

# SF/SM

## Oil Burner Manual

Beckett™

RESIDENTIAL BURNERS



### **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.

**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.

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# General Information

## Hazard Definitions

**⚠ DANGER** Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

**⚠ WARNING** Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

**⚠ CAUTION** Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

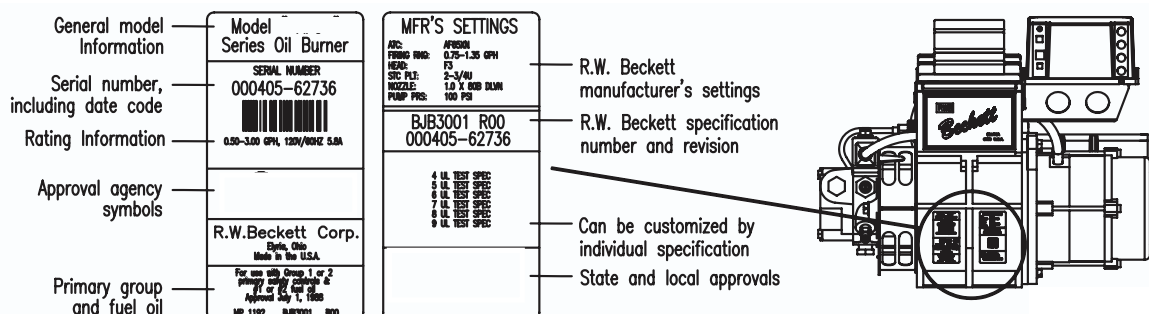
Within the boundaries of the hazard warning, there will be information presented describing consequences if the warning is not heeded and instructions on how to avoid the hazard.

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

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

Feature	SM	SF
Firing Rate Range	1.25 to 3.00 gph	1.25 to 5.50 gph
Motor	1/5 HP	1/4 HP
Fuel pump capacity	3 gph (standard)	7 gph (standard)
UL Air Tube Combinations	See Table 2	See Table 2
Blocking oil solenoid valve	Optional	Required above 3 gph
Primary control lockout timing	15 to 45 seconds (optional)	15 seconds maximum

Figure 1. Burner Label Location



## ⚠ 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.

**CAUTION** Frozen Plumbing and Water Damage Hazard

*If the residence is unattended in severely cold weather, burner primary control safety lockout, heating system component failures, power outages or other electrical system failures could result in frozen plumbing and water damage in a matter of hours. For protection, take preventive actions such as having a security system installed that operates during power outages, senses low temperature and initiates an effective action. Consult with your heating contractor or a home security agency.*

**Table 1 – Burner Specifications**

Model SM Capacity (Note1)	Firing rate range: 01.25 – 3.00 GPH Input: 175,000 – 420,000 Btu/hr
Model SF Capacity (Note1)	Firing rate range: 1.25 - 5.50 GPH Input: 175,000 – 770,000 Btu/hr
Certifications/ Approvals	Model SM - UL listed to comply with ANSI/UL296 and CSA-B140.0. Model SF - UL listed to comply with ANSI/UL 296 and CSA-B140.0.
Fuels	<b>CAUTION</b> <b>DO NOT USE GASOLINE, CRANKCASE OIL, OR ANY OIL CONTAINING GASOLINE.</b>  U.S. #1 or #2 fuel oil only (ASTM D396) Canada #1 stove oil or #2 furnace oil only
Electrical	<i>Power supply:</i> 120 volts AC, 60 Hz, single phase  <i>Operating load (SM):</i> 5.8 Amps max <i>Operating load (SF):</i> 7.1 Amps max  <i>Motor (SM):</i> 1/5 hp, 3450 rpm, NEMA 'N' flange, manual reset over load protection <i>Motor (SF):</i> 1/4 hp, 3450 rpm, NEMA 'N' flange, manual reset over load protection  <i>Ignition:</i> Continuous duty solid-state igniter
Fuel pump	Outlet pressure: Note 2
Air tube	ATC code: See Table 2
Dimensions (Standard)	<i>Height:</i> 12.5 in. <i>Width:</i> 15 in. <i>Depth:</i> 8.50 in. <i>Air tube diameter:</i> 4.00 in.
Air tube	ATC code: See Table 2

**Note 1:** Approval agency listed rating for Model SM is 1.25 to 3.00 gph and Model SF is 1.25 to 5.50 gph. However, the firing rate range is limited by the specific air tube combination being used. Refer to Table 2.

**Note 2.** UL Recognized to 4.0 GPH with a CleanCut pump for use in pressure washers.

**Note 3.** See appliance manufacturer's burner specifications for recommended pump discharge pressure.

**NOTICE** Special Requirements

- THE INSTALLATION OF A BURNER SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF AUTHORITIES HAVING JURISDICTION.
- For recommended installation practices in the U.S. refer to the latest edition of NFPA 31. (CSA-B139 and CSA-B140 in Canada).
- 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**.

**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 CSA-B140 in Canada). Regulation by these authorities take precedence over the general instructions provided in this installation manual.

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

Firing Rate (gph)	Head	Static plate size (in.)	ATC Codes for usable air tube lengths ('A' in inches; See Figure 3.)			
			6-5/8	9	13	16
<b>SF Burner Only</b>						
1.25-2.25	F12	2-3/4	SF65VW	SF90VW	SF130VW	SF160VW
1.75-2.75	F22	2-3/4	SF65VP	SF90VP	SF130VP	SF160VP
1.75-3.25	F220	None	SF65FD	SF90FD	SF130FD	SF160FD
2.5-5.5	F310	None	SF65FU	SF90FU	SF130FU	SF160FU
<b>SM Burner Only</b>						
1.25-2.00	F12	2-3/4	SM65VW	SM90VW	SM130VW	SM160VW
2.00-3.00	F220	None	SM65FF	SM90FF	SM130FF	SM160FF
2.00-3.00	F22	None	SM65VM	SM90VM	SM130VM	SM160VM

**Table 3. Chamber Dimensions**

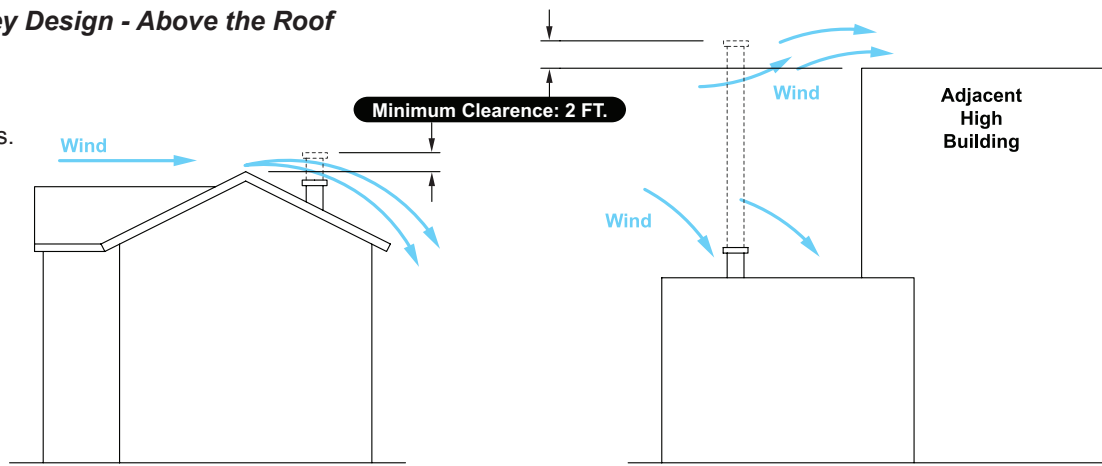
Chamber Dimensions (inches)					
Firing Rate (GPH)	Round I.D.	Rectangular		Height	Floor to nozzle
		Width	Length		
1.25	11	10	11	12	5-6
1.50	12	11	12	13	6-7
2.00	14	12	15	13	6-7
2.50	16	13	17	14	7-8
3.00	18	14	18	15	7-8
3.50	19	15	19	15	7-8
4.00	20	16	21	16	8-9
5.00	23	18	23	18	9-10
5.50	24	19	24	19	10-11

**Inspect/Prepare Installation Site****WARNING****Fire, Smoke & Asphyxiation Hazard**

- Carefully inspect the chimney or exhaust vent system.
- Make sure it is properly sized and in good working condition.
- Follow the instructions supplied by the appliance manufacturer.
- The installation must strictly comply with all applicable codes, authorities having jurisdiction and the latest revision of the National Fire Protection Association Standard NFPA 31 for the installation of chimneys and vent sizing, (or CSA-B139 and CSA-B140 in Canada).
- Regulation by these authorities take precedence over the general instructions provided in this installation manual.

**Figure 2 - Chimney Design - Above the Roof**

**NOTE:** Correct chimney design is shown by dotted lines. Incorrect chimney design, as shown by the solid lines, may result in down-drafts.



### Inspect chimney or direct vent system

1. Starting with minimum gph firing rate, the minimum size recommended is 6" flue pipe with 8" X 8" inside chimney, unless specified otherwise by the appliance manufacturer.
2. A chimney flue shall extend at least 3 feet above the highest point at which the chimney comes in contact with the roof, and not less than 2 feet above the highest roof surface or structure within 10 feet horizontally of the chimney. Refer to Figure 2.
3. Any accumulation of soot or debris in chimney offsets should be removed.
4. Any obstructions such as a protruding joint or a piece of broken tile wedged in the chimney should be removed.
5. No other appliance connection should be made to the same flue pipe.
6. The flue pipe should have an upward pitch toward the chimney of at least 1/4" per foot of length. It should fit tightly and should not project into the chimney.
7. Any leakage between tiles, around clean-out doors, or around the vent pipe should be sealed.

### INSULATED STAINLESS STEEL CHIMNEY LINERS

The new designs of high efficiency oil furnaces and boilers in conjunction with flame retention oil burners are more efficient. One result of increased efficiency is lower flue gas temperatures. As flue gases rise in the chimney, they will cool and condense when they reach the dew point. The condensation will mix with the sulphur in the flue gases creating sulphuric acid. The acid will attack the chimney mortar, brick and clay liners causing corrosion, deterioration and blockage of the chimney. Eventually the blockage could prevent exhausting the flue gases. Instead, the flue gases could vent out the barometric damper into the living space.

Therefore, it is strongly recommended that an approved insulated stainless steel liner be installed.

- 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.

### Combustion air supply

See NFPA 31 Standard for complete details.



**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

### 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.

### 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 retrofitting

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

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### **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.
- 

## Prepare the Burner

### Burner fuel unit

Verify that the burner fuel unit is compatible with the oil supply system. For more details, refer to the pump manufacturer's instructions provided with the burner.

### 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 4** for details.

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

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### **WARNING** Correct Nozzle and Flow Rate Required



**Incorrect nozzles and flow rates could result in impaired combustion, under-firing, over-firing, sooting, 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 (torque to 90 inch pounds). For typical nozzle flow rates at various pressures refer to **Table 4**.

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1. Remove the plastic plug protecting the nozzle adapter threads
2. Place a  $\frac{3}{4}$ " open-end wrench on the nozzle adapter. Insert the nozzle into the adapter and finger tighten. Finish tightening with a  $\frac{5}{8}$ " open-end wrench. Use care to avoid bending the electrodes.
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 3**.
4. If the nozzle is not installed, obtain a nozzle 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 5** 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.

**Table 4. 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
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	3.18
2.50	2.80	2.96	3.06	3.31	3.54
2.75	3.07	3.25	3.37	3.64	3.90
3.00	3.35	3.55	3.67	3.97	4.24
3.25	3.63	3.85	3.98	4.30	4.60
3.50	3.91	4.14	4.29	4.63	4.95
3.75	4.19	4.44	4.59	4.96	5.30
4.00	4.47	4.73	4.90	5.29	-
4.50	5.04	5.32	5.51	-	-
5.00	5.59	-	-	-	-
5.50	-	-	-	-	-

**Table 5. Nozzle Spray Angles**

Recommended nozzle spray angles	
"F" head	70°, 80° or 90° nozzle

Note: Always follow the appliance manufacturer's nozzle specification, when available.

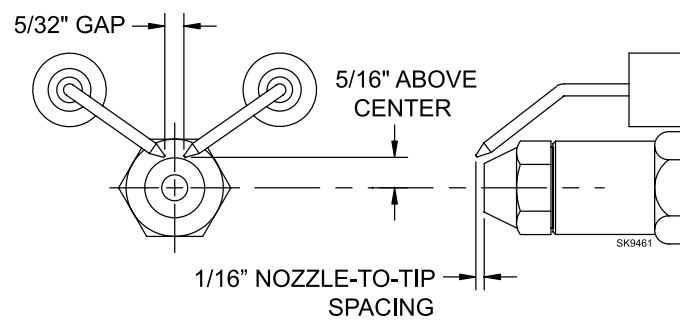
### Check/adjust electrodes

Check the electrode tip settings. Adjust if necessary to comply with the dimensions shown in **Figure 3**. To adjust, loosen the electrode clamp screw and slide/rotate electrodes as necessary. Securely tighten the clamp screw when finished.

### 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. To replace the nozzle assembly, reverse the above steps.

**Figure 3. – Electrode Tip Adjustment**



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

See **Figure 4** for complete details.

## Mount Burner on Appliance

### Mounting options



**WARNING** Do Not use Adjustable Mounting Flange on Mobile Units

*The shock and vibration could cause loss of burner alignment and insertion problems resulting in flame impingement, heavy smoke, fire and equipment damage.*

- Only use specified factory-welded flange and air tube combinations.

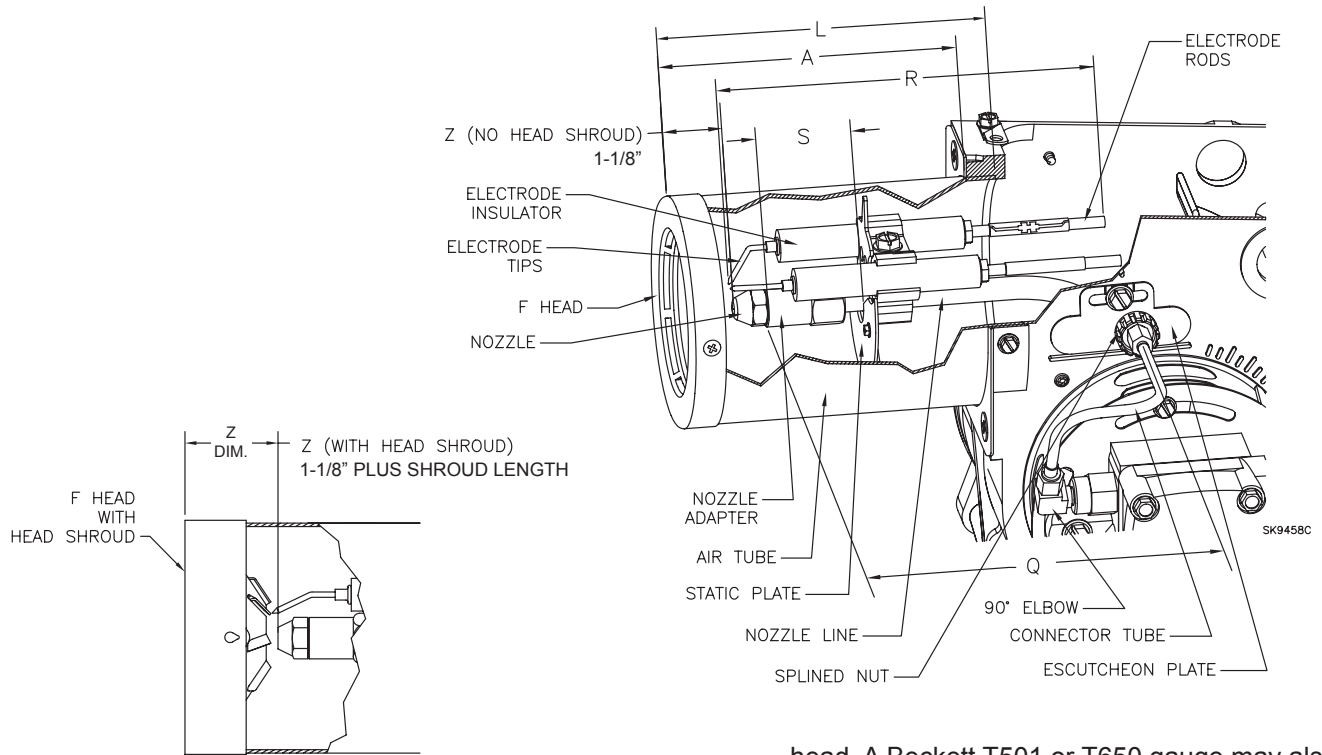
Bolt the burner to the appliance using the factory-mounted flange or an adjustable flange.

### 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 5**.
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, unless 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.



Figure 4. Check/Adjust 'Z' Dimension for 'F' Heads



### **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.

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 1-1/8" (1-3/8" 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 or T650 gauge may also be used.

- Slide the nozzle line forward or back until the Z dimension for F heads is 1-1/8" (1-1/8" plus shroud length, if using a straight edge).
  - 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.

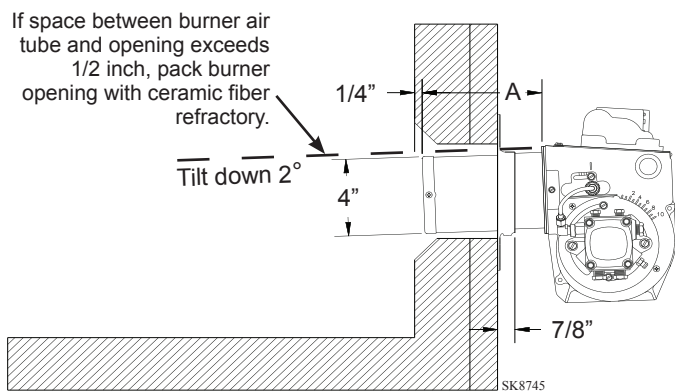
### Burner Dimensions - Models SM & SF

Dimension (inches)	F Head
A = Usable air length (inches)	(Measure accurately)
L (Total tube length)	A Dim. + 1/2
R (electrode length), $\pm 1/4$	A Dim. + 2-1/4
S (adapter to static plate), $\pm 1/16$	(Note 1)
Q (nozzle line length),	A Dim. + 15/16
Z (F head w/o head shroud) (F head-with head shroud)	1-1/8 1-1/8 + shroud length. (Note 2)

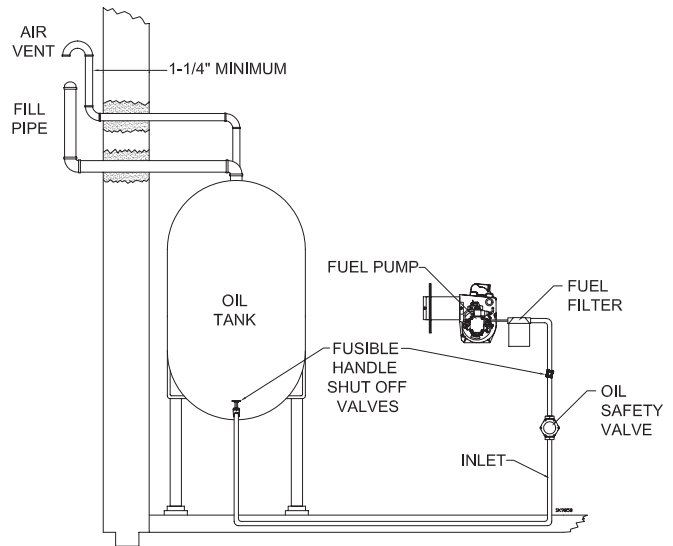
Note 1: 1-3/8 for dimension A less than 4"; 1-5/8 for dimension A from 4" through 4-1/2", 2-13/32" for dimension A greater than 4-1/2".

Note 2: When using a straight edge.

**Figure 5. – Mounting Burner in Appliance**



**Figure 6. – Inside Tank Gravity Feed System**



## Installing the Oil Tank and Supply System

### **WARNING** Oil Leak and Fire Hazard

Install the oil tank following applicable standards in the U.S. by referring to the latest edition of NFPA 31 or CSA-B139 & CSA-B140 in Canada, and all authorities having jurisdiction.

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

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

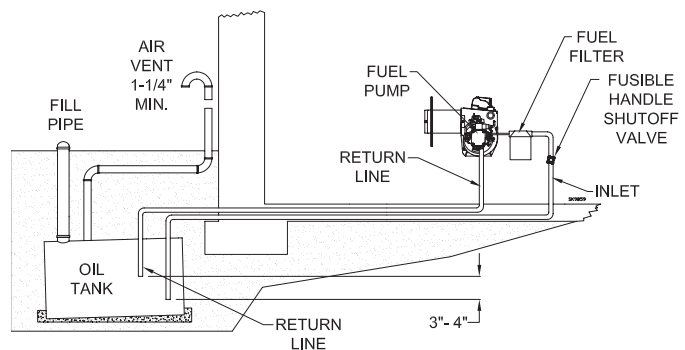
- Never use Teflon tape on fuel oil fittings.
- Tape fragments can lodge in fuel line components and fuel unit, damaging the equipment and preventing proper operation.
- Use oil-resistant pipe sealant compounds.

**Note:** to determine the proper fuel line size, refer to the fuel pump manufacturer's instructions provided with the burner. Refer to **Figure 6** or **Figure 7** for typical installation layouts.

### **NOTICE**

To further protect the fuel supply system and reduce nozzle orifice plugging, a dual filtration system can be installed. This typically consists of a 50 micron primary filter, located near the fuel tank and a secondary filter rated for at least 10 microns located near the burner.

**Figure 7. – Outside Buried Tank-Lift System**



## Connect fuel lines

Carefully follow the fuel unit manufacturer's literature and the latest edition of NFPA 31 for oil supply system specifications (CSA B-139 in Canada).

### **Fuel supply level with or above burner –**

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 –**


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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.
  - **Do NOT install valves in the return line.** (NFPA 31, Chapter 8.)
  - **Gravity Feed Systems:** Always install an oil safety valve (Webster OSV or Suntec PRV) 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.
- 

Continuous lengths of 0.035" nominal wall (0.032" minimum) 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.

**Fuel line valve and filter –**

- Install two high quality, oil duty rated, fusible-handle design shutoff valves in accessible locations on the oil supply line to comply with the NFPA 31 Standard and authorities having jurisdiction. Locate one close to the tank and the other close to the burner, upstream of the filter for service access.
- 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**


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**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 Figures 11a and 11b, for typical burner wiring, showing cad cell primary controls. Burner wiring may vary, depending on primary control actually used.
- Refer to the appliance manufacturer's wiring diagram prior to connecting the burner wiring. All wiring must be in accordance with the latest revision of National Electric Code NFPA 70 and all local codes and regulations. In Canada, all wiring is to be in accordance with the Canadian Electrical Code, Part 1.

The 7505 primary control with valve-on delay (pre-time) and burner motor-off delay (post-time) 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.**

# Burner Controls

## GeniSys Model 7505 Control

### **WARNING** Fire or Explosion Hazard

**Can cause severe injury, death, or property damage.**

- The control can malfunction if it gets wet, leading to accumulation of oil or explosive oil vapors.
- Never install where water can flood, drip or condense on the control.
- Never use a control that has been wet - replace it.

### Features

- Thermostat / Operating and Limit Control Compatible
- Welded Relay Protection
- Limited Recycle
- Limited Reset
- 3 Status Lights
- Valve-On Delay / Motor-Off Delay (Field programmable with 52067 GeniSys Display)
- 15 Second Lockout Time
- Interrupted or Intermittent Duty Ignition
- Technician Pump Priming Mode
- Disable Function
- Communication Ports

## Wiring

### **WARNING** Explosion, Fire, Scald, and Burn Hazard

**All heating appliances must have HIGH LIMIT protection to interrupt electrical power and shutdown the burner if operating or safety controls fail and cause a runaway condition.**

- Follow the appliance manufacturer's wiring diagrams and note all required safety controls.
- Typical safety controls include high temperature or pressure limits, low water cutoffs, pressure relief valves and blocked flue sensing switches.
- Verify all limit and safety controls are installed and functioning correctly, as specified by the manufacturer, applicable safety standards, codes and all authorities having jurisdiction.
- Ensure that the appliance is free of oil and oil vapor before starting or resetting the burner.

### **CAUTION** Incorrect Wiring Will Result in Improper Control Operation

- GeniSys wiring label colors may not match the wire colors of the burner or other manufacturers' controls.
- The GeniSys Control should be wired according to the appliance manufacturer's instructions.

Figure 8 - 7505 Control



### Optional Components:



**Contractor's Tool:**  
Hand-held device for programming and diagnostics

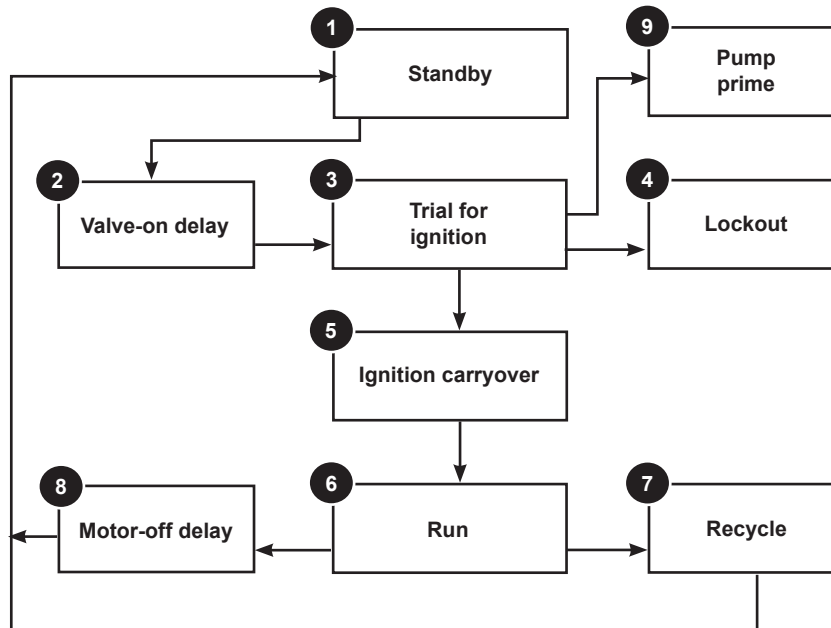
**Display Module:**  
Permanent device for programming and diagnostics

**Alarm Module:**  
For adding isolated low voltage alarm contacts to the base control. See Alarm Module Instructions for specifications.



**Typical Burner Sequence of Operation for GeniSys 7505 Control.**

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



1. **Standby:** The burner is idle, waiting for a call for heat.
2. **Valve-On Delay:** The igniter and motor are on while the control delays turning on the oil solenoid valve for the programmed time.
3. **Trial For Ignition:** The oil solenoid valve is energized. A flame should be established within the factory set trial for ignition time (lockout time).
4. **Lockout:** The control has shut down for one of the following safety reasons:
  - a. The trial for ignition (lockout) time expired without flame being established.
  - b. The cad cell detected flame at the end of the Valve On Delay state.

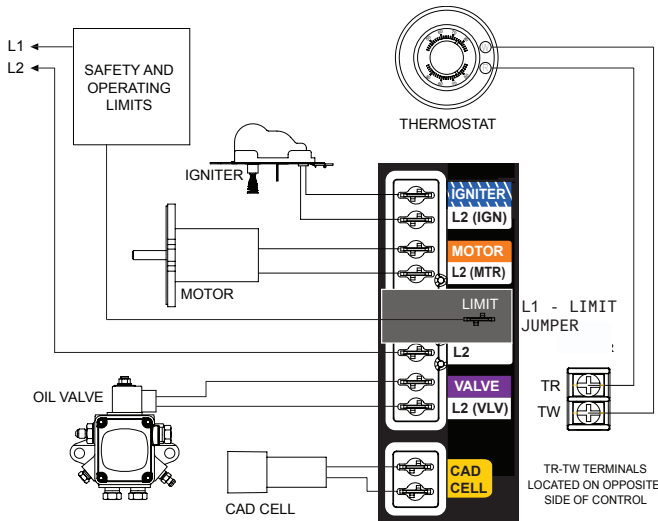
To reset the control from lockout click the button 1-second.
5. **Ignition Carryover:** Once flame is established, the igniter remains on for 10 additional seconds to ensure flame stability.
6. **Run:** The flame is sustained until the call for heat is satisfied. The burner is then sent to Motor-Off 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 repeats the ignition sequence. The control will continue to Recycle each time the flame is lost, until it reaches a pre-set time allotment. The control will then go into Hard Lockout instead of recycle. This feature prevents excessive accumulation of oil in the appliance firing chamber.
8. **Motor-Off Delay:** If applicable, the oil solenoid valve is turned off and the control delays turning the motor off for the set motor-off delay time before the control returns to standby.
9. **Pump Prime:** The igniter and motor are on with the oil solenoid valve energized for 4 minutes. During Pump Prime mode, the cad cell is disregarded, allowing the technician to prime the pump without having to jumper the cad cell.

**NOTE:** A recurrence of the above failure modes or a failed welded relay check could cause the control to enter a **Hard Lockout** state that must be reset only by a qualified service technician.

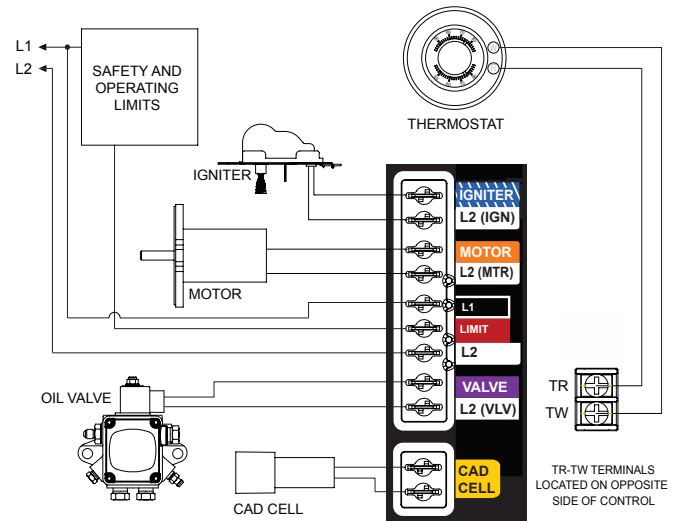
To reset from Hard Lockout, hold the reset button for 15 seconds until the yellow light turns on.

5. **Ignition Carryover:** Once flame is established,

**Figure 9a. – Interrupted ignition, valve-on delay only (no motor-off delay)**



**Figure 9b. – Interrupted ignition, valve-on delay and motor-off delay**



**Reset Button Operation**

**Table 2** explains what action the control will take when the reset button is pressed for different lengths of time during the various burner operating states.

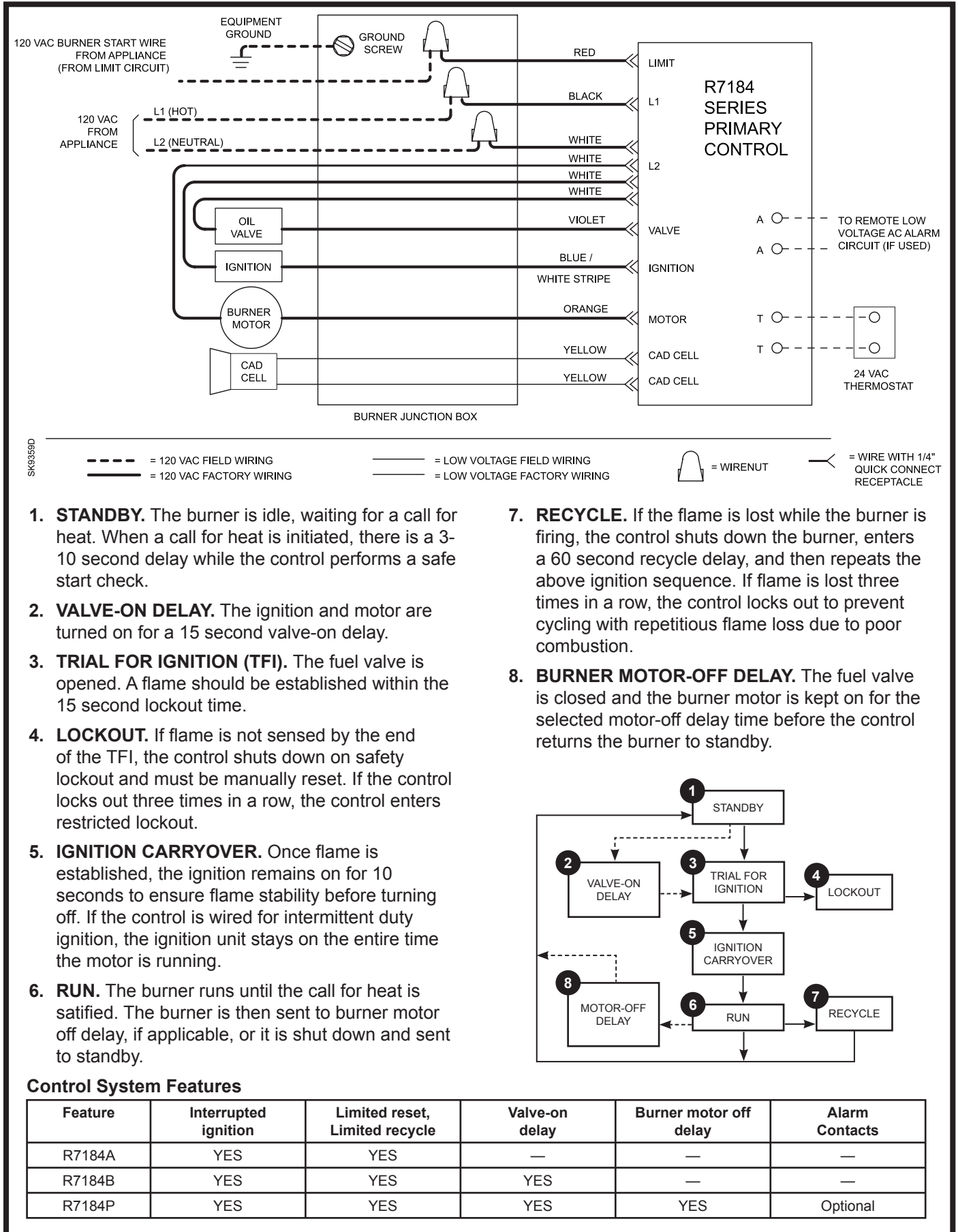
**Table 2 - Reset Button Operation**

If the burner is in the below state:	Pushing the reset button will:		
	Button Click (press < 1 second)	Button Hold (press > 1 second)	Button Hold (press 15+ seconds)
Lockout	Reset from Soft Lockout		Reset from Restricted (Hard) Lockout
Valve-on Delay, Trial for Ignition, Ignition Carryover	Go to Pump Prime (see "Priming the Pump" above)	Disable the Burner: Any time the burner is running, press and hold the reset button to disable the burner. The burner will remain off as long as the button is held.	Enables Pump Priming: After the reset button has been held for 15 seconds, the button can then be clicked during the next ignition sequence to enter Pump Prime mode.
Run (igniter is shut off)	No action		
Motor-Off Delay, Standby	No action		
Pump Prime	No action	Exit Pump Prime mode and return to Standby	

**Table 3 - Status Lights**

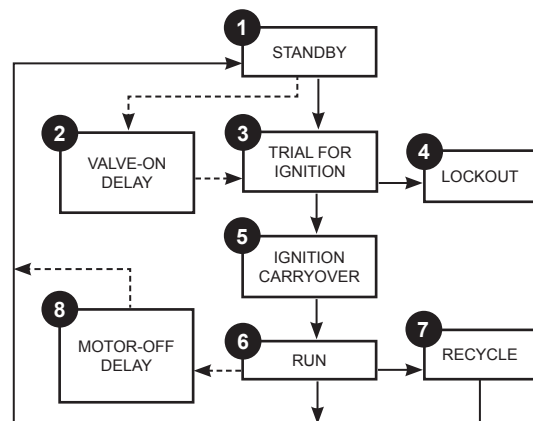
Light Color	On Continuously	Flashing
Red	Restricted (Hard) Lockout	Soft Lockout
Green	Flame Sensed during normal operation (Could be stray light during standby)	Recycle
Yellow	Control is in Pump Prime mode or Reset button currently held for 15+ seconds.	N/A

**Figure 10. Typical Burner Wiring & Burner Sequence of Operation for R7184 Control.**  
Refer to the appliance manufacturer's wiring diagram for actual specifications.



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	Valve-on delay	Burner motor off delay	Alarm Contacts
R7184A	YES	YES	—	—	—
R7184B	YES	YES	YES	—	—
R7184P	YES	YES	YES	YES	Optional

## Wire Burner

### NOTICE

**Some Thermostats Are Polarity Sensitive. Reversed polarity could cause erratic cycling of the burner control.**

Connect the wire from the R<sub>H</sub> or R terminal on the thermostat to the TR terminal on the control. Connect the wire from the W terminal on the thermostat to the TW terminal on the control.

- Make connections to the control's terminals as shown in **Figures 9a** and **9b**. Refer to the label on the underside of the control for wiring details.
- Note: Motor-off delay on a 7505P will be disabled if the safety and operating limits as shown in **Figures 9a and 9b** interrupt power to the control terminal L1.
- Connect thermostat leads to the TR and TW terminals on the control or jumper the TR and TW terminals on the control, as directed by the appliance wiring diagram.
  - Thermostat anticipator Current: 0.1 amp
  - Thermostat voltage: 24 volts AC

**Note that** if the thermostat short cycles or operates improperly, it may require an isolation relay for proper operation. The Beckett A/C Ready Kit (part no. 51950U) provides this function. Wiring instructions are included with the A/C Ready Kit.

## 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. If the air control is not preset, 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 to prevent smoke and carbon monoxide generation.

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.
  - For 7505 primary controls, see Technician's Quick Reference Guide, part number 61666 for special pump priming sequence.
  - Prepare for combustion tests by drilling a 1/4" sampling hole in the flue pipe between the appliance and the barometric draft regulator.
6. Initial air adjustment — Test the flue gas for smoke. Adjust the air shutter (and air band, if necessary) to obtain a clean flame. Now the additional combustion tests with instruments can be made.

### Cad Cell Resistance Measurement

- If the Beckett 7505 control is equipped with the GeniSys Display Module, part 52067U, the cad cell resistance can be selected and read on the LCD screen. Also, the GeniSys Contractor Tool, part 52082U, can be used for this purpose.
- If these are not available, the cad cell leads can be unplugged from the control and the resistance measured with a meter in the conventional way. Conduct these tests with flame present.

Flame Detection Range
Normal = 0 to 1600 ohms
Limited = 1600 ohms to lockout

### Resetting From Restricted or Hard Lockout

- If the control continues to lockout without a satisfied call for heat, or fails the motor relay check, the control



- enters Hard (restricted) Lockout in order to limit accumulation of unburned oil in the combustion chamber.
- To reset, hold the button down for 15 seconds until the red light turns off and the yellow light turns on.
- Always verify the control functions according to all specifications before leaving the installation site.
- Replace the control if it does not operate as specified.

## Startup / Checkout

### **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.

If the burner or control fails any of the following tests, recheck control wiring. If the burner or control still fails any tests, replace the control.

### Check Safety Features

- Safe Start Check
  1. Place a jumper across the cad cell terminals.
  2. Refer to the steps for "Start up burner/set combustion" and have the system call for heat.
  3. Burner must not start. Verify that the green light is on continuously and that the control remains in Standby mode.
  4. End the call for heat and remove the cad cell jumper.
- Simulate Flame Failure and Ignition Failure
  1. Refer to the steps for "Start up burner/set combustion" and have the system call for heat.
- 2. After flame is established and the burner igniter turns off, close the hand valve in the oil supply line.
- 3. At flame loss, the control will enter Recycle mode. Verify that the green light is flashing. The control will remain in Recycle for 60 seconds.
- 4. After the 60 second recycle period, the control will try to restart the system.
- 5. After the 15 second lockout time, the control will lock out the burner and the reset button will flash. Verify that the burner motor and igniter are off and that the burner oil solenoid valve (if used) is not energized.
- 6. Open the hand valve in the oil line.
- 7. Click the reset button and verify that the red light in the reset button shuts off and that the burner lights.
- 8. End the call for heat.
- Before leaving the installation, verify that all thermostat and boiler/furnace control wiring is correct. Consult heating appliance manual for directions.

## Set combustion with instruments

### **CAUTION** OIL-BURNING EQUIPMENT SHALL BE CONNECTED TO FLUES HAVING SUITABLE PRESSURE (DRAFT) AT ALL TIMES TO ASSURE SAFE AND PROPER OPERATION OF THE BURNER.

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  $CO_2$  (or  $O_2$ ). This is the vital reference point for further adjustments. Example: 13.5%  $CO_2$  (2.6%  $O_2$ )
  - Step 3:** Increase the air to reduce the  $CO_2$  by 1.5 to 2 percentage points. ( $O_2$  will be increased by approximately 2.0 to 2.7 percentage points.) Example: Reduce  $CO_2$  from 13.5% to 11.5% (2.6% to 5.3%  $O_2$ ).

- 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
- Once combustion is set, tighten all fasteners on air band, air shutter and escutcheon plate.
  - 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.

- 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.
- 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 all flue passages and flue pipe. Replace corroded or damaged pipes.
- 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.

## 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 UNIT OR CONTROLS - CALL YOUR QUALIFIED SERVICE TECHNICIAN OR SERVICE PERSONNEL.
- 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 the exact brand, pattern, gph flow rate and spray angle..
- 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 lens surface, if necessary.
- 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.

### Shutting the Burner Off

#### **CAUTION** ALWAYS KEEP THE FUEL OIL SUPPLY VALVE SHUT OFF IF THE BURNER(S) IS SHUT DOWN FOR AN EXTENDED PERIOD OF TIME.

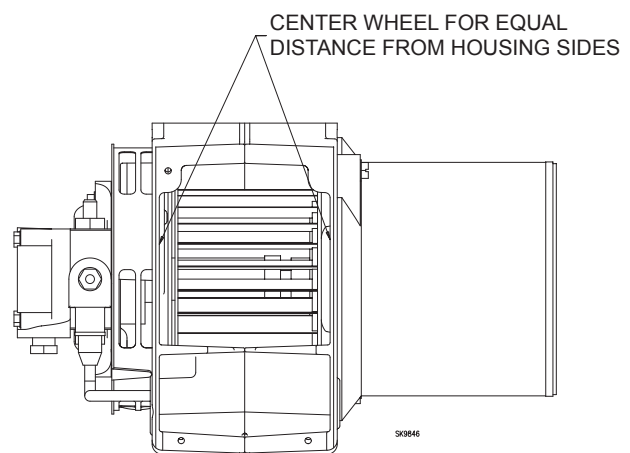
Turn off all electric power to the burner.

**Note:** There could be more than one disconnect switch.

### Replacing the blower wheel:

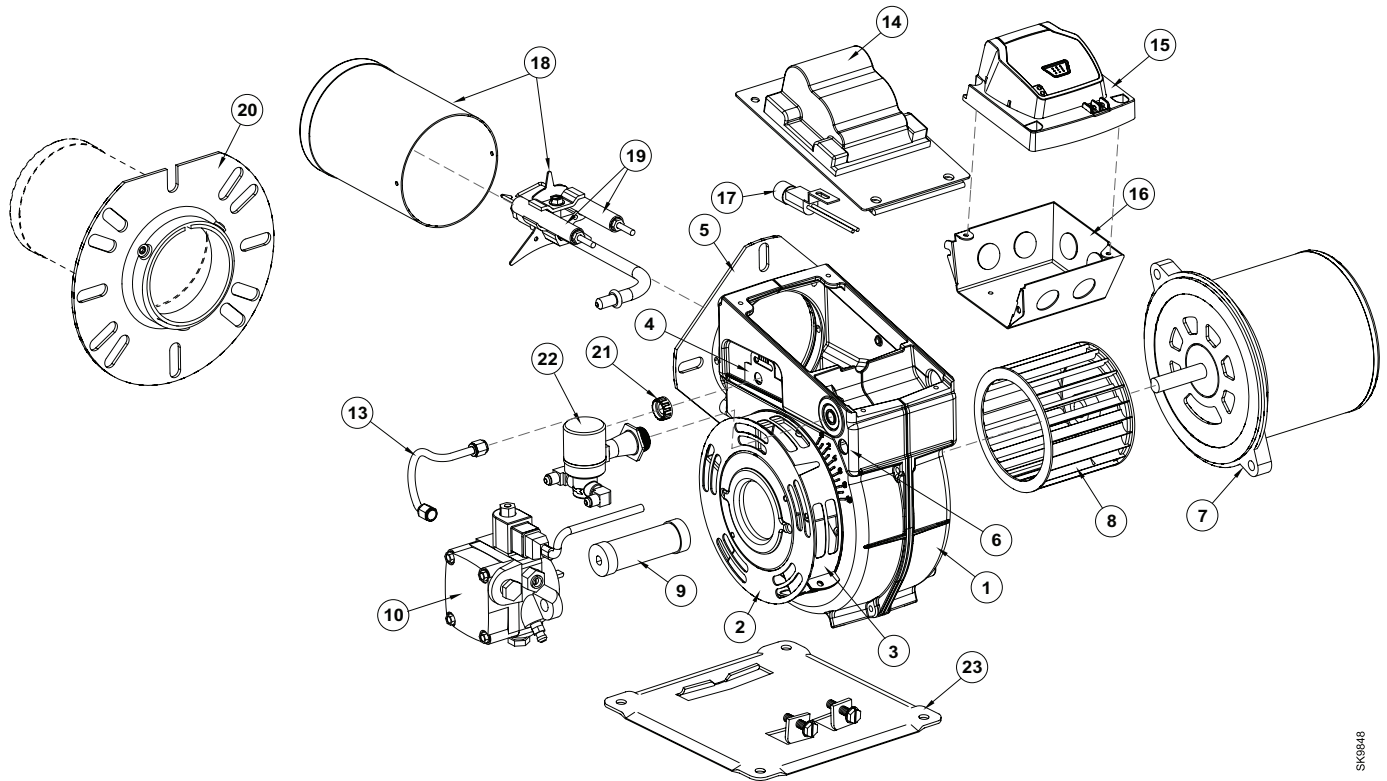
When replacing the blower wheel, insure that the wheel is centered between the two sides of the burner housing as shown below.

**Figure 10. Blower Wheel Assembly**



# Replacement Parts

For best performance specify genuine *Beckett* replacement parts



SK0548

#	Part No.	Description
1		Burner Housing Assembly with Inlet Bell
2	3215	Air shutter, 10 Slot
3	3819	Bulk Air Band, 10 Slot
4	3493	Nozzle-line Escutcheon Plate
5	Specify ** 3399	Unit Flange or Square Plate
	3416	Air Tube Gasket (not shown)
6	2139	Hole Plug - Wiring Box
7	2900U 2364U	Drive Motor, 1/5 HP (SM Models) Drive Motor, 1/4 HP (SF Models)
8	2383U	Blower Wheel (6-1/4 X 3-7/16)
9	2433	Flexible Coupling (Fits 5/16" pump shaft)
10	2591U 21188U	Fuel Units SF only Single-Stage 'A' Two-Stage 'B'
10	2184404U 2460	Fuel Units SM only CleanCut Single-Stage 'A'
	2256	Pump outlet fitting (not shown)
	482	Pump holding screws (not shown)
13	5394	Connector tube assembly, pump to nozzle line

#	Part No.	Description
14	51824U	Igniter and Base Plate
14	2289U	Ignition Transformer (10,000 V/23mA)
15	7505A	Replaces R7184A - Interrupted Ignition
	7505B	Replaces R7184B - Pre-time
	7505P	Replaces R7184P - Pre and Post-time
16	5770	Electrical Box
17	7006U	Cad Cell Detector
18	Specify **	Air Tube Combination
	5780	Electrode Kit - F Head up to 9"
19	5782	Electrode Kit - F Head over 9"
20	5432 3616	Universal Flange w/ Gasket Gasket Only
21	3666	Splined Nut
22	2182602U	Blocking Oil Solenoid Valve
23	5685	Base Pedestal Kit

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

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The R. W. BECKETT CORPORATION ("Beckett") warrants to persons who purchase its "Products" from Beckett for resale, or for incorporation into a product for resale ("Customers"), that its equipment is free from defects in material and workmanship. To qualify for warranty benefits, products must be installed by a qualified service agency in full compliance with all codes and authorities having jurisdiction, and used within the tolerances of Beckett's defined product specifications.

To review the complete warranty policy and duration of coverage for a specific product, or obtain a written copy of warranty form 61545, please choose one of the following options:

1. Visit our website at: [www.beckettcorp.com/warranty](http://www.beckettcorp.com/warranty)
2. Email your request to: [rwb-customer-service@beckettcorp.com](mailto:rwb-customer-service@beckettcorp.com)
3. Write to: R. W. Beckett Corporation, P. O. Box 1289, Elyria, OH 44036

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

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