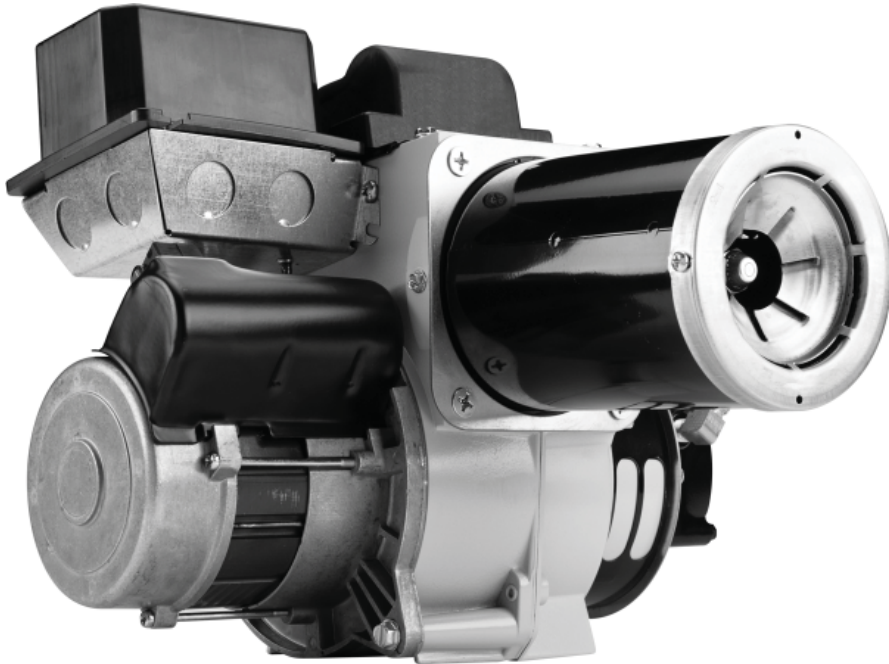
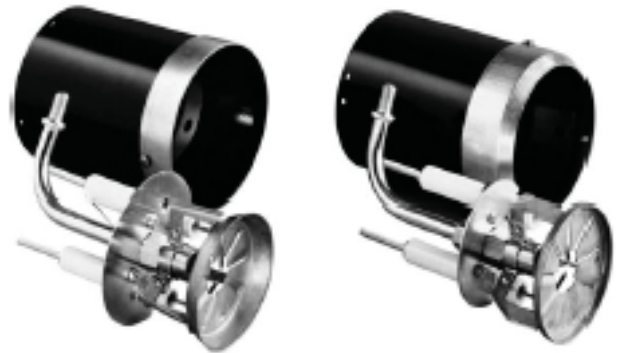


# Beckett AF/AFG Oil Burner Manual



Type 'M' Air Tube Combination  
(AFG Models only)



Type 'L1' Head

Type 'V1' Head

## **WARNING** Potential for Fire, Smoke and Asphyxiation Hazards



*Incorrect installation, adjustment, or misuse of this burner could result in death, severe personal injury, or substantial property damage.*

### To the Homeowner or Equipment Owner:

- Please read and carefully follow all instructions provided in this manual regarding your responsibilities in caring for your heating equipment.
- Contact a professional, qualified service agency for installation, start-up or service work.
- Save this manual for future reference.

### To the Professional, Qualified Installer or Service Agency:

- Please read and carefully follow all instructions provided in this manual before installing, starting, or servicing this burner or heating system.
- The Installation must be made in accordance with all state and local codes having jurisdiction.

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**NOTICE**


This manual contains information that applies to both AF and AFG burners. These burners may appear to be basically identical, but there are differences in design and performance. Please review the comparison chart below:

| Feature                           | AF                       | AFG                         |
|-----------------------------------|--------------------------|-----------------------------|
| Static Pressure Capability        | Conventional - Low range | Enhanced - Medium range     |
| Blower Wheel Design               | Standard strip           | Special tablock             |
| Inlet Airflow Design              | Standard inlet bell      | Special airguide            |
| UL Air Tube Combinations          | “F” Series ONLY          | “F” or “M” Series           |
| Igniter Gaskets Baseplate/Barrier | Optional, as specified   | Required, always specified  |
| Low Firing Rate Baffle            | Not required             | Required, per specification |

## Hazard Definitions

 **DANGER** Indicates an imminently hazardous situation, which, if not avoided, will result in death, serious injury, or property damage.



 **WARNING** Indicates a potentially hazardous situation, which, if not avoided, could result in death, severe personal injury, and/or substantial property damage.

 **CAUTION** Indicates a potentially hazardous situation, which, if not avoided, may result in personal injury or property damage.

Within the boundaries of the hazard warning, there will be information presented describing consequences if the warning is not heeded and instructions on how to avoid the hazard.

### NOTICE

Intended to bring special attention to information, but not related to personal injury or property damage.

 **WARNING** **Owner's Responsibility**  
  
***Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.***

Contact a professional, qualified service agency for the installation, adjustment and service of your oil heating system. This work requires technical training, trade experience, licensing or certification in some states and the proper use of special combustion test instruments.

Please carefully read and comply with the following instructions:

- Never store or use gasoline or other flammable liquids or vapors near this burner or appliance.
- Never attempt to burn garbage or refuse in this appliance.
- Never attempt to light the burner/appliance by throwing burning material into the appliance.
- Never attempt to burn any fuel not specified and approved for use in this burner.
- Never restrict the air inlet openings to the burner or the combustion air ventilation openings in the room.

## General Information

### To the Owner:

**Thank you for purchasing a Beckett burner** for use with your heating appliance. Please pay attention to the Safety Warnings contained within this instruction manual. Keep this manual for your records and provide it to your qualified service agency for use in professionally setting up and maintaining your oil burner.

Your Beckett burner will provide years of efficient operation if it is professionally installed and maintained by a qualified service technician. If at any time the burner does not appear to be operating properly, **immediately contact your qualified service agency** for consultation.

**We recommend annual inspection/service of your oil heating system by a qualified service agency.**

**Daily** – Check the room in which your burner/appliance is installed. Make sure:

- Air ventilation openings are clean and unobstructed
- Nothing is blocking burner inlet air openings
- No combustible materials are stored near the heating appliance
- There are no signs of oil or water leaking around the burner or appliance

#### Weekly

- Check your oil tank level. Always keep your oil tank full, especially during the summer, in order to prevent condensation of moisture on the inside surface of the tank.

 **WARNING** **Do NOT Alter the Original Burner Design**

***Tampering with or altering the burner design could seriously impair performance, resulting in loss of static pressure, damage to the system components, reduced air volume, heavy smoke, flame impingement, appliance sooting, hot gas puff-back, and asphyxiation or fire hazards.***

Maintain the design to its original configuration.

Only use parts specified for AF or AFG Burners

Do NOT remove the air guide from the AFG chassis.

Do NOT use 'M' Series air tube combinations on AF Burners.

Never try to convert and AF to and AFG or vice versa

Any design alteration will:

- Void UL Listing
- Void manufacturer's warranties
- Seriously impact burner performance
- Greatly increase your liability risk

# General Specifications

**Table 1 – Burner Specifications**

|                              |  |
|------------------------------|--|
| Capacity<br>(Note 1)         | 'F' Head (AF & AFG)<br>Firing rate range: ..... 0.40 – 3.00 GPH<br>Input: ..... 56,000 – 420,000 Btu   |
|                              | 'L1' Head (AFG Only)<br>Firing rate range: ..... 0.40 - 1.10 GPH<br>Input: ..... 56,000 – 154,000 Btu/h  |
|                              | 'L2' Head (AFG Only)<br>Firing rate range: ..... 0.50 - 1.00 GPH<br>Input: ..... 70,000 – 140,000 Btu/h  |
|                              | 'V1' Head (AFG Only)<br>Firing rate range: ..... 0.75 - 2.75 GPH<br>Input: ..... 105,000 – 385,000 Btu/h   |
| Certifications/<br>Approvals | UL certified to comply with ANSI/UL296 & tested to CSA B140.0  |
| Fuels                        | U. S: No.1 or No.2 heating oil only (ASTM D396)<br>Canada: No. 1 stove oil or No. 2 furnace oil only   |
| Electrical                   | Power supply: ..... 120 volts AC, 60 Hz, single phase<br>Operating load: ..... 5.8 Amps max<br>Motor: ..... 1/7 hp, 3450 rpm, NEMA 48M frame PSC rotation CCW when facing shaft end<br>Ignition: ... Continuous duty solid-state igniter |
| Fuel pump                    | Outlet pressure: ..... Note 2  |
| Air tube                     | ATC code: ..... See Table 2  |
| Dimensions<br>(with cover)   | Height (maximum) ..... 12.5 inches<br>Width (maximum) ..... 15 inches<br>Depth ..... 9.25 inches<br>Air tube diameter ..... 4.00 inches  |

*Note 1: Approval agency listed rating for these burners is 0.40 to 3.00 gph. However, the firing rate range is limited by the specific air tube combination being used. Refer to Table 2.*

*Note 2: See appliance manufacturer's burner specifications for recommended pump discharge pressure.*

**Table 2 – Air Tube Combination (ATC) codes**

| Firing Rate (gph) | Head | Static plate size | Venturi | ATC Codes for usable air tube lengths ('A' in inches; See Figure 3.) |         |        |        |         |        |         |         |         |         |
|-------------------|------|-------------------|---------|--|---------|--------|--------|---------|--------|---------|---------|---------|---------|
|                   |      |                   |         | 4-1/2  | 5       | 5-3/8  | 6-5/8  | 7       | 7-1/4  | 9       | 10-1/2  | 13      | 16      |
| (min-max)         |      | (inches)          |         |  |         |        |        |         |        |         |         |         |         |
| 0.50-0.75         | F0   | 3-3/8U            | None    | AF44XR   | -       | AF53XR | AF65XR | -       | AF72XR | AF90XR  | AF104XR | AF130XR | A160XR  |
| 0.75-1.25         | F3   | 2-3/4U            | None    | AF44XN   | -       | AF53XN | AF65XN | -       | AF72XN | AF90XN  | AF104XN | AF130XN | AF160XN |
| 0.85-1.35         | F4   | 2-3/4U            | None    | AF44WH   | -       | AF53WH | AF65WH | -       | AF72WH | AF90WH  | AF104WH | AF130WH | AF160WH |
| 0.85-1.65         | F6   | 2-3/4U            | None    | AF44YB   | -       | AF53YB | AF65YB | -       | AF72YB | AF90YB  | AF104YB | AF130YB | AF160YB |
| 1.10-2.00         | F12  | 2-3/4U            | None    | AF44XO   | -       | AF53XO | AF65XO | -       | AF72XO | AF90XO  | AF104XO | AF130XO | AF160XO |
| 1.65-2.50         | F22  | 2-3/4U            | None    | AF44XP   | -       | AF53XP | AF56XP | -       | AF72XP | AF90XP  | AF104XP | AF130XP | AF160XP |
| 2.50-3.00         | F31  | None              | None    | AF44XS   | -       | AF53XS | AF65XS | -       | AF72XS | AF90XS  | AF104XS | AF130XS | AF160XS |
| 0.50-1.10         | L1   | 3-3/8U            | 8hole   | -  | AFG50MB | -      | -      | AFG70MB | -      | AFG90MB | -       | -       | -       |
| 0.50-1.00         | L2   | 2-3/4U            | 8hole   | -  | AFG50MP | -      | -      | AFG70MP | -      | AFG90MP | -       | -       | -       |
| 0.75-2.75         | V1   | 2-3/4U            | 8hole   | -  | AFG50MD | -      | -      | AFG70MD | -      | AFG90MD | -       | -       | -       |
| 0.40-0.75         | F0   | 3-1/2U            | None    | AF44WG   | -       | AF53WG | AF65WG | -       | AF72WG | AF90WG  | AF104WG | AF130WG | A160WG  |



**WARNING Professional Service Required**



***Incorrect installation, adjustment, and use of this burner could result in severe personal injury, death, or substantial property damage from fire, carbon monoxide poisoning, soot or explosion.***

Please read and understand the manual supplied with this equipment. This equipment must be installed, adjusted and put into operation only by a qualified individual or service agency that is:

- Licensed or certified to install and provide technical service to oil heating systems.
- Experienced with all applicable codes, standards and ordinances.
- Responsible for the correct installation and commission of this equipment.
- Skilled in the adjustment of oil burners using combustion test instruments.

The installation must strictly comply with all applicable codes, authorities having jurisdiction and the latest revision of the National Fire Protection Association Standard for the installation of Oil-burning Equipment, NFPA 31 (or CSA B139 and B140 in Canada).

Regulation by these authorities take precedence over the general instructions provided in this installation manual.

## Notice Special Requirements

- For recommended installation practice in Canada, refer to the latest version of CSA Standard B139 & B140.
- Concealed damage — If you discover damage to the burner or controls during unpacking, notify the carrier at once and file the appropriate claim.
- When contacting Beckett for service information — Please record the burner serial number (and have available when calling or writing). You will find the serial number on the silver label located on the left rear of the burner. Refer to Figure 1.

## Inspect/Prepare Installation Site

### Chimney or vent

- Inspect the chimney or vent, making sure it is properly sized and in good condition for use.
- For those installations not requiring a chimney, such as through-the-wall vented appliances, follow the instructions given by the appliance and power venter (if used) manufacturers.



**WARNING**

### Adequate Combustion and Ventilation Air Supply Required

**Failure to provide adequate air supply could seriously affect the burner performance and result in damage to the equipment, asphyxiation, explosion or fire hazards.**

- The burner cannot properly burn the fuel if it is not supplied with a reliable combustion air source.
- Follow the guidelines in the latest editions of the NFPA 31 and CSA-B139 regarding providing adequate air for combustion and ventilation.

## Combustion air supply

See NFPA 31 Standard for complete details.

### Appliance located in confined space

The confined space should have two (2) permanent openings: one near the top of the enclosure and one near the bottom of the enclosure. Each opening shall have a free area of not less than (1) one square inch per 1,000 BTU's per hour of the total input rating of all appliances within the enclosure. The openings shall have free access to the building interior, which should have adequate infiltration from the outside.

### Exhaust fans and other air-using devices

Size air openings large enough to allow for all air-using devices in addition to the minimum area required for combustion air. If there is any possibility of the equipment room developing negative pressure (because of exhaust fans or clothes dryers, for example), either pipe combustion air directly to the burner or provide a sealed enclosure for the burner and supply it with its own combustion air supply.

### Direct air supply and sidewall venting

- Some AFG burners are equipped with combustion air boots to allow use of outside air for combustion.
- When sidewall venting appliances, carefully follow appliance and power venter instructions for installation and wiring.



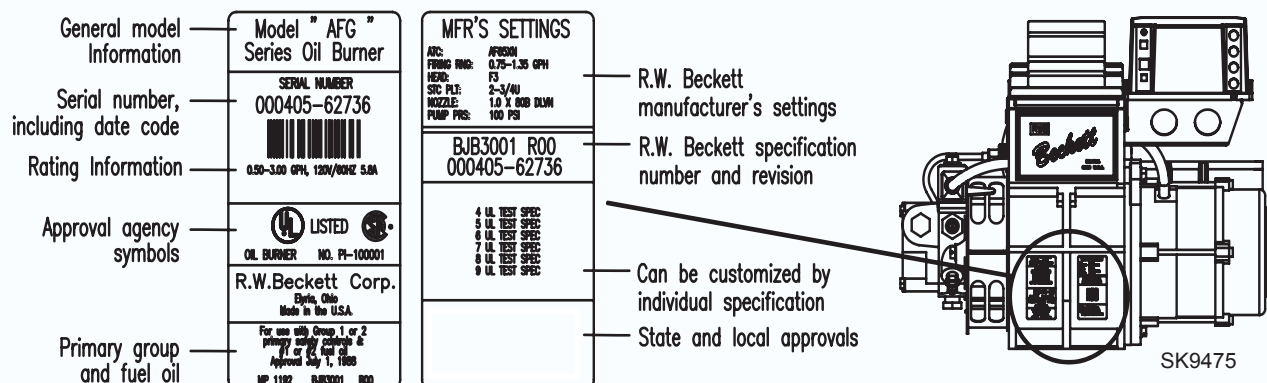
**WARNING**

### Follow the Outside Air Kit Instructions Exactly

**Failure to comply could result in impaired combustion, appliance soot-up, puffback of smoke, and fire or asphyxiation hazards.**

- Do not attempt to install outside air piping to the burner without using the outside air kit and instructions.

Figure 1. Burner label location





### Outside air kit applications

Refer to separate instruction sheet supplied with AF/AFG outside air kit for installation. This optional kit allows combustion air to be piped directly to the burner (Beckett part number 51747).

### Clearances to burner and appliance

- Provide space around burner and appliance for easy service and maintenance.
- Check minimum clearances against those shown by the appliance manufacturer and by applicable building codes.

### Combustion chamber — Burner retrofit- ting

Verify that the appliance combustion chamber provides at least the minimum dimensions given in Table 3.



**WARNING**

### Protect Steel Combustion Chamber From Burnout

**Failure to comply could result in damage to the heating equipment and result in fire or asphyxiation hazards.**

- When retrofitting appliances that have unlined stainless steel combustion chambers, protect the chamber by lining the inside surfaces with a ceramic fiber blanket, such as a wet-pac or other suitable refractory material.
- Some steel chambers may not require liners because the appliance was designed and tested for use with flame retention burners. Refer to the manufacturer's instructions.

**Table 3. Chamber Dimensions**

| Chamber Dimensions (inches) |            |             |        |        |                 |
|-----------------------------|------------|-------------|--------|--------|-----------------|
| Firing Rate (GPH)           | Round I.D. | Rectangular |        | Height | Floor to nozzle |
|                             |            | Width       | Length |        |                 |
| 0.50                        | 8          | 7           | 8      | 12     | 5-6             |
| 0.75                        | 9          | 8           | 9      | 12     | 5-6             |
| 1.00                        | 10         | 9           | 10     | 12.5   | 5-6             |
| 1.25                        | 11         | 10          | 11     | 12.5   | 5-6             |
| 1.50                        | 12         | 11          | 12     | 13     | 6-7             |
| 2.00                        | 14         | 12          | 15     | 13.5   | 6-7             |
| 2.50                        | 16         | 13          | 17     | 14     | 7-8             |
| 3.00                        | 18         | 14          | 18     | 15     | 7-8             |

## Prepare the Burner

### Low Firing Rate Baffle

The AFG Low Firing Rate Baffle (LFRB) reduces the air flow and pressure. The LFRB is sometimes used for firing rates under 1.00 gph as listed in Table 4. Refer to the appliance manufacturer's instructions. Do not omit the LFRB when specified. Omitting the baffle when specified or installing the baffle when not specified could result in impaired burner performance.

**Table 4. AFG Reduced Firing Rates (with LFRB)**

| Burner head type | Low Firing Rate Baffle installed |
|------------------|----------------------------------|
| F0               | up to 0.65 gph                   |
| F3 or L1         | up to 0.85 gph                   |
| F4 or F6         | up to 0.90 gph                   |
| V1               | up to 1.00 gph                   |

### Burner fuel unit

- Verify that the burner fuel unit is compatible with the oil supply system. For more details, refer to "Connect fuel lines" later in this manual.

### Nozzle and Pump Pressure



### WARNING Correct Nozzle and Flow Rate Required



**Incorrect nozzles and flow rates could result in impaired combustion, under-firing, over-firing, soot-ing, puff-back of hot gases, smoke and potential fire or asphyxiation hazards.**

Use only nozzles having the brand, flow rate (gph), spray angle and pattern specified by the appliance manufacturer.

Follow the appliance manufacturer's specifications for the required pump outlet pressure for the nozzle, since this affects the flow rate.

- Nozzle manufacturers calibrate nozzle flow rates at 100 psig.
- When pump pressures are higher than 100 psig, the actual nozzle flow rate will be greater than the gph stamped on the nozzle body. (Example: A 1.00 gph nozzle at 140 psig = 1.18 gph)

Securely tighten the nozzle (90 torque inch pounds). For typical nozzle flow rates at various pressures refer to Table 5.

**Table 5. Nozzle Flow Rate by Size**

| Nozzle flow rate U. S. gallons per hour of No. 2 fuel oil when pump pressure (psig) is: |         |         |         |         |         |
|---|---------|---------|---------|---------|---------|
| Nozzle size (rated at 100 psig)   | 125 psi | 140 psi | 150 psi | 175 psi | 200 psi |
| 0.40  | 0.45    | 0.47    | 0.49    | 0.53    | 0.56    |
| 0.50  | 0.56    | 0.59    | 0.61    | 0.66    | 0.71    |
| 0.60  | 0.67    | 0.71    | 0.74    | 0.79    | 0.85    |
| 0.65  | 0.73    | 0.77    | 0.80    | 0.86    | 0.92    |
| 0.75  | 0.84    | 0.89    | 0.92    | 0.99    | 1.06    |
| 0.85  | 0.95    | 1.01    | 1.04    | 1.13    | 1.20    |
| 0.90  | 1.01    | 1.07    | 1.10    | 1.19    | 1.27    |
| 1.00  | 1.12    | 1.18    | 1.23    | 1.32    | 1.41    |
| 1.10  | 1.23    | 1.30    | 1.35    | 1.46    | 1.56    |
| 1.20  | 1.34    | 1.42    | 1.47    | 1.59    | 1.70    |
| 1.25  | 1.39    | 1.48    | 1.53    | 1.65    | 1.77    |
| 1.35  | 1.51    | 1.60    | 1.65    | 1.79    | 1.91    |
| 1.50  | 1.68    | 1.77    | 1.84    | 1.98    | 2.12    |
| 1.65  | 1.84    | 1.95    | 2.02    | 2.18    | 2.33    |
| 1.75  | 1.96    | 2.07    | 2.14    | 2.32    | 2.48    |
| 2.00  | 2.24    | 2.37    | 2.45    | 2.65    | 2.83    |
| 2.25  | 2.52    | 2.66    | 2.76    | 2.98    | -       |
| 2.50  | 2.80    | 2.96    | -       | -       | -       |

**Attach air tube (if not already installed)**

If using a flange and gasket, slide them onto the air tube. Then attach the air tube to the burner chassis using the four sheet metal screws provided. Refer to Figure 3 for details.

**Install burner nozzle (if not already installed)**

1. Remove the plastic plug protecting the nozzle adapter threads
2. Place a 3/4" open-end wrench on the nozzle adapter. Insert the nozzle into the adapter and finger tighten. Finish tightening with a 5/8" open-end wrench. Use care to avoid bending the burner head support legs or electrodes. If you remove the head to replace the nozzle (type "L1"/"L2" or "V1" heads), carefully reconnect the head to the nozzle adapter, making sure that the head support makes contact with the nozzle adapter shoulder. Refer to Figure 4 or 5.

**Table 6. Nozzle Spray Angles**

| Recommended nozzle spray angles |                         |
|---------------------------------|-------------------------|
| "F" head                        | 70° or 80° nozzle       |
| "L1" & "L2" head                | 45°, 60°, or 70° nozzle |
| "V1" head                       | 45°, 60°, or 70° nozzle |

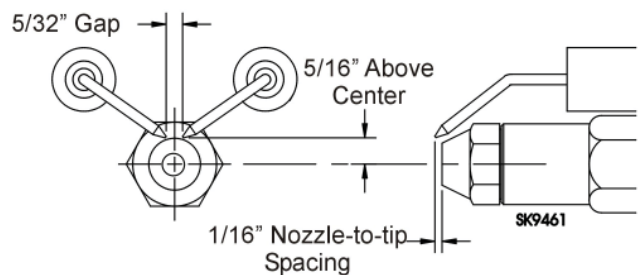
3. If the nozzle is already installed, remove the nozzle line assembly to verify that the nozzle size and spray pattern are correct for the application (per appliance manufacturer's information). Verify that the electrode tip settings comply with Figure 2.
4. If the nozzle is not installed, obtain a nozzle from the manufacturer, having the capacity and spray angle specified in the appliance manufacturer's information. For conversions or upgrades, when information is not available for the application:
  - Refer to Table 6 to select the mid-range nozzle spray angle for the head type being used.
  - Fire the burner and make sure the combustion is acceptable and the flame is not impinging on chamber surfaces.
  - If a shorter flame is needed, select a wider spray angle. If a longer flame is needed, select a narrower spray angle.
  - Either hollow or solid spray patterns may be used. If combustion results are not satisfactory with the selected spray pattern, try the other pattern.

**Check/adjust electrodes**

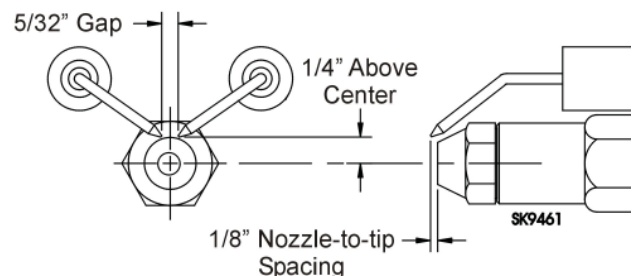
Check the electrode tip settings. Adjust if necessary to comply with the dimensions shown in Figure 2. To adjust, loosen the electrode clamp screw and slide/rotate electrodes as necessary. Securely tighten the clamp screw when finished.

**Figure 2. – Electrode Tip Adjustment**

Standard Dimensions for F, L1, and V1 Heads.



The Dimensions shown below are for use with L2 heads and M series air tube combinations ending with an 'N' suffix (example: AFG70MDAQN)



## Check/Adjust 'Z' Dimension for 'F' Heads

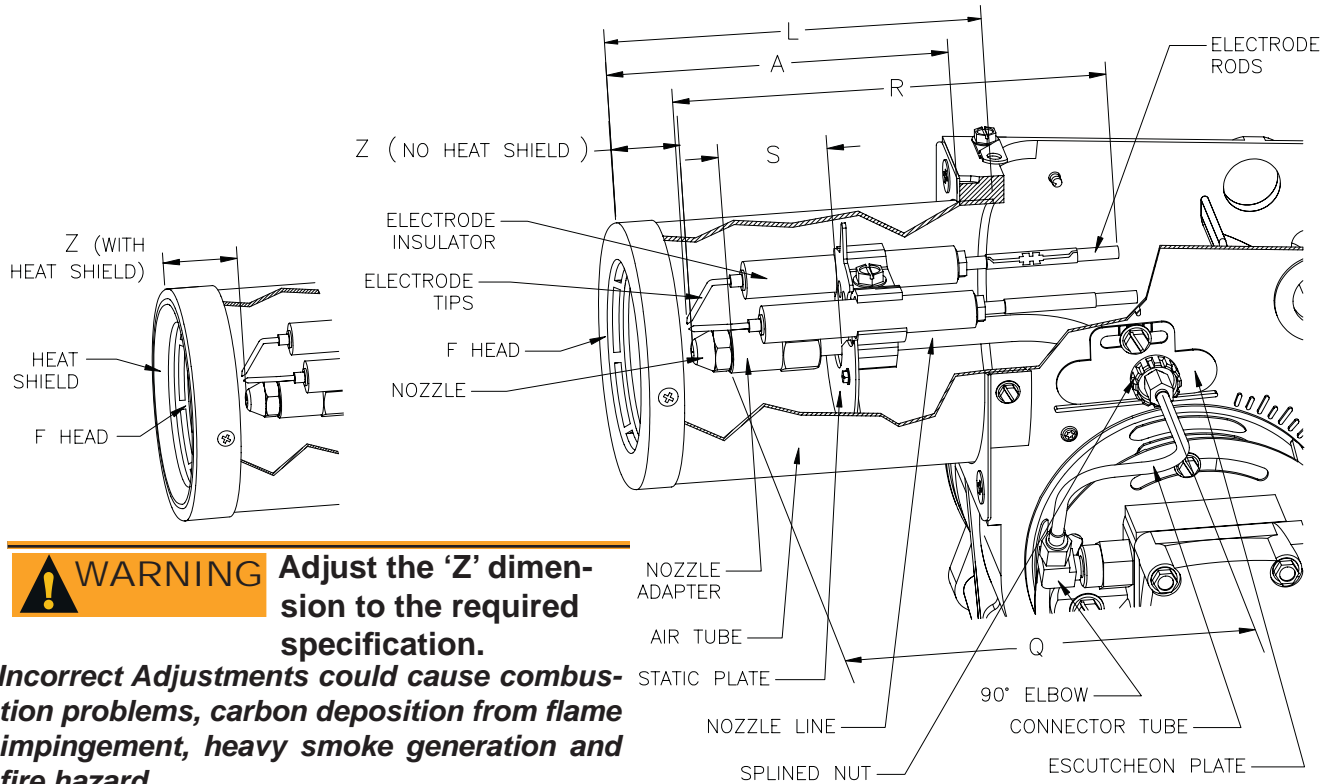


Figure 3. 'F' Head

**WARNING** Adjust the 'Z' dimension to the required specification.

**Incorrect Adjustments could cause combustion problems, carbon deposition from flame impingement, heavy smoke generation and fire hazard.**

- Make all adjustments exactly as outlined in the following information.

### Check/Adjust 'Z' Dimension - 'F' heads

1. The important 'Z' dimension is the distance from the face of the nozzle to the flat face of the head (or heat shield, if applicable). This distance for F heads is 1- $\frac{1}{8}$ " (1- $\frac{3}{8}$ " if the air tube has a heat shield). The "Z" dimension is factory set for burners shipped with the air tube installed. Even if factory set, verify that the "Z" dimension has not been changed.
2. Use the following procedure to adjust the "Z" dimension, if it is not correct:
  - Turn off power to the burner.
  - Disconnect the oil connector tube from the nozzle line
  - See above figure. Loosen the splined nut from the nozzle line. Loosen the hex head screw securing the escutcheon plate to the burner housing.
  - Place the end of a ruler at the face of the nozzle and, using a straight edge across the head, measure the distance to the face of the head. A Beckett T501 gauge may also be used.
  - Slide the nozzle line forward or back until this dimension for F heads is 1- $\frac{1}{8}$ " (1- $\frac{3}{8}$ " to the face of the heat shield, if applicable).
  - Tighten the hex head screw to secure the escutcheon plate to the burner chassis. Then tighten the splined nut and attach the oil connector tube.
3. Recheck the "Z" dimension periodically when servicing to ensure the escutcheon plate has not been moved. You will need to reset the "Z" dimension if you replace the air tube or nozzle line assembly. The Beckett Z gauge (part number Z-2000) is available to permit checking the F head "Z" dimension without removing the burner from the appliance.

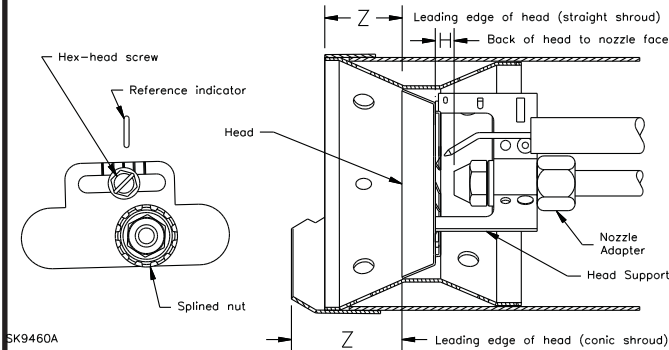
### Burner Dimensions

| Dimension (inches)                      | For usable length A (inches) |         |         |         |
|---|------------------------------|---------|---------|---------|
|   | F Head                       | L1 Head | L2 Head | V1 Head |
| H (nozzle to head), $\pm 1/32$          | N/A                          | 1/4     | 7/32    | 1/4     |
| L (Total tube length)                   | A+1/2                        | A+1/2   | A+1/2   | A+1/2   |
| R (electrode length), $\pm 1/4$         | A+2-1/4                      | A+1-1/8 | A+1-1/8 | A+1-1/8 |
| S (adapter to static plate), $\pm 1/16$ | (Note 1)                     | 1-3/8   | 1-3/8   | 1-3/8   |
| Q (nozzle line length),                 | A+ 15/16                     | A+ 3/16 | A+ 3/16 | A+ 3/16 |
| Z (F head-no heat shield)               | 1-1/8                        | N/A     | N/A     | N/A     |
| Z (F head-with heat shield)             | 1-3/8                        | N/A     | N/A     | N/A     |
| Z (L1 head w/straightshroud)            | N/A                          | 1-3/8   | N/A     | N/A     |
| Z (L1/L2/V1 head w/conic shroud)        | N/A                          | 1-3/4   | 1-3/4   | 1-3/4   |

Note 1: 1-3/8 for dimension A less than 4"; 1-5/8 for dimension A from 4" through 4-1/2 " , 2-13/32 for dimension A greater than 4-1/2".



## Check/Adjust 'Z' Dimension - L1 & L2 Heads



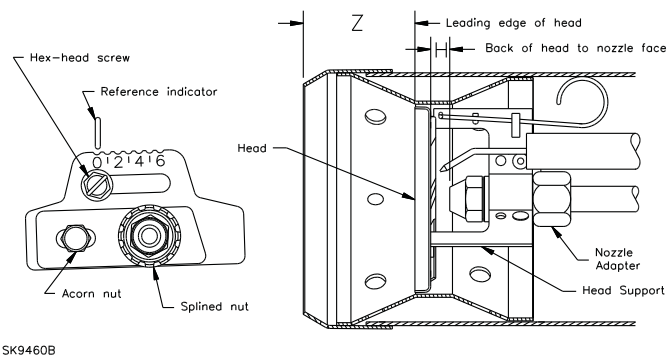
**Figure 4. 'L1 & L2' Heads**

L1/L2 heads (see Table 7 and Figure 3 for dimensions)

1. See figure above. The important "Z" dimension is the distance from the leading edge of the head to the end of the air tube. This distance for L1 & L2 heads is 1-3/8" if the tube has a straight shroud or 1-3/4" if the air tube has a conic shroud. The "Z" dimension is factory set for

2. Use the following procedure to adjust the "Z" dimension, if it is not correct:
  - Turn off power to the burner.
  - Disconnect the oil connector tube from the nozzle line.
  - Refer to figure. Loosen the splined nut from the nozzle line. Loosen the hex head screw securing the escutcheon plate to the burner housing.
  - Place the end of a ruler at the leading edge of the head and, using a straight edge across the end of the air tube, measure the distance to the end of the tube. A Beckett T501 gauge may also be used.
  - Slide the nozzle line forward or back until this dimension is 1-3/8" for L1 & L2 heads if the tube has a straight shroud, or 1-3/4" if the air tube has a conic shroud.
  - Tighten the hex head screw to secure the escutcheon plate to the burner chassis. Then tighten the splined nut and attach the oil connector tube.
3. Recheck the "Z" dimension periodically when servicing to ensure the escutcheon plate has not been moved. You will need to reset the "Z" dimension if you replace the air tube or nozzle line assembly.

## Check/Adjust 'Z' Dimension - V1 Heads



**Figure 5. 'V1' Head**

V1 heads (see Table below and Figure above for dimensions)

1. See figure above. The important "Z" dimension is the distance from the leading edge of the head to the end of the air tube. This distance for V1 heads is 1-3/4". The "Z" dimension is factory set for burners shipped with the air tube installed. Even if factory set, verify that the "Z" dimension has not been changed.

2. Use the following procedure to adjust the "Z" dimension, if it is not correct:
  - Turn off power to the burner.
  - Disconnect the oil connector tube from the nozzle line.
  - See figure above. Loosen the splined nut from the nozzle line. Loosen the hex head screw securing the head adjusting plate to the burner housing.
  - Loosen the acorn nut. Move the head adjusting plate until the "0" lines up with the reference indicator on the housing, and retighten the hex head screw. Place the end of a ruler at the leading edge of the head and, using a straight edge across the end of the air tube, measure the distance to the end of the tube. A Beckett T501 gauge may also be used.
  - Slide the nozzle line forward or back until this dimension is 1-3/4" for V1 heads. Tighten the acorn nut.
  - Tighten the hex head screw to secure the head adjusting plate to the burner chassis. Then tighten the splined nut and attach the oil connector tube.
3. Recheck the "Z" dimension periodically when servicing to ensure the escutcheon plate has not been moved. You will need to reset the "Z" dimension if you replace the air tube or nozzle line assembly.

## Set head position adjusting plate (V1 head only)

1. After setting "Z" dimension, loosen head adjusting plate hex head screw and nozzle line splined nut. Move the nozzle line assembly until the burner reference indicator lines up with the head adjusting plate setting number given in Table shown below.
2. Tighten the hex head screw and splined nut. (DO NOT loosen the acorn nut when setting head position.) Refer to the manufacturer's instructions for OEM settings.
3. The position of the head affects air flow volume and pattern. For most applications, the burner will perform satisfactorily with the air adjustment plate setting of Table shown below.
4. If combustion results indicate the need for change, adjust the head position adjusting plate forward or back one position at a time to optimize combustion.

## Table for initial adjusting plate settings for V1 Head

| V1 Adjusting Plate Setting | AFG with V1 Head Burner Firing Rates |
|----------------------------|--------------------------------------|
| 0                          | 0.75-1.00                            |
| 1                          | 1.00-1.50                            |
| 2                          | 1.50-1.75                            |
| 3                          | 1.75-2.00                            |
| 4                          | 2.00-2.25                            |
| 5                          | 2.25-2.50                            |
| 6                          | 2.50-2.75                            |

## Servicing nozzle line assembly

1. Turn off power to burner before proceeding.
2. Disconnect oil connector tube from nozzle line.
3. Loosen the two screws securing igniter retaining clips and rotate both clips to release igniter baseplate. Then tilt igniter back on its hinge.
4. Remove splined nut.
5. "F" head air tube. - Remove nozzle line assembly from burner, being careful not to damage the electrodes or insulators while handling. To ease removal of long assemblies (over 9 inches), rotate assembly 180° from installed position after pulling partially out of tube.
6. "L1", "L2", and "V1" head air tubes. - Slide nozzle line assembly forward (further into air tube) so the head clears the venturi opening. Then rotate the nozzle line assembly 90° so the nozzle line end points up. Pull the nozzle line assembly toward you and remove assembly from burner.
7. To replace the nozzle assembly, reverse the above steps.

less otherwise specified by the heating appliance manufacturer. Carefully measure the insertion depth when using an adjustable flange. Verify the insertion depth when using a welded flange.

## Connect fuel lines

Carefully follow the fuel unit manufacturer's literature and the latest edition of NFPA 31 for oil supply system specifications.

## Fuel supply level with or above burner –

---

### **WARNING** Do Not Install By-pass Plug with 1-Pipe System

**Failure to comply could cause immediate pump seal failure, pressurized oil leakage and the potential for a fire and injury hazard.**

- The burner is shipped without the by-pass plug installed.
  - Install the by-pass plug in two-pipe oil supply systems ONLY.
- 

## Mount burner on appliance

### Mounting options

1. Bolt the burner to the appliance using the factory-mounted flange or an adjustable flange.

### Mounting dimensions

1. When using the Beckett universal adjustable flange, mount the air tube at a 2° downward pitch unless otherwise specified by the appliance manufacturer.
2. Verify that the air tube installed on the burner provides the correct insertion depth. See Figure 6.
3. The end of the air tube should normally be 1/4" back from the inside wall of the combustion chamber. Never allow the leading edge of the head assembly to extend into the chamber, un-

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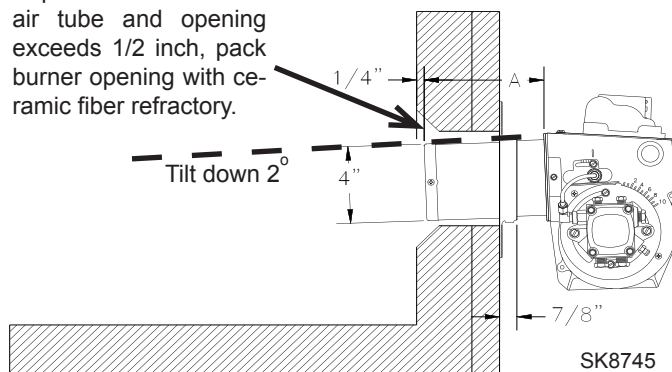
### **CAUTION** Oil Supply Pressure Control Required

**Damage to the filter or pump seals could cause oil leakage and a fire hazard.**

- The oil supply inlet pressure to the burner **cannot exceed 3 psig**.
  - Insure that a pressure limiting device is installed in accordance with the latest edition of NFPA 31.
  - Gravity Feed Systems: Always install an anti-siphon valve in the oil supply line or a solenoid valve (RWB Part # 2182602U) in the pump/nozzle discharge tubing to provide backup oil flow cut-off protection.
- 

**Figure 6. – Mounting Burner in Appliance**

If space between burner air tube and opening exceeds 1/2 inch, pack burner opening with ceramic fiber refractory.



The burner may be equipped with a single-stage fuel unit for these installations. Connect the fuel supply to the burner with a single supply line if you want a one-pipe system (making sure the bypass plug is NOT installed in the fuel unit.) Manual bleeding of the fuel unit is required on initial start-up. If connecting a two-pipe fuel supply, install the fuel unit bypass plug.

### **Fuel supply below the level of the burner –**

When the fuel supply is more than eight feet below the level of the burner, a two-pipe fuel supply system is required. Depending on the fuel line diameter and horizontal and vertical length, the installation may also require a two-stage pump. Consult the fuel unit manufacturer's literature for lift and vacuum capability.

### **Fuel line installation –**

- Continuous lengths of heavy wall copper tubing are recommended. **Always use flare fittings. Never use compression fittings.**
- Always install fittings in accessible locations. Proper routing of fuel lines is required to prevent air cavitation and vibration.

---

### **CAUTION Do Not Use Teflon Tape**

***Damage to the pump could cause impaired burner operation, oil leakage and appliance soot-up.***

- Never use Teflon tape on fuel oil fittings.
- Tape fragments can lodge in fuel line components and fuel unit, damaging the equipment and preventing proper operation.
- Use oil-resistant pipe sealant compounds.

---

### **Fuel line valve and filter –**

- Install two high quality fusible-handle design shutoff valves in accessible locations on the oil supply line to comply with the NFPA 31 Standard. Locate one close to the tank and the other close to the burner, upstream of the filter.
- Install a generous capacity filter inside the building between the fuel tank shutoff valve and the burner, locating both the filter and the valve close to the burner for ease of servicing. Filter should be rated for 50 microns or less.

## Wire burner

### **Burner packaged with appliance**

---

#### **WARNING Electrical Shock Hazard**



***Electrical shock can cause severe personal injury or death.***

- Disconnect electrical power before installing or servicing the burner.
- Provide ground wiring to the burner, metal control enclosures and accessories. (This may also be required to aid proper control system operation.)
- Perform all wiring in compliance with the National Electrical Code ANSI/NFPA 70 (Canada CSA C22.1)

- 
- Refer to appliance manufacturer's wiring diagram for electrical connections.

#### **Burner installed at jobsite**

- Refer to Figure 7, for typical burner wiring, showing cad cell primary controls. Burner wiring may vary, depending on primary control actually used.

The R7184 primary control with valve-on delay (prepurge) and burner motor-off delay (postpurge), requires a constant 120 volts AC power source supplied to the BLACK wire on the control. The RED wire goes to the appliance limit circuit. Please note that other control manufacturers may use different wire colors for power and limit connections.

#### **Special wiring required with covered burners**

The mounting plate is not a conduit connection point. Pass conduit and attached connector through the opening in the mounting plate and attach it directly to the burner-mounted 4x4 electrical box.

If attaching a burner cover to a previously installed burner, attach the mounting plate and then slide the conduit into the "J" shaped conduit slot.

## Typical Burner Wiring & Burner Sequence of Operation for R7184P Control.

Refer to the appliance manufacturer's wiring diagram for actual specifications.

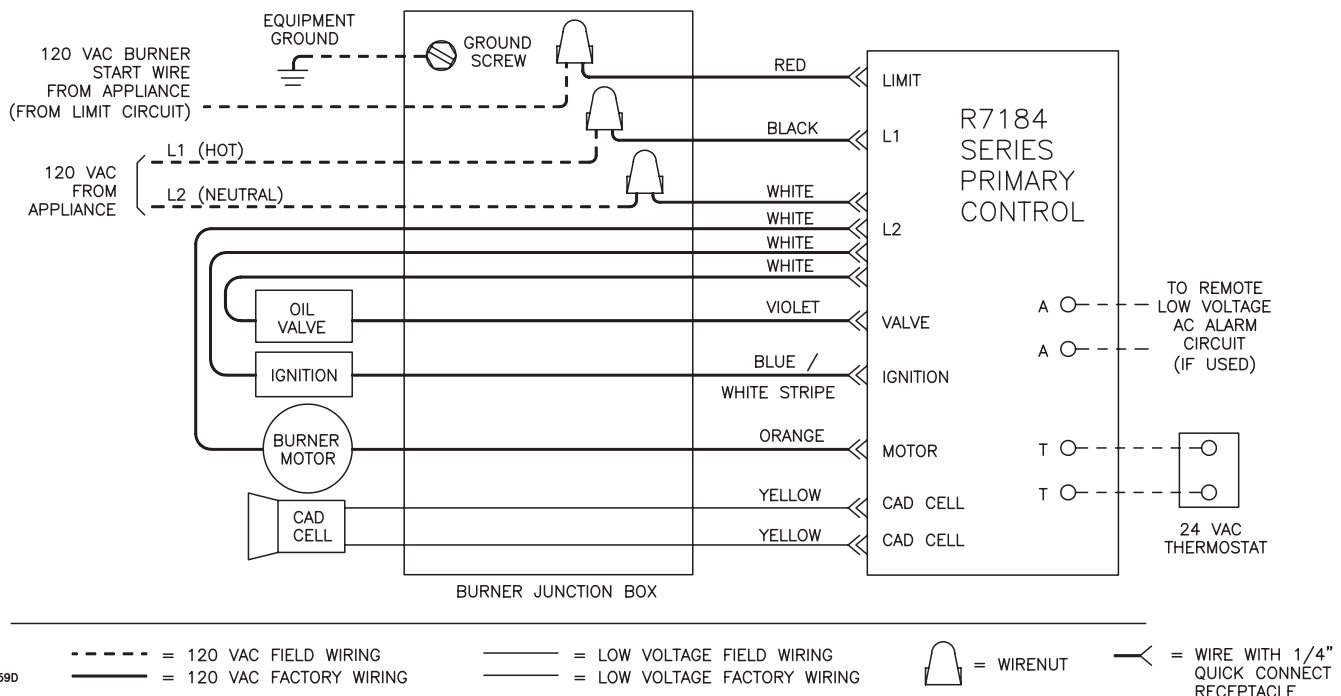
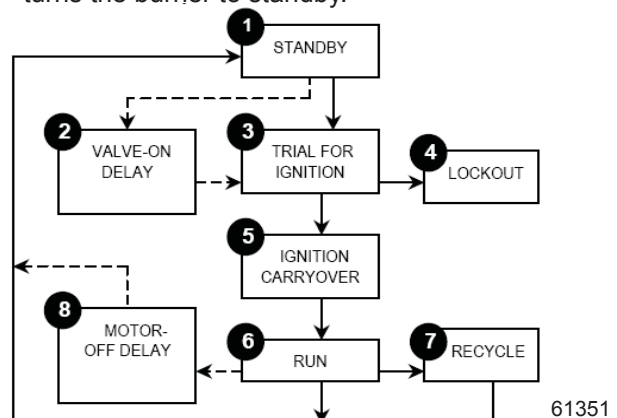


Figure 7. – Typical Burner Wiring

1. **STANDBY.** The burner is idle, waiting for a call for heat. When a call for heat is initiated, there is a 3-10 second delay while the control performs a safe start check.
2. **VALVE-ON DELAY.** The ignition and motor are turned on for a 15 second valve-on delay.
3. **TRIAL FOR IGNITION (TFI).** The fuel valve is opened. A flame should be established within the 15 second lockout time.
4. **LOCKOUT.** If flame is not sensed by the end of the TFI, the control shuts down on safety lockout and must be manually reset. If the control locks out three times in a row, the control enters restricted lockout.
5. **IGNITION CARRYOVER.** Once flame is established, the ignition remains on for 10 seconds to ensure flame stability before turning off. If the control is wired for intermittent duty ignition, the ignition unit stays on the entire time the motor is running.
6. **RUN.** The burner runs until the call for heat is satisfied. The burner is then sent to burner motor off delay, if applicable, or it is shut down and sent to standby.

7. **RECYCLE.** If the flame is lost while the burner is firing, the control shuts down the burner, enters a 60 second recycle delay, and then repeats the above ignition sequence. If flame is lost three times in a row, the control locks out to prevent cycling with repetitious flame loss due to poor combustion.
8. **BURNER MOTOR-OFF DELAY.** The fuel valve is closed and the burner motor is kept on for the selected motor-off delay time before the control returns the burner to standby.



### Control System Features

| Feature | Interrupted ignition | Limited reset, Limited recycle | Diagnostic LED, cad cell indicator | Valve-on delay | Burner motor off delay | Alarm Contacts |
|---------|----------------------|--------------------------------|------------------------------------|----------------|------------------------|----------------|
| R7184A  | YES                  | YES                            | YES                                | —              | —                      | —              |
| R7184B  | YES                  | YES                            | YES                                | YES            | —                      | —              |
| R7184P  | YES                  | YES                            | YES                                | YES            | YES                    | Optional       |

## Start up burner/set combustion

### **WARNING Explosion and Fire Hazard**



***Failure to follow these instructions could lead to equipment malfunction and result in heavy smoke emission, soot-up, hot gas puff-back, fire and asphyxiation hazards.***

- Do not attempt to start the burner when excess oil has accumulated in the appliance, the appliance is full of vapor, or when the combustion chamber is very hot.
  - Do not attempt to re-establish flame with the burner running if the flame becomes extinguished during start-up, venting, or adjustment.
  - Vapor-Filled Appliance: Allow the unit to cool off and all vapors to dissipate before attempting another start.
  - Oil-Flooded Appliance: Shut off the electrical power and the oil supply to the burner and then clear all accumulated oil before continuing.
  - If the condition still appears unsafe, contact the Fire Department. Carefully follow their directions.
  - Keep a fire extinguisher nearby and ready for use.
- 
1. Open the shutoff valves in the oil supply line to the burner.
  2. Close air band and partially open air shutter. This is an initial air setting for the pump bleeding procedure only. Additional adjustments must be made with instruments.
  3. Set the thermostat substantially above room temperature.
  4. Close the line voltage switch to start the burner. If the burner does not start immediately you may have to reset the safety switch of the burner primary control.
  5. Bleed air from fuel unit as soon as burner motor starts rotating.
    - To bleed the fuel unit, attach a clear plastic hose over the vent fitting. Loosen the fitting and catch the oil in an empty container. Tighten the fitting when all air has been purged from the oil supply system.
    - If the burner locks out on safety during bleeding, reset the safety switch and complete the bleeding procedure. Note — Electronic safety switches can be reset immediately; others may require a three- to five-minute wait.
    - If burner stops after flame is established, additional bleeding is probably required. Repeat the bleeding procedure until the pump is primed and a flame is established when the vent fitting is closed.

- For R7184 primary controls, see Technician's Quick Reference Guide, part number 61351 for special pump priming sequence.
  - Prepare for combustion tests by drilling a ¼" sampling hole in the flue pipe between the appliance and the barometric draft regulator.
6. Initial air adjustment — Using a smoke tester, adjust the air shutter (and air band, if necessary) to obtain a clean flame. Now the additional combustion tests with instruments can be made

### Set combustion with instruments

1. Allow the burner to run for approximately 5 to 10 minutes.
2. Set the stack or over-fire draft to the level specified by the appliance manufacturer.
  - **Natural Draft Applications**; typically over-fire draft is -0.01" or -0.02" w.c.
  - **Direct Venting**; typically may not require draft adjustment.
  - **High Efficiency/Positive Pressure Appliances**; also vary from traditional appliances (see manufacturer's recommendations).
3. Follow these four steps to properly adjust the burner:
  - Step 1:** Adjust the air shutter/band until a trace of smoke is achieved.
  - Step 2:** At the trace of smoke level, measure the CO<sub>2</sub> (or O<sub>2</sub>) . This is the vital reference point for further adjustments. Example: 13.5% CO<sub>2</sub> (2.6% O<sub>2</sub>)
  - Step 3:** Increase the air to reduce the CO<sub>2</sub> by 1.5 to 2 percentage points. (O<sub>2</sub> will be increased by approximately 2.0 to 2.7 percentage points.) Example: Reduce CO<sub>2</sub> from 13.5% to 11.5% (2.6% to 5.3% O<sub>2</sub>).
  - Step 4:** Recheck smoke level. It should be Zero.
    - This procedure provides a margin of reserve air to accommodate variable conditions.
    - If the draft level has changed, recheck the smoke and CO<sub>2</sub> levels and readjust the burner if necessary
4. Once combustion is set, tighten all fasteners on air band, air shutter and head adjusting plate or escutcheon plate.
5. Burner equipped with cover - Reinstall the cover and repeat Steps 2 and 4 above. If CO<sub>2</sub> increases (O<sub>2</sub> decreases), remove the cover and adjust the air setting so the CO<sub>2</sub> (O<sub>2</sub>) with cover on meets requirements of Step 3.
6. Start and stop the burner several times to ensure satisfactory operation. Test the primary control and all other appliance safety controls to verify that they function according to the manufacturer's specifications.



## Perform regular maintenance

### **WARNING** Annual Professional Service Required



***Tampering with or making incorrect adjustments could lead to equipment malfunction and result in asphyxiation, explosion or fire.***

- Do not tamper with the burner or controls or make any adjustments unless you are a trained and qualified service technician.
- To ensure continued reliable operation, a qualified service technician must service this burner annually.
- More frequent service intervals may be required in dusty or adverse environments.
- Operation and adjustment of the burner requires technical training and skillful use of combustion test instruments and other test equipment.

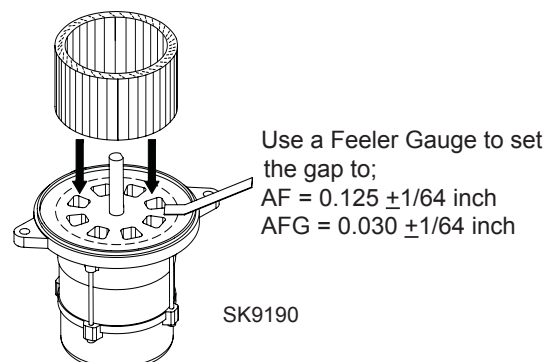
- ❑ Replace the oil supply line filter. The line filter cartridge must be replaced to avoid contamination of the fuel unit and nozzle.
- ❑ Inspect the oil supply system. All fittings should be leak-tight. The supply lines should be free of water, sludge and other restrictions.
- ❑ Remove and clean the pump strainer if applicable.
- ❑ Replace the nozzle with an equivalent nozzle.
- ❑ Clean and inspect the electrodes for damage, replacing any that are cracked or chipped.
- ❑ Check electrode tip settings. Replace electrodes if tips are rounded.
- ❑ Inspect the igniter spring contacts.
- ❑ Clean the cad cell grid surface, if necessary.
- ❑ Make sure Low Firing Rate Baffle is in place if required for the burner application. Omitting the baffle can result in unacceptable burner combustion.
- ❑ Inspect all gaskets. Replace any that are damaged or would fail to seal adequately.
- ❑ Inspect the combustion head and air tube. Remove any carbon or foreign matter. Replace all damaged units with exact parts.
- ❑ Clean the blower wheel, air inlet, air guide, burner housing and static plate of any lint or foreign material.
- ❑ If motor is not permanently lubricated, oil motor with a few drops of SAE 20 nondetergent oil at each oil hole. DO NOT over oil motor. Excessive oiling can cause motor failure.
- ❑ Check motor current. The amp draw should not exceed the nameplate rating by more than 10%.

- ❑ Check all wiring for secure connections or insulation breaks.
- ❑ Check the pump pressure and cutoff function.
- ❑ Check primary control safety lockout timing.
- ❑ Check ignition system for proper operation.
- ❑ Inspect the vent system and chimney for soot accumulation or other restriction.
- ❑ Clean the appliance thoroughly according to the manufacturer's recommendations.
- ❑ Check the burner performance. Refer to the section "Set combustion with test instruments".
- ❑ It is good practice to make a record of the service performed and the combustion test results.

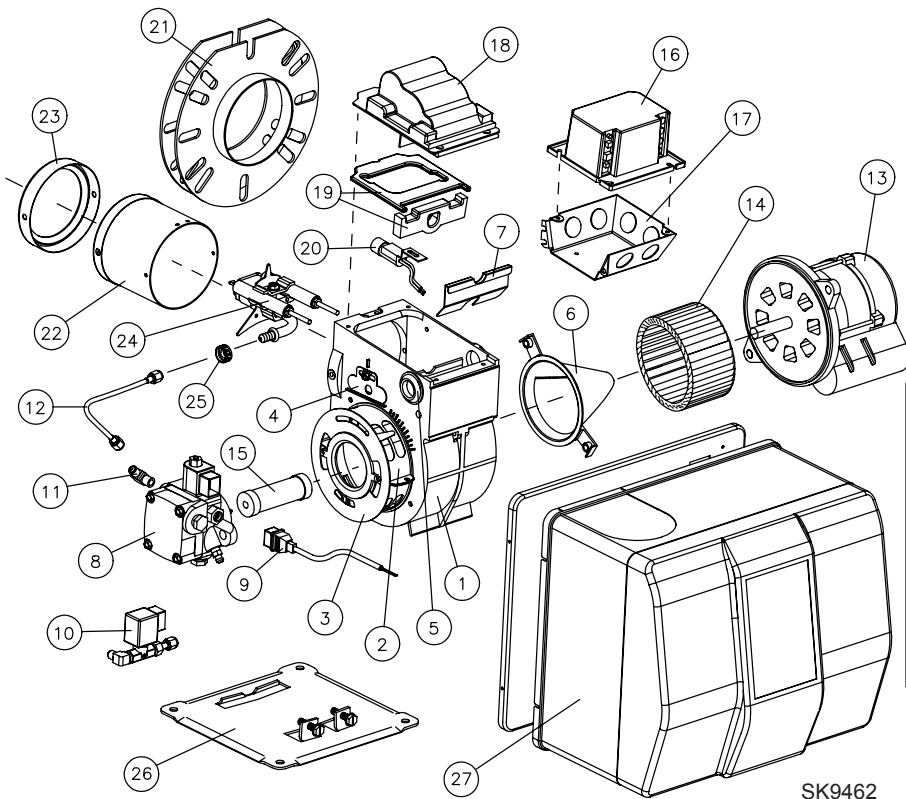
### Replace the blower wheel:

1. Turn off all power to the burner before servicing.
2. Disconnect the burner motor wires.
3. Remove the bolts securing the motor to the burner housing.
4. Remove the motor and blower wheel.
5. Remove the existing blower wheel.
6. Referring to the figure below, slide the new blower wheel onto the shaft.
  - Use a feeler gauge to set the wheel-to-motor gap, as shown below. (AF =  $0.125 \pm 1/64$  inch, AFG =  $0.030 \pm 1/64$  inch)
  - Slide blower wheel toward motor until it contacts feeler gauge.
  - Rotate the blower wheel until the setscrew is centered on the flat of the motor shaft. Tighten the setscrew to secure the wheel.
7. DO NOT use a motor that has endshield openings outside the blower wheel circumference (represented by the dashed line).
8. Install the motor on the burner housing. Tighten screws. Reconnect wires.
9. Restore power, start the burner and perform combustion tests. Refer to the section "Set combustion with test instruments".

**Figure 8. Blower wheel assembly**



For best performance specify genuine *Beckett* replacement parts



Parts that are unique to AF burners replace parts numbered 6 and 14. Refer to parts list below for part numbers.

SK9462

| #  | Part No.                   | Description                            |
|----|----------------------------|--|
| 1  |                            | Burner Housing Assembly                |
| 2  | Specify                    | Air Band - Specify # of slots          |
|    | 4198                       | Screw, 10-24 x 1/2"                    |
|    | 4150                       | Nut, 10-24 Square                      |
| 3  | Specify                    | Air Shutter - Specify # of slots       |
|    | 4292                       | Screws, 10-24 x 5/16"                  |
| 4  | 3493                       | Escutcheon (F & L1/L2 heads)           |
|    | 5941                       | Head Adjusting Plate (V1 head)         |
|    | 4292                       | Screw, 10-24 x 5/16"                   |
| 5  | 2139                       | Hole Plug                              |
| 6  | 31231U (AFG)<br>31841 (AF) | Air Guide (AFG)<br>Air Inlet Bell (AF) |
| 7  | 5880                       | Low Firing Rate Baffle                 |
| 8  | 2184404U                   | CleanCut Pump                          |
|    | 4189U                      | Mounting Screws                        |
| 9  | 21807U                     | Valve Cordset                          |
|    | 21887U                     | PD Timer Delay Cordset                 |
| 10 | 2182602U                   | Solenoid Valve Kit (delay)             |
| 11 | 2256                       | Pump Elbow                             |
| 12 | 5394                       | Copper Oil Line - 8"                   |
| 13 | 21805U<br>4189             | PSC Motor<br>Mounting Screws           |

| #  | Part No.                  | Description                               |
|----|---------------------------|---|
| 14 | 2999U (AFG)<br>2459U (AF) | Blower Wheel (AFG)<br>Blower Wheel (AF)   |
| 15 | 2454                      | Coupling                                  |
| 16 | 7455U                     | R7184A - Interrupted Ignition             |
|    | 7456U                     | R7184B - Pre-purge                        |
|    | 7457U                     | R7184P - Pre and Post-purge               |
|    | 7458U                     | R7184P w/ Alarm Contacts                  |
| 17 | 5770                      | Electrical Box                            |
| 18 | 51771U                    | Igniter & Base Plate                      |
| 19 | 51304                     | Igniter Gasket Kit                        |
| 20 | 7006U                     | Cad Cell Detector                         |
| 21 | 5432<br>3616              | Universal Flange w/ Gasket<br>Gasket Only |
| 22 | Specify **                | Air Tube Combination                      |
| 23 | Specify **                | Heat Shield, Ceramic or Fiber             |
| 24 | 5780                      | Electrode Kit - F Head up to 9"           |
|    | 5782                      | Electrode Kit - F Head over 9"            |
|    | 5940                      | Electrode Kit - M Head up to 9"           |
| 25 | 3666                      | Splined Nut                               |
| 26 | 5685                      | Pedestal Kit                              |
| 27 | 51814U                    | Cover                                     |

\*\* Contact your Beckett Representative for part number and pricing.

Limited  
**WARRANTY**

**For Residential, Commercial and Specialty Burners**

The R. W. BECKETT CORPORATION ("Beckett") warrants to persons who purchase its Beckett burners from Beckett for resale or for incorporation into a product for resale ("Customers") that its equipment is free from defects in material and workmanship under normal use and service for 60 months from the date of manufacture for Residential Burners and 18 months from the date of manufacture for Commercial and Specialty Burners. *Residential burner models include:* AF, AFG, AFIL, NX, SF, SR and SMG. *Commercial burner models include:* CF375, CF500, CF800, CF1400, CF2300A, CF2500, CF3500A, CG10, CG15, CG25 and CG50. *Specialty burner models include:* ADC, ADCP, ARV, SDC and SM. The provisions of this warranty are extended to individual major burner components as follows:

- a) 60 months from date of manufacture for all Beckett-branded major components, except for 12 Vdc components.
- b) 18 months from date of manufacture for all non-Beckett-branded major components and Beckett branded 12 Vdc components.

Note: Normal service items found to be defective upon receipt by the customer are covered by this warranty.

**THIS WARRANTY DOES NOT EXTEND TO EQUIPMENT SUBJECTED TO MISUSE, NEGLIGENCE, OR ACCIDENT; NOR DOES THIS WARRANTY APPLY UNLESS THE PRODUCT COVERED BY IT IS PROPERLY INSTALLED BY A QUALIFIED, COMPETENT TECHNICIAN, WHO IS LICENSED WHERE STATE AND LOCAL CODES REQUIRE, AND WHO IS EXPERIENCED IN MAKING SUCH INSTALLATIONS, IN ACCORDANCE WITH THE LATEST EDITION OF NFPA NO. 31 OF THE NATIONAL FIRE PROTECTION ASSOCIATION, THE LATEST EDITION OF THE NATIONAL FUEL GAS CODE (NFPA NO. 54) AND IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE AND NATIONAL CODES HAVING JURISDICTIONAL AUTHORITY.**

Equipment, which is defective in material or workmanship and within the warranty period, may be returned for credit as follows:

Beckett Burners, Beckett-branded major components and non-Beckett-branded major components that came as original equipment on a Beckett burner or were sold as a replacement part by Beckett should be returned, freight prepaid, to Beckett's home office. Credit will be issued to the customer unless the returned equipment is determined by Beckett to be out of warranty or damaged by user, in which case the equipment will be scrapped.

**Note: Beckett is not responsible for any labor cost for removal and replacement of equipment.**

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 BECKETT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGE OF ANY NATURE. Beckett neither assumes nor authorizes any person to assume for Beckett any other liability or obligation in connection with the sale of this equipment, Beckett's liability and Customer's exclusive remedy being limited to credit as set forth above.

**R.W. BECKETT CORPORATION**

P.O. Box 1289 Elyria, Ohio 44036

Form No. 61545 R72905

The Oilheat Manufacturers' Association supports the use of low sulfur fuels as defined by ASTM D396, Grades No. 1 Low Sulfur and No. 2 Low Sulfur, as the preferred heating fuel for the following reasons:

- Low sulfur fuels reduce deposits on heat exchanger surfaces, extending the service interval between cleanings.
- The reduced deposits increase the efficiency of the appliance.
- Low sulfur fuels reduce particulate emissions.
- Low sulfur fuels reduce oxides of nitrogen emissions.

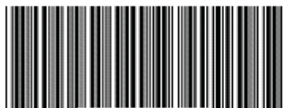
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Form Number 6104 BAFG R02



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