the nozzle size indicated. When you check combustion with instruments during start-up or servicing, you may have to adjust the air band slightly to achieve the desired efficiency. See “Adjust burner using test instruments,” page 22.
3. For EZ-1 burners equipped with the optional Air Intake System, set the air boot to the burner firing rate. Note that this a larger value than the nozzle size for “-HP” burners.

Figure 11 Initial setting of air band



3. Prepare burner *(continued)*

Inspect/install fuel supply

CAUTION Inspect the oil supply system. Ensure that the fuel lines are correctly sized and installed and that the fuel flow is unobstructed, the oil tank is clean and only # 1 or # 2 heating oil are supplied. Failure to supply a reliable oil flow could result in loss of heat and potential severe equipment damage.

General guidelines:

- When installing oil lines, use continuous runs of heavy-wall copper tubing if possible.
- Check fuel unit (oil pump) data sheet for recommended line sizing, lift limitations and maximum length.
- Check all connections and joints to ensure they are air-tight.
- Use flare fittings. Do NOT use compression fittings.
- Never use pipe sealing tape. Fragments can break off and plug fuel line components.
- Install a shut-off valve at the tank and one near the burner. (Use fusible handle design valves when possible or when required by codes.)
- Install a large capacity fuel filter (rated for 50 microns or less) near the burner.

Fuel unit bypass plug

WARNING The fuel unit is shipped ready for a one-line oil system (bypass plug is shipped loose). Install the bypass plug only if connecting to a two-line oil system. Operating with the plug in place on a one-line system will damage the fuel unit and could lead to oil leakage and fire hazard.

WARNING If the fuel line or fuel supply is above burner, never exceed 3 PSIG pressure at the fuel unit inlet. Install a suitable OSV to reduce the pressure. Operating the fuel unit with higher inlet pressure could result in fuel unit seal damage, oil leakage and potential fire hazard.

Nozzle line heater

- Oil burners often operate in spaces where temperatures tend to be cool, typically 60°F or lower. Cool oil has higher viscosity, which can affect atomization, ignition, combustion and fuel consumption. The nozzle line heater avoids this problem by heating the nozzle line oil to between 120°F and 130°F, resulting in smoother ignition and improved combustion.

- The nozzle line heater needs power when the burner is in standby (no call for heat from the appliance). Make sure the nozzle line heater is powered directly from the 120 VAC HOT line, not through the appliance operating control circuit. The nozzle line heater wiring should be shown on the wiring diagram supplied with the appliance/burner unit.
- The nozzle line heater is supplied with an electrical disconnect harness, allowing removal of the combustion head assembly without disconnecting wires. Position the heater harness disconnect in the rear of the blower housing, above the blower access cover. The wire leads to the disconnect route through the side of the housing into the junction box.

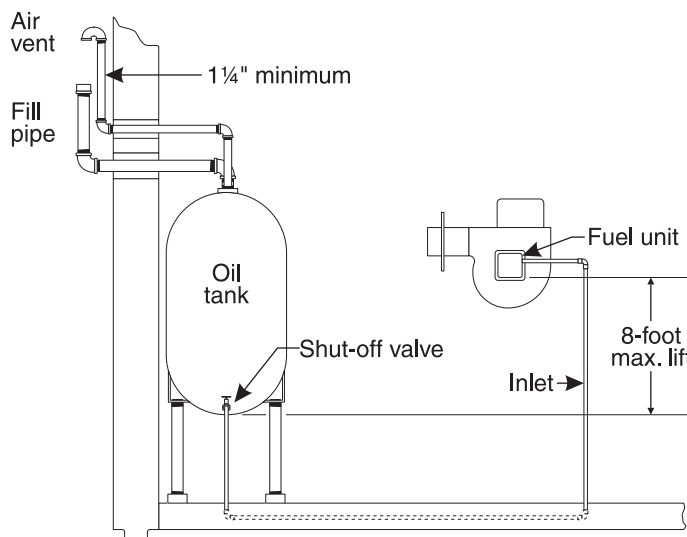
NOTICE

When first starting the burner, or after the service switch has been off for some time, the heater requires about 15 minutes to bring the oil to operating temperature.

One-line fuel system requirements

See Figure 12. The standard burner fuel unit is a single-stage, 3450-RPM oil pump. Apply this fuel unit only on one-line systems where the fuel supply is on the same level with, or higher than, the burner. This ensures oil flow by gravity. Also make sure the total lift does not exceed 8 feet (height difference from bottom of oil tank to fuel unit). For other conditions, you must provide a two-line fuel system. You may also have to change the fuel unit to a two-stage type.

Figure 12 One-line fuel system



3. Prepare burner *(continued)*

Two-line fuel system requirements

See Figure 13 and Table 4. Use Table 4 only for burners equipped with Suntec fuel units. For burners using other fuel units, read the fuel unit manufacturer's data sheet to determine maximum lengths and lifts.

The standard burner fuel unit is a single-stage, 3450-RPM oil pump. Use this fuel unit only on two-line oil systems that do not exceed the total tubing lengths allowed in Table 4 (for Suntec fuel units only). For longer systems (or where lift exceeds 10 feet), replace the one-stage fuel unit with a two-stage unit.

Always size fuel lines using an oil flow rate based on the fuel unit gearset capacity, not the burner firing rate. See fuel unit data sheet for information.

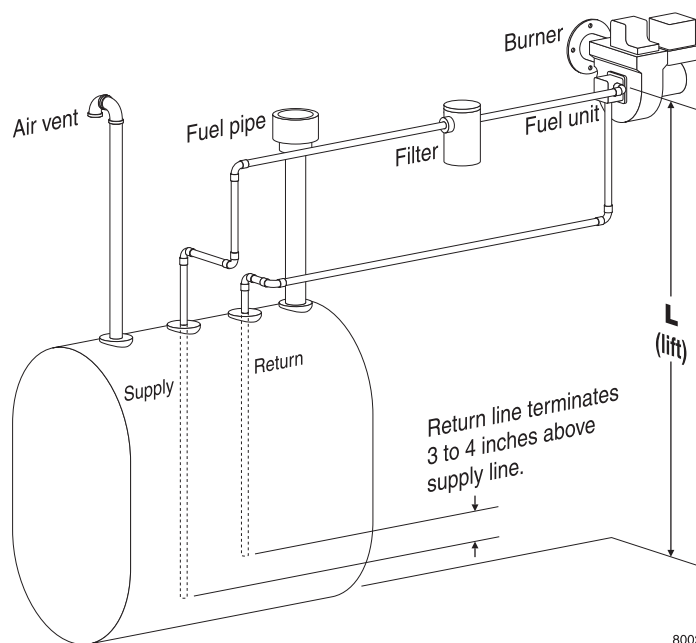
NOTICE

Install the fuel unit bypass plug when connecting to a two-line system. The plug is shipped in a bag attached to the fuel unit, along with a fuel unit data sheet.

Table 4 Two-line fuel system maximum lengths for 3/8" and 1/2" OD copper tubing distribution. Use only for burners equipped with Suntec fuel units. See fuel unit data sheet for any other fuel unit.

Lift (feet)	Max. total length of tubing, feet (including both horizontal and vertical)			
	Single-stage fuel unit		Two-stage fuel unit	
	3/8" tubing	1/2" tubing	3/8" tubing	1/2" tubing
0	84	100	93	100
2	73	100	85	100
4	63	100	77	100
6	52	100	69	100
8	42	100	60	100
10	31	100	52	100
12	NOT recommended — use two-stage fuel unit		44	100
14			36	100
16			27	100
18			-	76

Figure 13 Two-line fuel system



Perform checkout procedures

Verify before starting burner:

WARNING

Should overheating or an emergency occur, immediately:

- Shut off oil supply line valve.
- Under some circumstances power should remain on for water pumps or blowers. Determine proper response before attempting start-up.
- If burner fails ignition on several attempts, use burner blower to purge appliance chamber before restart.

Checklist

- ☐ Burner/appliance installed per appliance instruction manual?
- ☐ Burner nozzle and head positioning bar verified against Table 1, page 4, or appliance manufacturer's instructions?
- ☐ Burner/appliance installed per all applicable codes?
- ☐ Installation site has adequate combustion/ventilation air openings and vent system?
- ☐ Fuel supply line in good condition and sized/designed correctly?
- ☐ Oil tank has oil and oil line valves are open.
- ☐ Wiring installed per burner/appliance instructions?
- ☐ Burner, appliance and all components inspected and in good condition?

4. Wire burner • start burner — 48245 primary control

Wire burner — 48245 primary control

1. All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
2. Wire the burner following Figure 14 and any special instructions or wiring diagram provided with the appliance, burner or other components.
3. The burner requires a 120 VAC/60 HZ/single-phase power supply, with at least a 5-AMP fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 AMPS.
4. The 48245 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 48245 thermostat terminals. Then connect a voltmeter across wires. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
5. Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

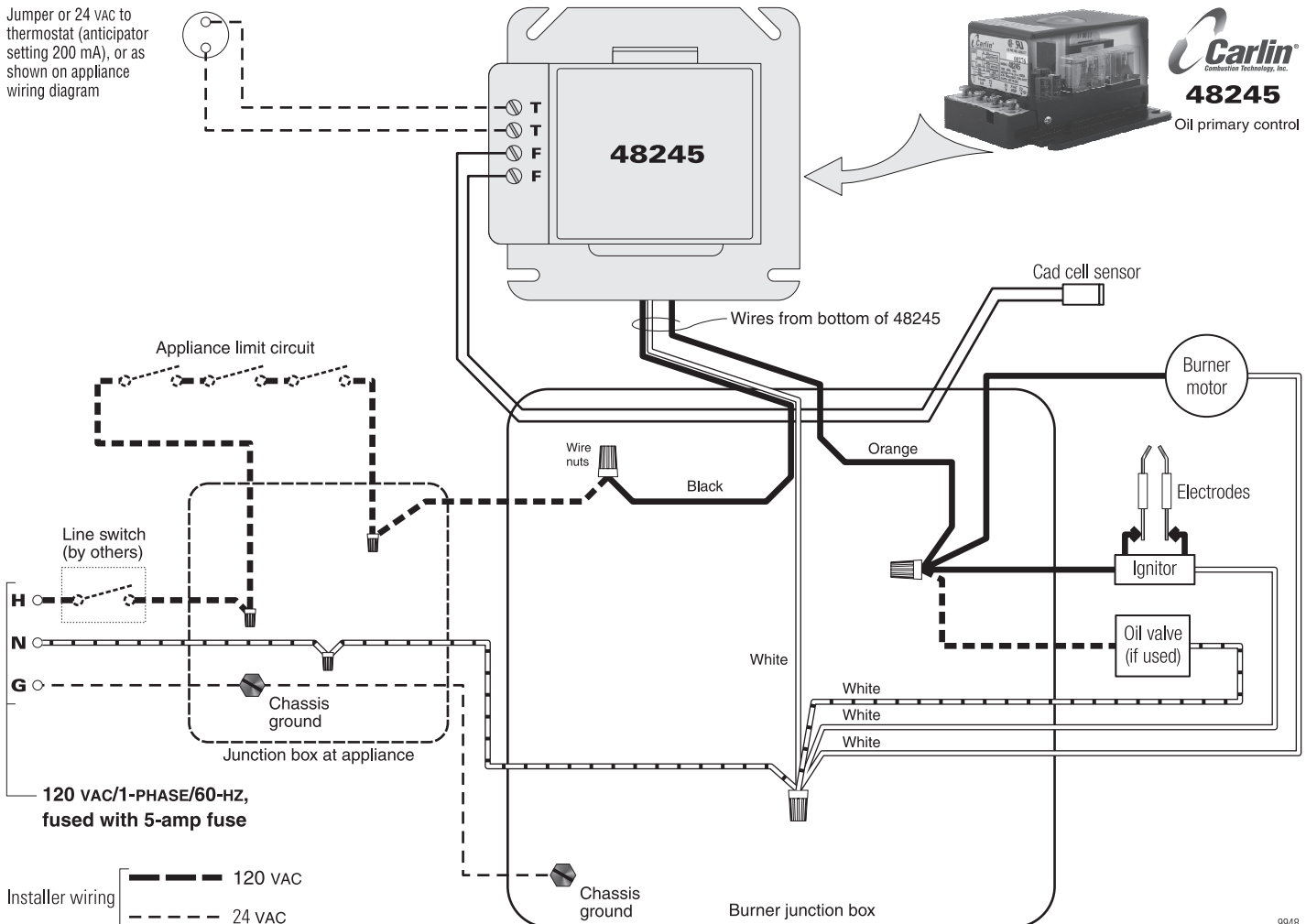
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

1. Turn service switch OFF.
2. Perform inspections and checkouts on pages 14 and 15.
3. Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
4. Set thermostat (operating controls) to call for heat.
5. Turn service switch ON.
6. Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
7. Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
8. Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
9. Should control/burner fail to operate correctly, see page 15 for suggestions in troubleshooting.

Figure 14 Burners up to 3.0 GPH only, wiring using Carlin 48245 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)



Start-up & operation

WARNING	Do not start the burner if the combustion chamber contains oil or oil vapor.
NOTICE	Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.
Power ON	Open all manual oil line valves. Close the line switch.
Reset	Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.
Stand-by	(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit). The circuit across terminals T-T will also have to close for burner to start.
Call for heat	Set thermostat (or aquastat) to call for heat. The limit circuit must provide power to the black wire and the circuit between terminals T-T must be closed.
Burner on	The ignitor and motor start. (The ignitor remains on throughout the call for heat cycle.)
TFI	The cad cell must sense flame within the control's trial for ignition (TFI) timing — 45 seconds.
Run	The burner continues firing during call for heat if the cad cell senses flame.
Lockout	If cad cell does not sense flame within the TFI timing (45 seconds), lockout occurs. The red LED indicator turns on.
WARNING	Red LED fully on indicates lockout (approximately 20 seconds after motor and ignitor turn off). If power is interrupted to the control before the Red LED turns fully on, the control will reset without the reset button being pushed.
To Reset	To reset after lockout, push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.
Flame failure	If the cad cell loses flame signal during operation (after the TFI), control will lockout if flame is not established within 45 seconds.
Burner off	Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.
Stand-by	Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).
Power loss	If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 vac).
- Check all electrical connections.

Control is in lockout (red LED on)

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control. If control does not start when receiving power on the black wire and T-T circuit is closed, check for:
 - light is leaking into the burner housing, *OR*
 - CAD cell is defective, *OR*
 - there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber. To troubleshoot:
 - **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
 - **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.

Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 40200 or 42230 primary control

Wire burner — 40200 primary control 42230 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 15 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 HZ/single-phase power supply, with at least a 5-AMP fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 AMPS.
- The 40200 or 42230 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 40200 or 42230 thermostat terminals. Then connect a voltmeter across wires. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

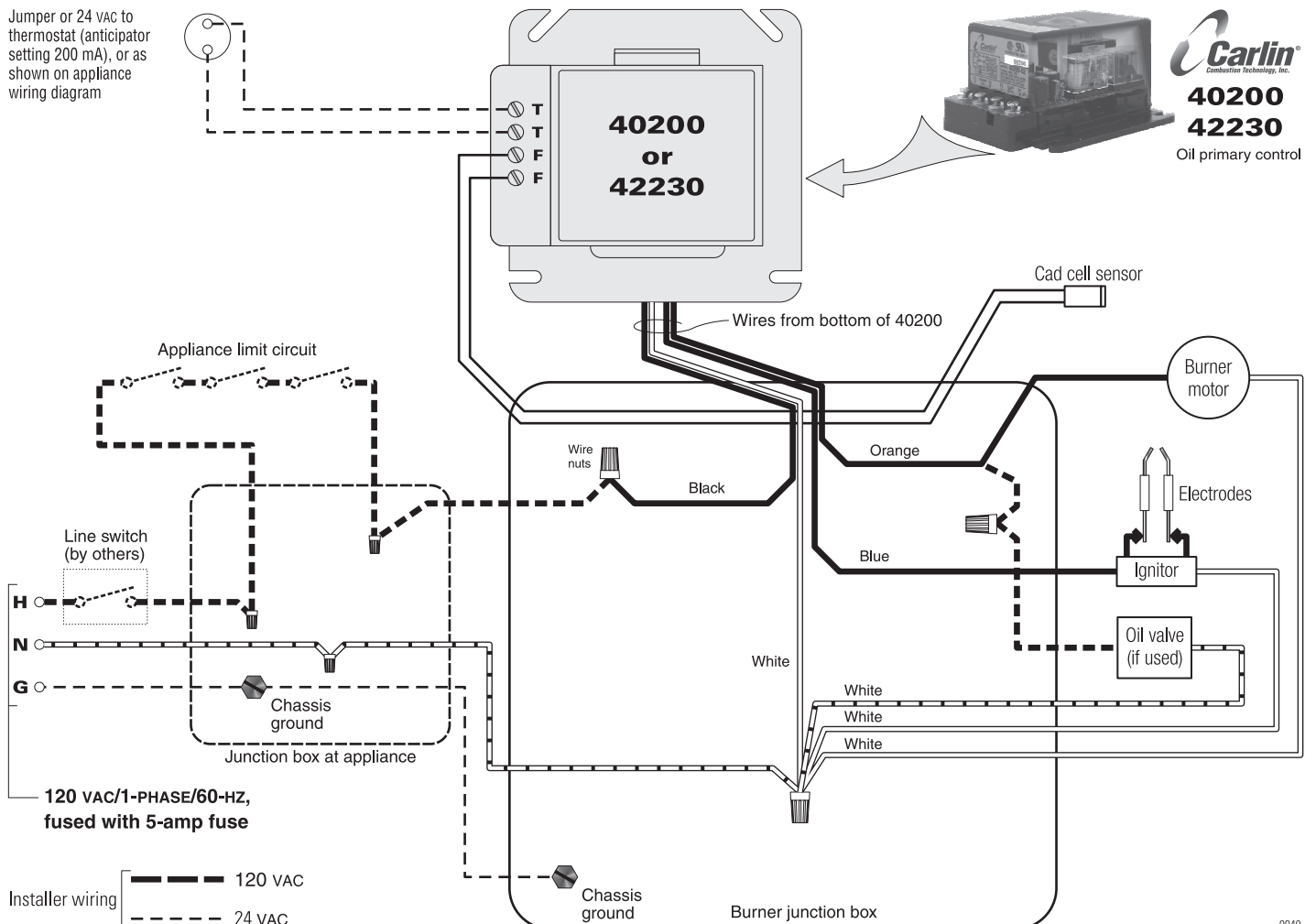
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 16 and 17.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 17 for suggestions in troubleshooting.

Figure 15 99FRD, 100CRD, and 102CRD burners wiring using Carlin 40200 or 42230 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)



9940

Start-up & operation

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.

Power ON	Open all manual oil line valves. Close the line switch.
Reset	Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.
Stand-by	(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit).
Call for heat	Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
Burner on	The <i>ignitor</i> and <i>motor</i> start.
TFI	The cad cell must sense flame within the control's trial for ignition (TFI) timing — 15 seconds for 40200 control or 30 seconds for 42230 control. After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
Run	The burner continues firing during call for heat if the cad cell is sensing flame.
Lockout	If cad cell does not sense flame within the TFI timing (15 or 30 seconds), lockout occurs.
To Reset	Push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.
Flame failure	If the cad cell loses flame signal during operation (after the TFI), the burner shuts off within 1.3 seconds. Recycle : After 60 to 90 seconds the control will restart (Burner on mode).
Burner off	Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.
Stand-by	Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).
Power loss	If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 VAC).
- Check all electrical connections.

Control is in lockout

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control.

If control starts when receiving power on the black wire and T-T circuit is closed, check for:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head

Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 50200 primary control

Wire burner — 50200 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 16 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 HZ/single-phase power supply, with at least a 5-AMP fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 AMPS.
- The 50200 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 50200 thermostat terminals. Then connect a voltmeter across terminals. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

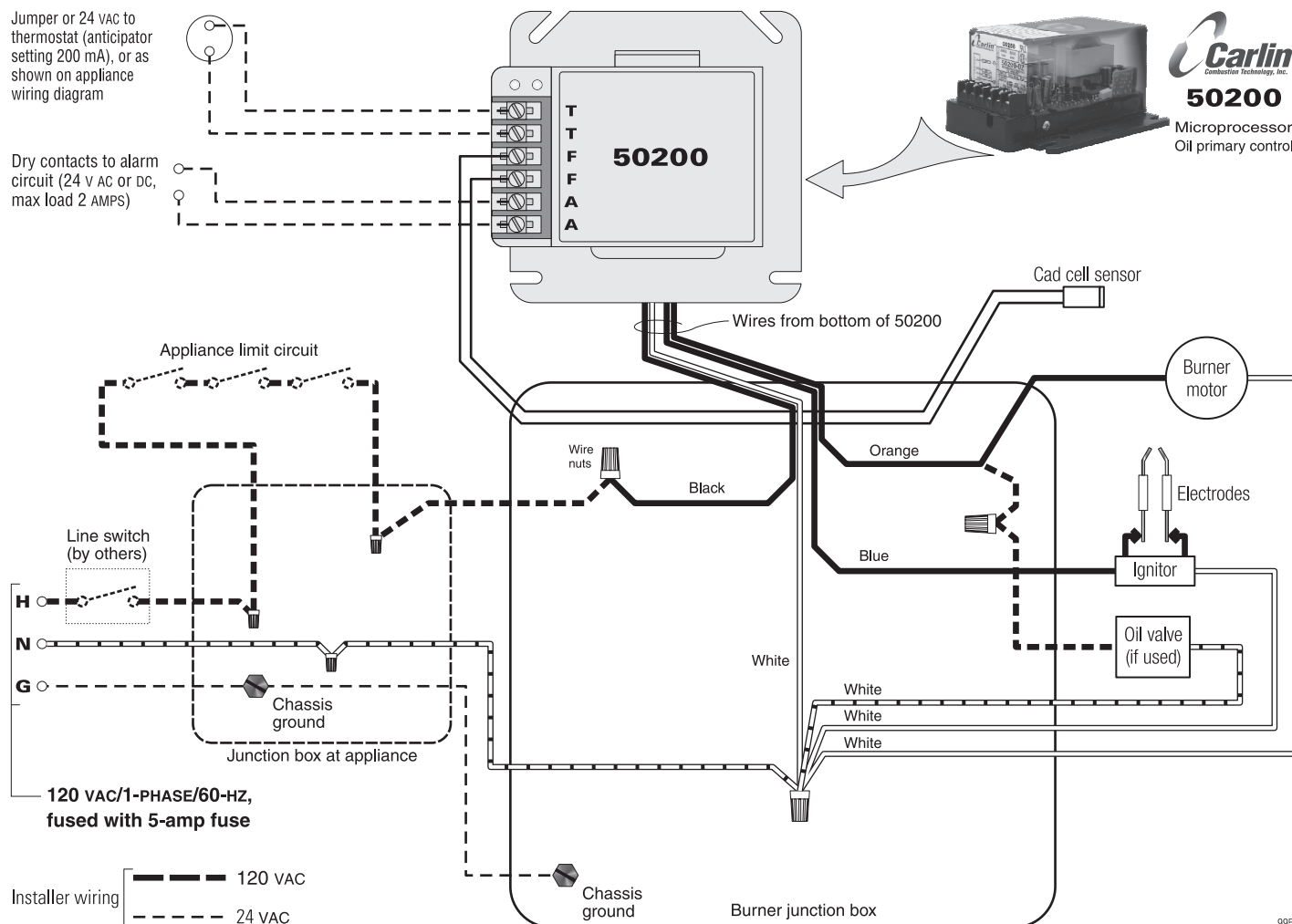
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 18 and 19.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 19 for suggestions in troubleshooting.

Figure 16 99FRD, 100CRD, and 102CRD burners wiring using Carlin 50200 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)



Start-up & operation

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily (A) every 3 to 4 seconds.

NOTICE

Check 50200 control label for trial for ignition (TFI) timing.

(A) (R) Power ON

Open all manual oil line valves. Close the line switch. (If Red light turns on constant (R), control is in lockout. See below to reset.)

(A) (R) Self-test 1

(Revision B controls only) Each time the limit circuit sends power to the black wire, the control performs a "boot-up" test to verify internal operation. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful. (This test occurs on every call for heat cycle if burner is operated by a limit control (terminals "T-T" jumpered).)

(A) (R) Stand-by

(Thermostat circuit open, limit circuit closed) If Self-test 1 is successful, amber LED turns off and control waits for thermostat circuit to close.

(A) (R) Call for heat

Set thermostat to call for heat. Thermostat circuit must close (and black wire must receive power from the limit circuit).

Self-test 2

The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED remains on, but blinks off momentarily (A) every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.

(A) (R) Burner on

After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)

(A) (R) TFI

The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).

(A) (R) Run

The burner continues firing during call for heat if the cad cell senses flame. LED's are off during normal running.

(A) (R) Lockout

If cad cell does not sense flame within 15 seconds after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the *alarm* contact.

To Reset

Push in and hold reset button for 1 second, then release.

(A) (R) Latch-up

If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.

WARNING

Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.



Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.



After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)

NOTICE

The 50200 control will not reset from lockout or latch-up if power is interrupted.

(A) (R) Flame failure

If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The burner shuts off within 2 seconds. **Recycle:** Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off (R).

(A) (R) End cycle

Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.

(A) (R) Stand-by

Control remains in stand-by mode until limit circuit sends power to the black wire (call for heat).

Model 50200 diagnostic LED's

(R) — Red **OFF**

(R) — Red **ON**

(R) — Red **FLASHING**

(A) — Amber **OFF**

(A) — Amber **ON**

(A) — Amber **FLASHING**

(A) — Amber **BLINKING** (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on



No power to control

- Check line voltage to the control (at least 102 VAC).
- Check all electrical connections.



Control is in lockout

- Red LED will be on. Press the reset button for 1 second.
- If the control returns immediately to lockout, The Safety Monitoring Circuit may have detected an internal control problem. Replace the control.



CAD cell seeing light

- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control.

If the amber **LED remains on** (A) with a wire detached, the control is defective.

If amber **LED goes off** (A), control is OK, and:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (A) (R) flashing red LED

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (A) (R) red LED on

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 60200 primary control

Wire burner — 60200 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 17 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 HZ/single-phase power supply, with at least a 5-AMP fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 AMPS.
- The 60200 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 60200 thermostat terminals. Then connect a voltmeter across terminals. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

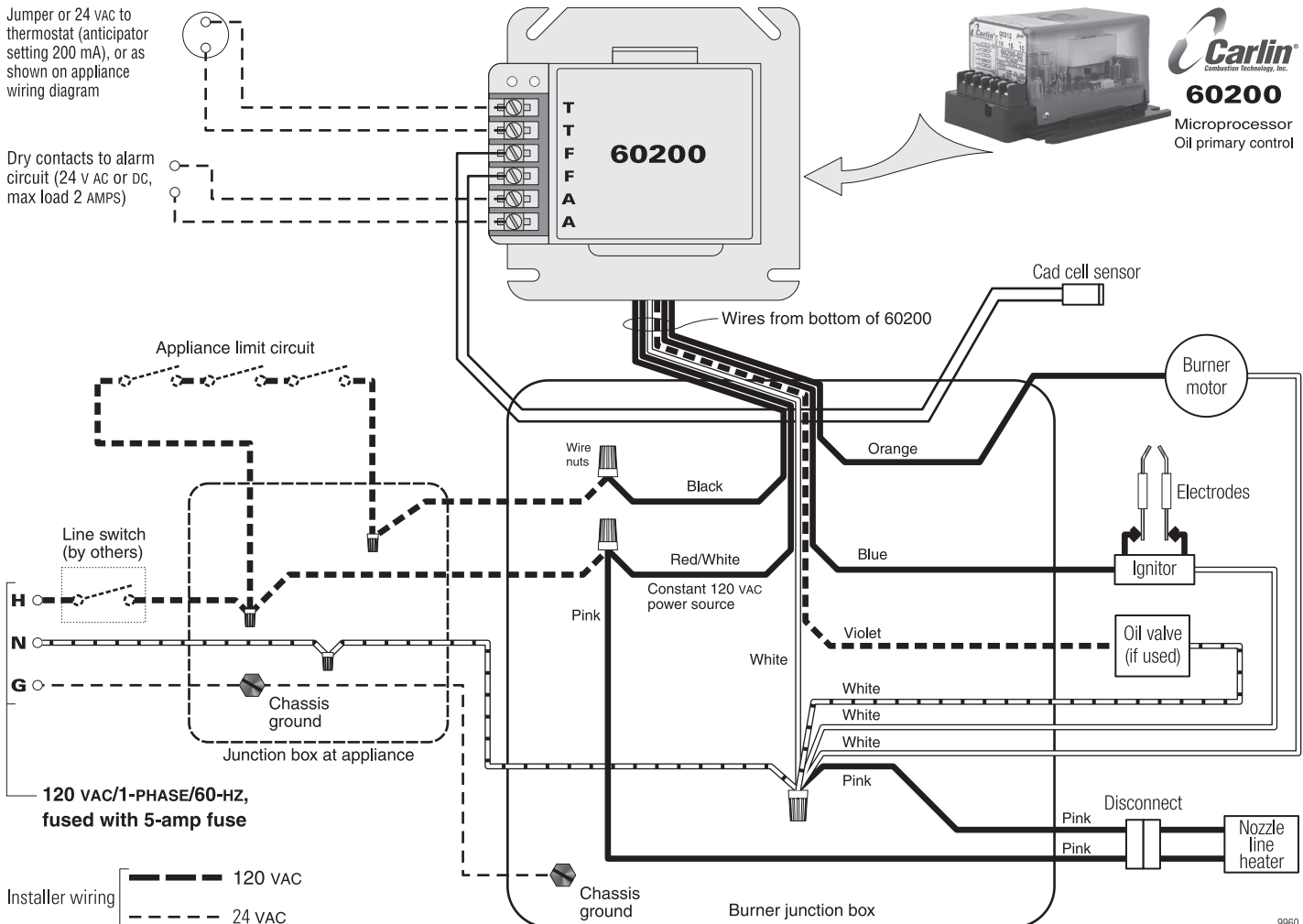
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 20 and 21.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 21 for suggestions in troubleshooting.

Figure 17 99FRD, 100CRD, and 102CRD burners wiring using Carlin 60200 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)




Start-up & operation

WARNING


































Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily  every 3 to 4 seconds.

NOTICE

Check 60200 control label for trial for ignition (TFI), pre-purge and post-purge timings.









-   **Power ON** Open all manual oil line valves. Close the line switch. (If Red LED turns on constant , control is in lockout. See below to reset.)
-   **Self-test 1** (*Revision B controls only*) The control performs a “boot-up” test to verify internal operation each time power is applied to the red/white wire. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful.
-   **Stand-by** (No call for heat) If Self-test 1 is successful, amber LED turns off and control waits for heat call.
-   **Call for heat** Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
- Self-test 2** The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED will remain on, but blink off momentarily  every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.
-   **Burner on** After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)
-   **Pre-purge** The *oil valve* opens after the valve delay-on period (pre-purge). (For oil valve delay on operation, wire oil valve to the violet lead. If not using an oil valve, cap the violet lead to automatically disable pre-purge and post-purge.)
-   **TFI** The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
-   **Run** The burner continues firing during call for heat if the cad cell senses flame. Both LED's are off during normal running.
-   **Lockout** If cad cell does not sense flame within the TFI time limit after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the *alarm* contact.
- To Reset** Push in and hold reset button for 1 second, then release.
-   **Latch-up** If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.
- WARNING** **Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.**
-   Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.
-   After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)
- NOTICE** The 60200 control will not reset from lockout or latch-up if power is interrupted.
-   **Flame failure** If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The *oil valve* closes within 2 seconds. The *motor* remains on for the motor delay off period, then shuts off. (If no oil valve is wired to the control, the burner shuts down within 2 seconds.) **Recycle:** Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off .
-   **Post-purge** Set thermostat (or aquastat) to stop call for heat. The *oil valve* (if installed) will turn off within 2 seconds. The *motor* remains on for the motor delay off period (post-purge), then turns off. (If no oil valve is wired to the control, the burner shuts off within 2 seconds after end of call for heat. There is no post-purge.)
-   **Stand-by** Control remains in stand-by mode until limit circuit sends power to the black wire and thermostat circuit closes (call for heat).

Model 60200 diagnostic LED's

-  — Red OFF  — Red ON  — Red FLASHING
-  — Amber OFF  — Amber ON  — Amber FLASHING
-  — Amber BLINKING (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on

-   **No power to control**
- Check line voltage to the control (at least 102 vac).
 - Check all electrical connections.
-   **Control is in lockout**
- Red LED will be on. Press the reset button for 1 second.
 - If the control returns immediately to lockout, the Safety Monitoring Circuit may have detected an internal control problem. Replace the control.
-   **CAD cell seeing light**
- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control. If the amber **LED remains on**  with a wire detached, the control is defective.
- If amber **LED goes off** , control is OK, and:
- light is leaking into the burner housing, *OR*
 - CAD cell is defective, *OR*
 - there is a problem with the CAD cell wiring or holder.
 - If appliance was recently shut down, CAD cell may see residual hot spots in chamber.
- To troubleshoot:
- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
 - **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (flashing red LED)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (red LED on)

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve stuck in closed position.
- Check wiring connections.

5. Adjustment and verification

Perform combustion test

Adjust burner using test instruments

1. Operate burner for 15 minutes before making final adjustments using test equipment.
2. Check for leaks in fuel piping.

WARNING

Inspect fuel piping system for leaks. Repair any leaks to avoid fire hazard from oil leakage or combustion problems due to air infiltration into oil.

3. Inspect flame
 - Look at flame through appliance combustion chamber observation port. The flame should be well-defined and should not impinge on any appliance surface. (If you make air or gas pressure changes later, inspect the flame again.)

WARNING

Do not attempt to confirm combustion simply by inspecting the flame visually. You must use combustion test instruments. Failure to properly verify/adjust combustion could allow unsafe operation of the burner, resulting in severe personal injury, death or substantial property damage.

1. Insert test probe into vent or appliance flue damper sample opening to sample flue products.
2. With the EZ burner equipped with the correct positioning bar, oil nozzle and initial air band setting, the flue products will usually contain between 11½% and 12½% CO₂ (5.9% and 3.8% O₂) and zero (Bacharach) smoke.
3. Use combustion test equipment to verify that burner is properly set up for your installation, within the range listed in Table 3. Appliances with positive pressure in the chamber may require a wider air opening. See appliance instructions for details. Verify/adjust settings by testing with instruments.
 - a. Check smoke. It should be zero on the Bacharach scale.
 - b. Set the appliance flue damper or barometric draft regulator so the draft or pressure in the vent complies with the appliance manufacturer's instructions.

WARNING

Heating units designed for natural draft operation are normally set for a slightly negative pressure, usually -0.01 to -0.02 inches w.c. draft at the combustion chamber test port. Appliances designed for forced draft (positive pressure in the chamber) must be air-tight to prevent exfiltration of harmful combustion products. Failure to properly set draft for the appliance could result in severe personal injury or death.

- c. Check percent of CO₂ (or O₂). Fine tune the burner, if necessary, by slightly adjusting the air band for more or less air.
- d. Recheck smoke (should be zero) and flue or chamber pressure/draft (adjust if necessary and retest).
- e. Tighten air band clamping screw.

WARNING

All installations should be checked after one to two weeks of operation to ensure the appliance/burner units are operating correctly.

Verify burner/appliance operation

Check burner/appliance/controls operation

- Test operating and limit controls on appliance as specified in appliance instructions.
- Check operation of the primary control by forcing lockout to occur. For primary controls that enter latch-up after multiple lockouts, force latch-up to occur as well. Reset primary control per control data sheet instructions after each test.
- Start and stop the burner several times, allowing the primary control to sequence through normal operation. Verify correct operation of burner and primary control throughout.

Verify vent system operation

- Verify vent is operating correctly and flue products are properly exhausted from building. If the building contains any exhaust fans or conditions that could affect vent performance, check burner/appliance/vent operation with exhaust fans (or other conditions) operating.

Combustion/ventilation air

- Verify combustion/ventilation air openings are not/will not be obstructed.
- Verify air opening louvers are full open.
- If louvers are motor-operated, verify motor and end switch are interlocked with appliance/burner wiring to prevent operation of the burner if the air louvers are not fully opened.

Prepare burner for normal operation

- Cycle burner off with appliance controls.
- Turn off power to the appliance.
- Seal the appliance flue damper test opening.
- Verify all components and wires are in place and burner is ready for operation.
- Restore power to the appliance.

Train the user

- Train the user to operate the burner and appliance under normal conditions.
- Explain procedure to shut down burner/appliance when required.
- Review rear cover of this manual (and the appliance manual) with the user.
- Verify the user is aware of all procedures specified in the manuals.
- Verify user will not store or use combustible liquids or materials or contaminants in the vicinity of the burner/appliance.

6. Annual start-up and service

Annual start-up & service

Perform the following

WARNING

This burner must be started and serviced at least annually by a qualified service technician. Failure to properly maintain and service the burner could result in severe personal injury, death or substantial property damage.

- Discuss burner/appliance operation with user to determine any problems that may have occurred during the previous season and to verify user is aware of proper operation and care of the burner/appliance.
- Review proper operation of the appliance/burner unit with the user.
- Turn off power to appliance.
- Remove combustion head assembly to clean and adjust if necessary. (See procedure on page 10.)
- If the inside surface of the air tube and/or retention ring need to be cleaned, clean them with a vacuum cleaner with brush attachment while the combustion head assembly is out of the burner.
- Replace the oil nozzle with the correct size.
- Inspect and adjust the ignition electrodes and insulators per instructions on pages 10 and 11 of this manual. Replace if proper spacing cannot be achieved or if components are damaged.
- Close the housing cover plate and secure in place.
- Inspect the fuel line oil filter. Replace if necessary.

NOTICE

Oil line filters — Use a non-bypassing filter to prevent nozzle plugging caused by poor oil filtration. Non-bypassing filters prevent small foreign particles from bypassing the filter, a common problem with fiber element type filters. Another problem of some filters is the fiber from filter element tears can break away and plug the nozzle or fuel unit.

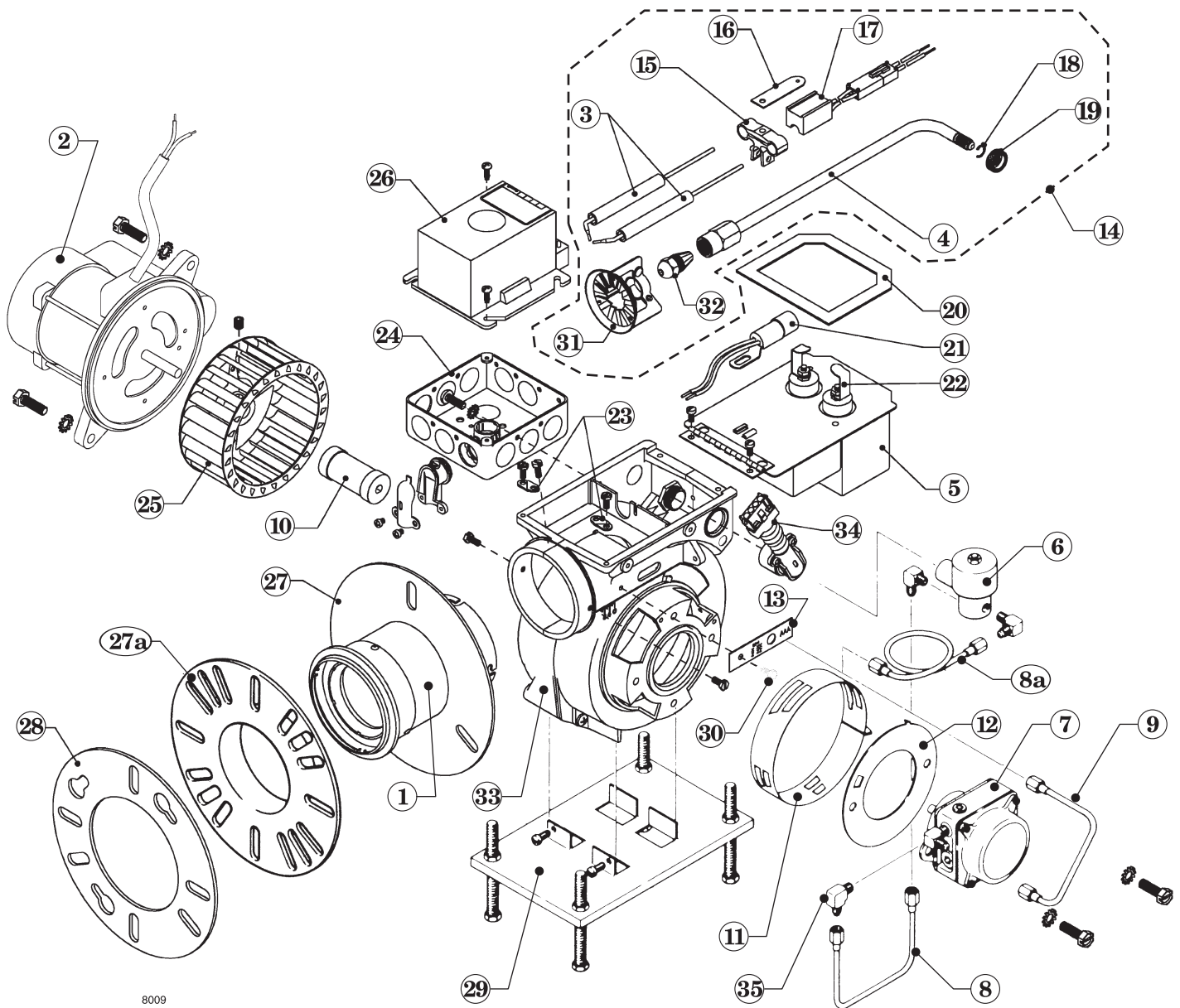
- Perform the complete checkout procedures of pages 10 to 13, including system inspection and checks.
- Inform the user of any problems found.

Model EZ-1/2/3 oil burners — Instruction manual

7. Repair parts

Item	Description	Part No.	Item	Description	Part No.
1	Air tube, 4" nominal, approx. 4-3/8" oal (EZ -1), universal flange	77719	11	Air band (EZ-1), with 100 PSIG scale	98055
	Air tube, 5" nominal, approx. 5-3/8" oal (EZ -1), universal flange	77727		Air band (EZ -2), with 100 PSIG scale	98087
	Air tube, 7" nominal, approx. 7-3/8" oal (EZ -1), universal flange	77735		Air band (EZ -3), with 100 PSIG scale	98089
	Air tube, 9" nominal, approx. 9-3/8" oal (EZ -1), universal flange	77743	12	Air shutter, blank (EZ-1)	97780
	Air tube, 11" nominal, approx. 11-3/8" oal (EZ -1), universal flange	77750		Air shutter, one slot (EZ -1)	98052
	Air tube, 5" nominal, approx. 5-1/4" oal (EZ -2 & 3), universal flange	83816		Air shutter, three slots (EZ -2)	98109
	Air tube, 7" nominal, approx. 7-1/4" oal (EZ -2 & 3), universal flange	83824		Air shutter, four slots (EZ -3)	98108
	Air tube, 9" nominal, approx. 9-1/4" oal (EZ -2 & 3), universal flange	83832	13	Head positioning bar kit w/7 bars & thumb screw (EZ -1, EZ-1-HP)	98078
	Air tube, 11" nominal, approx. 11-1/4" oal (EZ -2 & 3), universal flange	83840		Head positioning bar kit w/4 bars & thumb screw (EZ -2, EZ-2-HP)	84715
	Air tube with welded flange, for specific appliance (contact factory)	—		Head positioning bar kit w/3 bars & thumb screw (EZ -3, EZ-3-HP)	86389
2	Motor, 1/6 hp, 3450 rpm, Carlin PSC	98022	14	Combustion head assembly 4"	77941
	Motor, 1/6 hp, 3450 rpm, for Suntec J/H pumps	27631		Combustion head assembly 5"	77958
3	Electrode wire, set of 2, 4" nominal, approx. 5-1/2" oal (EZ -1 only)	82750		Combustion head assembly 7"	77966
	Electrode wire, set of 2, 5" nominal, approx. 6-1/2" oal	82768		Combustion head assembly 9"	77974
	Electrode wire, set of 2, 7" nominal, approx. 8-1/2" oal	82776		Combustion head assembly 11"	77982
	Electrode wire, set of 2, 9" nominal, approx. 10-1/2" oal	82784	15	Electrode bracket	23135
	Electrode wire, set of 2, 11" nominal, approx. 12-1/2" oal	82792	16	Bracket, nozzle line heater	64493
4	Nozzle line/adaptor assembly, 4" nominal, approx. 5-3/4" oal (EZ -1 only)	56804	17	Nozzle line heater w/electrical disconnect	66787
	Nozzle line/adaptor assembly, 5" nominal, approx. 6-3/4" oal	56820	18	C-ring for nozzle line	31633
	Nozzle line/adaptor assembly, 7" nominal, approx. 8-3/4" oal	56861	19	Thumb nut, nozzle line	62885
	Nozzle line/adaptor assembly, 9" nominal, approx. 10-3/4" oal	57315	20	Gasket, transformer	40167
	Nozzle line/adaptor assembly, 11" nominal, approx. 12-3/4" oal	56754	21	Cad cell	4002400A
5	Ignitor, Carlin electronic	41000	22	Transformer terminal kit, (2 terminals & nuts)	24463
6	Oil valve, instant opening	40857	23	Transformer hold-down tab, two required	44842
	Oil valve kit, instant opening, w/fittings & oil lines	24638	24	Junction box, 4"x4", w/grommet and lockwasher	44586
	Oil valve, instant opening, Carlin	SVC10FF	25	Blower wheel, 5-1/16d x 2w	77933
	Oil valve kit with fitting, Carlin	98289	26	Primary control (consult factory for other controls)	60200
7	Fuel unit, std. single stage, Suntec A2VA-7116, w/fitting	22996	27	Welded flange, when supplied (contact factory)	—
	Fuel unit, std. two stage, Suntec B2VA-8216, w/fitting	23002	27a	Mounting flange, 3-1/2 id x 8-1/4 od Universal flange	81364
	Fuel unit, std. single stage, Danfoss BFPH w/fitting (ez-1)	27813	28	Gasket, mounting flange	40287
	Fuel unit, opt. single stage, Suntec JB2BB-300, w/fitting (Note 1)	23127	29	Pedestal w/hardware	23317
	Fuel unit, opt. two stage, Suntec HB2BB-300, w/fitting	23069	30	Screw, head positioning bar	98349
8	Oil line, 3/16 od, std. fuel unit to oil valve	34397	31	Flame retention ring assembly	77438
	Oil line, 3/16 od, opt. fuel unit (J/H pump) to oil valve	34413	32	Nozzle (obtain locally)	—
8a	Oil line, 3/16 od, oil valve to nozzle line	34439	33	Housing, w/84939 access cover	7781801
9	Oil line, 3/16 od, std. fuel unit to nozzle line	34470	34	Plug-in wire harness, when supplied (contact factory)	—
	Oil line, 3/16 od, opt. fuel unit (J/H pump) to nozzle line	34512	35	Elbow, 3/16 flare x 1/8 NPT	29926
10	Coupling, for std. fuel units, approx. 2-3/8" oal	75564			
	Coupling, for opt. fuel units (J/H pumps), approx. 2-3/16" oal	28704			
	Note 1: Requires 1/6 hp motor (item 2) and special coupling				
For parts not shown or listed, contact factory and/or check separate documentation supplied with appliance/burner unit.					

7. Repair parts (continued)



8. Maintenance procedures

Maintenance/service procedures

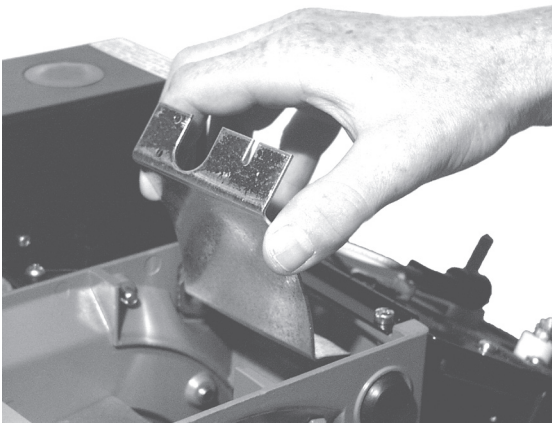
WARNING

Turn off power to appliance when servicing burner. Failure to comply could result in severe personal injury, death or substantial property damage.

Cleaning blower wheel

1. The blower wheel accumulates dust and debris from normal operation. You will need to clean the wheel blades periodically to prevent reduction in airflow.
 - Inspect the blower wheel by removing the blower wheel access cover. See Figure 18.
 - To remove the cover, open the ignitor plate and loosen the blower wheel access cover screw about three turns.
 - Inspect the blower wheel to see if it needs to be cleaned. Dirt and lint on the wheel reduce air flow, and must be removed if the burner is to operate correctly.
2. To clean blades, remove the two bolts securing the motor to blower housing.
 - a. Slide the motor out and rotate to remove and access blower wheel.
 - b. Use a brush and vacuum to clean each blade and the blower housing interior.
 - c. Replace motor/wheel in blower housing and secure with the two bolts.
 - d. Push wire slack back into junction box.

Figure 18 Remove blower access cover to inspect blower wheel



Replacing blower motor or wheel

1. If either the blower wheel or motor must be replaced, remove the two bolts securing the motor to housing.
2. Disconnect the motor wires in the burner junction box.
3. Loosen the Allen screw securing the blower to the motor shaft and remove the wheel.
4. When assembling the replacement assembly, slide the wheel onto the motor shaft and use feeler gauges to set a space of 3/64 inch between the blower wheel and the motor face.
5. Replace the motor/wheel assembly in the housing, wire the motor leads and secure the motor with the two bolts.

Motor maintenance

- The Carlin PSC motor is constructed with permanently-lubricated bearings, and requires no oiling. Should you replace the original motor with another type of motor, occasional oiling may be required, depending on motor design and manufacturer's recommendations.
- Any time you replace a component or disassemble any part of the burner for service/maintenance, perform a complete operational test after reassembly to verify the burner operates correctly. Failure to verify operation could result in severe personal injury, death or substantial property damage.

Checking ignitor

WARNING

Never test an ignitor by placing a screwdriver (or other metallic object) across the high voltage clips. Check 40700 & 40900 ignitors only by observing spark at appliance ignition electrodes, with fuel supply OFF. Using any other method could cause ignitor damage and severe personal injury.

1. Checking 41000 ignitors only:
 - Disconnect electrical power to burner.
 - Remove hold down clips or screws. Lift ignitor mounting plate to the full-open position. Set high voltage clips to a 1/2" to 3/4" gap.
 - Carefully energize ignitor and check for spark arcing at the high voltage terminals. If spark jumps the gap, ignitor is good.

Ceramic fiber materials

WARNING

The appliance may contain ceramic fiber and/or fiberglass materials. Ceramic fiber materials, such as chamber liners, may contain carcinogenic particles (chrysotilites) after exposure to heat. Airborne particles from fiberglass or ceramic fiber components have been listed as potentially carcinogenic by the State of California. Take the following precautions when removing, replacing and handling these items.

Avoid breathing dust and avoid contact with skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves and eye protection. Use a NIOSH N95 certified respirator. This respirator meets requirements for protection from chrysotilites. Actual job requirements or NIOSH regulations may require other or additional protection. For information, refer to the NIOSH website, <http://www.cdc.gov/niosh/homepage.html>.

Ceramic fiber removal: To prevent airborne dust, thoroughly wet ceramic fiber with water before handling. Place ceramic fiber materials in a plastic bag and seal to dispose.

Avoid blowing, tearing, sawing or spraying fiberglass or ceramic fiber materials. If such operations are necessary, wear extra protection to prevent breathing dust.

Wash work clothes separately from other laundry. Rinse clothes washer thoroughly afterwards to prevent contamination of other clothing.

NIOSH First aid procedures:

Eye exposure — irrigate immediately



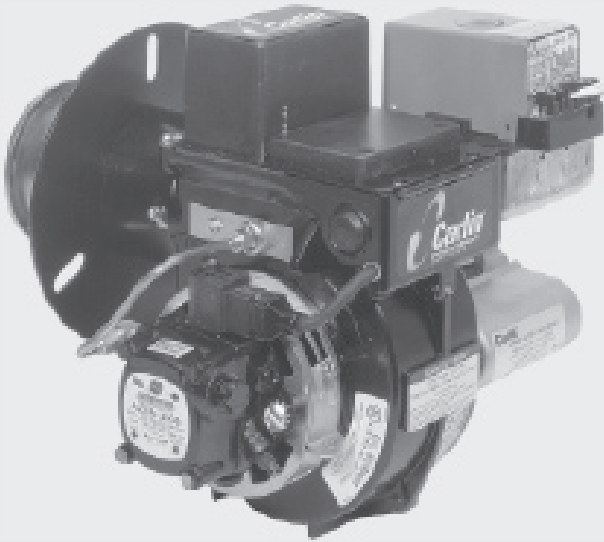
Limited Warranty

Carlin Combustion Technology, Inc. (Carlin) warrants its products, to the original purchaser, to be free from defects in material and workmanship, under normal use and service for 36 months from the date of manufacture, except for commercial Products (over 3 GPH) that are warranted for 12 months from the date of manufacture; and except for EZ-Pro™ Burners that are warranted for 36 months from the date of manufacture, plus an extended period of two (2) additional years (total of five (5) years).

This warranty does not extend to equipment subjected to misuse, neglect, accident or water damage; nor does this warranty apply unless the product covered by it is properly installed by a qualified, competent technician, who is licensed where state or local codes require, and who is experienced in making such installations, in accordance with NFPA No. 31 of the National Fire Protection Association and in accordance with all applicable local, state and national codes. Parts that are defective in material or workmanship and within the warranty period will be repaired or replaced as follows:

1. Motors, fuel units, transformers and other non-Carlin products should be sent for repair or replacement to an authorized service point or distributor of the manufacturer of such components when reasonably available in the Customer's locality.
2. Where such local service is not available with respect to the above listed components, or where Carlin components are involved, or for component parts of EZ-Pro Burners that fall within the extended warranty period, such defective parts should be returned, freight prepaid to Carlin. The repaired component or replacement part will be provided to the Customer freight prepaid by Carlin unless the returned part is determined by Carlin to be out of warranty or not to be defective, in which case it will be provided to the customer F.O.B., Carlin, East Longmeadow, Massachusetts.
3. Contact Carlin Customer Service for warranty return procedures.
4. The return of a burner is not covered by this warranty. Contact Carlin Tech Service for assistance before replacing any burner.
5. Carlin is not responsible for any labor cost for removal and replacement of equipment.
6. Equipment that is repaired or replaced will carry the unexpired portion of the original equipment warranty.
7. If inspection by Carlin does not disclose any defect covered by this warranty, the equipment may be repaired or replaced at the expense of the Customer, and Carlin's regular charges will apply.
8. Non-Carlin components are warranted for 12 months from date of installation or 18 months from date of manufacture, whichever date occurs first.

This warranty is limited to the precise terms set forth above, and provides exclusive remedies expressly in lieu of all other remedies and in particular there shall be excluded the implied warranties of merchantability and fitness for a particular purpose. In no event will Carlin Combustion Technology, Inc. be liable for any incidental or consequential damage of any nature. Carlin neither assumes nor authorizes any person to assume for Carlin any other liability or obligations in connection with the sale of this equipment. Carlin's liability and Customer's exclusive remedy being limited to repairs or replacement as set forth above.



WARNING The burner must be cleaned, tested and adjusted annually by a qualified oil burner service technician.

WARNING **Should overheating occur:**

- (1) shut off the oil supply to the burner.
- (2) **DO NOT** shut off the control switch to the circulator or blower.
- (3) contact your oil dealer or service technician and the fire department (if needed).

EZ-1/2/3 oil burner

User care and maintenance

WARNING Refer only to the information on this page, intended for your use. The remainder of this manual is intended only for your service technician. Failure to comply could result in severe personal injury, death or substantial property damage.

For other than routine maintenance, contact a qualified service company. Perform the following as needed.

- Keep the area around the burner clear and free from combustible vapors and liquids.
- Do not obstruct the flow of combustion and ventilating air.
- Most motors currently used on residential type burners use permanently-lubricated bearings, and do not require field lubrication. Read the label on the motor to determine oiling needs, if any. Do not over-lubricate. This can cause as much trouble as not lubricating at all.

WARNING Never attempt to use gasoline as a fuel for this burner, as it is more combustible and could result in a serious explosion. Never attempt to burn refuse or use any fuel other than # 1 or # 2 heating oil (ASTM).

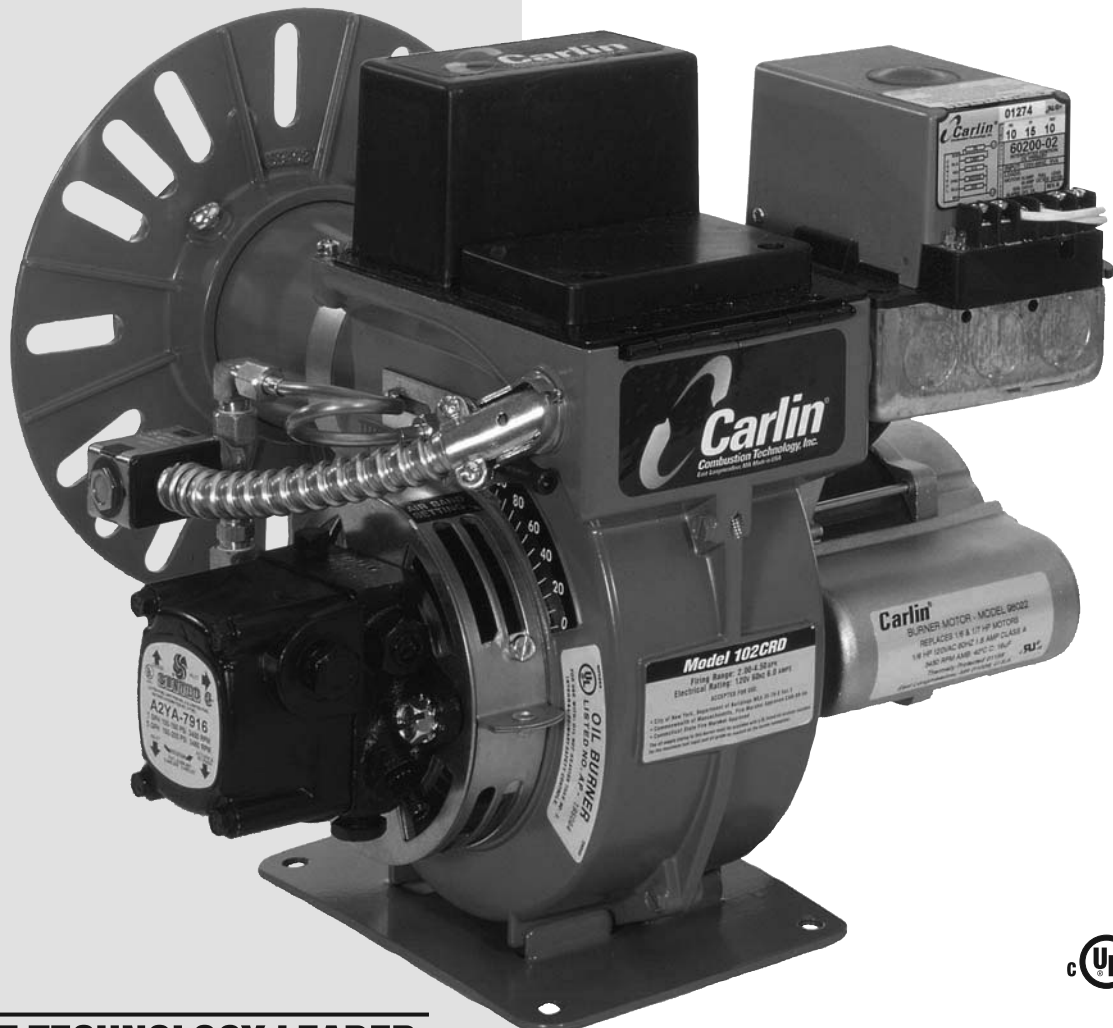


MODELS **102CRD™**
99FRD™ & 100CRD™
Advanced Oil Burners

0.5 TO 4.5 GPH

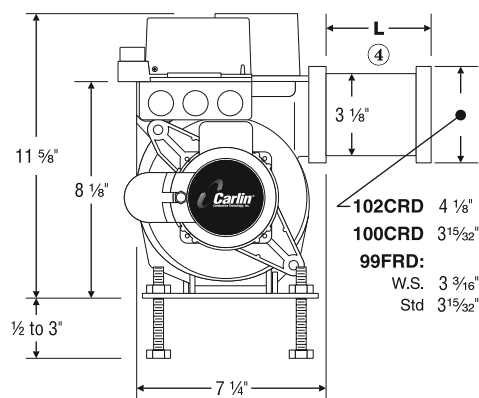
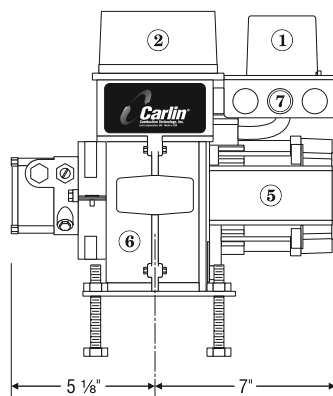
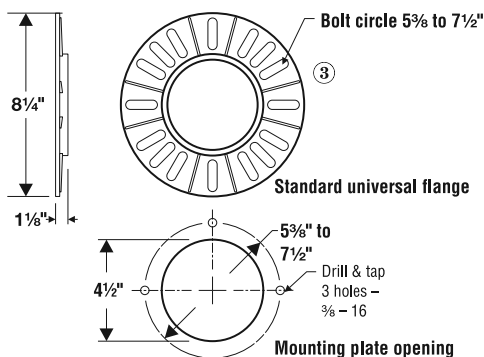
- Compact
- Versatile
- High-speed . .

**The oil burners
for all your
applications**



CARLIN. THE TECHNOLOGY LEADER.

Carlin 99FRD, 100CRD & 102CRD Advanced Oil Burners



- ① Carlin 60200 microprocessor control
② Carlin 41000 solid state ignitor
③ Universal flange (welded flange optional)
④ Air tube (L = 5", 7", 9", or 11") (subtract 1 1/8" on 102CRD burners for finished length of air tube)
- ⑤ Carlin PSC motor
⑥ Cast aluminum blower housing
⑦ Junction box

Features

The 99FRD, 100CRD and 102CRD advanced oil burners feature Carlin's adjustable head assembly — for unmatched fuel/air mixing, smooth light-offs and quiet running.

Proven for years in the field and in extensive boiler and furnace testing, these burners cover the range from residential to semi-commercial, to meet your needs for oil-burning applications.

Look at the features and options:

Easy adjustment and service

- Only adjustments are the air band and the retention ring, with Carlin's unique Allen key setting method
- Blower access cover allows full view of blower compartment
- Burners use the same air handling parts for each firing rate range
- Compact design using standard components, including Carlin electronic ignition and microprocessor primary controls. Optional oil line heater and SVC oil valve also available.
- Tapered electrode tip design doubles the life of electrodes

Unmatched performance

- Positive ignition, stable operation, and compact flame
- Insensitive to draft or moderate back-pressure variations
- Damper not required to maintain high seasonal efficiencies
- Excellent performance tested in appliances that do not use refractory combustion chambers
- Pressure augments in 99FRD increases static pressure to 3.5 inches w.c. — for cleaner starts and stops

Specifications

Input

99FRD	0.50 to 3.00 GPH
100CRD	0.50 to 2.25 GPH
102CRD (2 5/8" air cone)	2.00 to 3.50 GPH
102CRD (3" air cone)	3.00 to 4.50 GPH

The maximum firing rate shown is for natural draft at elevations up to 2,000 feet above sea level. Reduce the rate for forced draft firing as given in the burner manual (up to 21% reduction for 100CRD at 0.20 inches w.c. overfire pressure). For altitudes higher than 2,000 feet, reduce capacity 4% per 1,000 feet above sea level.

Fuels

U. S.	No. 1 or No. 2 Fuel oil
Canada	No. 1 Stove oil or No. 2 Furnace oil

Electrical

Power	120 VAC/60 HZ/1-PHASE
Limit circuit input (60200 primary)	120 VAC/60 HZ
Current	
99FRD	Approximately 5.5 AMPS
100CRD	Approximately 5.5 AMPS
102CRD	Approximately 6.0 AMPS
Motor	
99FRD	1/6 HP, 3450 RPM
100CRD	1/6 HP, 3450 RPM
102CRD	1/6 HP, 3450 RPM
(Optional) Oil valve power	120 VAC/60 HZ
(Optional) Nozzle line heater	120 VAC/60 HZ

Ignition

Carlin Model 41000 solid state electronic ignitor	
Ignition voltage	14,000 VOLTS

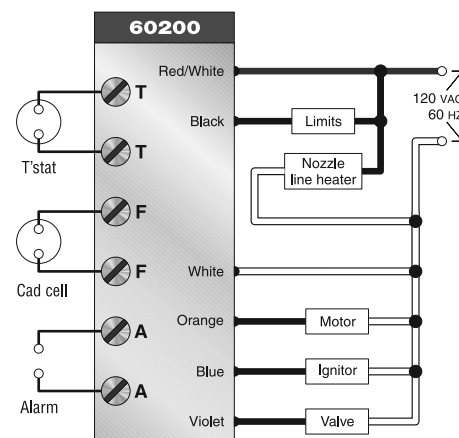
Agencies

UL Listed	(US & Canada)
-----------	---------------

Special notes

- 99FRD burners ship with blank (closed) air shutters. The maximum input with blank shutters is 2.25 GPH. For higher firing rates, order with open air shutter (for range from 1.50 to 3.00 GPH).
- Burners ship standard with adjustable flange unless ordered for specific OEM application. Special welded flange and required insertion depth if welded flange is required. Use welded flange when firing into a positive-pressure combustion chamber.
- All burners ship with single-stage fuel pumps unless optional two-stage pump is specified.

Wiring (typical, using 60200 primary)



Warning — For use only by a qualified service technician.

- Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
- Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.
- Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.

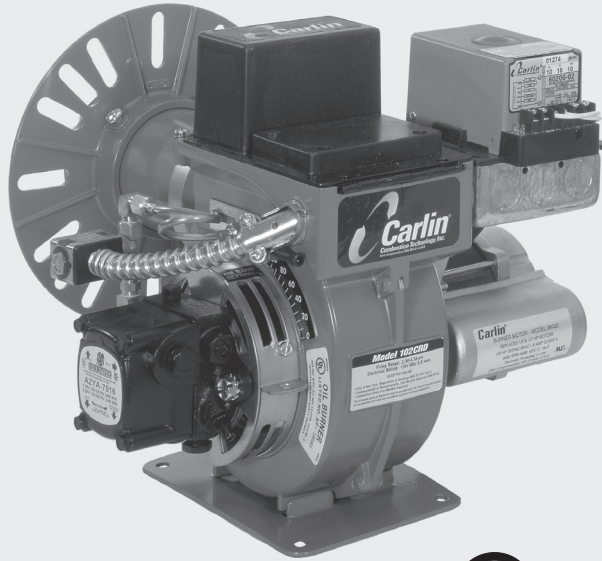
TECH SUPPORT HOTLINE 800-989-2275



Carlin Combustion Technology, Inc.

70 Maple Street East Longmeadow, MA 01028
e-mail us at: info@carlincombustion.com

Phone 413-525-7700 Fax 413-525-8306
visit our website: www.carlincombustion.com



Ratings



Input:	99FRD	0.50 to 3.00 GPH
	100CRD	0.50 to 2.25 GPH
	102CRD (2 $\frac{5}{8}$ " air cone).....	2.00 to 3.50 GPH
	102CRD (3" air cone)	3.00 to 4.50 GPH
Fuels:	U.S.	No. 1 or No. 2 Fuel oil
	Canada.....	No. 1 Stove oil or No. 2 Heating oil
Fuel unit:	.....	Suntec
	.....	100 to 150 PSIG nozzle pressure
Electrical:	Power.....	120V/60 Hz/1-Phase
	Motor.....	Carlin PSC, 1/6 HP, 3450 RPM
	Current	
	99FRD	Approx. 5.5 amps
Ignition:	.....	Carlin Model 41000 electronic — 14,000 volts
	Control:	U.L. Group I or II primary safety control

WARNING

Installer/servicer — Except where specifically stated otherwise, this manual must be used only by a *qualified service technician*. Failure to comply with this or other requirements in this manual could result in severe personal injury, death or substantial property damage.

WARNING

User — Refer only to User care and maintenance on back page for information regarding operation of this burner. The burner Instruction Manual is intended only for your service technician. The burner and heat exchanger must be inspected

MODELS **102CRD** **99FRD & 100CRD** Advanced Oil Burners **0.5 TO 4.5 GPH** **Instruction manual**

Contents

PLEASE read this first.....	2
Codes and standards.....	2
1. 99, 100, & 102 Oil nozzle selections.....	3
2. Prepare site • assemble burner • mount burner 4	
3. Prepare burner	9
4. Wire burner • start burner – 48245 primary control .14	
4. Wire burner • start burner – 40200 primary control .16	
4. Wire burner • start burner – 50200 primary control .18	
4. Wire burner • start burner – 60200 primary control .20	
5. Adjustment and verification.....	22
6. Annual start-up and service	23
7. Repair parts	24
8. Maintenance procedures.....	26
Warranty	27
User care and maintenance.....	Rear cover

© Copyright 2004 — Carlin Combustion Technology, Inc.

70 Maple Street
Ph 413-525-7700

East Longmeadow, MA 01028
Fx 413-525-8306

TECH SUPPORT 800-989-2275

carlincombustion.com

PLEASE read this first . . .

Special attention flags

Please pay particular attention to the following when you see them throughout this manual.

DANGER

Notifies you of hazards that *WILL* cause severe personal injury, death or substantial property damage.

WARNING

Notifies you of hazards that *CAN* cause severe personal injury, death or substantial property damage.

CAUTION

Notifies you of hazards that *WILL* or *CAN* cause minor personal injury or property damage.

NOTICE

Notifies you of special instructions on installation, operation or maintenance that are important, but are not normally related to injury or property damage hazards.

General information

Burner applications

Follow all instructions in this manual, the primary control data sheet and the appliance manual. Verify the burner is correct for the appliance being used and for all applicable codes/standards.

Damage or shortage claims

The consignee of the shipment must file damage or shortage claims immediately against the transportation company.

When calling or writing about the burner . . .

Please provide us with the UL serial number and burner model number to assist us in locating information. This information can be helpful when troubleshooting or obtaining replacement parts.

WARNING

Should overheating occur:

- (1) shut off the oil supply to the burner.
- (2) do not shut off the control switch to the circulator or

WARNING

Follow the guidelines below to avoid potential severe personal injury, death or substantial property damage.

Installer/service technician . . .

- Read all instructions before proceeding. Perform all procedures, and in the order given to avoid potential of severe personal injury, death or substantial property damage.
- Before leaving the site after startup or service, review the *User's information* page with the user. Make the user aware of all potential hazards and perform the training outlined below.

Train the user . . .

- To properly operate the burner/appliance per this manual and the appliance instructions see *User's information*.
- To keep this manual at or near the burner/appliance for ready access by the user and service technician.
- To contact the service technician or oil dealer if he encounters problems with the burner/appliance.
- To keep the appliance space free of flammable liquids or vapors and other combustible materials.
- Do not use laundry products, paints, varnishes or other chemicals in the room occupied by the burner/appliance.
- To contact the service technician at least annually for startup and burner/appliance service.

When servicing the burner . . .

- Disconnect electrical supply to burner before attempting to service to avoid electrical shock or possible injury from moving parts.
- Burner and appliance components can be extremely hot. Allow all parts to cool before attempting to handle or service to avoid potential of severe burns.

Codes and standards

Certification

99FRD, 100CRD, and 102CRD burners are U.L. listed for the U.S. and Canada, certified to comply with ANSI/UL 296, for use with #1 or #2 heating oil (per standard ASTM D396).

Burner labels list compliance, when required, with special local, state or provincial approvals.

NOTICE

Install this burner in accordance with all local codes and authorities having jurisdiction. Regulations of these authorities take precedence over the general instructions provided

in this manual.

United States installations

Burner/appliance installations in the United States must comply with the latest editions of NFPA 31 (Standard for the Installation of Oil-Burning Equipment), ANSI/NFPA 70 (National Electrical Code), and all applicable local codes.

Canadian installations

Burner/appliance installations in Canada must comply with the latest editions of CSA B139 (Installation Code for Oil Burning Equipment), CSA standard

1. 99, 100, & 102 Oil nozzle selections (when appliance data is not available)

Table 1 Apply the guidelines below to select a nozzle when appliance-specific nozzle data is not available from the manufacturer. See notes at end of table for application tips. 99FRD wrapped-shield air tubes are intended only for approved applications in wet-base combustion chambers.

99FRD Nozzle specifications — Standard air tubes						
Brand	Spray	Angle & pattern	Nozzle rating, GPH			
			0.50 to 0.75		0.85 to 3.00	
Delevan	Hollow	60°A	•	•	•	•
	Hollow	45°A			•	•
	Solid	60°B			•	•
Hago	Hollow	60°H	•	•		
	Hollow	45°H			•	•
	Semi-solid	45°SS			•	•
	Semi-solid	60°SS	•	•	•	•
	Solid	45°ES			•	•
	Solid	60°ES			•	•
Monarch	Hollow	60°NS	•	•		
	Seimi-solid	45°AR	•	•	•	•
	Semi-solid	60°AR	•	•	•	•
	Solid	45°R			•	•
	Solid	60°R			•	•
Steinen	Hollow	45°H			•	•
	Hollow	60°H	•	•	•	•

100CRD Nozzle specifications						
Brand	Spray	Angle & pattern	Nozzle rating, GPH			
			0.50 to 0.75		0.85 to 2.25	
Delevan	Hollow	60°A	•	•	•	•
	Hollow	45°A			•	•
	Solid	60°B			•	•
Hago	Hollow	60°H	•	•		
	Hollow	45°H			•	•
	Semi-solid	45°SS			•	•
	Semi-solid	60°SS	•	•	•	•
	Solid	45°ES			•	•
	Solid	60°ES			•	•
Monarch	Hollow	60°NS	•	•		
	Seimi-solid	45°AR	•	•	•	•
	Semi-solid	60°AR	•	•	•	•
	Solid	45°R			•	•
	Solid	60°R			•	•
Steinen	Hollow	45°H			•	•
	Hollow	60°H	•	•	•	•

99FRD Nozzle specifications — Wrapped-shield air tubes						
Brand	Spray	Angle & pattern	Nozzle rating, GPH			
			0.50 to 3.00			
Delavan	Hollow	60°A	•	•	•	•
	Hollow	70°A	•	•	•	•
Hago	Hollow	60°H	•	•	•	•
	Hollow	70°H	•	•	•	•
Monarch	Hollow	60°NS	•	•	•	•
	Hollow	70°NS	•	•	•	•
Steinen	Hollow	60°H	•	•	•	•
	Hollow	70°H	•	•	•	•
	Semi-solid	70°Q	•	•	•	•

102CRD Nozzle specifications						
Brand	Spray	Angle & pattern	Nozzle rating, GPH			
			2.00 to 3.50		3.00 to 4.50	
Delavan	Solid	60°B	•	•		
	Solid	70°B	•	•		
	Solid	80°B	•	•		
Hago	Semi-solid	45°SS	•	•		
	Semi-solid	60°SS	•	•		
Delevan	Solid	70°B			•	•
Hago	Holow	45°H			•	•
	Semi-solid	45°SS			•	•

1. In general, all the nozzles shown above will burn well. However, in short combustion chambers, solid nozzles are not recommended because the flame may impinge on the back wall.
2. If the nozzle selected for a retrofit application results in a smoky fire, you can sometimes determine the best nozzle to use by observing the flame. To do this, slowly cover the air band slots with your fingers while the burner is firing. The flame will begin to smoke in the area where there is more fuel than air. If the smoke begins on the outer edges, try a narrower or more solid nozzle spray pattern. If the flame begins to smoke at the tips, try a wider or more hollow nozzle spray pattern.
3. For a packaged appliance application on which the burner has been tested, use the nozzle given in the appliance manufacturer's instructions or supplement for the best results.

2. Prepare site • assemble burner • mount burner

Inspect/repair/replace vent system

WARNING

Do not install this burner unless you have verified the entire vent system and the appliance are in good condition and comply with all applicable codes. And ...

- The vent and chimney must be sized and constructed in accordance with all applicable codes.
- Do not install or use an existing manual damper in the breeching (vent connector) or chimney.
- Do not connect the appliance vent connector to a chimney or vent serving a fireplace, incinerator or solid-fuel-burning apparatus.
- In a cold climate, do not vent into a masonry chimney that has one or more sides exposed to the outside. Install a listed stainless steel liner to vent the flue products.
- A defective vent system could result in severe personal injury, death or substantial property damage.

Prepare vent/chimney

- Secure all metal vent joints with screws, following the vent manufacturer's instructions. Seal all joints in the vent system and chimney. Repair masonry chimney lining and repair all mortar joints as needed.
- Install a double-acting barometric draft regulator in the vent piping if specified in the appliance manual. (The damper must be located in the same space as the appliance.)
- Provide support for the vent piping. Do not rest the weight of any of the vent piping on the appliance flue outlet.

Combustion/ventilation air openings

Check appliance manual and applicable codes for required sizing/design/ placement of combustion/ventilation air openings. You can use the following general guidelines, taken from NFPA 31, provided they meet all local requirements.

Louvers/screens

- Air opening sizes are always given in free area. This means after deduction for louver obstruction. If you can't find the louver reduction for the grilles used, assume free area is 20% of total for wood louvers, or 60% of total for metal louvers.
- Screens can be no finer than ¼-inch mesh, and must be accessible for cleaning.

Residential installations

Unconfined spaces (at least 7,000 cubic feet per GPH)

- An unconfined space means a room with at least 7,000 cubic feet volume for each GPH input (or 50 cubic feet per MBH) of all appliances in the room. Example: For each 1 GPH oil input, the room must have 7,000 cubic feet (875 square feet with an 8-foot ceiling height.)
- Open basements and crawl spaces are usually large enough, and will generally allow enough air infiltration so special provisions will seldom be required.
- If the building is tightly constructed, you will have to provide outside air openings into the building. The total free area of the openings must be

at least 1 square inch per 5,000 Btuh (28 square inches per GPH) of all appliances in the space.

- See Table 2 for summary.

Confined spaces (less than 7,000 cubic feet per GPH)

- Air taken from inside building only —
 - Provide two openings — one near floor, the other near ceiling. Provide free area of 140 square inches per GPH input. If building is tightly constructed, provide air opening(s) into building providing 30 square inches per GPH as well.
- Air taken from outside —
 - Direct through outside wall or vertical ducts: Provide two openings — one near floor, the other near ceiling. Provide free area of 35 square inches per GPH input.
 - Through horizontal ducts: Provide two openings — one near floor, the other near ceiling. Provide free area of 70 square inches per GPH input.
- Ventilation air from inside/combustion air from outside
 - Size openings to interior to provide 140 square inches free area per GPH input. Size outside air duct to provide 28 square inches free area per GPH.
- See Table 2 for summary.

Table 2 Minimum combustion/ventilation air openings

Source of air	Minimum free area of opening(s)	Total grill area, typical (sq. in.) for firing rates of:					
		1 GPH		2 GPH		3 GPH	
		Wood	Metai	Wood	Metai	Wood	Metai
Residential installations, unconfined spaces (7,000 cu. ft. volume per GPH)							
From inside building, typical construction	No special openings required if natural infiltration is sufficient.						
From inside building, tight construction	1 or more grilles 30 Sq. in./ GPH	150	50	300	100	450	150
Residential installations, confined spaces							
From inside building through interior walls	2 openings, each 140 Sq. in./ GPH	700	234	1400	467	2100	700
From outside building direct through outside wall	2 openings, each 35 Sq. In./ GPH	175	59	350	117	525	175
From outside building through vertical ducts	2 openings, each 35 Sq. In./ GPH	175	59	350	117	525	175
From outside building through horizontal ducts	2 openings, each 70 Sq. In./ GPH	350	117	700	234	1050	350
Ventilation through interior walls, with an opening to outside	2 Int. openings, each 140 Sq. In./ GPH	700	234	1400	467	2100	700
	1 Exterior opening 28 Sq. In./ GPH	140	47	280	94	420	140
Commercial installations							
From outside building direct through adjacent outside wall	One opening through outside wall, providing free area of at least 28 Square inches per GPH input						
Other conditions	Size openings per local codes/jurisdictions						

2. Prepare site • assemble burner • mount burner *(continued)*

Combustion/ventilation air checklist

WARNING The burner may operate successfully under momentary downdraft conditions, but sustained downdraft is unsafe. This can occur with an inadequate or incorrectly installed chimney/vent. It can also occur in rooms/buildings equipped with exhaust fans or unsealed return air ducts. Always check operation of the burner under all conditions to verify vent system operates correctly. You may have to interlock the burner with exhaust fans to shut burner off when fan operates; or provide make-up air to the appliance room sufficient to prevent any negative pressure in the space. Failure to correct downdraft or negative room pressure operation could result in severe personal injury, death or substantial property damage.

- ❑ Verify that openings are unobstructed.
- ❑ Verify that appliance space and air source spaces are free of:
 - Gasoline or other flammable liquids or vapors.
 - Combustible materials.
 - Air contaminants and chemicals, such as laundry products, paint, thinner, varnish, etc.
- ❑ Confirm with the building owner that the area will be kept free of these materials at all times and that air openings will be kept unobstructed.

Verify clearances

Verify that the burner/appliance will maintain all clearances from combustible construction and clearances for service/maintenance as required in the appliance manual and applicable codes.

Verify that the vent system components maintain all necessary clearances to combustible construction, including the correct design of thimbles and insulation where penetrating combustible walls.

Verify combustion chamber

Chamber dimensions and construction

- If retrofitting the burner to an appliance, install the burner in accordance with the appliance instruction manual, when available. If no specific application data is available from the appliance manufacturer, read the guidelines in Figure 1, page 6, to check whether the burner is likely to work acceptably in the application.

- Illustrations A to F in Figure 1 show different chamber configurations with and without refractory linings. The chamber dimensions listed in Figure 1 depend on whether the chamber is lined or water-backed.
- Do not attempt to fire the burner in a chamber with dimensions smaller than shown in Figure 1, page 6, unless the application has been specifically tested and listed by the appliance manufacturer and/or Carlin.
- Chambers with dimensions larger than shown in Figure 1, page 6, should not have much effect on combustion/performance.

General guidelines

- Clean all appliance flues and heating surfaces thoroughly, removing all soot and scale.
- Seal all joints and gaps using furnace cement to prevent excess air infiltration.

CAUTION The 99FRD wrapped-shield air tube must be used only in wet-base combustion chamber applications.

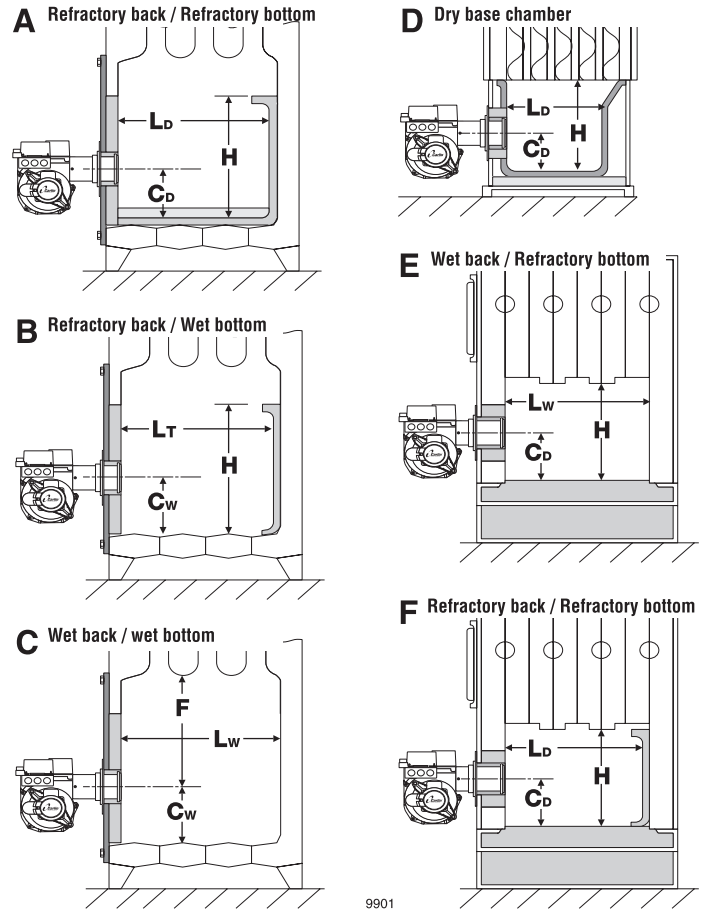
Using chamber linings and lightweight chambers

- When using refractory liners or lightweight chambers, use insulating-type refractory rated 2300°F minimum.
- You must install a target wall liner if flame length is close to the length of the chamber.
- Use a floor liner when possible. The floor liner will improve firing in most applications. Extend floor liner 3 to 4 inches up side wall.
- Target wall liners — Corbel the top of target wall liners 1½ to 2½ inches deep and extend at least 3 to 4 inches above the center of the flame.
- Use pre-formed chamber liners when available.
- For firing rates below 0.75 GPH, it is best to apply in a refractory-lined or stainless tube (designed for application) chamber. Lining the floor and target wall of the chamber with lightweight insulating refractory will accomplish the same.
- When conversion firing coal-fired units, install a combustion chamber in the ashpit area, or fill ashpit with sand up to 2 inches above the “mud ring” of a boiler (firing through the door). Install a lightweight refractory liner on the target wall as in Figure 1F, page 6. Make sure the minimum dimensions comply with those for Figure 1F.

2. Prepare site • assemble burner • mount burner (continued)

Figure 1 99FRD, 100CRD and 102CRD Minimum combustion chamber dimensions (all dimensions in inches)

Firing rate GPH	LD	LT	LW	W	DV	CD	CW	H	F
	Lined	Target liner	Unlined	Note 3	Note 5	Lined	Unlined		
99FRD									
0.50	7	Line floor and target wall or use refractory chamber		6	7	3		8	
0.65	7.5			7	7.5	3.5	NR	9	NR
0.75	8			7	8	3.5		9	
0.85	9	10-11	12	7	8.5	3.5	4	9	5
1.00	10	11-12	13	8	9	4	4.5	10	6
1.10	11	12-13	14	8	9.5	4	4.5	10	6
1.25	12	13-14	15	8	10	4	4.5	10	6
1.35	13	14-15	16	8	11	4	4.5	10	6
1.50	14	15-17	18	9	12	4.5	5	11	7
1.65	15	16-18	19	9	13	4.5	5	11	7
1.75	16	17-19	20	9	14	4.5	5	11	7
2.00	17	18-21	22	9	15	4.5	5	11	7
2.25	18	19-22	23	10	16	5	5.5	12	7.5
2.50	19	20-23	24	10	17	5	5.5	12	7.5
2.75	20	21-24	25	10	18	5	6	12	8
3.00	22	23-26	27	11	20	5.5	6	12	8
100CRD									
0.50	7	Line floor and target wall or use refractory chamber		6	7	3		8	
0.65	7.5			7	7.5	3.5	NR	9	NR
0.75	8			7	8	3.5		9	
0.85	9	10-11	12	7	8.5	3.5	4	9	5
1.00	10	11-12	13	8	9	4	4.5	10	6
1.10	11	12-13	14	8	9.5	4	4.5	10	6
1.25	12	13-14	15	8	10	4	4.5	10	6
1.35	13	14-15	16	8	11	4	4.5	10	6
1.50	14	15-17	18	9	12	4.5	5	11	7
1.65	15	16-18	19	9	13	4.5	5	11	7
1.75	16	17-19	20	9	14	4.5	5	11	7
2.00	17	18-21	22	9	15	4.5	5	11	7
2.25	18	19-22	23	10	16	5	5.5	12	7.5
2.50	19	20-23	24	10	17	5	5.5	12	7.5
2.75	20	21-24	25	10	18	5	6	12	8
3.00	22	23-26	27	11	20	5.5	6	12	8
102CRD with 2½" air cone									
2.00	14	14	17	15	13	6.5	6.5	15	8
2.25	15	15	18.5	15	13.5	6.5	6.5	15	8
2.50	16	16	19.5	15.5	14.0	6.5	6.5	15.5	8
2.75	17.5	17.5	21	15.5	15.5	6.5	6.5	15.5	8
3.00	18.5	18.5	22.5	15.5	16.5	7	7	15.5	8.5
3.25	20	20	24	16	17.5	7	7	16	8.5
3.50	21	21	25	16	18.5	7	7	16	8.5
102CRD with 3" air cone									
3.00	25	25	29	12	23	5	5	12	6.5
3.25	26	26	30	13	24	5.5	5.5	13	7
3.50	27	27	31	13.5	24	6	6	13.5	7.5
3.75	28	28	32.5	14	25	6	6	14	7.5
4.00	29	29	34	14.5	26	7	7	14.5	8.5
4.25	30	30	35	15.5	27	7	7	15.5	8.5
4.50	31	31	36	17	28	7.5	7.5	17	9



Chamber configurations

- A Chamber with water-backed floor and target wall, with refractory linings on floor and target wall.
- B Chamber with water-backed floor and target wall, with refractory lining on target wall only.
- C Chamber with water-backed floor and target wall, without refractory linings.
- D Refractory chamber, no water-backed surfaces (dry base design).
- E Chamber with refractory floor and water-backed target wall (*without* target refractory lining).
- F Chamber with refractory floor and water-backed target wall (*with* target refractory lining).

Notes for dimension table

- 1 Some tested appliances operate well with dimensions other than shown below.
2. Generally, applications should be acceptable with dimensions larger than listed.
3. Horizontal cylinder chambers should have a diameter at least as large as the minimum width listed. For steel cylinder chambers, increase this dimension by from 1 to 4 inches.
4. Wing walls are not recommended. Corbels can be beneficial to heat distribution in some applications.
5. DV is the minimum diameter for vertical cylindrical chambers (refractory or refractory-lined chambers only).

2. Prepare site • assemble burner • mount burner *(continued)*

Inspect burner and components

- Check the air tube length. Verify the usable length of the tube UTL will be long enough (see "Mount burner in appliance").
- Visually inspect all burner components and wiring.
- Verify that wiring is intact and leads are securely connected.
- Verify that all burner components are in good condition.

WARNING

Do not install or operate the burner if any component is damaged or if burner does not comply with the specifications of Table 1, page 3, and other guidelines of this manual and the appliance manual.

Welded-flange burners

1. Verify the bolt pattern on the appliance chamber matches the flange pattern.
2. Verify the insertion depth (UTL) matches the depth of the appliance opening (so the end of the air tube is flush with, or slightly short of, the inside surface of the combustion chamber).

Assemble burner (when required)

Universal (adjustable) flange burners

1. Verify the flange mounting slots line up with the appliance bolts. See Figure 2.
2. Slip the adjustable flange onto the air tube.
3. Measure the distance from the inside of the combustion chamber to the outside of the appliance mounting plate.
4. Position the universal flange at this distance from the end of the air tube.
5. Tighten the locking screws finger tight.
6. Insert the air tube/flange assembly into the appliance opening and level the air tube with a spirit level. Adjust flange if needed.
7. The end of the air tube should be flush, or almost flush, with the inside of the combustion chamber wall.
8. Verify the air tube is level and inserted the correct depth. Adjust if necessary. Then tighten the flange locking screws securely.
9. Remove the flange/air tube assembly from the opening.

Pedestal mount burners

1. Check the diameter of the appliance opening. If larger than 4½ inches, rebuild the opening so the open is reduced to 4½ inches maximum.
2. Insert the air tube into the appliance opening as in Figure 3. Do not attach air tube to housing yet.
3. Slide the tube in until the end of the tube is flush with, or up to ¼ inch short of, the inside of the combustion chamber.

Figure 2 Universal flange mounting dimensions

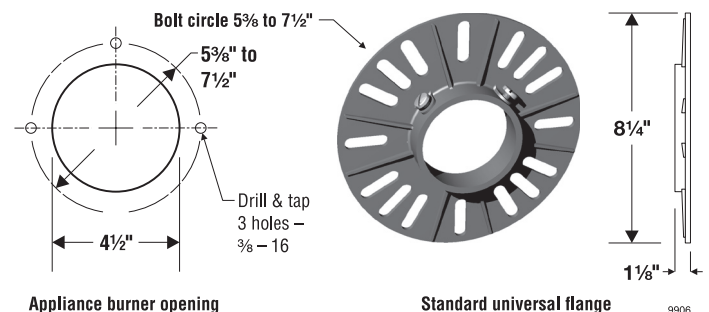
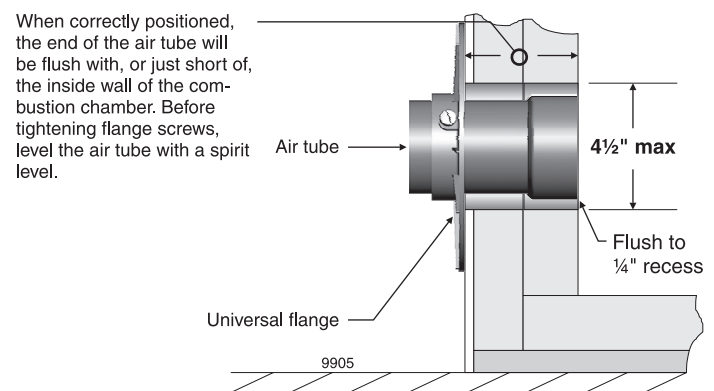


Figure 3 Mark insertion depth on air tube when using universal flange mounting



4. Level the air tube using a spirit level.
5. Mark the air tube position with a pen or pencil around the circumference of the tube.
6. Remove air tube from the opening.

NOTICE — 99FRD burners firing above 2.25 GPH

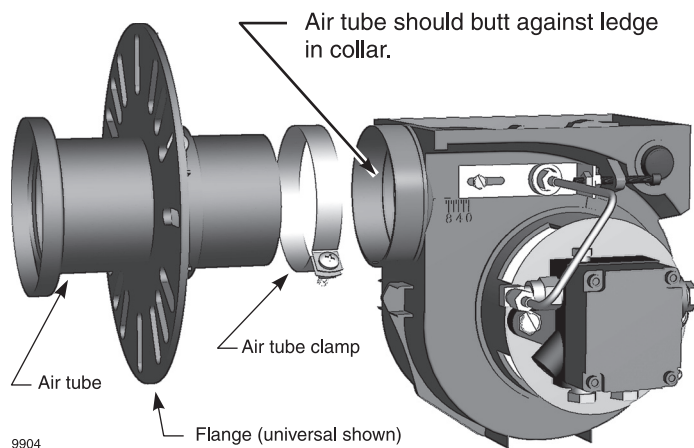
1. 99FRD burners are shipped with the blank air shutter (behind fuel unit) installed. This shutter is suitable only for firing rates up to 2.25 GPH.
2. For firing rates over 2.25 GPH, obtain an open type air shutter from your Carlin dealer. Remove the blank shutter and replace with the open shutter.
3. The optional open air shutter is suitable for firing rates from 1.50 to 3.00 GPH.
4. To change air shutters, remove the burner fuel unit. (The fuel unit holds the shutter in place.) Install the correct shutter and replace the fuel unit.

2. Prepare site • assemble burner • mount burner (continued)

Attach air tube to housing

1. See Figure 4. Loosen air tube holding clamp on the front of the burner chassis.
2. Open ignitor cover plate by loosening the hold-down tabs and swinging them away.
3. Spread the housing slightly using a flat screwdriver between the two halves of the housing on top at the air tube collar.
4. Insert the air tube into the housing, make sure the tube is inserted completely, butting against the air tube collar ledge. If necessary, tap on the end of the air tube with a block of wood until properly seated.
5. When using 99FRD wrapped-shield air tube or 102 CRD "B" style air tube, locate the drip hole in the air cone. Rotate the air tube so the drip hole is at the bottom before pressing into place.
6. Slide air tube holding clamp onto collar and tighten.

Figure 4 Attaching air tube to burner chassis

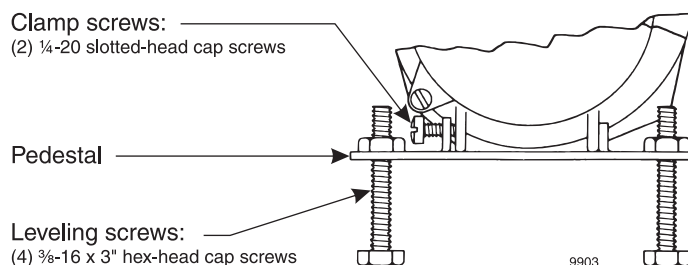


2. Insert burner into appliance.
3. Verify burner is seated level and straight. Adjust flange slightly if necessary.
4. Secure flange to appliance with hardware supplied with appliance.

Pedestal-mounted burner

1. Assemble pedestal to the bottom of the burner by tightening the two 1/4-20 slotted cap screws against the front feet of the housing. See Figure 5. Install the four adjusting legs (3/8-16 x 3" hex-head cap screws).
2. Adjust the pedestal legs so the air tube is level and the center of the tube is at the same height as the center of the appliance opening.
3. Tighten the pedestal leg jam nuts to lock legs in place.
4. Insert the burner/air tube into the appliance opening until pen/pencil line is even with appliance front (so end of air tube is flush with, or slightly short of, the inside of the chamber).
5. Seal the space around the air tube with furnace cement or equivalent (Figure 6).

Figure 5 Attaching burner to pedestal (when used)



Mount burner in appliance

Welded flange-mounted burner

1. Place gasket over burner air tube and insert burner into appliance opening. Secure in place with hardware supplied with appliance.

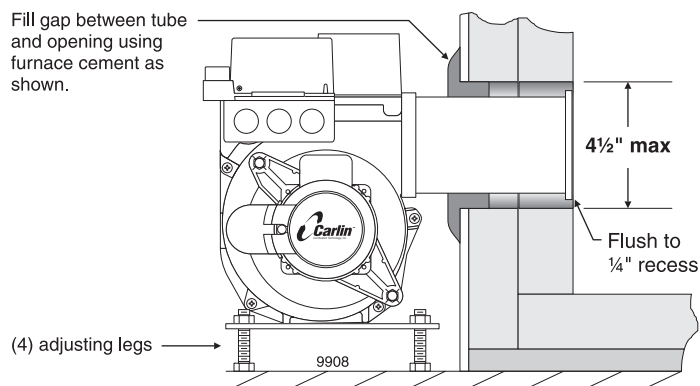
WARNING

Universal flange or pedestal mount — these insertion methods are intended only for negative overfire pressure. For pressurized firing, you must obtain a burner with a welded flange, designed for use with the specific appliance. Failure to comply could result in severe personal injury, death or substantial property damage.

Universal flange-mounted burner

1. Place gasket over burner air tube.

Figure 6 Seal opening around burner air tube when pedestal mounting (burner shown with tube attached to housing and installed)



3. Prepare burner

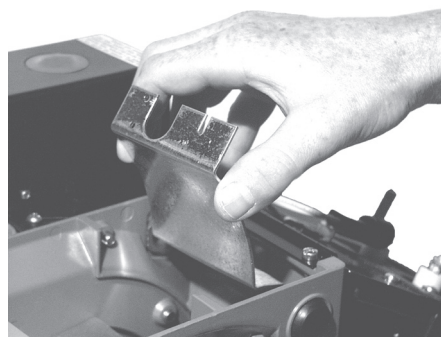
Removing/installing head assembly

WARNING Use care when handling burner components after the burner has been firing. Components can be hot and could cause severe personal injury.

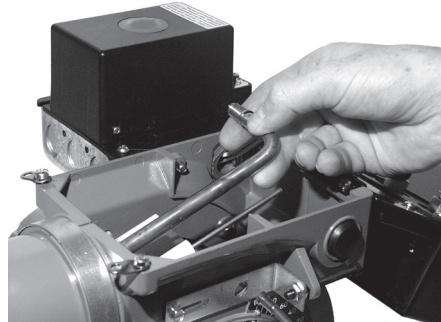
You will need to remove the combustion head assembly for inspection of the assembly, replacement of the oil nozzle or adjustment of electrodes. To remove the assembly:

1. Loosen, and then rotate the two screw clamps securing the ignitor in place. Swing the ignitor plate open.
2. See Figure 7. Remove the blower shield by loosening the retaining screw on its front edge if needed for easier removal or insertion of the combustion head assembly.
3. Unscrew the oil line fitting and thumb nut at the burner housing.
4. Pull the threaded end of the oil tube into the blower housing.
5. See Figure 7. Rotate the combustion head assembly 180° so the electrodes are upside down. This places the electrode insulators out of the way for easy removal.
6. Remove the combustion head assembly by pulling the assembly up and out of the housing.
7. Handle the assembly with care to avoid bending/moving the electrodes, or damaging the electrode ceramic insulators.
8. Inspect the gasket on the bottom of the ignitor plate. The gasket prevents air from escaping from the housing. Replace the gasket if not in good condition.
9. Inspect the ignitor contact clips. Clean or replace if necessary to ensure reliable contact with the electrodes.

Figure 7 Removing/inserting combustion head assembly



Remove blower access cover if necessary for easier insertion or removal of combustion head assembly.



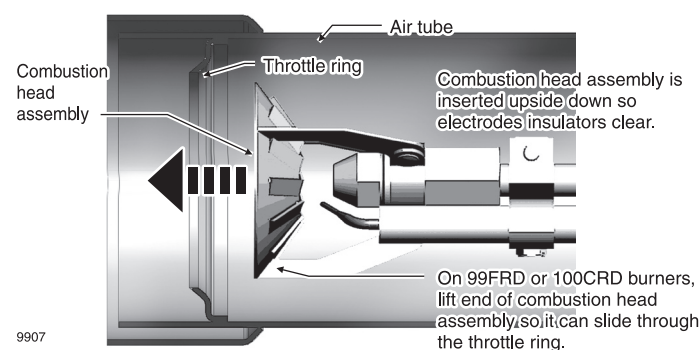
Rotate oil tube 180° to simplify removal of combustion head assembly.

To replace the combustion head assembly, reverse the sequence.

- Remember to put the assembly in upside down, so the electrode insulators are out of the way. Remove, then replace, the blower shield if necessary for easier removal/insertion of the assembly.
- See Figure 8. For 99FRD or 100CRD burners, you will have to lift the end of the assembly to guide it through the throttle at the end of the air tube. DO NOT FORCE.

CAUTION Use care when tightening the oil line fitting to oil tube extension. Tighten securely, but do not cross-thread or over-tighten.

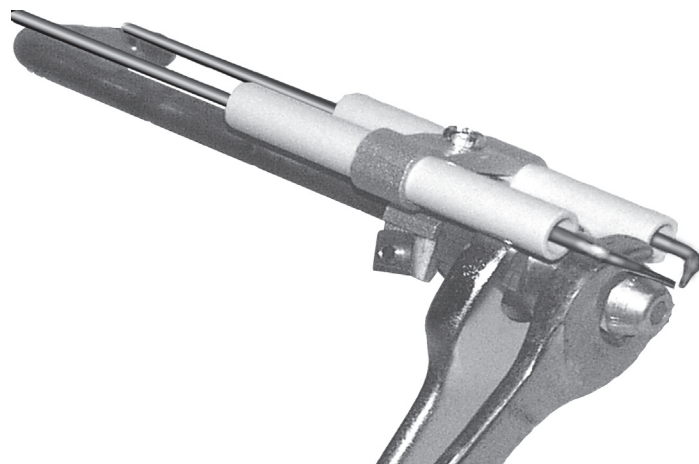
Figure 8 Inserting combustion head assembly



Install nozzle/check electrodes

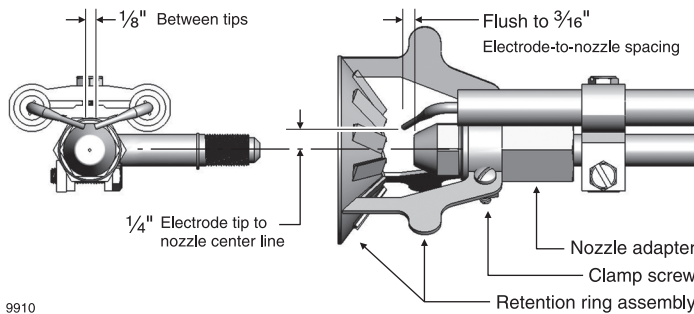
1. Loosen the clamp screw on the retention ring assembly (see Figure 10, page 10). Slide the retention ring assembly off of the nozzle adapter. Then loosen electrodes to rotate out of the way.
2. Install and tighten the nozzle shown in Table 1, page 3, for retrofit applications. Install the nozzle given in the appliance manual when application information for the 99FRD, 100CRD, and 102CRD oil burner is given.
3. Hold the nozzle adapter securely when removing or replacing the nozzle (Figure 9). Take care not to damage the electrode insulators or to bend the electrodes in the process.

Figure 9 Carefully support the nozzle adapter when installing or removing nozzle



3. Prepare burner (continued)

Figure 10 Combustion head/nozzle/electrode settings



9910

WARNING Inspect the nozzle adapter before replacing the nozzle. If the threads have been damaged or show score marks, replace the nozzle line/adapter assembly.

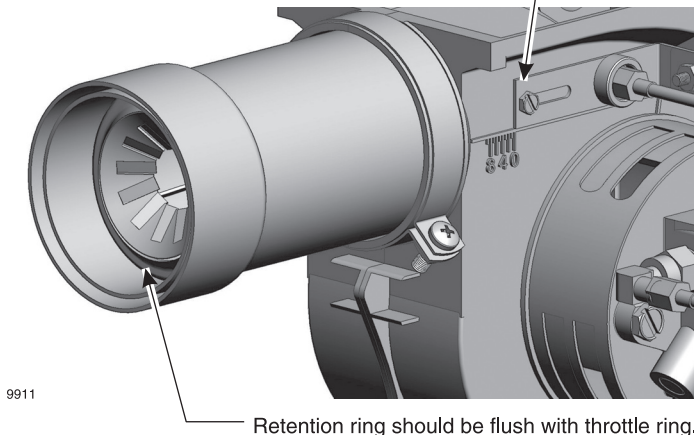
4. Replace the retention ring assembly by slipping one of the riveted arms through the gap between the electrode tips. Align this arm straight up, with the ring clamp firmly against the nozzle adapter shoulder (see Figure 10). Then tighten the clamping screw.
5. Reposition and check the electrode settings. Position the electrodes as shown in Figure 10. These settings are critical in ensuring a reliable ignition. Once the electrodes are set, check all clamps to be sure they are securely tightened.
6. Insert the combustion head/nozzle assembly in the burner.

Check zero position (99FRD & 100CRD only)

1. See Figures 11, 12 and 13. Loosen the oil line thumb nut and adjusting slide locking screw. Use a $\frac{5}{32}$ " Allen wrench to rotate the adjusting screw until the lead edge of the slide aligns to "0" on the scale. The retention ring should be flush, or nearly flush, with the edge of the throttling ring.
2. If the retention ring is not close to flush with the throttle ring, make sure the air tube is completely inserted into the housing collar and the

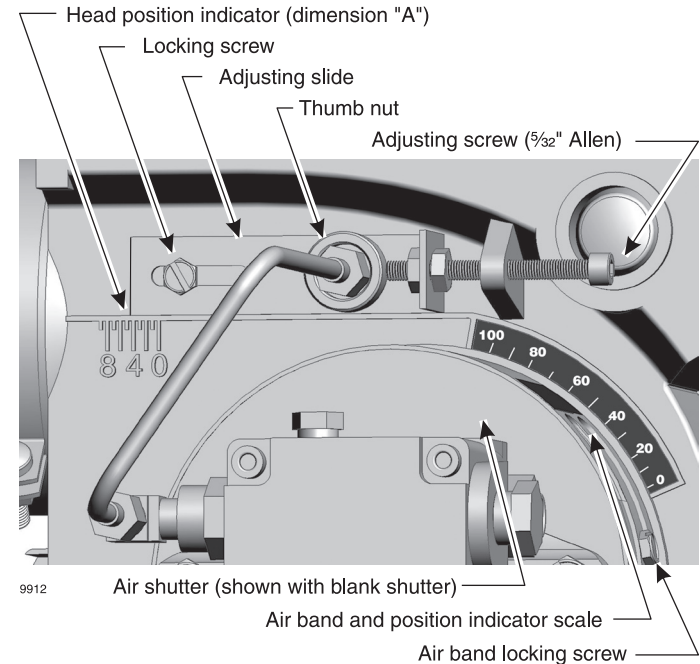
Figure 11 Check zero position — 99FRD & 100CRD only

Set adjusting slide to "0" position.



9911

Figure 12 Combustion head and air band adjustments



9912

Set initial burner air settings

Combustion head

1. The combustion head adjusting slide controls the spacing between the retention ring and throttle ring (or air cone), regulating how much air passes around the retention ring.
2. Loosen the oil line thumb nut and adjusting slide locking screw. Use a $\frac{5}{32}$ " Allen wrench to rotate the adjusting screw until the lead edge of the slide aligns to the number given in Table 3, page 11. Lock in place by first tightening the oil line thumbnut, then tightening the locking screw.

Air shutter

1. The air shutter is fixed for all 99FRD, 100CRD and 102CRD burners. See page 7 for the correct air shutter type. (Some 102CRD burners may be equipped with 3-slot air shutters.)

Air band

1. The air band is marked in percent opening. Loosen the air band locking screw and move the air band until the pointer lines up with the percent opening given in Table 3, page 11.

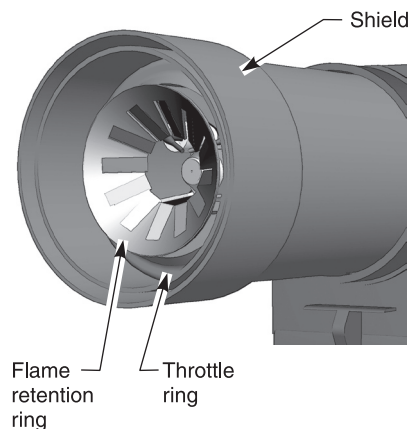
Final adjustments

1. The burner is now adjusted to the approximate air settings for the firing rate chosen. When you check combustion with instruments during start-up or servicing, you may have to adjust the head slightly to achieve the desired efficiency. See "Adjust burner using test instruments," page 22. (Note that pressure overfire will reduce air flow, requiring more air opening.)

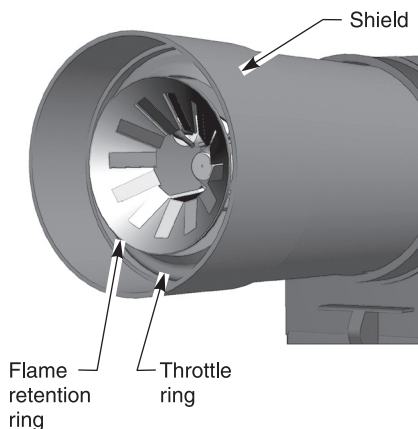
3. Prepare burner *(continued)*

Figure 13 Combustion head/air tube combinations, typical

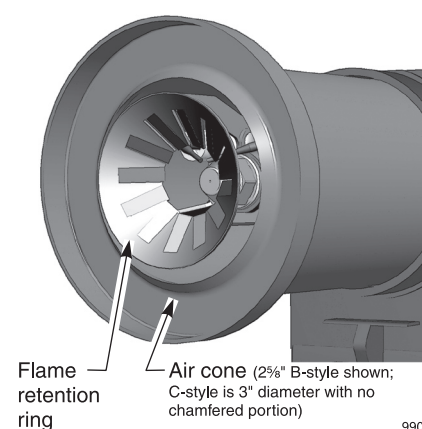
99FRD/100CRD Standard air tube



99FRD Wrapped-shield air tube



102CRD air tube



9902

Table 3 Approximate air band and combustion head settings

Firing rate	99FRD (standard air tube)				99FRD (wrapped-shield air tube)				100CRD (standard air tube)				Firing rate			
	Blank air shutter		Open air shutter		Blank air shutter		Open air shutter		Blank air shutter		Open air shutter					
GPH @ 100 PSI	Air band	Head	Air band	Head	Air band	Head	Air band	Head	Air band	Head	Air band	Head	GPH @ 100 PSI			
	% open	Dim. "A"	% open	Dim. "A"	% open	Dim. "A"	% open	Dim. "A"	% open	Dim. "A"	% open	Dim. "A"				
0.50	15-20	0	---		15	0	---		20	0	---		0.50			
0.60	15-20	0			15-20	0			35	0			0.60			
0.65	15-20	0			20	0			40	0-1			0.65			
0.75	20	0-1			25	1			45	0-1			0.75			
0.85	20-25	0-1			30	1-2			50	1-2			0.85			
1.00	30	1-2			40	2			100	1-2			1.00			
1.10	35	1-2			40	2-3			100	1-2			1.10			
1.20	45	1-2			45	3			100	2-3			1.20			
1.25	50	1-2			50	3			100	2-3			1.25			
1.35	55	2			55	3-4			100	3-4			100	2-3	1.35	
1.50	70	2	15	2	60	4	0	4	100	4-5	100	3-4	1.50			
1.65	75	2-3	20	2-3	65	5	5	4-5	100	6-7	100	4-5	1.65			
1.75	80	3	25	3	70	5	10	5	100	7-8	100	4-5	1.75			
2.00	100	4-5	70	4	100	6	45	6	---		100	6-7	2.00			
2.25	100	6	100	5	100	8	65	7			100	8-9	2.25			
2.50	---		100	6-7	---		100	9			---		---		2.50	
2.75			100	8			---	100							11	---	---	2.75
3.00			100	10			---			---					---	3.00

GPH @ 100 PSI	102CRD (2% air cone — "B"-style air tube)			102CRD (3" air cone — "C"-style air tube)			GPH @ 100 PSI
	Head	Air band	Air shutter	Head	Air band	Air shutter	
	Dimension "A"	% open	Type	Dimension "A"	% open	Type	
2.00	2	25	Open (4-slot)	-----			2.00
2.25	4	100	Open (4-slot)				2.25
2.50	5	100	Open (4-slot)				2.50
2.75	7	100	Open (4-slot)				2.75
3.00	9	100	Open (4-slot)	0	100	Open (4-slot)	3.00
3.25	10	100	Open (4-slot)	1	100	Open (4-slot)	3.25
3.50	11	100	Open (4-slot)	2	100	Open (4-slot)	3.50
3.75	-----			4	100	Open (4-slot)	3.75
4.00				6	100	Open (4-slot)	4.00
4.25				9	100	Open (4-slot)	4.25
4.50				11	100	Open (4-slot)	4.50

3. Prepare burner *(continued)*

Inspect/install fuel supply

CAUTION

Inspect the oil supply system. Ensure that the fuel lines are correctly sized and installed and that the fuel flow is unobstructed, the oil tank is clean and only # 1 or # 2 heating oil are supplied. Failure to supply a reliable oil flow could result in loss of heat and potential severe equipment damage.

General guidelines:

- When installing oil lines, use continuous runs of heavy-wall copper tubing if possible.
- Check fuel unit (oil pump) data sheet for recommended line sizing, lift limitations and maximum length.
- Check all connections and joints to ensure they are air-tight.
- Use flare fittings. Do NOT use compression fittings.
- Never use pipe sealing tape. Fragments can break off and plug fuel line components.
- Install a shut-off valve at the tank and one near the burner. (Use fusible handle design valves when possible or when required by codes.)
- Install a large capacity fuel filter (rated for 50 microns or less) near the burner.

Fuel unit bypass plug

WARNING

The fuel unit is shipped with its bypass plug not installed, intended for a one-line oil system. Install the bypass plug only if connecting to a two-line oil system. Operating with the plug in place on a one-line system will damage the fuel unit and could lead to oil leakage and fire hazard.

WARNING

If the fuel line or fuel supply is above burner, never exceed 3 PSIG pressure at the fuel unit inlet. Install a suitable OSV to reduce the pressure. Operating the fuel unit with higher inlet pressure could result in fuel unit seal damage, oil leakage and potential fire hazard.

Nozzle line heater

- Oil burners often operate in spaces where temperatures tend to be cool, typically 60°F or lower. Cool oil has higher viscosity, which can affect atomization, ignition, combustion and fuel consumption. The nozzle line heater avoids this problem by heating the nozzle line oil to between 120°F and 130°F, resulting in smoother ignition and improved combustion.

- The nozzle line heater needs power when the burner is in standby (no call for heat from the appliance). Make sure the nozzle line heater is powered directly from the 120 VAC HOT line, not through the appliance operating control circuit. The nozzle line heater wiring should be shown on the wiring diagram supplied with the appliance/burner unit.
- The nozzle line heater is supplied with an electrical disconnect harness, allowing removal of the combustion head assembly without disconnecting wires. Position the heater harness disconnect in the rear of the blower housing, above the blower access cover. The wire leads to the disconnect route through the side of the housing into the junction box.

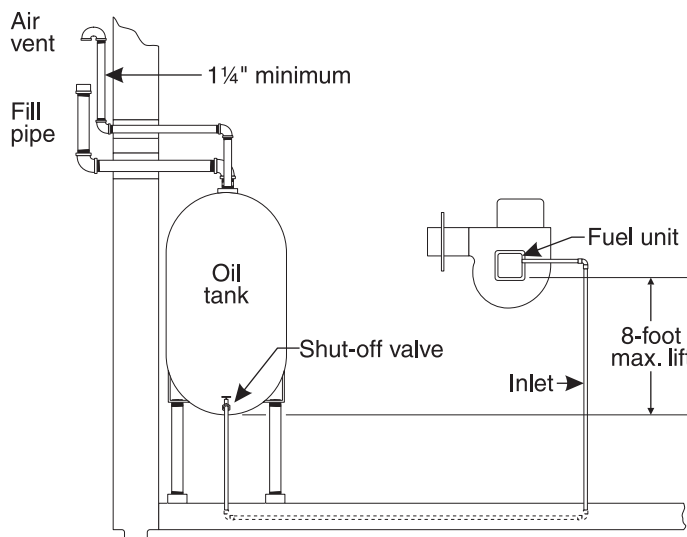
NOTICE

When first starting the burner, or after the service switch has been off for some time, the heater requires about 15 minutes to bring the oil to operating temperature.

One-line fuel system requirements

See Figure 14. The standard burner fuel unit is a single-stage, 3450-RPM oil pump. Apply this fuel unit only on one-line systems where the fuel supply is on the same level with, or higher than, the burner. This ensures oil flow by gravity. Also make sure the total lift does not exceed 8 feet (height difference from bottom of oil tank to fuel unit). For other conditions, you must provide a two-line fuel system. You may also have to change the fuel unit to a two-stage type.

Figure 14 One-line fuel system



3. Prepare burner *(continued)*

Two-line fuel system requirements

See Figure 15 and Table 4. Use Table 4 only for burners equipped with Suntec fuel units. For burners using other fuel units, read the fuel unit manufacturer's data sheet to determine maximum lengths and lifts.

The standard burner fuel unit is a single-stage, 3450-RPM oil pump. Use this fuel unit only on two-line oil systems that do not exceed the total tubing lengths allowed in Table 4 (for Suntec fuel units only). For longer systems (or where lift exceeds 10 feet), replace the one-stage fuel unit with a two-stage unit.

Always size fuel lines using an oil flow rate based on the fuel unit gearset capacity, not the burner firing rate. See fuel unit data sheet for information.

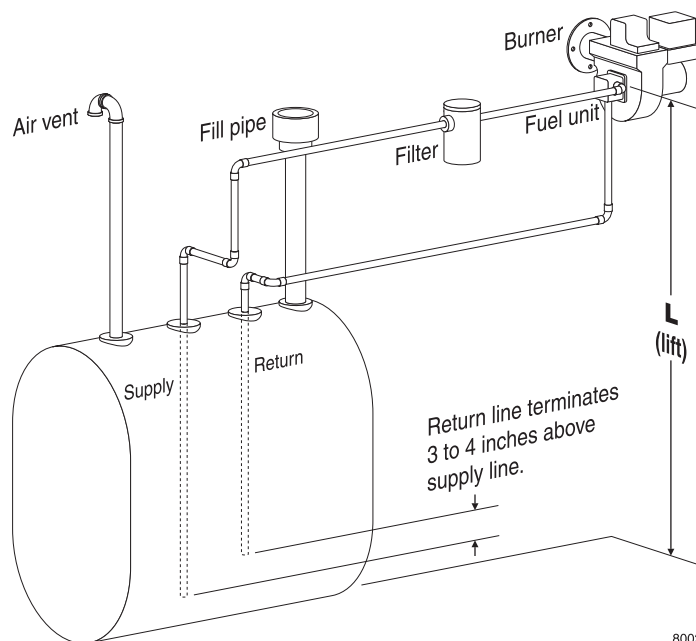
NOTICE

Install the fuel unit bypass plug when connecting to a two-line system. The plug is shipped in a bag attached to the fuel unit, along with a fuel unit data sheet.

Table 4 Two-line fuel system maximum lengths for 3/8" and 1/2" OD copper tubing distribution. Use only for burners equipped with Suntec fuel units. See fuel unit data sheet for any other fuel unit.

Lift (feet)	Max. total length of tubing, feet (including both horizontal and vertical)			
	Single-stage fuel unit		Two-stage fuel unit	
	3/8" tubing	1/2" tubing	3/8" tubing	1/2" tubing
0	84	100	93	100
2	73	100	85	100
4	63	100	77	100
6	52	100	69	100
8	42	100	60	100
10	31	100	52	100
12	NOT recommended — use two-stage fuel unit		44	100
14			36	100
16			27	100
18			-	76

Figure 15 Two-line fuel system



8002

Perform checkout procedures

Verify before starting burner:

WARNING

Should overheating or an emergency occur, immediately:

- Shut off oil supply line valve.
- Under some circumstances power should remain on for water pumps or blowers. Determine proper response before attempting start-up.
- If burner fails ignition on several attempts, use burner blower to purge appliance chamber before restart.

Checklist

- ☐ Burner/appliance installed per appliance instruction manual?
- ☐ Burner nozzle and head positioning bar verified against Table 1, page 3, or appliance manufacturer's instructions?
- ☐ Burner/appliance installed per all applicable codes?
- ☐ Installation site has adequate combustion/ventilation air openings and vent system?
- ☐ Fuel supply line in good condition and sized/designed correctly?
- ☐ Oil tank has oil and oil line valves are open.
- ☐ Wiring installed per burner/appliance instructions?
- ☐ Burner, appliance and all components inspected and in good condition?

4. Wire burner • start burner — 48245 primary control

Wire burner — 48245 primary control

1. All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
2. Wire the burner following Figure 16 and any special instructions or wiring diagram provided with the appliance, burner or other components.
3. The burner requires a 120 VAC/60 hz/single-phase power supply, with at least a 5-amp fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 amps.
4. The 48245 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 48245 thermostat terminals. Then connect a voltmeter across wires. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
5. Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

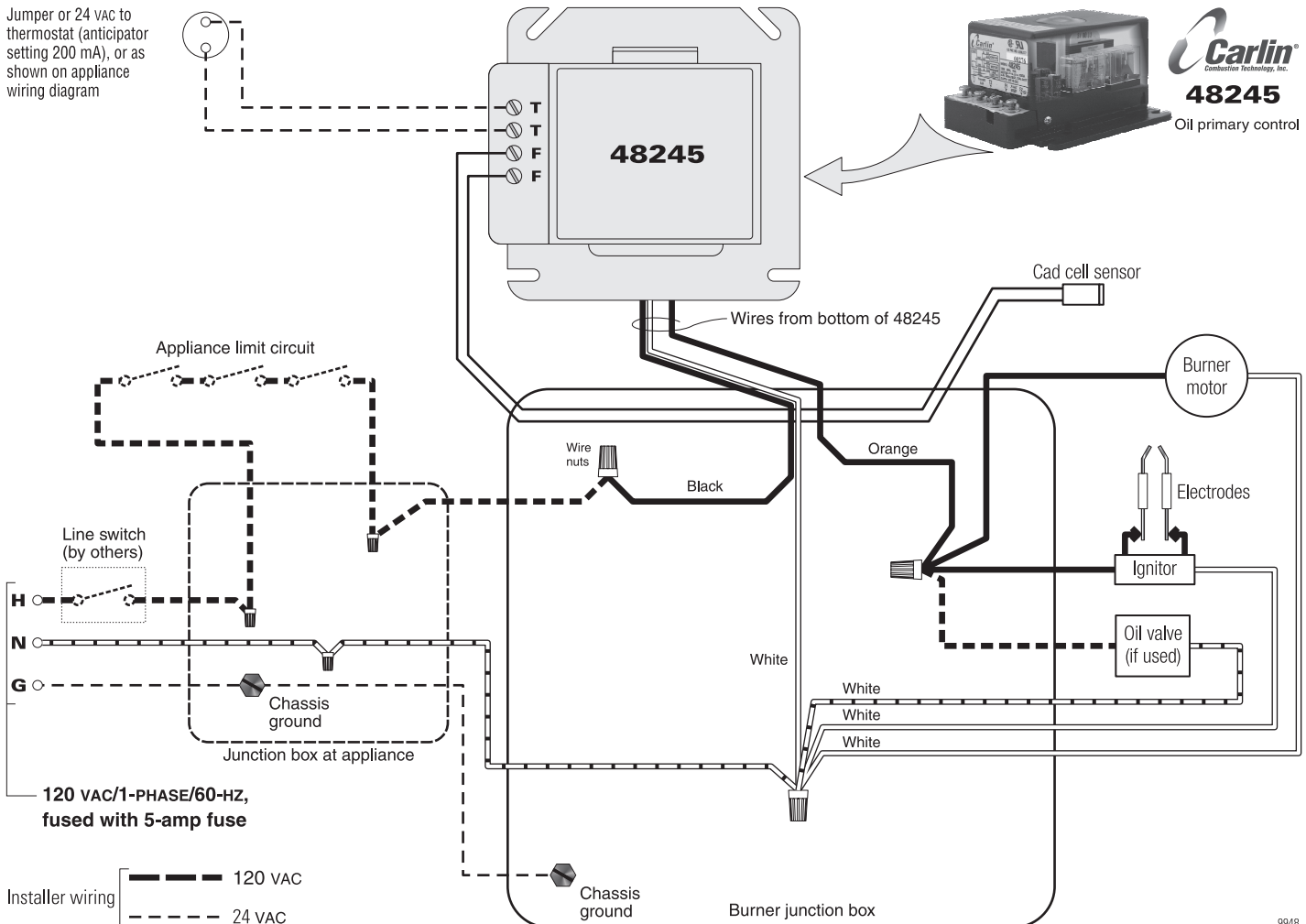
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

1. Turn service switch OFF.
2. Perform inspections and checkouts on pages 14 and 15.
3. Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
4. Set thermostat (operating controls) to call for heat.
5. Turn service switch ON.
6. Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
7. Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
8. Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
9. Should control/burner fail to operate correctly, see page 15 for suggestions in troubleshooting.

Figure 16 Burners up to 3.0 GPH only, wiring using Carlin 48245 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)



Start-up & operation

WARNING	Do not start the burner if the combustion chamber contains oil or oil vapor.
NOTICE	Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.
Power ON	Open all manual oil line valves. Close the line switch.
Reset	Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.
Stand-by	(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit). The circuit across terminals T-T will also have to close for burner to start.
Call for heat	Set thermostat (or aquastat) to call for heat. The limit circuit must provide power to the black wire and the circuit between terminals T-T must be closed.
Burner on	The ignitor and motor start. (The ignitor remains on throughout the call for heat cycle.)
TFI	The cad cell must sense flame within the control's trial for ignition (TFI) timing — 45 seconds.
Run	The burner continues firing during call for heat if the cad cell senses flame.
Lockout	If cad cell does not sense flame within the TFI timing (45 seconds), lockout occurs. The red LED indicator turns on.
WARNING	Red LED fully on indicates lockout (approximately 20 seconds after motor and ignitor turn off). If power is interrupted to the control before the Red LED turns fully on, the control will reset without the reset button being pushed.
To Reset	To reset after lockout, push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.
Flame failure	If the cad cell loses flame signal during operation (after the TFI), control will lockout if flame is not established within 45 seconds.
Burner off	Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.
Stand-by	Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).
Power loss	If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 vac).
- Check all electrical connections.

Control is in lockout (red LED on)

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control. If control does not start when receiving power on the black wire and T-T circuit is closed, check for:
 - light is leaking into the burner housing, *OR*
 - CAD cell is defective, *OR*
 - there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber. To troubleshoot:
 - **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
 - **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.

Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 40200 or 42230 primary control

Wire burner — 40200 primary control 42230 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 17 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 hz/single-phase power supply, with at least a 5-amp fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 amps.
- The 40200 or 42230 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 40200 or 42230 thermostat terminals. Then connect a voltmeter across wires. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

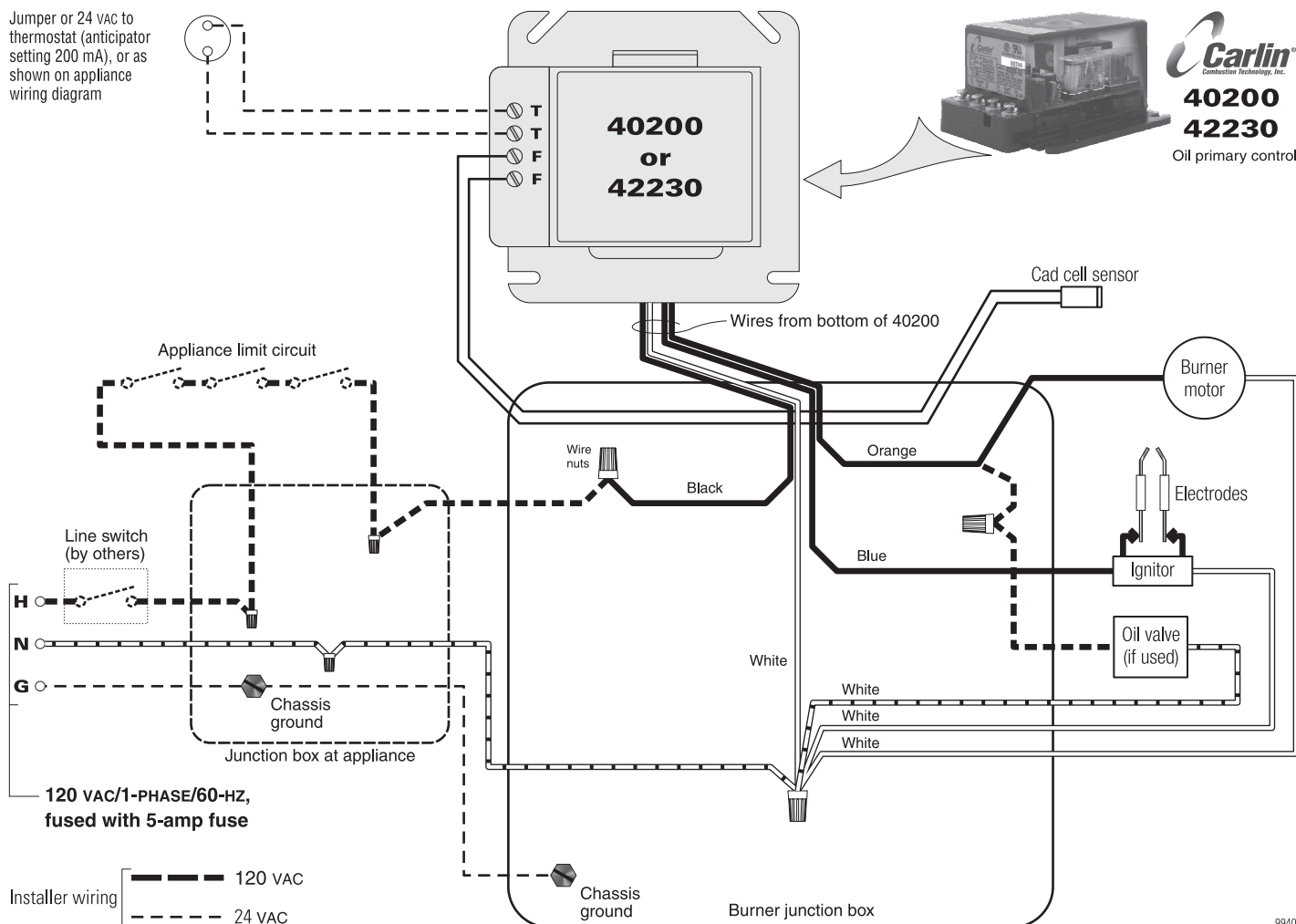
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 16 and 17.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 17 for suggestions in troubleshooting.

Figure 17 99FRD, 100CRD, and 102CRD burners wiring using Carlin 40200 or 42230 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)



Start-up & operation

WARNING	Do not start the burner if the combustion chamber contains oil or oil vapor.
NOTICE	Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.
Power ON	Open all manual oil line valves. Close the line switch.
Reset	Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.
Stand-by	(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit).
Call for heat	Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
Burner on	The <i>ignitor</i> and <i>motor</i> start.
TFI	The cad cell must sense flame within the control's trial for ignition (TFI) timing — 15 seconds for 40200 control or 30 seconds for 42230 control. After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
Run	The burner continues firing during call for heat if the cad cell is sensing flame.
Lockout	If cad cell does not sense flame within the TFI timing (15 or 30 seconds), lockout occurs.
To Reset	Push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.
Flame failure	If the cad cell loses flame signal during operation (after the TFI), the burner shuts off within 1.3 seconds. Recycle : After 60 to 90 seconds the control will restart (Burner on mode).
Burner off	Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.
Stand-by	Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).
Power loss	If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 VAC).
- Check all electrical connections.

Control is in lockout

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control.

If control starts when receiving power on the black wire and T-T circuit is closed, check for:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head

Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 50200 primary control

Wire burner — 50200 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 18 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 hz/single-phase power supply, with at least a 5-amp fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 amps.
- The 50200 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 50200 thermostat terminals. Then connect a voltmeter across terminals. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Alarm terminals provide a 24 vac-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

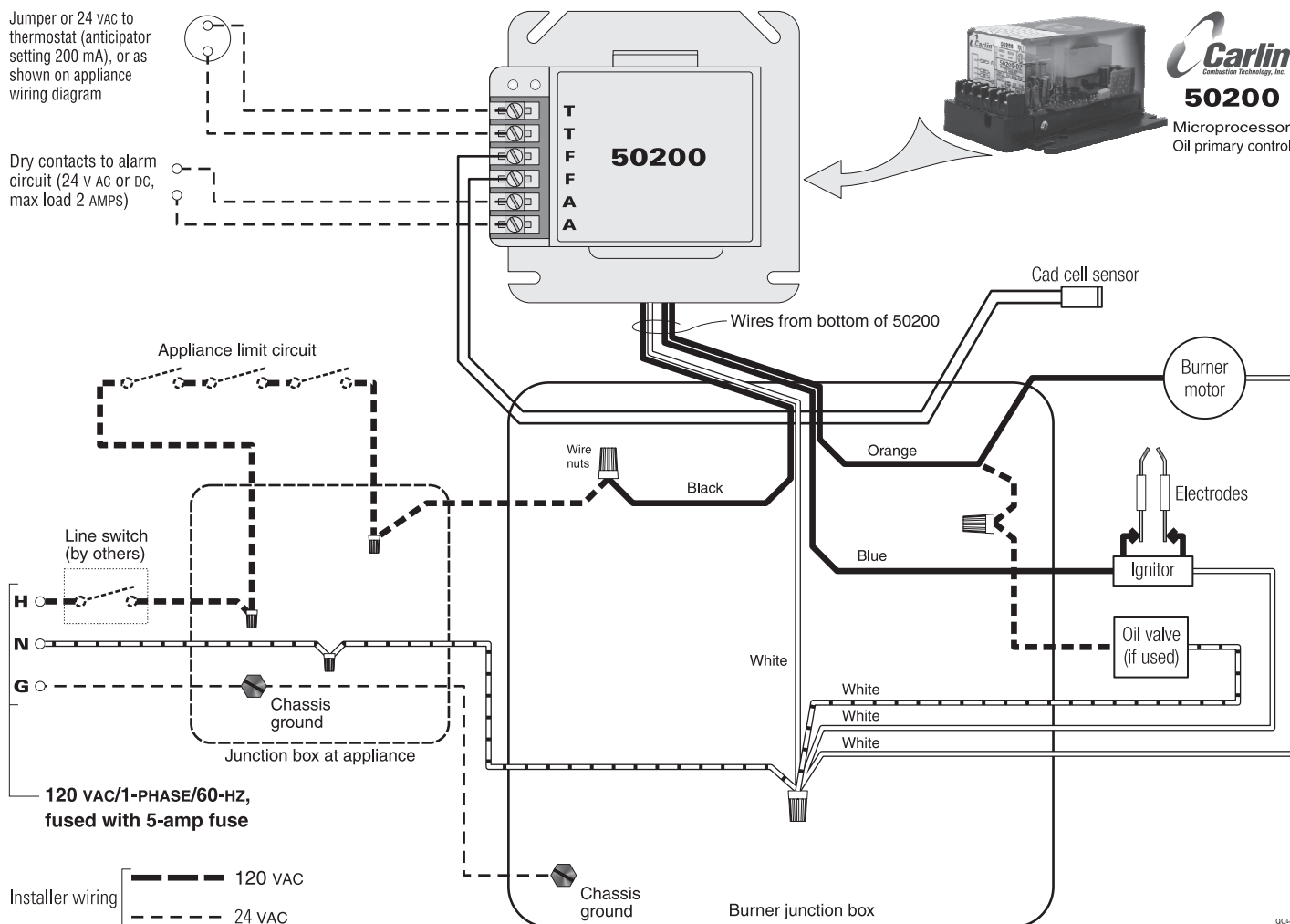
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 18 and 19.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 19 for suggestions in troubleshooting.

Figure 18 99FRD, 100CRD, and 102CRD burners wiring using Carlin 50200 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)




Start-up & operation

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.


NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily  every 3 to 4 seconds.

NOTICE

Check 50200 control label for trial for ignition (TFI) timing.

Power ON

Open all manual oil line valves. Close the line switch. (If Red light turns on constant , control is in lockout. See below to reset.)

Self-test 1

(*Revision B controls only*) Each time the limit circuit sends power to the black wire, the control performs a "boot-up" test to verify internal operation. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful. (This test occurs on every call for heat cycle if burner is operated by a limit control (terminals "T-T" jumpered).)


Stand-by

(Thermostat circuit open, limit circuit closed) If Self-test 1 is successful, amber LED turns off and control waits for thermostat circuit to close.

Call for heat

Set thermostat to call for heat. Thermostat circuit must close (and black wire must receive power from the limit circuit).

Self-test 2

The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED remains on, but blinks off momentarily  every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.

Burner on

After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)

TFI

The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).

Run

The burner continues firing during call for heat if the cad cell senses flame. LED's are off during normal running.

Lockout

If cad cell does not sense flame within 15 seconds after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the **alarm** contact.

To Reset

Push in and hold reset button for 1 second, then release.

Latch-up

If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.

WARNING

Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.


Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.

After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)

NOTICE

The 50200 control will not reset from lockout or latch-up if power is interrupted.

Flame failure

If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The burner shuts off within 2 seconds. **Recycle:** Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off .

End cycle

Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.

Stand-by

Control remains in stand-by mode until limit circuit sends power to the black wire (call for heat).

Model 50200 diagnostic LED's

 — Red OFF

 — Red ON

 — Red FLASHING

 — Amber OFF

 — Amber ON

 — Amber FLASHING

 — Amber BLINKING (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 VAC).
- Check all electrical connections.

Control is in lockout

- Red LED will be on. Press the reset button for 1 second.
- If the control returns immediately to lockout, The Safety Monitoring Circuit may have detected an internal control problem. Replace the control.

CAD cell seeing light

- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control.

If the amber **LED remains on**  with a wire detached, the control is defective.

If amber **LED goes off** , control is OK, and:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (flashing red LED)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (red LED on)

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.

4. Wire burner • start burner — 60200 primary control

Wire burner — 60200 primary control

- All wiring must comply with:
 - In the U.S — the National Electrical Code, ANSI Z223.1/NFPA 54.
 - In Canada — the Canadian Electrical Code Part 1, CSA standard C22.1.
 - All applicable local codes/standards.
- Wire the burner following Figure 19 and any special instructions or wiring diagram provided with the appliance, burner or other components.
- The burner requires a 120 VAC/60 hz/single-phase power supply, with at least a 5-amp fuse. The current draw (equipped with Carlin PSC motor) will be approximately 2.5 amps.
- The 60200 thermostat terminals provide a power source. Never apply external power to these terminals under any circumstances. To avoid this problem when using zone valves, disconnect field wires from 60200 thermostat terminals. Then connect a voltmeter across terminals. Operate all zones and verify that there is never a voltage reading at the meter. A voltage reading indicates incorrect wiring that must be corrected before attempting to operate the burner.
- Alarm terminals provide a 24 vac-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.
- Make sure the burner and appliance are correctly wired and the line switch is properly fused for the load.

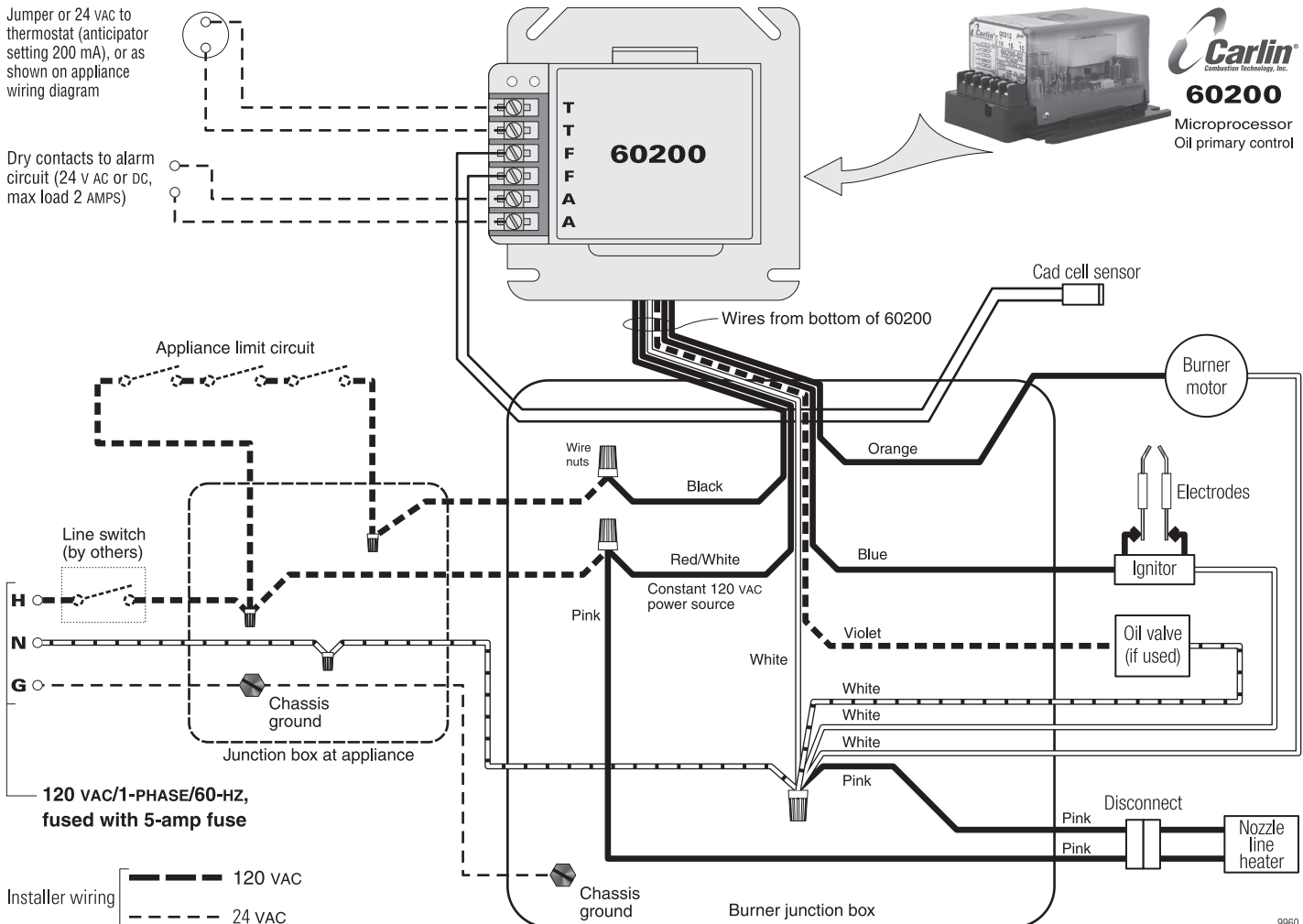
To start burner

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

- Turn service switch OFF.
- Perform inspections and checkouts on pages 20 and 21.
- Slip one end of a 3/16-inch I.D. clear plastic hose over end of bleed valve, the other end into a container. Then open bleed valve.
- Set thermostat (operating controls) to call for heat.
- Turn service switch ON.
- Bleed oil line until plastic line is free of bubbles; then another 15 seconds longer. (Should the primary control timing cause a lockout during purging, restart the burner following the primary control data sheet instructions.)
- Close bleed valve. The burner should cycle through the sequence given in the primary control data sheet.
- Perform primary control flame failure lockout and safety timing tests per instructions in primary control data sheet.
- Should control/burner fail to operate correctly, see page 21 for suggestions in troubleshooting.

Figure 19 99FRD, 100CRD, and 102CRD burners wiring using Carlin 60200 primary control (see appliance manual or separate wiring information for burner equipped with a primary control not covered in this manual)




Start-up & operation

WARNING


































Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily  every 3 to 4 seconds.

NOTICE

Check 60200 control label for trial for ignition (TFI), pre-purge and post-purge timings.









-   **Power ON** Open all manual oil line valves. Close the line switch. (If Red LED turns on constant , control is in lockout. See below to reset.)
-   **Self-test 1** (*Revision B controls only*) The control performs a “boot-up” test to verify internal operation each time power is applied to the red/white wire. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful.
-   **Stand-by** (No call for heat) If Self-test 1 is successful, amber LED turns off and control waits for heat call.
-   **Call for heat** Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
- Self-test 2** The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED will remain on, but blink off momentarily  every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.
-   **Burner on** After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)
-   **Pre-purge** The *oil valve* opens after the valve delay-on period (pre-purge). (For oil valve delay on operation, wire oil valve to the violet lead. If not using an oil valve, cap the violet lead to automatically disable pre-purge and post-purge.)
-   **TFI** The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
-   **Run** The burner continues firing during call for heat if the cad cell senses flame. Both LED's are off during normal running.
-   **Lockout** If cad cell does not sense flame within the TFI time limit after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the *alarm* contact.
- To Reset** Push in and hold reset button for 1 second, then release.
-   **Latch-up** If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.
- WARNING** **Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.**
-   Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.
-   After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)
- NOTICE** The 60200 control will not reset from lockout or latch-up if power is interrupted.
-   **Flame failure** If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The *oil valve* closes within 2 seconds. The *motor* remains on for the motor delay off period, then shuts off. (If no oil valve is wired to the control, the burner shuts down within 2 seconds.) **Recycle:** Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off .
-   **Post-purge** Set thermostat (or aquastat) to stop call for heat. The *oil valve* (if installed) will turn off within 2 seconds. The *motor* remains on for the motor delay off period (post-purge), then turns off. (If no oil valve is wired to the control, the burner shuts off within 2 seconds after end of call for heat. There is no post-purge.)
-   **Stand-by** Control remains in stand-by mode until limit circuit sends power to the black wire and thermostat circuit closes (call for heat).

Model 60200 diagnostic LED's

-  — Red OFF  — Red ON  — Red FLASHING
-  — Amber OFF  — Amber ON  — Amber FLASHING
-  — Amber BLINKING (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on

-   **No power to control**
- Check line voltage to the control (at least 102 vac).
 - Check all electrical connections.
-   **Control is in lockout**
- Red LED will be on. Press the reset button for 1 second.
 - If the control returns immediately to lockout, the Safety Monitoring Circuit may have detected an internal control problem. Replace the control.
-   **CAD cell seeing light**
- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control. If the amber **LED remains on**  with a wire detached, the control is defective.
- If amber **LED goes off** , control is OK, and:
- light is leaking into the burner housing, *OR*
 - CAD cell is defective, *OR*
 - there is a problem with the CAD cell wiring or holder.
 - If appliance was recently shut down, CAD cell may see residual hot spots in chamber.
- To troubleshoot:
- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
 - **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (flashing red LED)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (red LED on)

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve stuck in closed position.
- Check wiring connections.

5. Adjustment and verification

Adjust burner using test instruments

1. Operate burner for 15 minutes before making final adjustments using test equipment.
2. Check for leaks in fuel piping.

WARNING

Inspect fuel piping system for leaks. Repair any leaks to avoid fire hazard from oil leakage or combustion problems due to air infiltration into oil.

3. Inspect flame

- Look at flame through appliance combustion chamber observation port. The flame should be well-defined and should not impinge on any appliance surface. (If you make air changes later, inspect the flame again.)

WARNING

Do not attempt to confirm combustion simply by inspecting the flame visually. You must use combustion test instruments. Failure to properly verify/adjust combustion could allow unsafe operation of the burner, resulting in severe personal injury, death or substantial property damage.

1. Insert test probe into vent sample opening to sample flue products.
2. With the 99FRD, 100CRD, or 102CRD burner equipped with the correct oil nozzle, head setting and air band setting, the flue products will usually contain between 11½% and 12½% CO₂ (5.9% and 3.8% O₂) and zero (Bacharach) smoke.
3. Use combustion test equipment to verify that burner is properly set up for your installation, within the range listed in Table 3. Appliances with positive pressure in the chamber may require a wider air opening. See appliance instructions for details. Verify/adjust settings by testing with instruments.
 - a. Check smoke. It should be zero on the Bacharach scale.
 - b. Set the appliance flue damper or barometric draft regulator so the draft or pressure in the vent complies with the appliance manufacturer's instructions.

WARNING

Heating units designed for natural draft operation are normally set for a slightly negative pressure, usually -0.01 to -0.02 inches w.c. draft at the combustion chamber test port. Appliances designed for forced draft (positive pressure in the chamber) must be air-tight to prevent exfiltration of harmful combustion products. Failure to properly set draft for the appliance could result in severe personal injury or death.

- c. Check percent of CO₂ (or O₂). Fine tune the burner, if necessary, by slightly adjusting the head position for more or less air.
- d. Recheck smoke (should be zero) and flue or chamber pressure/draft (adjust if necessary and retest).

WARNING

All installations should be checked after one to two weeks of operation to ensure the appliance/burner units are operating correctly.

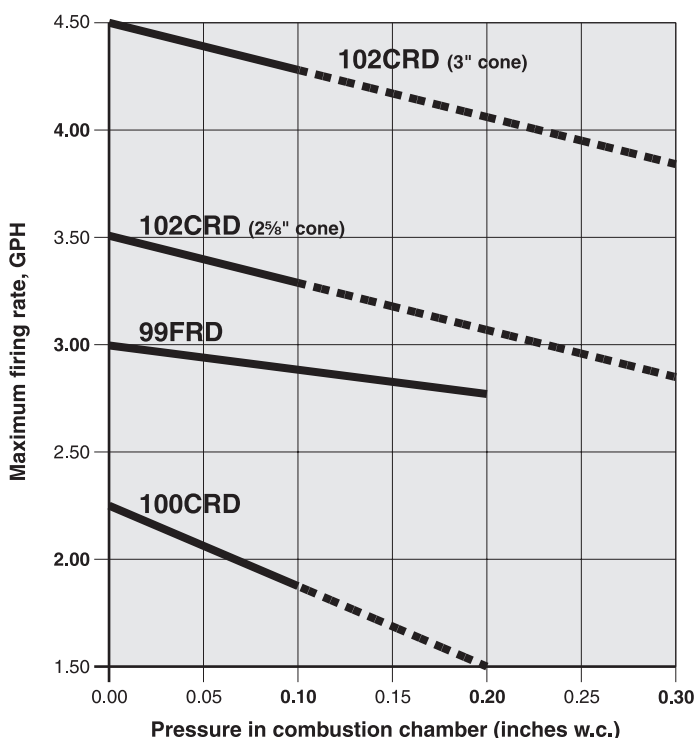
Firing against positive overfire pressure

1. Burner rating maximum inputs are based on operation with zero to slightly negative pressure overfire, typically 0.01 to 0.03 inches w.c.
2. When a burner is applied to an appliance that operates with a higher pressure overfire, the maximum firing rate decreases because the maximum available air flow from the burner blower decreases.
3. Read the graph below in Figure 20 to find the maximum burner firing rate at positive overfire pressures.

WARNING

Do not apply a 99FRD, 100CRD or 102CRD burner at a pressure higher than listed in Figure 20 unless the application has been factory pretested.

Figure 20 Maximum firing rate decreases as overfire pressure increases



9916

99FRD

(Do not fire at overfire pressure greater than 0.20 inches w.c. without factory pretesting.)

100CRD

(Do not fire at overfire pressure greater than 0.10 inches w.c. without factory pretesting.)

102CRD

(Do not fire at overfire pressure greater than 0.10 inches w.c. without factory pretesting.)

5. Adjustment and verification *(cont.)*

Verify burner/appliance operation

Check burner/appliance/controls operation

- Test operating and limit controls on appliance as specified in appliance instructions.
- Check operation of the primary control by forcing lockout to occur. For primary controls that enter latch-up after multiple lockouts, force latch-up to occur as well. Reset primary control per control data sheet instructions after each test.
- Start and stop the burner several times, allowing the primary control to sequence through normal operation. Verify correct operation of burner and primary control throughout.

Verify vent system operation

- Verify vent is operating correctly and flue products are properly exhausted from building. If the building contains any exhaust fans or conditions that could affect vent performance, check burner/appliance/vent operation with exhaust fans (or other conditions) operating.

Combustion/ventilation air

- Verify combustion/ventilation air openings are not/will not be obstructed.
- Verify air opening louvers are full open.
- If louvers are motor-operated, verify motor and end switch are interlocked with appliance/burner wiring to prevent operation of the burner if the air louvers are not fully opened.

Prepare burner for normal operation

- Cycle burner off with appliance controls.
- Turn off power to the appliance.
- Seal the appliance flue damper test opening.
- Verify all components and wires are in place and burner is ready for operation.
- Restore power to the appliance.

Train the user

- Train the user to operate the burner and appliance under normal conditions.
- Explain procedure to shut down burner/appliance when required.
- Review the back cover of this manual (and the appliance manual) with the user.
- Verify the user is aware of all procedures specified in the manuals.
- Verify user will not store or use combustible liquids or materials or contaminants in the vicinity of the burner/appliance.

6. Annual start-up and service

Annual start-up & service

WARNING

This burner must be started and serviced at least annually by a qualified service technician. Failure to properly maintain and service the burner could result in severe personal injury, death or substantial property damage.

- Discuss burner/appliance operation with user to determine any problems that may have occurred during the previous season and to verify user is aware of proper operation and care of the burner/appliance.
- Review proper operation of the appliance/burner unit with the user.
- Turn off power to appliance.
- Remove combustion head assembly to clean and adjust if necessary. (See procedure on page 9.)
- If the inside surface of the air tube and/or retention ring need to be cleaned, clean them with a vacuum cleaner with brush attachment while the combustion head assembly is out of the burner.
- Replace the oil nozzle with the correct size specified in Table 1, page 3.
- Inspect and adjust the ignition electrodes and insulators per instructions on page 9 of this manual. Replace if proper spacing cannot be achieved or if components are damaged.
- Close the housing cover plate and secure in place.
- Inspect the fuel line oil filter. Replace if necessary.

NOTICE

Oil line filters — Use a non-bypassing filter to prevent nozzle plugging caused by poor oil filtration. Non-bypassing filters prevent small foreign particles from bypassing the filter, a common problem with fiber element type filters. Another problem of some filters is the fiber from filter element tears can break away and plug the nozzle or fuel unit.

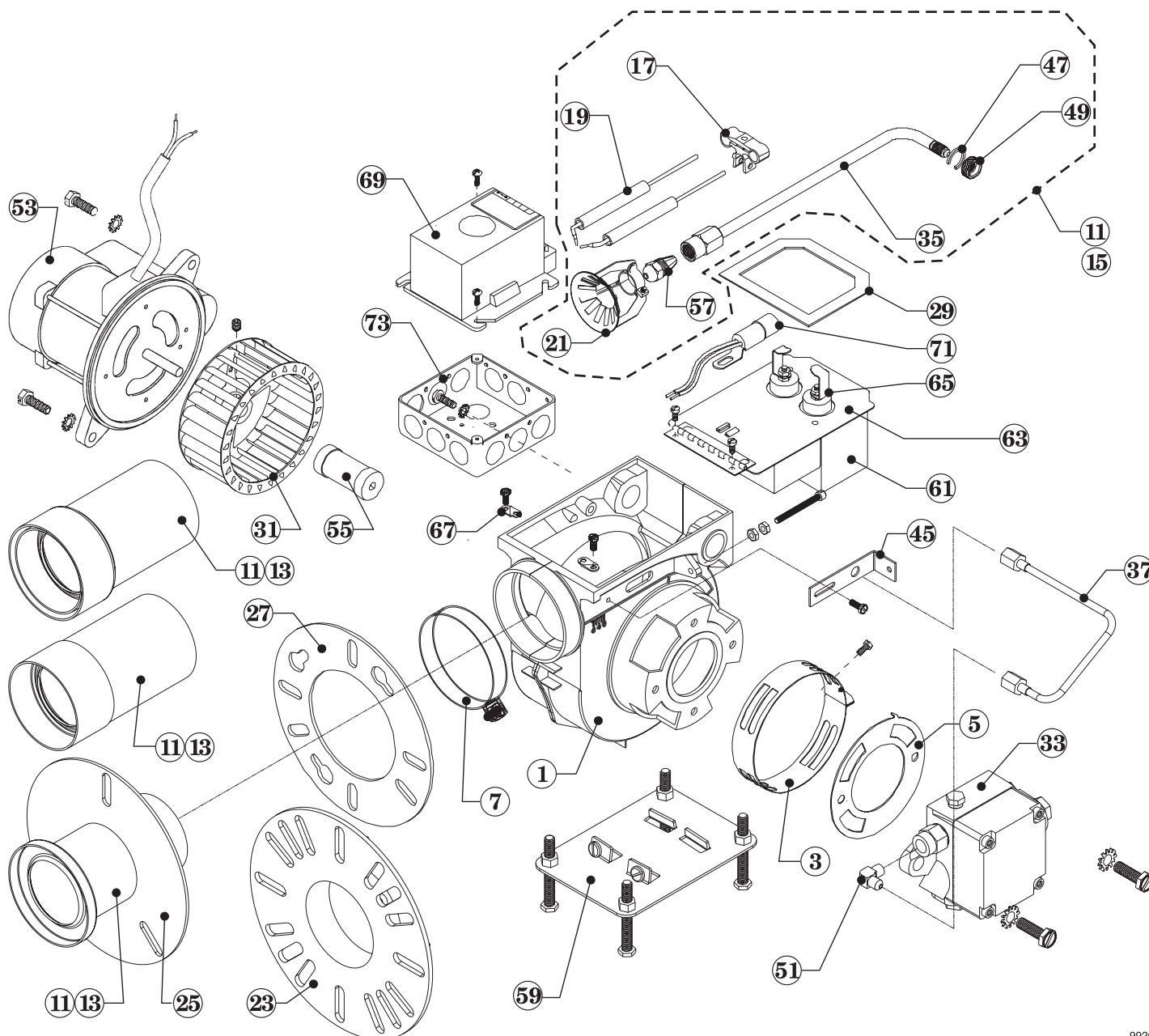
- Perform the complete checkout procedures of pages 13 to 23, including system inspection and checks.
- Inform the user of any problems found.

7. Repair parts

For parts not shown or listed, contact factory and/or check separate documentation supplied with appliance/burner unit.

Item	Description	Part No.	99 FRD	100 CRD	102 CRD	Item	Description	Part No.	99 FRD	100 CRD	102 CRD
1	Blower housing	Consult factory				19	Electrode sets				
3	Air bands						Set of 2, 5" nominal, approx. 6-3/4" oal	82768S	•	•	•
	Single	50732S	•				Set of 2, 7" nominal, approx. 8-3/4" oal	82776S	•	•	•
	Double (standard)	98101	•	•	•		Set of 2, 9" nominal, approx. 10-3/4" oal	82784S	•	•	•
5	Air shutters						Set of 2, 11" nominal, approx. 12-3/4" oal	82792S	•	•	•
	Air shutter, 4-Slot	46946S	•	•	•	21	Flame retention ring assemblies				
	Air shutter, blank style	46938S	•	•			Flame retention ring assembly	54981S	•	•	
7	Air tube housing clamp	46979	•	•	•		Flame retention ring assembly	55061S			•
11	Air tube/combustion head assemblies						Flange & gasket combinations				
	5" Air tube/combustion head combination	20180	•	•			Mounting flange & gasket	23150S	•	•	•
	7" Air tube/combustion head combination	20230	•	•			Mounting flange & gasket (10 pack)	72462S	•	•	•
	9" Air tube/combustion head combination	20313	•	•			Mounting flanges				
	11" Air tube/combustion head combination	19919	•	•		23	3-1/8 id x 8-1/4 od Universal flange	59402	•	•	•
	5" WS Air tube/combustion head combination	64006	•			25	Welded flange, when supplied (contact factory)	—			
	7" WS Air tube/combustion head combination	65524	•				Gaskets				
	7" Air tube/combustion head combination	65516	•			27	Mounting flange	40287	•	•	•
	5" B Air tube/combustion head combination	21790			•	29	Transformer	40167	•	•	•
	7" B Air tube/combustion head combination	21857			•	31	Blower wheels (fans)				
	9" B Air tube/combustion head combination	21881			•		Blower wheel, 5-1/4d x 2w	28605	•		
	11" B Air tube/combustion head combination	21691			•		Blower wheel, 4-1/4d x 2-15/16w	28530		•	
	5" C Air tube/combustion head combination	21980			•		Blower wheel, 5-1/16d x 2-1/4w	28506			•
	7" C Air tube/combustion head combination	21998			•	33	Fuel units				
	9" C Air tube/combustion head combination	22004			•		Single stage, Suntec A2VA-7116, w/fitting	22996S	•	•	
	11" C Air tube/combustion head combination	21915			•		Two stage, Suntec B2VA-8216, w/fitting	23002S	•	•	
13	Air tubes						Single stage, Danfoss BFPH w/fitting	27813D	•	•	
	5" nominal, approx. 5-3/8" oal	44990	•	•			Single stage, Suntec JA2BB-300, w/fitting (requires 1/6 motor (item 2) and special coupling)	23127S	•	•	•
	7" nominal, approx. 7-5/8" oal	45039	•	•			Two stage, Suntec HA2BB-300, w/fitting	23069S	•	•	•
	9" nominal, approx. 9-5/8" oal	45070	•	•			Single stage, Suntec A2VA-3006, w/fitting	98750S	•	•	
	11" nominal, approx. 11-5/8" oal	44917	•	•			Single stage, Suntec A2YA-7916, w/fitting	23234S			•
	WS-Style, 5" nominal, approx. 5-1/2" oal	45005	•				Two stage, Suntec B2YA-8916, w/fitting	23267S			•
	WS-style, 7" nominal, approx. 7-1/2" oal	45047	•			35	Nozzle line/adaptor assemblies with C-ring				
	B-style, 5" nominal, approx. 5-1/16" oal	45617			•		5" nominal, approx. 6-3/4" oal	56820S	•	•	•
	B-style, 7" nominal, approx. 7-1/16" oal	45641			•		7" nominal, approx. 8-3/4" oal	56861S	•	•	•
	B-style, 9" nominal, approx. 9-1/16" oal	45674			•		9" nominal, approx. 10-3/4" oal	57315S	•	•	•
	B-style, 11" nominal, approx. 11-1/16" oal	45492			•		11" nominal, approx. 12-3/4" oal	56754S	•	•	•
	C-style, 5" nominal, approx. 5-1/16" oal	45898			•	37	Oil lines				
	C-style, 7" nominal, approx. 7-1/16" oal	45914			•		3/16" od, std. fuel unit to nozzle line	34470S	•	•	•
	C-style, 9" nominal, approx. 9-1/16" oal	45930			•		3/16" od, std. oil valve (when used) to nozzle line	34439S	•	•	•
	C-style, 11" nominal, approx. 11-1/16" oal	45716			•	39	Oil valves (when used) - Not shown				
15	Combustion head assemblies						Carlin oil valve	SVC10FF	•	•	•
	5" nominal, approx. 8-1/8" oal	51805	•	•			Carlin oil valve kit	98289	•	•	•
	7" nominal, approx. 10-1/8" oal	51854	•	•			Instant-opening (Peter Paul)	40857			
	9" nominal, approx. 12-1/8" oal	51896	•	•			Instant-opening (Peter Paul) kit	24638			
	11" nominal, approx. 14-1/8" oal	51599	•	•		NS	Nozzle line heater kit	66795S	•	•	
	5" nominal, approx. 8-1/8" oal	52316			•	41	Nozzle line heater (element only)	66787	•	•	
	7" nominal, approx. 10-1/8" oal	52373			•	43	Nozzle line heater, bracket	64493	•	•	
	9" nominal, approx. 12-1/8" oal	52472			•	45	Nozzle line adjusting slide	5489001	•	•	•
	11" nominal, approx. 14-1/8" oal	52183			•	47	Retaining ring ("C" -Clip), nozzle line	31633	•	•	•
17	Electrode bracket	23135S	•	•	•	49	Thumb nut, nozzle line	62885	•	•	•
NS	Electrode setting guage (red)	76893	•	•	•	51	Elbow, 3/16" flare x 1/8" NPT	29926	•	•	•

7. Repair parts (continued)



9920

Item	Description	Part No.	99 FRD	100 CRD	102 CRD	Item	Description	Part No.	99 FRD	100 CRD	102 CRD
53	Motor, 1/6 hp, 3450 rpm, Carlin PSC	98022	•	•	•	63	Ignitor base plate only	41013	•	•	•
55	Couplings					NS	Ignitor/base plate/cad cell assembly	410000CA	•	•	•
	For std. fuel units, approx. 2-3/8" oal	75564	•	•	•	65	Transformer terminal kit (2 terminals & nuts)	24463	•	•	•
	For opt. fuel units (J/H pumps), approx. 2-3/16" oal	28704	•	•	•	67	Transformer hold-down tab, two required	44842S	•	•	•
57	Nozzle (obtain locally)	—	•	•	•	69	Primary control (consult factory for other controls)	60200	•	•	•
59	Pedestal w/hardware	23317S	•	•	•	71	Cad cell assembly	1440700K	•	•	•
61	Ignitor, Carlin electronic: 120 vac, 60 hz 40 va 14 kv, 35 ma rms / Secondary grounding — midpoint	41000	•	•	•	73	Junction box, 4"x4", w/grommet and lockwasher	44586	•	•	•

8. Maintenance procedures

Maintenance/service procedures

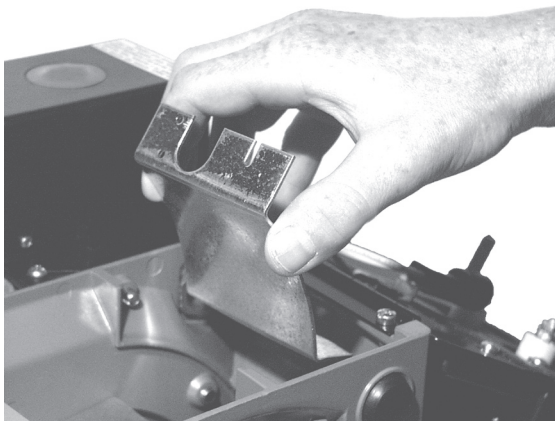
WARNING

Turn off power to appliance when servicing burner. Failure to comply could result in severe personal injury, death or substantial property damage.

Cleaning blower wheel

1. The blower wheel accumulates dust and debris from normal operation. You will need to clean the wheel blades periodically to prevent reduction in airflow.
 - Inspect the blower wheel by removing the blower wheel access cover. See Figure 21.
 - To remove the cover, open the ignitor plate and loosen the blower wheel access cover screw about three turns.
 - Inspect the blower wheel to see if it needs to be cleaned. Dirt and lint on the wheel reduce air flow, and must be removed if the burner is to operate correctly.
2. To clean blades, remove the two bolts securing the motor to blower housing.
 - a. Slide the motor out and rotate to remove and access blower wheel.
 - b. Use a brush and vacuum to clean each blade and the blower housing interior.
 - c. Replace motor/wheel in blower housing and secure with the two bolts.
 - d. Push wire slack back into junction box.

Figure 21 Remove blower access cover to inspect blower wheel



Replacing blower motor or wheel

1. If either the blower wheel or motor must be replaced, remove the two bolts securing the motor to housing.
2. Disconnect the motor wires in the burner junction box.
3. Loosen the Allen screw securing the blower to the motor shaft and remove the wheel.
4. When assembling the replacement assembly, slide the wheel onto the motor shaft and use feeler gauges to set space between the blower wheel and the motor face. This space must be:

99FRD – 3/64"	100CRD – 1/8"	102CRD – 7/16"
---------------	---------------	----------------
5. Replace the motor/wheel assembly in the housing, wire the motor leads and secure the motor with the two bolts.

Motor maintenance

- The Carlin PSC motor is constructed with permanently-lubricated bearings, and requires no oiling. Should you replace the original motor with another type of motor, occasional oiling may be required, depending on motor design and manufacturer's recommendations.
- Any time you replace a component or disassemble any part of the burner for service/maintenance, perform a complete operational test after reassembly to verify the burner operates correctly. Failure to verify operation could result in severe personal injury, death or substantial property damage.

Checking ignitor

WARNING

Never test an ignitor by placing a screwdriver (or other metallic object) across the high voltage clips. Check 40700 & 40900 ignitors only by observing spark at appliance ignition electrodes, with fuel supply OFF. Using any other method could cause ignitor damage and severe personal injury.

1. Checking 41000 ignitors only:
 - Disconnect electrical power to burner.
 - Remove hold down clips or screws. Lift ignitor mounting plate to the full-open position. Set high voltage clips to a 1/2" to 3/4" gap.
 - Carefully energize ignitor and check for spark arcing at the high voltage terminals. If spark jumps the gap, ignitor is good.

Ceramic fiber materials

WARNING

The appliance may contain ceramic fiber and/or fiberglass materials. Ceramic fiber materials, such as chamber liners, may contain carcinogenic particles (chrysotilites) after exposure to heat. Airborne particles from fiberglass or ceramic fiber components have been listed as potentially carcinogenic by the State of California. Take the following precautions when removing, replacing and handling these items.

Avoid breathing dust and avoid contact with skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves and eye protection. Use a NIOSH N95 certified respirator. This respirator meets requirements for protection from chrysotilites. Actual job requirements or NIOSH regulations may require other or additional protection. For information, refer to the NIOSH website, <http://www.cdc.gov/niosh/homepage.html>.

Ceramic fiber removal: To prevent airborne dust, thoroughly wet ceramic fiber with water before handling. Place ceramic fiber materials in a plastic bag and seal to dispose.

Avoid blowing, tearing, sawing or spraying fiberglass or ceramic fiber materials. If such operations are necessary, wear extra protection to prevent breathing dust.

Wash work clothes separately from other laundry. Rinse clothes washer thoroughly afterwards to prevent contamination of other clothing.

NIOSH First aid procedures:

Eye exposure — irrigate immediately



Limited Warranty

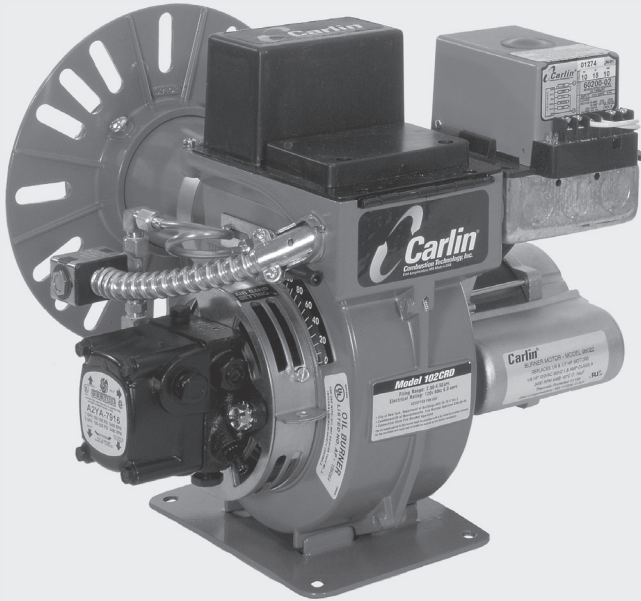
Carlin Combustion Technology, Inc. (Carlin) warrants its products, to the original purchaser, to be free from defects in material and workmanship, under normal use and service for 36 months from the date of manufacture, except for commercial Products (over 3 GPH) that are warranted for 12 months from the date of manufacture; and except for EZ-Pro™ Burners that are warranted for 36 months from the date of manufacture, plus an extended period of two (2) additional years (total of five (5) years).

This warranty does not extend to equipment subjected to misuse, neglect, accident or water damage; nor does this warranty apply unless the product covered by it is properly installed by a qualified, competent technician, who is licensed where state or local codes require, and who is experienced in making such installations, in accordance with NFPA No. 31 of the National Fire Protection Association and in accordance with all applicable local, state and national codes. Parts that are defective in material or workmanship and within the warranty period will be repaired or replaced as follows:

1. Motors, fuel units, transformers and other non-Carlin products should be sent for repair or replacement to an authorized service point or distributor of the manufacturer of such components when reasonably available in the Customer's locality.
2. Where such local service is not available with respect to the above listed components, or where Carlin components are involved, or for component parts of EZ-Pro Burners that fall within the extended warranty period, such defective parts should be returned, freight prepaid to Carlin. The repaired component or replacement part will be provided to the Customer freight prepaid by Carlin unless the returned part is determined by Carlin to be out of warranty or not to be defective, in which case it will be provided to the customer F.O.B., Carlin, East Longmeadow, Massachusetts.
3. Contact Carlin Customer Service for warranty return procedures.
4. The return of a burner is not covered by this warranty. Contact Carlin Tech Service for assistance before replacing any burner.
5. Carlin is not responsible for any labor cost for removal and replacement of equipment.
6. Equipment that is repaired or replaced will carry the unexpired portion of the original equipment warranty.
7. If inspection by Carlin does not disclose any defect covered by this warranty, the equipment may be repaired or replaced at the expense of the Customer, and Carlin's regular charges will apply.
8. Non-Carlin components are warranted for 12 months from date of installation or 18 months from date of manufacture, whichever date occurs first.

This warranty is limited to the precise terms set forth above, and provides exclusive remedies expressly in lieu of all other remedies and in particular there shall be excluded the implied warranties of merchantability and fitness for a particular purpose. In no event will Carlin Combustion Technology, Inc. be liable for any incidental or consequential damage of any nature.

Carlin neither assumes nor authorizes any person to assume for Carlin any other liability or obligations in connection with the sale of this equipment. Carlin's liability and Customer's exclusive remedy being limited to repairs or replacement as set forth above.



WARNING The burner must be cleaned, tested and adjusted annually by a qualified oil burner service technician.

WARNING Should overheating occur:

- (1) shut off the oil supply to the burner.
- (2) **DO NOT** shut off the control switch to the circulator or blower.
- (3) contact your oil dealer or service technician and the fire department (if needed).

99FRD, 100CRD, and 102CRD oil burner

User care and maintenance

WARNING Refer only to the information on this page, intended for your use. The remainder of this manual is intended only for your service technician. Failure to comply could result in severe personal injury, death or substantial property damage.

For other than routine maintenance, contact a qualified service company. Perform the following as needed.

- Keep the area around the burner clear and free from combustible vapors and liquids.
- Do not obstruct the flow of combustion and ventilating air.
- Most motors currently used on residential type burners use permanently-lubricated bearings, and do not require field lubrication. Read the label on the motor to determine oiling needs, if any. Do not over-lubricate. This can cause as much trouble as not lubricating at all.

WARNING Never attempt to use gasoline as a fuel for this burner, as it is more combustible and could result in a serious explosion. Never attempt to burn refuse or use any fuel other than # 1 or # 2 heating oil (ASTM



MODEL 48245

CAD cell

Oil primary control

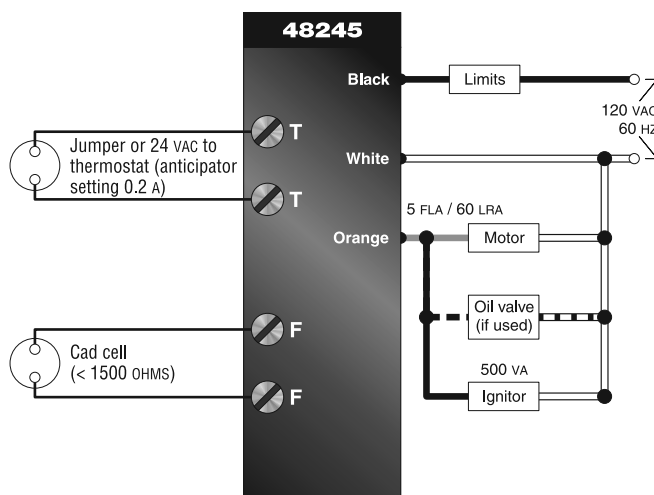
Data sheet



- Intermittent duty ignition
- 45-second trial for ignition
- Red LED lockout indicator
- Thermostat/aquastat compatible
- **SMC Technology**⁽¹⁾

Power input (from limit circuit)	120 VAC, 60 HZ, 10 VA
Motor load	5 FLA / 60 LRA
Ignitor load	120 VAC, 60 HZ, 500 VA
Operating temperature limits	+32°F to +140°F
Storage temperature limits	-40°F to +185°F
Thermostat anticipator current	0.2 A, AC
Cad cell resistance — WITH FLAME	R < 1500 OHMS
Agencies	UL recognized (US) CSA certified (Canada)

(1) The 48245 provides two motor relays. Carlin's patented SMC technology (Safety Monitoring Circuit) monitors the contacts of both motor relays. **Lockout** occurs if a motor relay contact is found closed when it should be open. The second motor relay ensures motor shutdown even if the first motor relay fails.



Installing and wiring

Warning — The 48245 control must be installed and serviced only by a qualified service technician.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
2. Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.

Mounting

- The control may be mounted on a 4" x 4" junction box in any convenient location on the burner, furnace or wall. The location must not exceed the ambient temperature limit, 140°F.

Wiring

- Wiring must comply with local and national electrical codes, and in accordance with the wiring diagram above.

Field checks

1. **Safety timing (TFI) test** — Remove one cad cell wire (F-F). Start burner. The control should lockout within 45 seconds. Replace cad cell wire.
2. **Flame failure test** — Start burner. After flame is established (after TFI period), close the oil supply hand valve. This will cause a flame failure sequence as described on the reverse side of this Data sheet.
3. If control does not operate as described, check the wiring.

Model 48245 Cad cell Oil primary control — Data sheet — Operation/Troubleshooting

Start-up & operation

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.

Power ON

Open all manual oil line valves. Close the line switch.

Reset

Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.

Stand-by

(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit). The circuit across terminals T-T will also have to close for burner to start.

Call for heat

Set thermostat (or aquastat) to call for heat. The limit circuit must provide power to the black wire and the circuit between terminals T-T must be closed.

Burner on

The *ignitor* and *motor* start. (The ignitor remains on throughout the call for heat cycle.)

TFI

The cad cell must sense flame within the control's trial for ignition (TFI) timing — 45 seconds.

Run

The burner continues firing during call for heat if the cad cell senses flame.

Lockout

If cad cell does not sense flame within the TFI timing (45 seconds), **lockout** occurs. The red LED indicator turns on.

WARNING

Red LED fully on indicates lockout (approximately 20 seconds after motor and ignitor turn off). If power is interrupted to the control before the Red LED turns fully on, the control will reset without the reset button being pushed.

To Reset

To reset after lockout, push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.

Flame failure

If the cad cell loses flame signal during operation (after the TFI), control will lockout if flame is not established within 45 seconds.

Burner off

Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.

Stand-by

Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).

Power loss

If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 vac).
- Check all electrical connections.

Control is in lockout (red LED on)

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control. If control does not start when receiving power on the black wire and T-T circuit is closed, check for:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.

Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.



MODELS **40200** **42230**

CAD cell
Oil primary controls

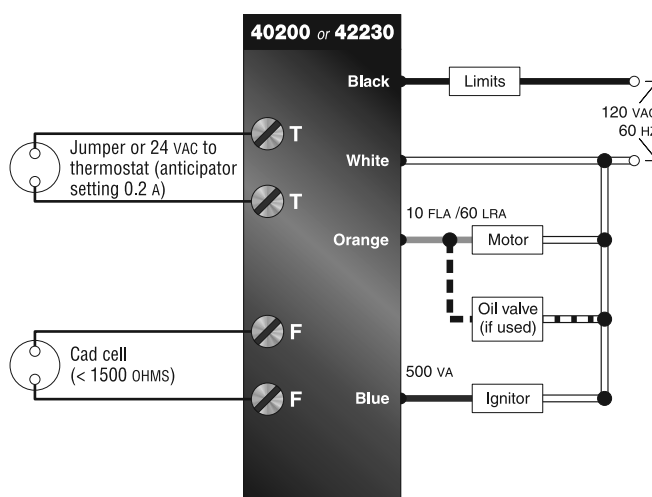
Data sheet



- Interrupted duty ignition
- 15-second trial for ignition 40200
(1.3-second flame failure response time (FFRT))
- 30-second trial for ignition 42230
(1.3-second flame failure response time (FFRT))
- Recycle on flame failure
- Thermostat/aquastat compatible
- **SMC Technology** ⁽¹⁾

Power input (from limit circuit)	120 VAC, 60 HZ, 10 VA
Motor load	10 FLA / 60 LRA
Ignitor load	120 VAC, 60 HZ, 500 VA
Operating temperature limits	+32°F to +140°F
Storage temperature limits	-40°F to +185°F
Thermostat anticipator current	0.2 A, AC
Cad cell resistance — WITH FLAME	R < 1500 OHMS
Agencies	UL recognized (US) CSA certified (Canada)

(1) The 40200 & 42230 controls provide two motor relays. Carlin's patented SMC technology (Safety Monitoring Circuit) monitors the contacts of both motor relays. **Lockout** occurs if a motor relay contact is found closed when it should be open. The second motor relay ensures motor shutdown even if the first motor relay fails.



Installing and wiring

Warning — 40200 and 42230 controls must be installed and serviced only by a qualified service technician.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
2. Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.

Mounting

- The control may be mounted on a 4" x 4" junction box in any convenient location on the burner, furnace or wall. The location must not exceed the ambient temperature limit, 140°F.

Wiring

- Wiring must comply with local and national electrical codes, and in accordance with the wiring diagram above.

Field checks

1. **Safety timing (TFI) test** — Remove one cad cell wire (F-F). Start burner. The control should lockout within 15 seconds (40200) or 30 seconds (42230). Replace cad cell wire.
2. **Flame failure test** — Start burner. After flame is established (after TFI period), close the oil supply hand valve. This will cause a flame failure sequence as described on the reverse side of this Data sheet.
3. If control does not operate as described, check the wiring.

Start-up & operation

WARNING	Do not start the burner if the combustion chamber contains oil or oil vapor.
NOTICE	Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light (flame) at the beginning of a cycle, the control will wait until it no longer senses the problem.
Power ON	Open all manual oil line valves. Close the line switch.
Reset	Press and hold the reset button for 3 seconds, then release. This will reset the control at any time during its operation.
Stand-by	(No call for heat) Control waits for power to be applied to the black wire (from appliance limit circuit).
Call for heat	Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
Burner on	The <i>ignitor</i> and <i>motor</i> start.
TFI	The cad cell must sense flame within the control's trial for ignition (TFI) timing — 15 seconds for 40200 control or 30 seconds for 42230 control. After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
Run	The burner continues firing during call for heat if the cad cell is sensing flame.
Lockout	If cad cell does not sense flame within the TFI timing (15 or 30 seconds), lockout occurs.
To Reset	Push in and hold reset button for 3 seconds, then release. This will reset control at any time during operation.
Flame failure	If the cad cell loses flame signal during operation (after the TFI), the burner shuts off within 1.3 seconds. Recycle: After 60 to 90 seconds the control will restart (Burner on mode).
Burner off	Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.
Stand-by	Control remains in stand-by mode until limit circuit sends power to the black wire and T-T circuit closes (call for heat).
Power loss	If power to control/burner is interrupted during a normal run cycle, the control will begin a normal cycle again after power is restored.

Service & Troubleshooting

Burner (control) will not come on

No power to control

- Check line voltage to the control (at least 102 VAC).
- Check all electrical connections.

Control is in lockout

- Press the reset button for 3 seconds.

CAD cell seeing light

- Remove one lead from FF terminal on the control. Press and hold the reset button for 3 seconds. If voltmeter shows power between control white and black wires, and T-T circuit is closed, but control does not start, replace the control.

If control starts when receiving power on the black wire and T-T circuit is closed, check for:

- light is leaking into the burner housing, *OR*
- CAD cell is defective, *OR*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Control will not reset

- If the control will not reset, the Safety Monitoring Circuit may be detecting an internal control problem. Replace the control.

Repeated flame failures (burner lights, but shuts down)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head

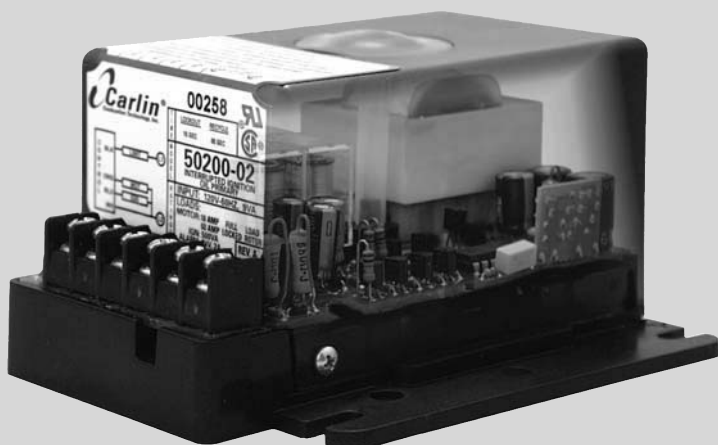
Check for proper air band setting and draft.

- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.



- Interrupted duty ignition
- Recycle on flame failure
- Serviceman reset protection
(Latch-up after three consecutive lockouts ⁽¹⁾)
- Diagnostic LED's
- 15-second TFI (trial for ignition)(other timings available)
(1.3-second flame failure response time (FFRT))
- Alarm contacts
- Thermostat/aquastat compatible
- **SMC Technology** ⁽²⁾

Power input (from limit circuit)	120 VAC, 60 HZ, 9 VA
Motor load	10 FLA, 60 LRA
Ignitor load	120 VAC, 60 HZ, 500 VA
Alarm contacts	24 V, AC/DC, 2 A
Operating temperature limits	+32°F to +140°F
Storage temperature limits	-40°F to +185°F
Thermostat anticipator current	0.2 A, AC
Cad cell resistance — WITH FLAME	R < 1500 OHMS
Agencies	UL recognized (US) CSA certified (Canada)

- (1) Latch-up mode shuts down the control after three consecutive lockouts, and requires a special procedure to reset. This ensures the owner will call in a technician to troubleshoot burner problems.
- (2) The 50200 provides two motor relays. Carlin's patented SMC technology (Safety Monitoring Circuit) monitors the contacts of both motor relays. **Lockout** occurs if a motor relay contact is found closed when it should be open. The second motor relay ensures motor shutdown even if the first motor relay fails.

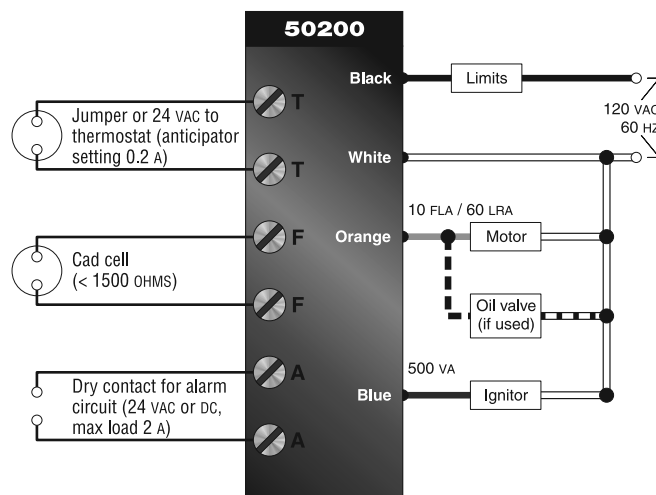
MODEL 50200

CAD cell

Microprocessor

Oil primary control

Data sheet



Installing and wiring

Warning — The 50200 control must be installed and serviced only by a qualified service technician.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
2. Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.
3. Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.

Mounting

- The control may be mounted on a 4" x 4" junction box in any convenient location on the burner, furnace or wall. The location must not exceed the ambient temperature limit, 140°F.

Wiring

- Wiring must comply with local and national electrical codes, and in accordance with the wiring diagram above.

Field checks

1. **Safety timing (TFI) test** — Remove one cad cell wire (F-F). Start burner. The control should lockout within 15 seconds. Replace cad cell wire.
2. **Flame failure/recycle test** — Start burner. After flame is established (after TFI period), close the oil supply hand valve. This will cause a flame failure sequence as described on the reverse side of this Data sheet. The control should recycle (restart after 65 seconds).
3. If control does not operate as described, check the wiring.

Model 50200 Microprocessor oil primary control — Data sheet — Operation/Troubleshooting

Start-up & operation

WARNING

Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily **A** every 3 to 4 seconds.

NOTICE

Check 50200 control label for trial for ignition (TFI) timing.

A R **Power ON** Open all manual oil line valves. Close the line switch. (If Red light turns on constant **R**, control is in lockout. See below to reset.)

A R **Self-test 1** (*Revision B controls only*) Each time the limit circuit sends power to the black wire, the control performs a “boot-up” test to verify internal operation. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful. (This test occurs on every call for heat cycle if burner is operated by a limit control (terminals “T-T” jumpered).)

A R **Stand-by** (Thermostat circuit open, limit circuit closed) If Self-test 1 is successful, amber LED turns off and control waits for thermostat circuit to close.

A R **Call for heat** Set thermostat to call for heat. Thermostat circuit must close (and black wire must receive power from the limit circuit).

Self-test 2 The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED remains on, but blinks off momentarily **A** every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.

A R **Burner on** After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)

A R **TFI** The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).

A R **Run** The burner continues firing during call for heat if the cad cell senses flame. LED's are off during normal running.

A R **Lockout** If cad cell does not sense flame within 15 seconds after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the *alarm* contact.

To Reset Push in and hold reset button for 1 second, then release.

A R **Latch-up** If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.

WARNING

Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.



Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.



After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)

NOTICE

The 50200 control will not reset from lockout or latch-up if power is interrupted.

A R **Flame failure** If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The burner shuts off within 2 seconds.
Recycle: Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off **R**.

A R **End cycle** Set thermostat (or aquastat) to stop call for heat. The burner shuts off within 2 seconds after end of call for heat.

A R **Stand-by** Control remains in stand-by mode until limit circuit sends power to the black wire (call for heat).

Model 50200 diagnostic LED's

R — Red OFF

R — Red ON

R — Red FLASHING

A — Amber OFF

A — Amber ON

A — Amber FLASHING

A — Amber BLINKING (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on



No power to control

- Check line voltage to the control (at least 102 vac).
- Check all electrical connections.



Control is in lockout

- Red LED will be on. Press the reset button for 1 second.
- If the control returns immediately to lockout, The Safety Monitoring Circuit may have detected an internal control problem. Replace the control.



CAD cell seeing light

- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control.

If the amber **LED remains on** **A** with a wire detached, the control is defective.

If amber **LED goes off** **A**, control is OK, and:

- light is leaking into the burner housing, *or*
- CAD cell is defective, *or*
- there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (**A** **R** flashing red LED)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (**A** **R** red LED on)

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve (if used) stuck in closed position.
- Check wiring connections.



- Interrupted duty ignition
- Recycle on flame failure
- Serviceman reset protection
(Latch-up after three consecutive lockouts ⁽¹⁾)
- Diagnostic LED's
- Valve delay on/motor delay off
(Pre/post purge — contact Carlin for available timings)
- 15-second TFI (trial for ignition)(other timings available)
(1.3-second flame failure response time (FFRT))
- Alarm contacts
- Thermostat/aquastat compatible
- SMC Technology ⁽²⁾

Power input (red/white wire)	120 VAC, 60 HZ, 9 VA
Limit circuit input (black wire)	120 VAC, 60 HZ
Motor load	10 FLA, 60 LRA
Ignitor load	120 VAC, 60 HZ, 500 VA
Valve load	120 VAC, 60 HZ, 0.3 A
Alarm contacts	24 V, AC/DC, 2 A
Operating temperature limits	+32°F to +140°F
Storage temperature limits	-40°F to +185°F
Thermostat anticipator current	0.2 A, AC
Cad cell resistance — WITH FLAME	R < 1500 OHMS
Agencies	UL recognized (US) CSA certified (Canada)

(1) Latch-up mode shuts down the control after three consecutive lockouts, and requires a special procedure to reset. This ensures the owner will call in a technician to troubleshoot burner problems.

(2) The 60200 provides two motor relays. Carlin's patented SMC technology (Safety Monitoring Circuit) monitors the contacts of both motor relays. **Lockout** occurs if a motor relay contact is found closed when it should be open. The second motor relay ensures motor shutdown even if the first motor relay fails.

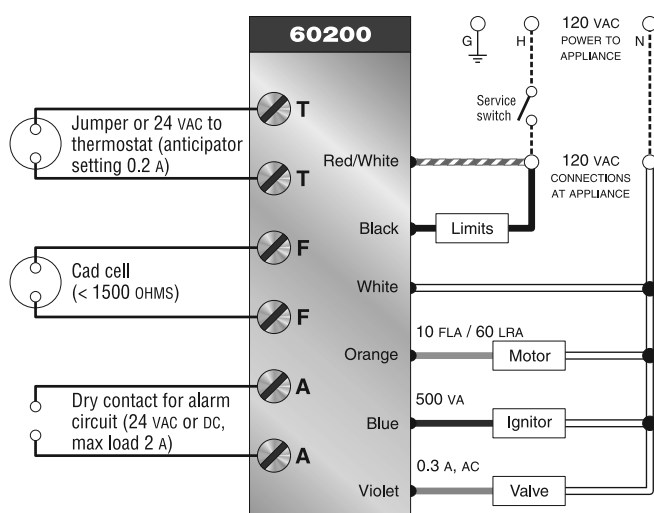
MODEL 60200

CAD cell

Microprocessor

Oil primary control

Data sheet



Installing and wiring

Warning — The 60200 control must be installed and serviced only by a qualified service technician.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
2. Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.
3. Alarm terminals provide a 24 VAC-rated dry contact, suitable for use with security/fire alarm systems such as Carlin SecureHeat™.

Mounting

- The control may be mounted on a 4" x 4" junction box in any convenient location on the burner, furnace or wall. The location must not exceed the ambient temperature limit, 140°F.

Wiring

- Wiring must comply with local and national electrical codes, and in accordance with the wiring diagram above.

Field checks

1. **Safety timing (TFI) test** — Remove one cad cell wire (F-F). Start burner. After the pre-purge period (valve delay on), the control should lockout within the TFI time limit. Replace cad cell wire.
2. **Flame failure/recycle test** — Start burner. After flame is established (after TFI period), close the oil supply hand valve. This will cause a flame failure sequence as described on the reverse side of this Data sheet. The control should recycle (restart after 65 seconds).
3. If control does not operate as described, check the wiring.


Model 60200 Microprocessor oil primary control — Data sheet — Operation/Troubleshooting

Start-up & operation

WARNING























Do not start the burner if the combustion chamber contains oil or oil vapor.

NOTICE

Per UL requirements, the control will not turn on if the cad cell senses flame during the self-test. If the cad cell sees light, the control will remain in self-test mode until the cad cell no longer senses light (flame). The amber LED will remain on, but blink off momentarily  every 3 to 4 seconds.

NOTICE

Check 60200 control label for trial for ignition (TFI), pre-purge and post-purge timings.

-   **Power ON** Open all manual oil line valves. Close the line switch. (If Red LED turns on constant , control is in lockout. See below to reset.)
-   **Self-test 1** (*Revision B controls only*) The control performs a “boot-up” test to verify internal operation each time power is applied to the red/white wire. About 4 seconds after power application, the amber LED turns on. The test continues for about 6 more seconds. If the test fails, the control turns the amber LED off and repeats this test sequence until successful.
-   **Stand-by** (No call for heat) If Self-test 1 is successful, amber LED turns off and control waits for heat call.
-   **Call for heat** Set thermostat (or limit) to call for heat. Thermostat circuit must be closed and power coming to black wire from limit circuit.
- Self-test 2** The amber LED turns on. For the first 3 to 4 seconds, the control performs a self-test. If the cad cell senses flame, the control repeats this test until flame is no longer detected. During this time, the amber LED will remain on, but blink off momentarily  every 3 to 4 seconds. If the control detects motor contacts closed, lockout occurs.
-   **Burner on** After the self-test, amber LED turns off. The *ignitor* starts, followed 1 second later by the *motor*. (This delay compensates for sluggish start-up of some AC transformers.)
-   **Pre-purge** The *oil valve* opens after the valve delay-on period (pre-purge). (For oil valve delay on operation, wire oil valve to the violet lead. If not using an oil valve, cap the violet lead to automatically disable pre-purge and post-purge.)
-   **TFI** The cad cell must sense flame within the TFI time limit (trial for ignition). After cad cell senses flame, the ignitor stays on another 10 seconds (flame stabilization period).
-   **Run** The burner continues firing during call for heat if the cad cell senses flame. Both LED's are off during normal running.
-   **Lockout** If cad cell does not sense flame within the TFI time limit after burner starts, **lockout** occurs. The control turns the red LED on constant, and closes the *alarm* contact.
- To Reset** Push in and hold reset button for 1 second, then release.
-   **Latch-up** If the control locks out **3 times** during a single call for heat, **latch-up** occurs. The control turns on both the amber and red LED's constant. You must use the special procedure below to reset the control after latch-up.

WARNING

Reset after latch-up — Only a qualified service technician should attempt to reset the control after latch-up. The problem that caused the repeated burner problems must be corrected before returning the burner to normal operation.










Push in and hold the reset button for about 10 seconds. The amber and red LED's will begin to flash alternately.










After the LED's begin flashing, continue holding the reset button for about another 20 seconds. The LED's will turn off. Release the reset button and the control will restart. (Releasing the button before the LED's turn off will cause the control to remain in latch-up.)

NOTICE

The 60200 control will not reset from lockout or latch-up if power is interrupted.

-   **Flame failure** If the cad cell loses flame signal during operation (after the TFI), the red LED flashes. The *oil valve* closes within 2 seconds. The *motor* remains on for the motor delay off period, then shuts off. (If no oil valve is wired to the control, the burner shuts down within 2 seconds.) **Recycle:** Control waits for 65 seconds (with red LED flashing), then begins again at **Self-test 2**. Red LED goes off .
-   **Post-purge** Set thermostat (or aquastat) to stop call for heat. The *oil valve* (if installed) will turn off within 2 seconds. The *motor* remains on for the motor delay off period (post-purge), then turns off. (If no oil valve is wired to the control, the burner shuts off within 2 seconds after end of call for heat. There is no post-purge.)
-   **Stand-by** Control remains in stand-by mode until limit circuit sends power to the black wire and thermostat circuit closes (call for heat).

Model 60200 diagnostic LED's

-  — Red OFF  — Red ON  — Red FLASHING
-  — Amber OFF  — Amber ON  — Amber FLASHING
-  — Amber BLINKING (blinks off momentarily every 3 to 4 seconds)

Service & Troubleshooting

Burner (control) will not come on



No power to control

- Check line voltage to the control (at least 102 vac).
- Check all electrical connections.





Control is in lockout

- Red LED will be on. Press the reset button for 1 second.
- If the control returns immediately to lockout, the Safety Monitoring Circuit may have detected an internal control problem. Replace the control.



CAD cell seeing light

- Amber LED blinks off each 3 to 4 seconds. Remove one yellow lead from FF terminal on the control. If the amber **LED remains on**  with a wire detached, the control is defective. If amber **LED goes off** , control is OK, and:
 - light is leaking into the burner housing, *OR*
 - CAD cell is defective, *OR*
 - there is a problem with the CAD cell wiring or holder.
- If appliance was recently shut down, CAD cell may see residual hot spots in chamber.

To troubleshoot:

- **Check CAD cell** by unplugging it and measuring the resistance across its pins: dark resistance at least 50 KOHMS; room light resistance less than 10 KOHMS. Replace if necessary. If the CAD cell functions properly, reinstall the cell and close the burner housing.
- **Check for stray light** by measuring the CAD cell resistance looking into the inactive combustion chamber. It should read at least 50 KOHMS.

Repeated flame failures (flashing red LED)

Check for:

- CAD cell is defective.
- Air leaking into oil line causing flame out — Check oil line connections and filter gasket.
- Defective nozzle causing flame to be erratic — Change nozzle.
- Excessive airflow or draft causing flame to leave burner head — Check for proper air band setting and draft.
- Excessive back pressure causing flame to be erratic — Check appliance and flue for sooting/plugging.

Control locks out after TFI (red LED on)

Check for:

- No oil to burner — Check oil supply, filter, lines.
- Shorted electrodes — Inspect for cracked porcelain and replace as needed.
- Poor spark — Check electrode spacing and condition per burner manual. Replace or realign if necessary.
- Nozzle clogged — Replace nozzle.
- Airflow too high — Check air band setting.
- Ignitor module defective — Replace if no spark.
- CAD cell defective.
- Oil valve stuck in closed position.
- Check wiring connections.



- 14,000-volt and 20,000-volt output for smoother ignition
- Solid state technology yields high performance, long life and durability
- Constant-duty rated
- Low current draw saves electricity
- Epoxy sealant provides water resistance and heat dissipation
- Consistent voltage output across a wide range of input voltages
- Easy testing — 41000 ignitor spark can jump $\frac{3}{4}$ " gap

MODELS **41000** **40700 & 40900**

14-kV & 20-kV continuous-duty
Electronic ignitors

Data sheet

Installing and wiring

WARNING Carlin ignitors and ignitor kits must be installed and serviced only by a qualified burner service technician. Always disconnect power source before wiring to avoid electrical shock or damage to electrical components.

1. Carlin 41000 series ignitors can be mounted directly on top of the burner housing or other location, in the same manner as standard transformers. See back side of this sheet for available mounting plates and kits.

WARNING Mounting **40900** ignitors — **Mount 40900 ignitors ONLY on burner cover plate** so air blows across bottom of ignitor at all times during operation. Consult factory for details.

2. Disconnect electrical power to the burner. Disconnect wires from primary control to existing ignition transformer or ignitor.
3. Remove any screws securing ignition transformer or ignitor.
4. Observe the routing of electrical wiring from burner junction box to ignition transformer or ignitor.
5. Remove existing ignition transformer or ignitor.
6. Install new ignitor, reversing the above steps. Install, connect and route the ignitor wiring the same as the original ignition transformer or ignitor wiring was installed.
7. Make sure the ignitor is firmly attached and that all electrical connections meet local codes before applying power.

Field check

WARNING Never test an ignitor by placing a screwdriver (or other metallic object) across the high voltage clips. Check 40700 & 40900 ignitors only by observing spark at appliance ignition electrodes, with fuel supply **OFF**. Using any other method could cause ignitor damage and severe personal injury.

1. Checking 41000 ignitors only:
 - Disconnect electrical power to burner.
 - Remove hold down clips or screws. Lift ignitor mounting plate to the full-open position. Set high voltage clips to a $\frac{1}{8}$ " to $\frac{3}{4}$ " gap.
 - Carefully energize ignitor and check for spark arcing at the high voltage terminals. If spark jumps the gap, ignitor is good.

Ignitor model	41000	40700	40900
Power input	120 VAC, 60 HZ, 40 VA	208 – 240 VAC, 50/60 HZ, 60 VA	12 VDC, 50 VA
Ignitor output	14 KV, 35 mA RMS	14 KV, 35 mA RMS	20 KV, 28 mA RMS
Secondary grounding	Midpoint	Midpoint	Midpoint
Operating temperature limits	+32°F to +140°F	+32°F to +140°F	+32°F to +140°F
Storage temperature limits	-40°F to +185°F	-40°F to +185°F	-40°F to +185°F
Agencies	UL recognized (US) CSA certified (Canada)	NA	NA

Models 41000/40700/40900 14-kv & 20-kv electronic ignitors & kits — Part numbers

41000 Replacement Ignitors with Base Plates (Note 1)



Application	Part Number
ABC Bantom T-29-15 constant duty ignitor	41000-S0-BAN
ABC Sunray D & LC T-34-B constant duty ignitor	41000-S0-SUN
Aero constant duty ignitor	41000-S0-AR
Beckett AF, AFG constant duty ignitor	41000-S0-BK1
Beckett S, SR constant duty ignitor	41000-S0-BK2
Carlin constant duty ignitor (EZ, 99, 100 & 102)	41000-S0-CAS
Carlin constant duty ignitor (201-301CRD)	41000-S0-SC
Carlin constant duty ignitor (601CRD-1150FFD)	41000-S0-LC
Wayne E constant duty ignitor	41000-S0-WA2
Wayne HS constant duty ignitor	41000-S0-WA1
Wayne M constant duty ignitor	41000-S0-WA3
Weil-McLain QB constant duty ignitor	41000-S0-WM

Note 1 Above base-plate-mounted ignitors are for the 41000 ignitor only. Consult factory for part number and availability of base-plate-mounted 40700 or 40900 ignitors.

Base Plate Kits (Use only for 41000 ignitors) (Note 1)



Application	Part Number
ABC Bantom T-29-15	41020-00-BAN
ABC Sunray D & LC T-34-B	41020-00-SUN
Aero	41020-00-AR
Beckett AF, AFG	41020-00-BK1
Beckett S, SR	41020-00-BK2
Carlin residential	41020-00-CAS
Carlin small commercial (201-301CRD)	41020-00-CSC
Carlin large commercial (601CRD-1150FFD)	41020-00-CLC
Wayne E	41020-00-WA2
Wayne HS	41020-00-WA1
Wayne M	41020-00-WA3
Weil-McLain QB	41020-00-WM

Note 1 Above base plates can be used only with 41000 ignitors. Model 40700 & 40900 ignitors may require special base plates. Consult factory for availability and part numbers.

Constant Duty Ignitor Only (No Base Plate)



Application	Part Number
Constant duty ignitor only, 120 VAC	41000-S
Constant duty ignitor only, 208/240 VAC	40700-S
Constant duty ignitor only, 12 VDC	40900-S

Universal Ignitor Kit (For 41000 ignitors only)



Application	Part Number
Universal ignitor kit in tote box	41000-S0-KIT

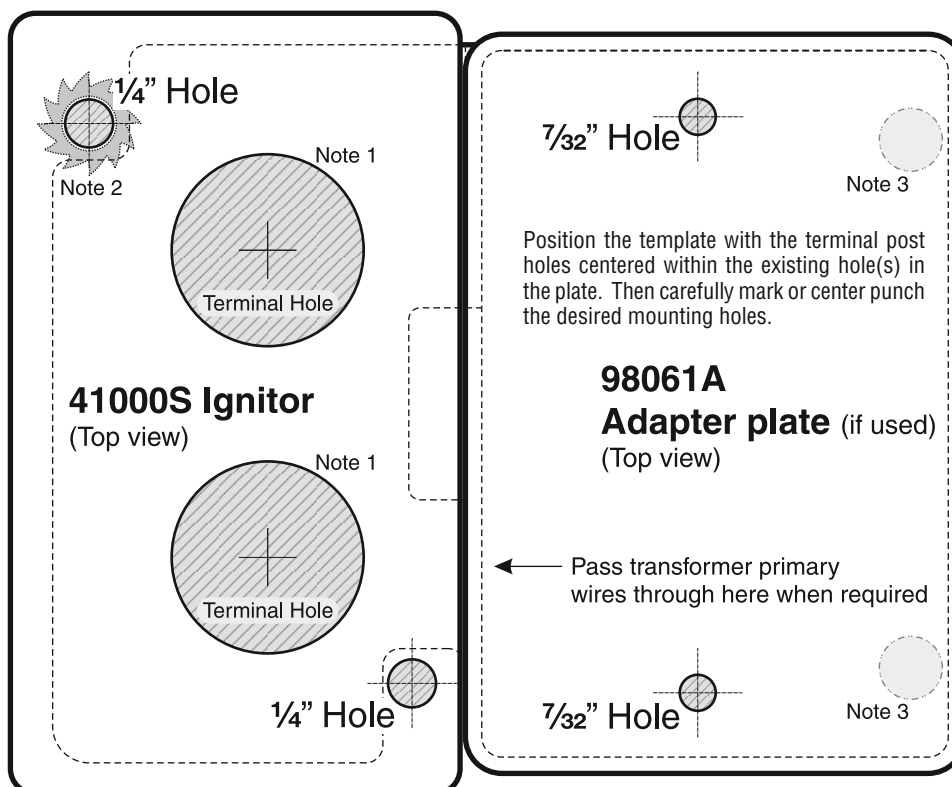
Mounting hole template (41000 & 40700 ONLY)

- Use the template at right to drill clearance holes in the base plate to replace an existing ignitor or transformer with a Carlin 41000 or 40700 ignitor.

NOTICE Mounting **40900** ignitors — Do not use this template for 40900 ignitors. Consult Carlin for 40900 applications.

98061A adapter plate

- Obtain a **98061A-S** kit when needed for wire routing or to cover an existing baseplate opening. The kit contains the plate and mounting screws.
- Note 1: The opening, or openings, in the plate must clear the ignitor posts. Holes must be no smaller than in template.
- Note 2: Place the star lock wash under the screw head of this mounting screw. This is required to ensure good ground contact with the base plate.
- Note 3: Knock out the plastic centers of these two holes for access to Beckett base plate screws.





■ More **Efficient** —

- both starting and running

■ More **Reliable** —

- auto reset thermal overload
- **quiet** sealed ball bearings
- eliminates centrifugal start switch
- 3-year warranty
- UL recognized

■ More **Versatile** —

- replace 1/15 to 1/4 HP motors
- replaceable capacitor

MODEL **PSC** motors

98022 • 98611 • 98627
98628 • 98629 • 98630 • 98866

Data sheet

Installing and wiring

WARNING Carlin PSC motors must be installed and serviced only by a qualified service technician.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the electrical components. All wiring must comply with applicable codes and ordinances.
2. Disconnect existing motor lead wires from control wiring. Release motor lead wire strain relief bushing at junction box entrance. Pull wire from junction box.
3. Remove mounting bolts securing existing motor to blower housing.
4. Remove motor from burner.
5. Oil burners: Check condition of oil pump coupling and coupling ends. Replace if necessary.
6. Remove blower wheel from existing motor. (Clean the wheel if needed to remove lint and other debris.)
7. Install blower wheel on the new Carlin PSC motor. See burner manual for correct gap between blower wheel and motor rabbet.
8. Mount new motor on blower housing. Tighten bolts evenly to prevent misalignment of the motor/blower wheel on housing.
9. Insert motor wires through strain relief bushing and connect to control wires.

Application tips

1. Use Carlin PSC motors for all replacement motors on oil and gas burners.
2. The Carlin PSC motor design allows air to flow through the motor into the blower housing, providing necessary cooling.
3. The high running torque of the PSC design ensures more consistent air flow to the burner head. Perform a combustion test with the new motor installed, and set the air adjustments as needed to provide the CO₂ (O₂) specified in the appliance manual.
4. Thermal overload — Overload will trip after approximately 3 minutes of running at locked rotor condition. Switch will cool and reset automatically.

Part number:	98022	98611	98627	98628	98629	98630	98866
Power input (VAC, 1-PHASE)	120	120	220 / 240	120	120	120	120
Frequency (HZ)	60	60	50/60	60	60	60	60
Rating (HP)	1/6	1/6	1/6	1/6	1/15	1/4	1/6
Starting/running currents (AMPS RMS)	6.1 / 1.8	6.1 / 1.8	3.9 / 1.0	6.1 / 1.8	4.3 / 1.25	12.1 / 2.7	4.3 / 1.25
Speed (RPM)	3450	3450	2840/3390	3450	3450	3450	1725
Frame	48M	48N	48M	48N5	48M	48N	48N
Lead length (INCHES)	10	10	10	20	10	10	10
Rotation (LOOKING FROM REAR)	clockwise	clockwise	clockwise	counterclockwise	clockwise	clockwise	clockwise
Capacitor location (LOOKING FROM REAR)	9:00	9:00	9:00	6:00	9:00	9:00	9:00
Capacitor (µF)	16	16	5	16	12.5	25	14
Part number	98022CAP	98022CAP	98627CAP	98022CAP	98629CAP	98630CAP	98866CAP
Agencies	UL & CUL recognized						

PSC Motors — Data sheet — Construction/Operation/Troubleshooting/Dimensions

Construction

- All Carlin PSC motors are cast aluminum and Class A insulation.
- The Carlin PSC Motor utilizes a capacitor to assist startup and run of the motor. This eliminates the need for a start switch used in the split phase motor. The Carlin motor capacitor is field replaceable for ease of service.
- The Carlin PSC Motor has sealed ball bearings — not sleeve bearings. The ball bearings are sealed and permanently lubricated — no oiling required. Ball bearing design eliminates much of the end play of typical motor shafts, and allows for more consistent air flow to the combustion head.
- Automatic thermal overload protection system — far more tolerant of overloads than manual reset configurations. Automatic reset eliminates nuisance service calls caused by manual overload reset switch failures and overloads due to temporary voltage fluctuations.
- The motor capacitor is located for convenient mounting to any burner with or without an electrical box over the motor.
- Electrical leads are long enough for easy installation on any manufacturer's burner.

Operation

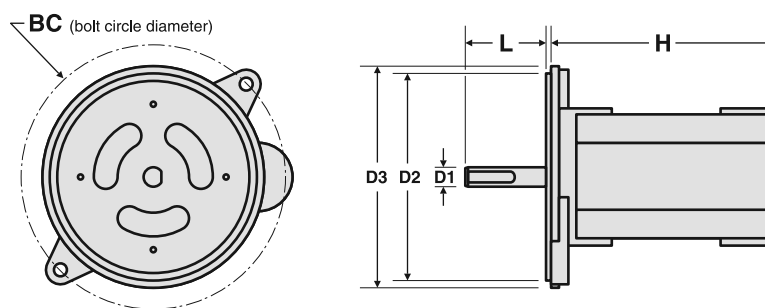
- The superior design and construction of the Carlin PSC motor allow for more consistent airflow to the combustion head of the burner.
NOTICE: As with any component change on a burner, when installing the Carlin PSC motor you should expect performance changes to the burner. The installing technician must perform a combustion test to determine how the airflow to the burner was affected by the new motor. The Carlin PSC motor will usually provide more airflow through the burner than a typical split phase motor.
- Carlin PSC motors use less than half the starting amps and have significantly lower running amps.
- You will notice a significant reduction in mechanical noise emission from the Carlin PSC motor compared to a typical split phase motor.

Troubleshooting

To check the capacitor operation:

1. Disconnect electrical power to the burner.
2. Use insulated electrical pliers to carefully remove the two wires from the capacitor, one at a time.
 Electrical shock hazard. Do not attempt to reinstall a capacitor removed from use until you have followed the procedure below to remove any stored charge. Handle the capacitor with care, avoiding contact with the terminals. Failure to comply could result in severe personal injury or death.
3. You must discharge the capacitor in case it holds any stored charge. Use a shorting bar if available, specifically designed for this purpose. (Do not attempt to use a screwdriver or any other device.) Connect the shorting bar to one capacitor terminal and lay the other end on the other terminal. If there is a residual charge, a spark will occur. Keep your hands away from the terminals. Do not discharge the capacitor if there are flammable liquids or vapors near your work area. An explosion could occur.
4. You will need an ohmmeter, preferably a VOM (analog meter). Digital meters may not respond quickly enough to resistance changes. Connect one meter lead to each of the capacitor terminals. The meter should show to a non-infinite reading immediately and then rapidly increase to an infinity reading (within about a second). If the meter stays on a non-infinite reading, the capacitor has an open circuit. If the meter reads a constant zero ohm reading, the capacitor has a short. Replace the capacitor if either of these conditions occurs.
5. To order replacements, see table on front page for part numbers of motors and capacitors.

Dimensions (inches)



Motor Part Number	Dimensions (inches)		Motor Part Number	Dimensions (inches)	
	H	L		H	L
98022	4.29	1.85	98611 / 98866	4.29 / 4.69	1.85
	0.500	5.50		0.500	6.375
98627	4.29	1.85	98628	4.29	0.74
	0.500	5.50		0.500	110 mm
98629	3.52	1.14	98630	4.73	1.85
	0.500	5.50		0.500	6.375



SVC10-FF (valve only)



- Instant opening
- Normally-closed, two-way
- UL recognized as a safety shut-off valve
- SVC-10FF available in field retrofit kit (part number 98289)

VALVE MODEL	Coil type (see right)	Voltage	Power	Inlet/outlet
SVC-01FF	F	12 VDC	10 WATTS	female/female
SVC-01MF				male/female
SVC-10FF	M	120 VAC 50/60 HZ 1-PHASE	9 WATTS	female/female
SVC-10MF				male/female
SVC-11FF	F		10 WATTS	female/female
SVC-11MF				male/female
SVC-20FF	M		9 WATTS	female/female
SVC-20MF				male/female
SVC-21FF	F		10 WATTS	female/female
SVC-21MF				male/female

MODEL

SVC

Oil valve

AND P/N

98289

Oil valve kit

Data sheet

Kit # 98289 (SVC10-FF only)



Installing and wiring

WARNING The Carlin SVC oil valve or oil valve kit must be installed and serviced only by a qualified burner service technician.

See back page for kit installation instructions.

Application tips

1. Carlin solenoid oil safety shut-off valves help to provide years of safe, efficient oil burner performance while adding reliability to the burner and oil delivery system.
2. Carlin's SVC oil valves are direct-acting, two-way, normally-closed. Use on single or two-pipe oil systems to isolate the fuel pump, preventing the possibility of oil tank siphoning.
3. Carefully review the burner instruction manual when applying to ensure the oil valve is correctly wired and the burner fuel lines are correctly installed.

GENERAL SPECIFICATIONS

M-type coil	<ul style="list-style-type: none"> • Two-wire lead by 27.67 inches (700 mm) • Molded hub for attachment of flexible metal conduit • Not intended for use with rigid conduit
F-Type coil	<ul style="list-style-type: none"> • JIC connector • No conduit hub or lead wires
Fluid rating	• #1 or #2 fuel oil; kerosene; waste oil
Maximum pressure	• 355 PSIG
Inlet/outlet size	• 1/8" NPT (see left for male or female)
Orifice size	• 2 mm
Body/spring	• Brass/stainless steel
Agencies	• UL & CUL recognized (UL429, File MH26469)

P/N 98289 Oil valve kit — Installing/wiring/kit contents

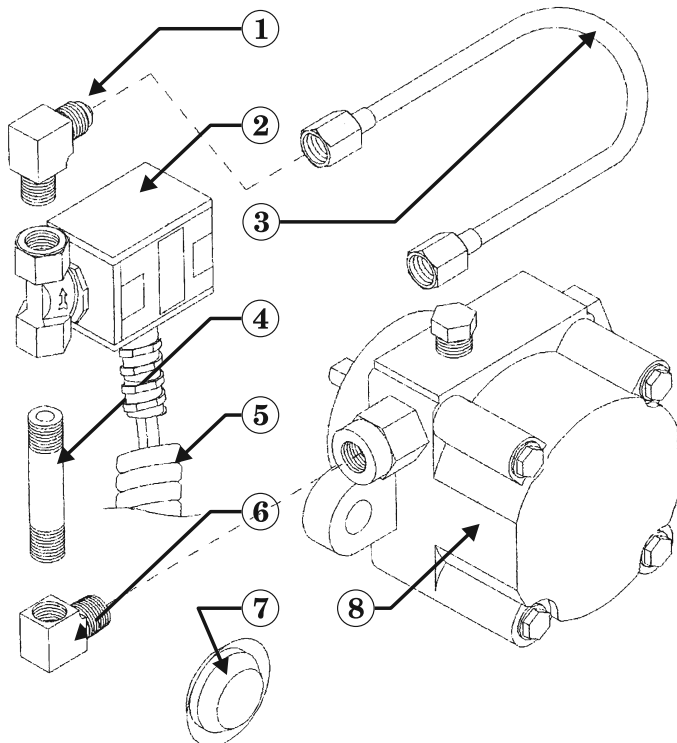
Installing and wiring (P/N 98289 kit)

WARNING The Carlin SVC oil valve or oil valve kit must be installed and serviced only by a qualified burner service technician. Follow burner manufacturer's instructions for installation of oil valve.

1. Always disconnect power source before wiring to avoid electrical shock or damage to the electrical components. All wiring must comply with applicable codes and ordinances.
2. Remove existing nozzle line(s), oil valve (if installed) and fuel unit (oil pump) from the burner housing.
3. Remove and **save** the male elbow fitting from the fuel unit nozzle port. Assemble/install fittings and valve as shown below (use thread sealant/lubricant on all threads).

WARNING Do not use pipe sealing tape (such as Teflon) to seal pipe joints. Tape fragments can dislodge, enter burner fuel unit and lines and cause erratic or unsafe operation. Use only appropriate pipe dope, applied sparingly, to seal joints.

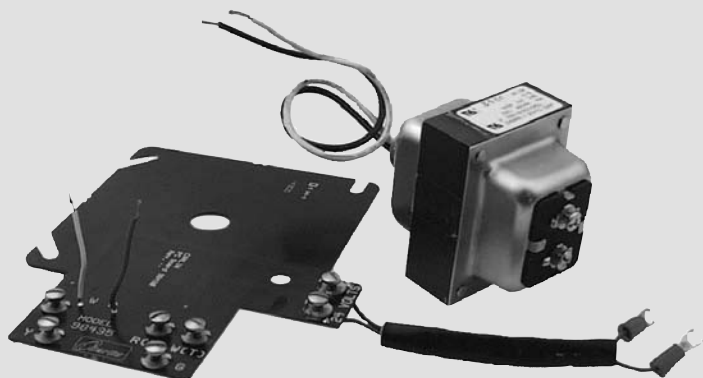
4. Reinstall all components on burner.
5. Remove middle knockout from boiler side of junction box and install a BX connector.
6. Thread flexible metal conduit onto pigtail of oil valve. Connect other end to connector at junction box.
7. Connect one valve lead to power source (violet lead of 60200 control, or orange lead or separate time delay lead for other control, or other lead if specified by control manufacturer). Connect second valve lead to common.
8. Install plastic plug in unused fuel unit tapping left by existing oil valve (if equipped).



P/N 98289 Kit contents



Item	Description	Part number
1	Existing fitting from fuel unit	NOT included
2	Carlin oil valve	SVC10FF
3	Oil line (bend to fit application)	75382
4	Brass nipple, 1/8" NPT x 1 1/2"	98194
5	BX conduit, 3/8" x 16 1/2"	82941
	Conduit bushing, 3/8"	34645
	BX connector, 3/8"	34173
6	Street elbow, brass, 1/8" NPT	118-2671-001
7	Plastic plug, 7/8"	36814
8	Fuel unit	NOT included



- Interfaces with any Carlin primary control
- Terminals C, Y and G connect to cooling equipment
- Kit includes 40 VA transformer, 120/24 VAC
- Designed for quick installation
- Direct replacement, without rewiring, for Honeywell R8184M
- Low-cost upgrade to 'M' type control, with a high-performance Carlin primary

Transformer input (primary)	120 VAC, 60 HZ
Transformer output (secondary)	24 VAC, 60 HZ, 40 VA
Control specifications	Refer to primary control Data sheet

Installing and wiring

Warning

1. The 98435 kit must be installed only by a qualified service technician.
2. Always disconnect power source before wiring to avoid electrical shock or damage to the control. All wiring must comply with applicable codes and ordinances.
3. Thermostat terminals (T-T) provide a current source. Never apply external power to these terminals under any circumstances.

Mounting

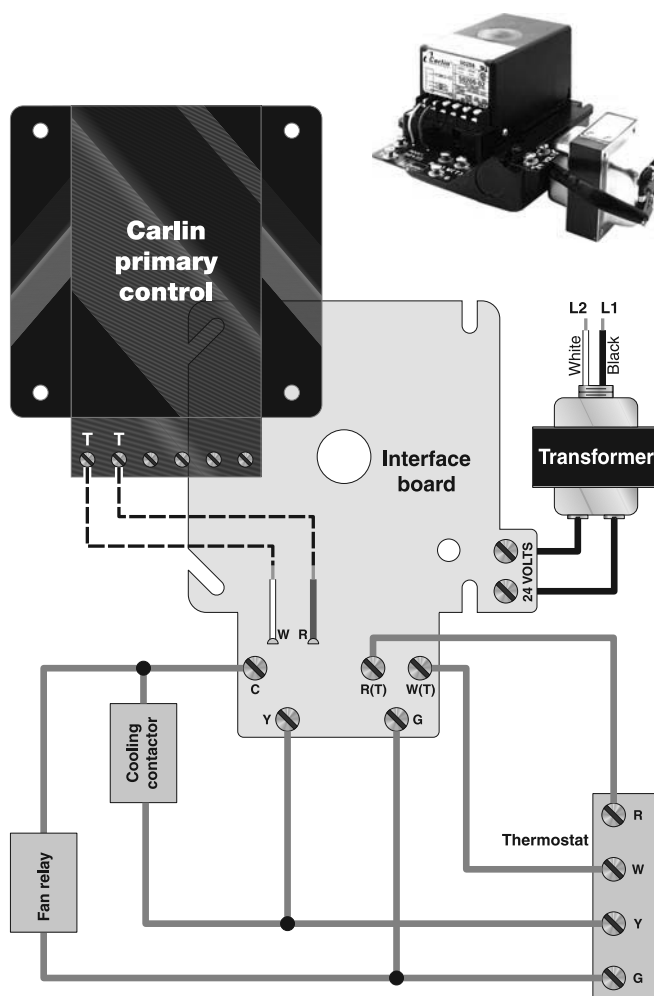
- Mount the Interface board on the burner 4x4 junction box as shown in typical installation photo above, right column. Insert the transformer hub through a junction box knockout and secure with lock nut.
- The control location must not exceed the ambient temperature limit, listed in the primary control Data sheet.

MODEL 98435

Kool Kit primary control

cooling circuit interface

Data sheet



Wiring

- Wiring must comply with local and national electrical codes, and in accordance with the wiring diagram above.
- Use longer wires to connect transformer to board if necessary. Wire the primary control per burner and control instructions. Wire control terminals T-T as shown above only.

Field checks

1. **Fan and cooling check** — Set thermostat to call for cooling or fan. Verify correct operation.
2. **Heating control check** — Set thermostat to call for heat. Follow the primary control Data sheet checkout procedure to verify.
3. If control does not operate correctly, check all wiring and wiring connections.



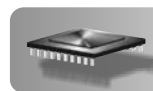


- **Multiple sensor option (1 or 2)**
(Using individual and/or dual sensor assemblies)
- **Easy remote sense**
(Electronic sensors, wired to control)
- **Smart manual reset**
(Manual reset only if operating limit doesn't open)
- **Serviceman reset protection**
(Latch-up after three consecutive lockouts ⁽¹⁾)
- **Power-independent lockout**
(Power cycling won't reset from lockout or latch-up)
- **Diagnostic LED's**
(Power, call for heat, and lockout/latchup)
- **SMC Technology** ⁽²⁾

- (1) Latch-up mode shuts down the control after three consecutive lockouts, and requires a special procedure to reset. This ensures the owner will call in a licensed technician to troubleshoot and correct burner problems.
- (2) The 90000 provides two limit relays. Carlin's patented SMC technology (Safety Monitoring Circuit) monitors the contacts of both relays. Lockout occurs if a limit relay contact is found closed when it should be open.

EZ-Temp™

MODEL 90000



Microprocessor
Temperature Controls

Data sheet

Specifications

- Carlin's Model 90000 microprocessor-operated, multiple-contact temperature limit controls are available in four configurations, described below. Each model provides two contacts — one for operating limit and one from high limit.
- Refer to separate product listing sheets for pre-defined models, or request a control to meet your specifications, within the available ranges listed below.

	90000A 90000AL	Dual limit temperature control <ul style="list-style-type: none"> • Operating and high limit action • Smart manual reset on high limit • 2 electronic sensors (operating and high limit) • Independent operating limit contact • Independent high limit contact
	90000B 90000BL	Temperature limit control <ul style="list-style-type: none"> • Operating and high limit action • Smart manual reset on high limit • 1 electronic sensor • Operating and limit contacts in series
	90000C 90000CL	Redundant limit temperature control <ul style="list-style-type: none"> • Operating and high limit action • Smart manual reset on high limit • 2 electronic sensors (operating and high limit) • Operating and limit contacts in series
	90000CE 90000CEL	Combination operating limit and manual reset high limit control <ul style="list-style-type: none"> • Independent operating limit contact • Independent high limit contact • Operating and limit contacts in series • 2 electronic sensors (operating and high limit) • Lockout on diagnostic failure and limit action • Manual reset from lockout

Control model		A/AL	B/BL	C/CL	CE/CEL
Control power input (red-white wire)		120 VAC, 11 VA			
Contacts		2 independent	2 in series		
Contact rating		Full load Locked rotor			
		120 VAC, 10 AMPS 120 VAC, 60 AMPS			
Wires	Quantity	6	3		
	120 VAC Hot / Neutral	red-white / white			
	Oper. limit IN / OUT	black-green / black	N/A		
	High limit IN / OUT	black-red / black-yellow	N/A		
	Limits OUT	NA	black		
	Adjustable oper. limit range		Any range between 50°F to 240°F		
Fixed high limit temperature		Any value from 160°F to 240°F			Any value from 160°F to 250°F
Fixed differential (subtractive)		Any value from 5°F to 100°F			
Operating temperature limits		+32°F to +140°F			
Storage temperature limits		-40°F to +185°F			
Agencies		ULC Recognized & Listed United States & Canada			

Model 90000 Microprocessor Temperature Controls — Data sheet — Operation & Dimensions

Model 90000A, B & C diagnostic LED's

GREEN (G) — OFF (G) — ON Power (G) — FLASHING Latch-up

RED (R) — OFF (R) — ON Lockout

AMBER (A) — OFF (A) — ON Control call for heat

WARNING Electrical shock hazard: Disconnect power to appliance when wiring or servicing any electrical component.

Operation

(See wiring diagrams below for wiring connections.)

(G) (R) (A) Power OFF

With no power applied to the red-white wire, all lights are off. Power can be wired directly from appliance 120 vac terminal to maintain power at all times. Or jumper red-white wire and black-green wire to cycle power with the appliance limit circuit.

(G) (R) (A) Power ON

When power is applied to the red-white wire, the green LED turns on.

(G) (R) (A) Self-test

When power is applied, the 90000 performs a self-test, checking sensor(s) and microprocessor and verifying limit contacts are open. The power-up test lasts from 3 to 5 seconds. The 90000 continues diagnostic checking during the operating cycle as well. Any self-check failure causes a lockout (see below).

(G) (R) (A) Operate

If the temperature at the operating sensor(s) is below setpoint by at least the fixed differential, the control closes the operating limit contacts. The amber LED turns on.

(G) (R) (A) Stand-by

When the operating sensor(s) see setpoint temperature or above, the 90000 opens the operating limit contact. The amber LED turns off.

(G) (R) (A) Limit action

90000A, B or C: If the high limit sensor(s) see a temperature above high limit setting, the control opens the high limit contacts, turns on the red LED and checks the operating limit contacts. If the operating limit contacts are open, the control will automatically reset when temperature drops below high limit setting minus differential. The high limit contacts close and the red LED turns off. Diagnostic failures invoke "limit action" until cause is cleared.

(G) (R) (A) Lockout

If the high limit sensor(s) sees a temperature above high limit setting and the 90000A, B, or C model finds the operating limit contacts closed, the red LED turns on and lockout occurs. If the high limit sensor on the 90000CE sees a temperature above the high limit setting, the high limit contact opens, the red LED turns on and lockout occurs. When the temperature drops below high limit setting minus differential, reset the control by pressing the manual reset button. The control will not reset by cycling power off and on.

(G) (R) (A) Latch-up

If the 90000 locks out three consecutive times, it enters latch-up. Reset from latch-up requires a special procedure, intended to require *licensed serviceman intervention*. During latch-up, the red LED stays on and the green LED flashes. Reset as follows:

(G) (R) (A) Temperature must be less than high limit setting minus differential.

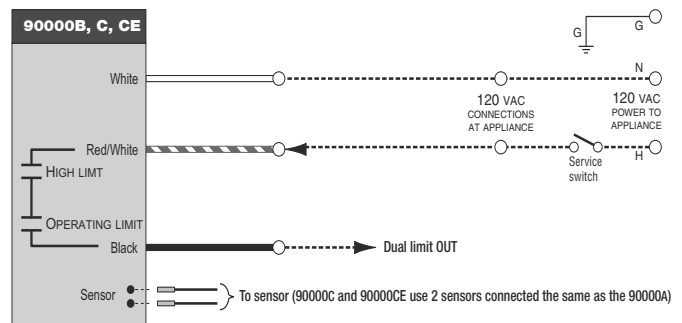
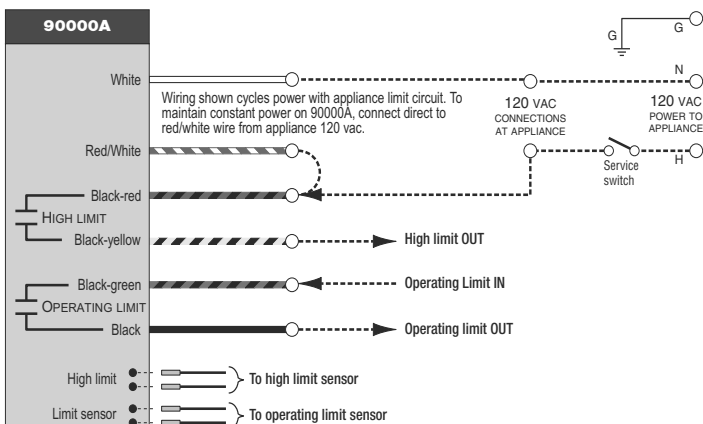
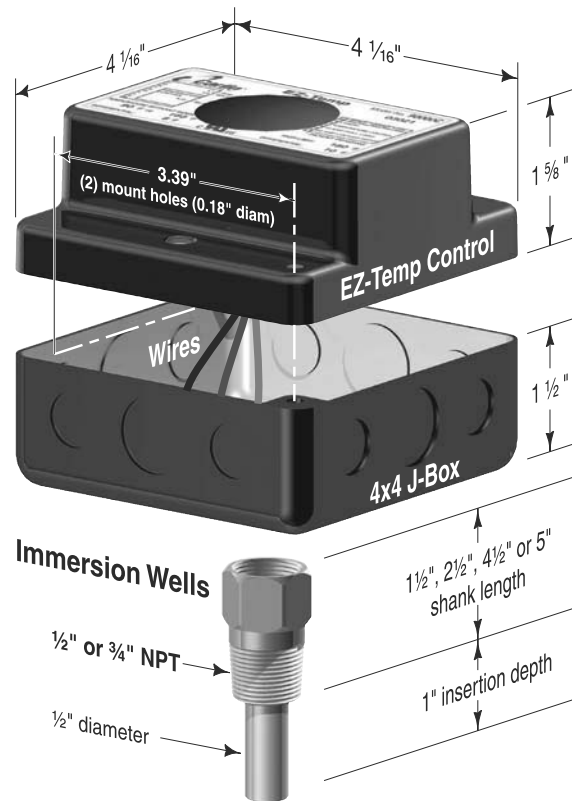
(G) (R) (A) Hold reset button at least 10 seconds. The green LED flashes faster.

(G) (R) (A) Continue holding button another 20 seconds. The control resets and the red LED turns off.

NOTICE Power must flow through the contacts in the direction shown. Changing flow direction will cause the control to lockout or fail to operate.

Configurations

- Control kits** — 90000 controls mount to a standard 4x4 J-box, supplied with the control. Mount the box directly to a well (new or existing) with hardware supplied, or panel mount. See below for dimensions.
- Well kits** — Wells for 90000 sensors are available in the sizes shown below. Well kits include sensor mounting hardware designed to hold sensor securely in position.
- Sensors** — Sensors are available in single and dual configurations.
- Notice: UL-Listed control** — UL-Listed controls are supplied complete with control, J-Box, well, sensor, and mounting hardware.





Microprocessor-operated

(Processor coordinates limit and diagnostic functions)

Easy remote sense

(Electronic sensor, wired to control)

Select from break-on-rise, make-on-rise or SPDT operation

Self-checking program

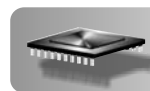
(Control locks out on diagnostic failure)

Diagnostic/status LED's

(LED's indicate power, call for heat, and lockout)

EZ-TempTM

MODEL 90200



Microprocessor
Temperature Controls

Data sheet

Specifications

- Carlin's Model 90200AL, BL, DL and GL microprocessor-operated temperature controls are UL Listed and provided as a complete package, consisting of control, J-box, sensor and well. Model 90200A, B, D or G controls are UL Recognized, and provided as individual components, with J-box, sensor and well available separately.
- Carlin's model 90200 microprocessor-operated temperature controls are available in four configurations described below. Each model provides one limit-duty-rated contact.
- Refer to separate product listing sheets for pre-defined models, or request a control to meet your specifications within the available ranges listed below.

	90200A	Temperature limit control <ul style="list-style-type: none"> 1 break-on-rise contact 1 electronic sensor lockout on diagnostic failure reset from lockout via power cycle
	90200B	Temperature limit control <ul style="list-style-type: none"> 1 make-on-rise contact 1 electronic sensor lockout on diagnostic failure reset from lockout via power cycle
	90200D	Temperature limit control <ul style="list-style-type: none"> SPDT contacts (1 break-/1 make-on-rise) 1 electronic sensor lockout on diagnostic failure reset from lockout via power cycle
	90200G	Temperature limit control <ul style="list-style-type: none"> 1 break-on-rise isolated contact 1 electronic sensor lockout on diagnostic failure reset from lockout via power cycle

Control model	A	B	D	G
Control power input (red-white wire)	120 VAC, 11 VA			
Contacts (action on temperature rise:)	1 (breaks)	1 (makes)	1 (breaks) 1 (makes)	1 (breaks)
Contact rating Full load Locked rotor	120 VAC, 10 AMPS 120 VAC, 60 AMPS			
Wires Quantity	3	3	4	4
120 VAC H & Limit IN / N	red-white / white			
Break-on-rise OUT	black	NA	black	black/ green black
Make-on-rise OUT	NA	blk-white	blk-white	N/A
Adjustable oper. limit range	Any range between 50°F to 240°F			
Fixed differential (subtractive)	Any value from 5°F to 100°F			
Operating temperature limits	+32°F to +140°F			
Storage temperature limits	-40°F to +185°F			
Agencies	UL & ULC Recognized & Listed component United States & Canada			

Model 90200 Microprocessor Temperature Controls — Data sheet — Operation & Dimensions

Model 90200 diagnostic LED's

GREEN	— OFF	— ON Power on	— FLASHING Lockout
Center AMBER	— OFF	— ON Call for low fire (90200G only)	
Right AMBER	— OFF	— ON Control call for heat or high fire	

WARNING Electrical shock hazard: Disconnect power to appliance when wiring or servicing any electrical component.

Operation

(See wiring diagrams below for wiring connections.)

Indicator LED's

90200 controls have a green LED (power/lockout indicator) and center amber LED (Low Fire indicator only present on 90200G) right amber LED (operation or High Fire indicator).

Power OFF With no power applied to the red-white wire, all lights are off.

Power ON When power is applied to the red-white wire, the green and center amber LED's (only present on 90200G) turn on.

Self-test When power is applied, the 90200 performs a self-test, checking the sensor and microprocessor. The power-up test lasts from 3 to 5 seconds.

The 90200 continues diagnostic checking during the operating cycle as well. Any self-check failure causes a lockout (see below).

Call for heat or high fire When the temperature at the operating sensor is below setpoint minus fixed differential, the control powers the limit relay (break-on-rise contact closes; make-on-rise contact opens). The center amber LED (if present) turns off, the right amber LED turns on.

Stand-by or low fire When the operating sensor reaches setpoint temperature or above, the 90200 turns off the relay (break-on-rise contact opens; make-on-rise contact closes). The center amber LED (if present) turns on and the right amber LED turns off.

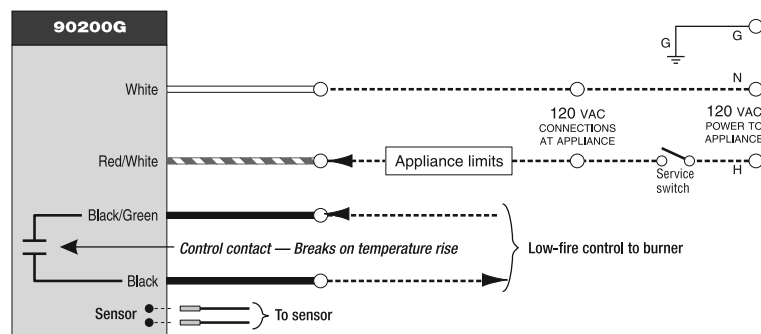
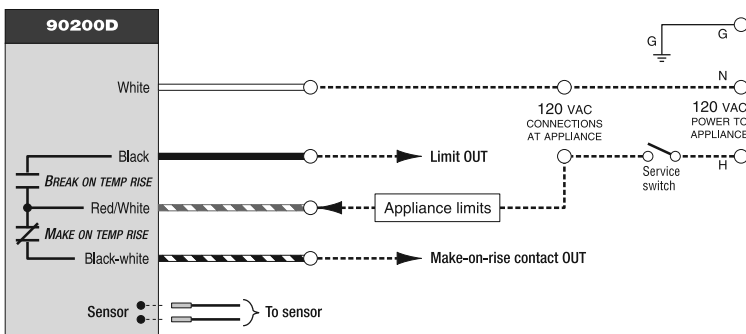
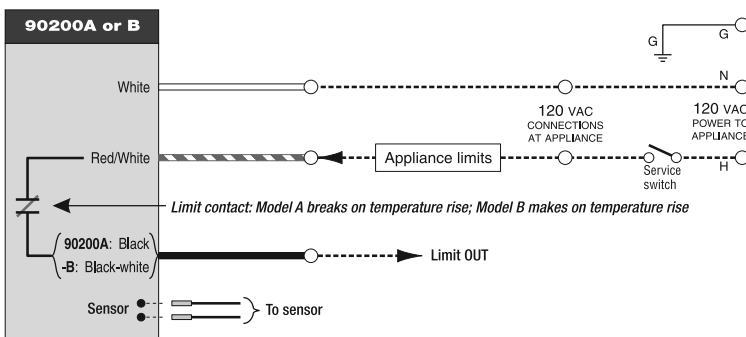
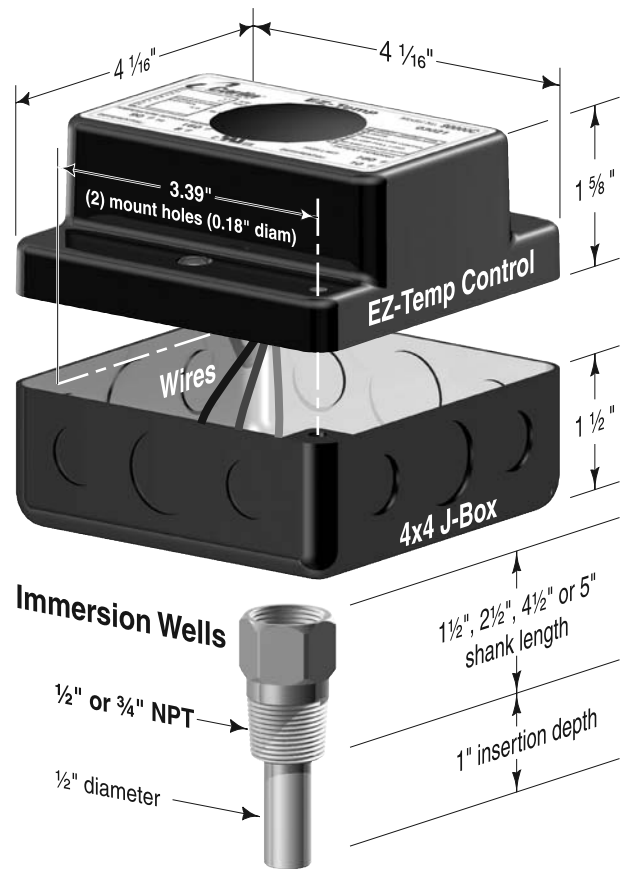
Lockout If the control detects a diagnostic failure, **lockout** occurs. During lockout, the green LED flashes.

After the temperature drops below high limit setting minus differential, reset the control by turning power off, then back on. The green LED will stop flashing.

NOTICE Power must flow through the contacts in the direction shown. Changing flow direction will cause the control to lockout or fail to operate.

Configurations

- Mounting** — 90200A, B, D, and G controls mount to a standard 4x4 J-box, supplied with the control. Mount the box directly to a well (new or existing) with hardware supplied, or panel mount. See below for dimensions.
- Well kits** — Wells for 90200A, B, D, and G sensors are available in the sizes shown below. Well kits include sensor mounting hardware designed to hold sensor securely in position.
- Sensors** — Sensors are available separately for 90200A, B, D, and G only. The sensor is supplied with 90200AL, BL, DL, and GL.
- NOTICE** — UL Listed model 90200AL, BL, DL, GL controls must be shipped complete with a sensor, well and J-box. Only UL recognized component models 90200A, B, D, and G controls can be purchased as individual components.

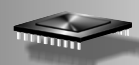




EZ-Temp™

MODEL 90524A

**Triple limit or
Cold-start control**



**Microprocessor
Temperature Controls**

Data sheet



Functions

- Carlin's 90524 triple limit control provides high limit function and can also provide:
 - Minimum water temperature control for operation with a tankless heater in a boiler. (Function can be turned off by turning LOW LIMIT setting to "OFF.")
 - Low temperature limit to prevent flow through boiler if temperature is below preset minimum — for preventing condensation in conventional boilers.
 - Operates as a cold-start control when Low Limit is in "OFF" position.
- Provides input from zone controllers or relays and output to enable circulators.
- Provides operation of burner/gas valve and heating circulator.

Specifications

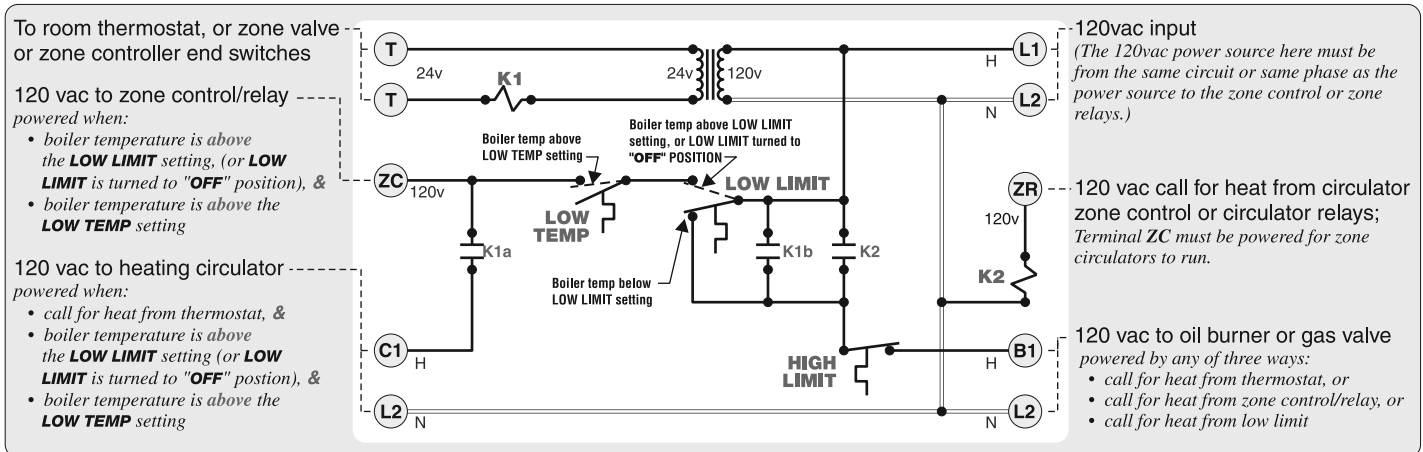
- Carlin's Model 90524 microprocessor-operated temperature controls are described below.
- Refer to separate product listing sheets for pre-defined models, or request a control to meet your specifications, within the available ranges listed below.

Model	90524A
Input power (L1-L2)	120 VAC, 10 VA, 60 Hz
Control power (T-T)	24 VAC, 130 mA
High limit range	Adjustable
High limit differential	Fixed if low limit is used or if differential setpoint is OFF Adjustable if low limit is turned OFF
Low limit range	Adjustable with OFF position
Low limit differential	Adjustable (fixed if differential setpoint is OFF)
Low temp function	Fixed
Low temp differential	Fixed
Temperature ranges	
Setting —	Any value/range between 50° & 250°
Differential —	Any value/range between 5°F and 100°F
Contact ratings	
Full load	Burner, circulator and ZC contacts 120 VAC, 10 amps (total current on all contacts not to exceed 16 amps)
Locked rotor	120 VAC, 60 amps (total current on all contacts not to exceed 96 amps)
Ambient temperature	+32°F to +140°F (0°C to +60°C)
Storage temperature	-40°F to +185°F (-40°C to +85°C)
Agencies	UL Listed US and Canada

- **Easy-wire terminal strip**
- **Microprocessor-operated**
(Processor coordinates operation and diagnostic)
- **Easy remote sense**
(Electronic sensor, wired to control)
- **Self-checking program**
(Control locks out on diagnostic failure)
- **Diagnostic/status LED's**
(LED's indicate power, call for heat, and lockout)
- **SMC technology on burner relay** (lockout when welded contact sensed)

Model 90524 Microprocessor Temperature Controls — Data sheet

Figure 1 Equivalent circuit diagram (the 90524 controls power to the burner and circulators as in the simplified circuit below)



Model 90524 diagnostic LED's

LED's	90524 controls have a green LED (power/lockout indicator) and amber LED's (operation indicator) for Burner and Circulator.
GREEN	<p>ⓐ – OFF ⓐ – ON Power on</p> <p>ⓐ – FLASH Slowly (once per second) <i>Soft lockout</i></p> <p>ⓐ – FLASH Rapidly (twice per second) <i>Hard lockout</i></p>
AMBER	<p>ⓐ – OFF ⓐ – ON Burner on or Circulators powered</p>

LED indications

- ⓐ ⓐ ⓐ **Power OFF** — With no power applied, the thermostat (TT) circuit and all output contacts are de-energized. All LED's are off.
- ⓐ ⓐ ⓐ **Power ON** — When power is applied to the L1/L2 terminals, the thermostat circuit is energized. Voltage (24 VAC) is applied to the thermostat terminals. The 90524 starts a self test to check the sensor and the microprocessor, and to verify that the limit contacts are open. The 90524 becomes fully operational after this 2-second self test.
- ⓐ ⓐ ⓐ or ⓐ ⓐ ⓐ **Soft lockout** — Green light flashing once per second, burner light off, burner contact open, and circulator light on or off — occurs if control senses internal failure or sensor problem (open or shorted sensor). The control will revert to normal operation if the problem is corrected within 15 seconds. Otherwise, the control enters hard lockout.
- ⓐ ⓐ ⓐ **Hard lockout** — Green light flashing twice per second, burner light off and burner contacts open, circulator light on and circulator contacts closed — occurs when burner contact is sensed closed, and does not clear after two attempts. Reset by cycling power off/on.
- ⓐ ⓐ ⓐ **Latchup** — Green light off, burner light off, B1 contact open, circulator light on, and ZC and C1 contacts closed — occurs when burner contact is sensed closed, and does not clear after three attempts. Not resettable — requires control replacement.

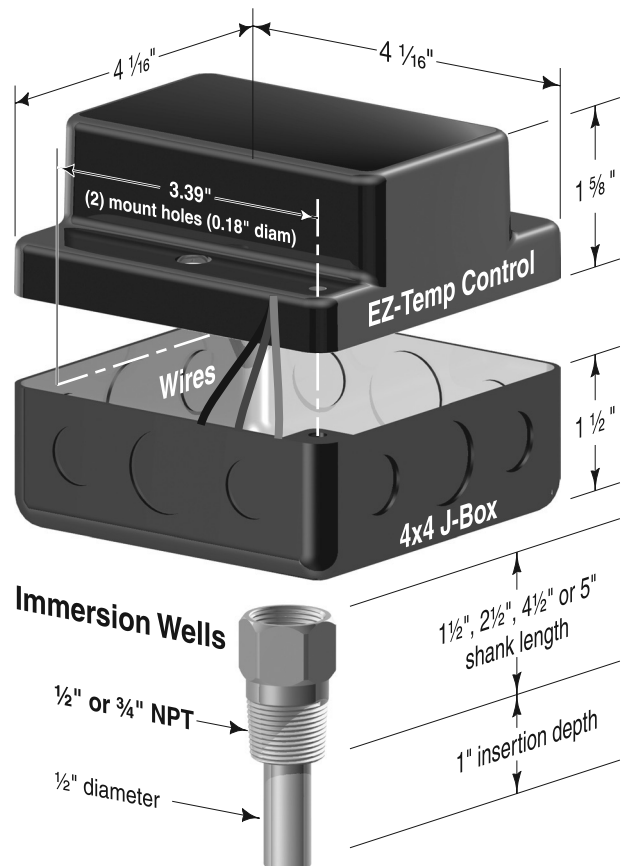
Fault log

90524 controls self monitor and indicate fault conditions with the LED's. Fault conditions are recorded in the retrievable fault log. For applications that might encounter unexplainable control outages, contact Carlin Technical Support for instructions to access the fault log and interpret the results.

Configurations

- Control kits — 90524 controls mount to a standard 4x4 J-box, supplied with the control. Mount the box directly to a well (new or existing) with hardware supplied, or panel mount. See Figure 2 for dimensions.
- Well kits — Wells for 90524 sensors are available in the sizes shown in Figure 2. Well kits include sensor mounting hardware designed to hold sensor securely in position.
- Sensors — Sensors are available in single configurations.

Figure 2 Mounting the 90524



**WARNING**

Installer/servicer — Except where specifically stated otherwise, this manual must be used only by a **qualified service technician**. Read and follow all instructions in this manual and in the appliance manual. Failure to comply with this or other requirements in this manual could result in severe personal injury, death or substantial property damage.

WARNING

This symbol calls out a hazard that could cause severe personal injury, death or substantial property damage if the instructions given are not followed.

NOTICE

Wiring: Refer to EZ-Temp data sheet for wiring information.

EZ-Temp™



Microprocessor
Temperature Controls

Instruction Manual

WARNING

Verify ratings: Verify the ratings of the control meet the requirements of the appliance as specified in the appliance instructions. Refer to the EZ-Temp control data sheet for required electrical supply and load ratings. Verify that the controls, wiring and installation comply with all applicable codes.

Electrical shock hazard: Disconnect power to appliance when wiring or servicing any electrical component.

Scald hazard: Water hotter than 130°F can cause serious burns or death. Follow water heating appliance manufacturer's guidelines when installing temperature limit controls - DO NOT install a control that can be set at a higher temperature than specified. Also verify that the installation includes all water temperature regulating means needed to ensure the safety of building occupants, in compliance with all applicable codes.

Verify operation: Test the controls/appliance to verify the appliance operates as specified in the appliance manual before leaving the installation.

© Copyright 2008 — Carlin Combustion Technology, Inc.

Carlin Combustion Technology, Inc.

70 Maple Street
Ph 413-525-7700

East Longmeadow, MA 01028
Fx 413-525-8306

TECH SUPPORT 800-989-2275

carlincombustion.com

Install sensor(s)

To install a new immersion well:

1. Turn off power to the appliance and close isolation valves.
2. Follow appliance instructions to drain the appliance so water line is below the insertion tapping.
3. Remove existing well and sensor. Apply a small amount of pipe dope to the new well and secure in tapping.
4. Insert EZ-Temp sensor into well and secure sensor in place as described in the following.
5. Refill appliance with water, following appliance manual procedures.

WARNING

When routing sensor wires, avoid sharp edges and use strain relief bushings at penetrations to prevent movement or electrical shorting of the sensor. Sensor wires are not low voltage, and must be routed in conduit.

Configuration A: Sensor and well only

1. Insert the sensor into well (1) until the sensor (2) tip bottoms in the well socket.
2. EZ-Temp well: Slide the rubber retainer (3) over the sensor wires until it firmly contacts the sensor casing. Slide the retainer washer (4) and the jam nut (5) over the wires. Thread the jam nut into the well until snug.
3. Existing well: Press the sensor retainer plug (11) into the well until it securely holds the sensor wires, to prevent movement of the sensor.

Configuration B: Sensor, EZ-Temp well and J-box

1. Insert the sensor into well (1) until the sensor (2) tip bottoms in the well socket.
2. Slide the rubber retainer (3) over the sensor wires until it firmly contacts the sensor casing. Slide the retainer washer (4) over the wires.
3. Slide the lock washer (8), J-box (7), and jam nut (4) over the wires.
4. Thread the jam nut into the well and tighten to secure the J-box and sensor in place.

Configuration C: Sensor, EZ-Temp well and J-box

1. Remove the center knock-out from one side of the J-box (7).
2. Position the well clamp (10) over the end of the well (9) (sensor not yet installed) and slide the well clamp (10) toward the side of the J-box (9) engaging the keyslot opening with the well undercut.
3. Position the flat washer (12) over the open knockout and install the tensioning screw (13) through the flat washer (12) and into the well clamp (10), tighten.
4. Insert the sensor into well (9) until the sensor (2) tip bottoms in the well socket.
5. Press the sensor retainer plug (11) into the well until it securely holds the sensor wires, to prevent movement of the sensor.

Mount the control

1. Insert sensor wire terminals into the labelled openings on the back of the control. Press into place firmly.
2. Attach the control to the 4x4 J-box or panel mount, as desired.

Wire the control

1. Control wiring (including sensor wires) must be routed through conduit or electrical enclosures. Follow all applicable codes and the appliance manual.
2. Follow the burner and appliance wiring diagrams to connect the control(s) into the appliance limit circuit.
3. For specific applications, contact your Carlin supplier for further information.

Set the control

1. Follow the appliance manual to set the correct limit temperature for the appliance. To adjust the EZ-Temp control:
 - Insert a screwdriver into the setting slot and rotate until the indicator points to the desired temperature.
2. Test the operation of the appliance and the new limit control(s) to verify correct operation.
3. NOTE: EZ-Temp controls have a subtractive differential — control contacts trigger when the temperature setting is reached. Contacts reset after temperature drops below setpoint minus the differential amount.

Configurations

Carlin EZ-Temp components are available in the following configurations, allowing use with existing wells in addition to EZ-Temp wells.

Surface-mount sensors are also available.

Control kits

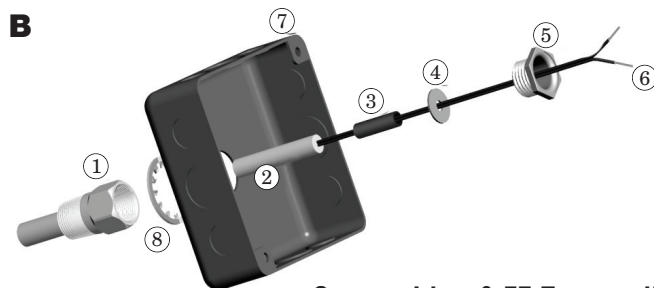
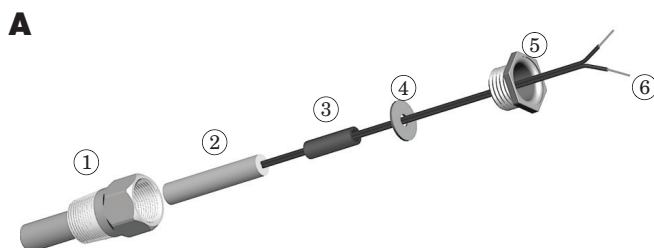
EZ-Temp controls mount to a standard 4x4 J-box or can be panel mounted. Control kits include the control and sensor(s) (item 2) plus hardware needed for mounting to an existing well (items 10 and 11). To obtain an EZ-Temp well and hardware, obtain an EZ-Temp well kit, below.

Well kits

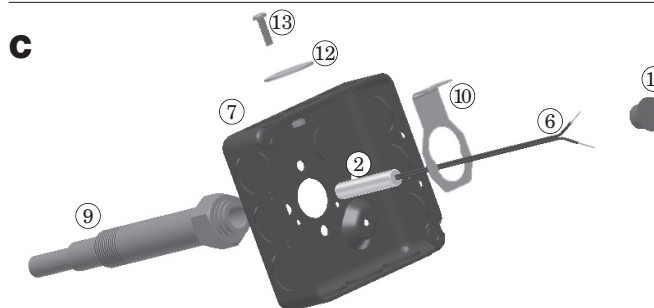
EZ-Temp wells are available in the sizes shown below. Well kits include a well (item 1), rubber sensor retainer (item 3), retainer washer (item 4), jam nut (item 5), and J-box lock washer (item 8).

Sensor Kits

Sensor kits include only the sensor (item 2). Sensors are available in single and dual configurations (two sensors in the same assembly). For controls that use multiple sensors, obtain separate sensor kits or a sensor kit and a dual sensor.



Sensor, J-box & EZ-Temp well



Sensor, J-box & existing well

- | | |
|------------------------|------------------------|
| ① EZ-Temp well | ⑧ Lock washer |
| ② EZ-Temp sensor | ⑨ Existing well |
| ③ EPDM rubber retainer | ⑩ Well clamp |
| ④ Retainer washer | ⑪ Sensor retainer plug |
| ⑤ Jam nut | ⑫ Flat washer |
| ⑥ Sensor leads | ⑬ Tensioning screw |
| ⑦ J-box, 4 x 4 | |

TECH SUPPORT HOTLINE 800-989-2275



Carlin Combustion Technology, Inc.

70 Maple Street East Longmeadow, MA 01028 Phone 413-525-7700 Fax 413-525-8306
e-mail us at: info@carlincombustion.com visit our website: www.carlincombustion.com