

## Mount Burner on Appliance



### 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.

### • Mounting options

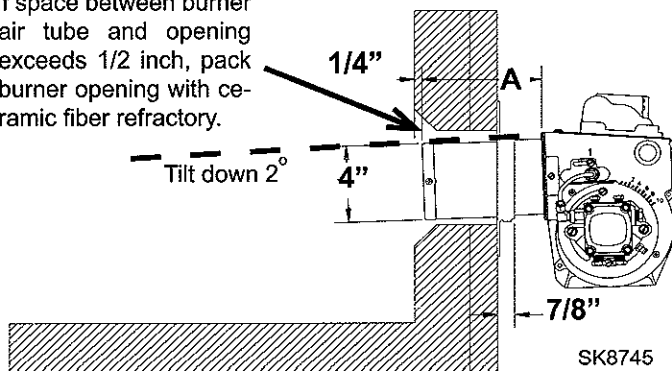
Bolt the burner to the appliance using the factory-mounted flange or an adjustable flange.

### • 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 3.
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 3. – Mounting Burner in Appliance**

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



### • Connect fuel lines

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



### 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. **EXCEPTION:** Unless specified by the equipment manufacturer and noted on the label at top of pump cover.
- Install the by-pass plug in two-pipe oil supply systems **ONLY**.



### 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 anti-siphon valve in the oil supply line or a solenoid valve (RWB Part # 2182602U or 2233U) in the pump/nozzle discharge tubing to provide backup oil flow cut-off protection.

### 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.

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

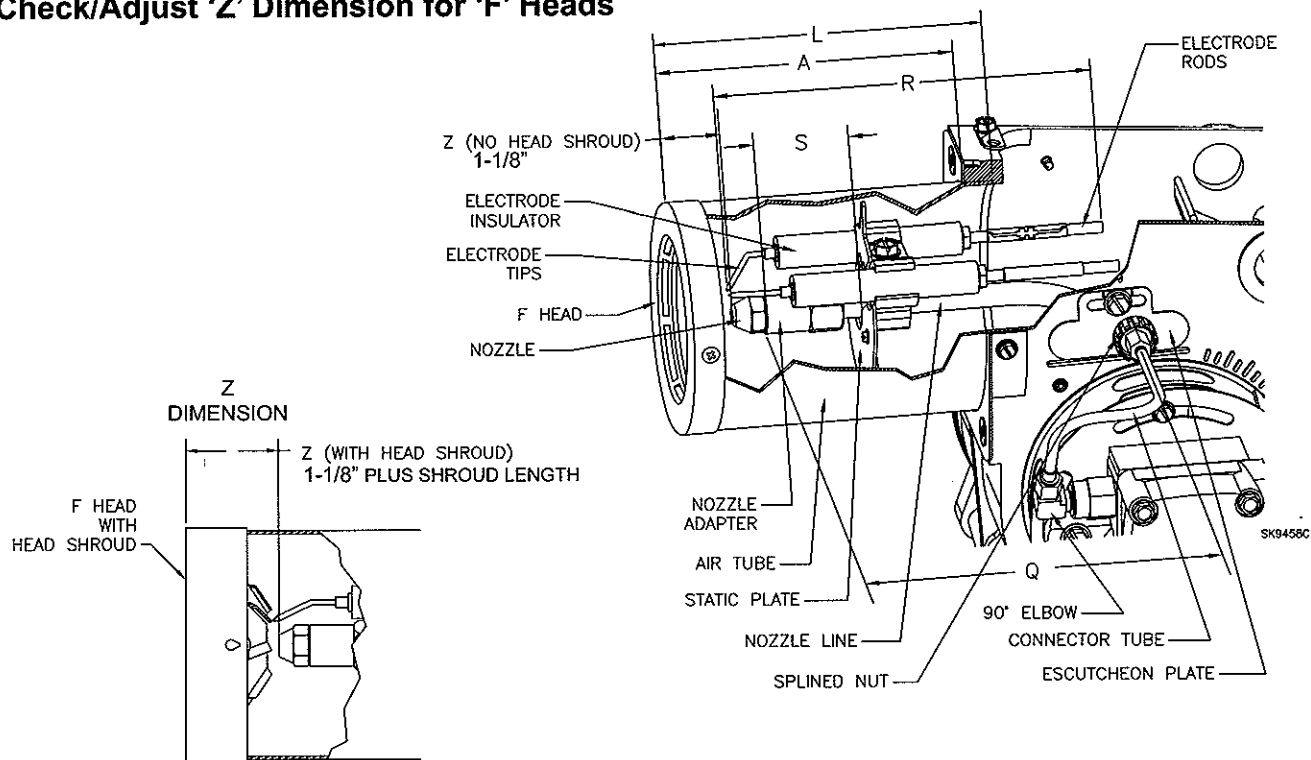


Figure 4. 'F' Head

### • Check/Adjust 'Z' Dimension - '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  $1\frac{1}{8}$ " ( $1\frac{3}{8}$ " 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 or T650 gauge may also be used.

- Slide the nozzle line forward or back until the Z dimension for F heads is  $1\frac{1}{8}$ " ( $1\frac{1}{8}$ " 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)	$A + \frac{1}{2}$
R (electrode length), $\pm \frac{1}{4}$	$A + 2\frac{1}{4}$
S (adapter to static plate), $\pm \frac{1}{16}$	(Note 1)
Q (nozzle line length),	$A + \frac{15}{16}$
Z (F head w/o head shroud)	$1\frac{1}{8}$
(F head-with head shroud)	$1\frac{1}{8} + \text{shroud length. (Note 2)}$

Note 1:  $1\frac{3}{8}$  for dimension A less than 4";  $1\frac{5}{8}$  for dimension A from 4" through  $4\frac{1}{2}$  ";  $2\frac{13}{32}$  for dimension A greater than  $4\frac{1}{2}$  ".

Note 2: When using a straight edge.

## Fuel line installation –

### **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 of Teflon tape will void the Suntec warranty.
- Use oil-resistant pipe sealant compounds.

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.

### Fuel line valve and filter –

- Install two high quality fusible-handle design shut-off 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.
- 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

### **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)

### • Burner packaged with appliance

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

### • Burner installed at jobsite

Refer to Figure 5, 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.

## 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.

## Typical Burner Wiring & Burner Sequence of Operation for R7184 Control.

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

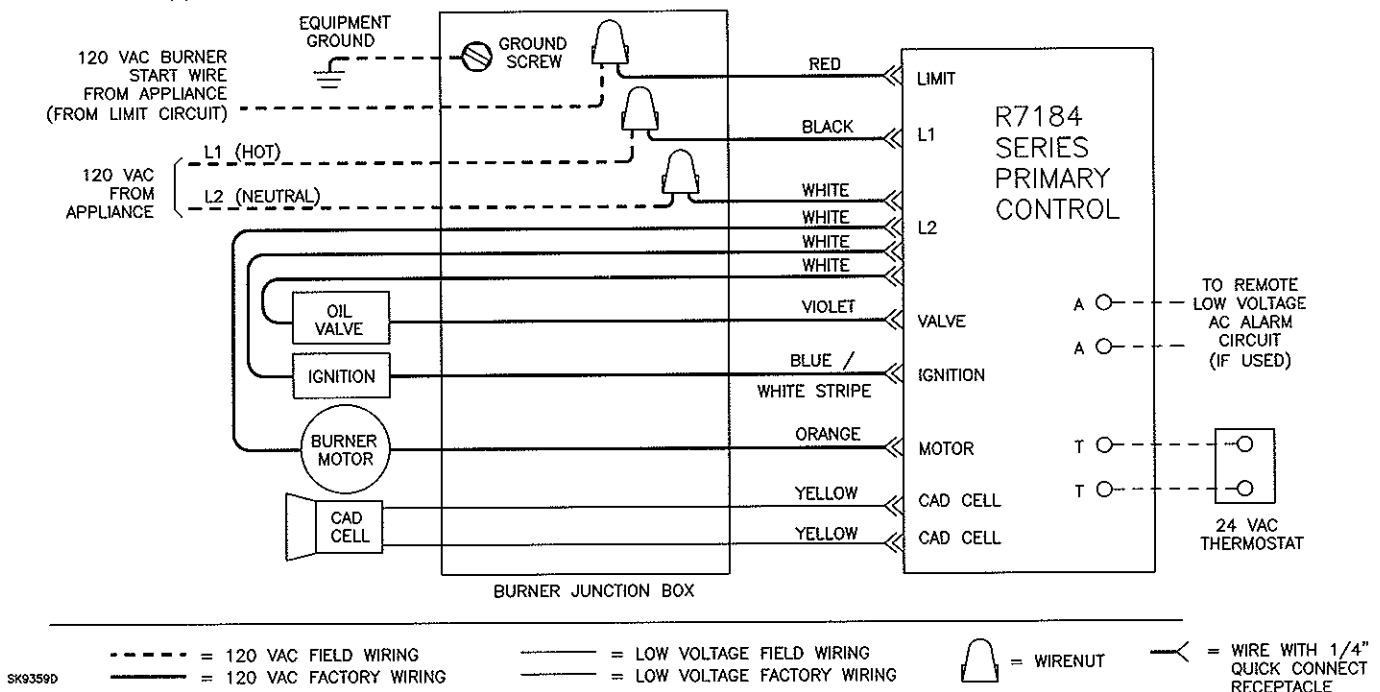
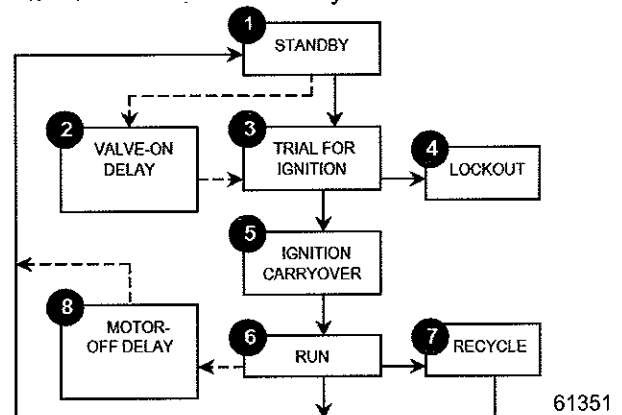


Figure 5. – Typical Burner Wiring

- 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

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 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

## • 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 escutcheon plate.
5. 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



### Annual Professional Service Required



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

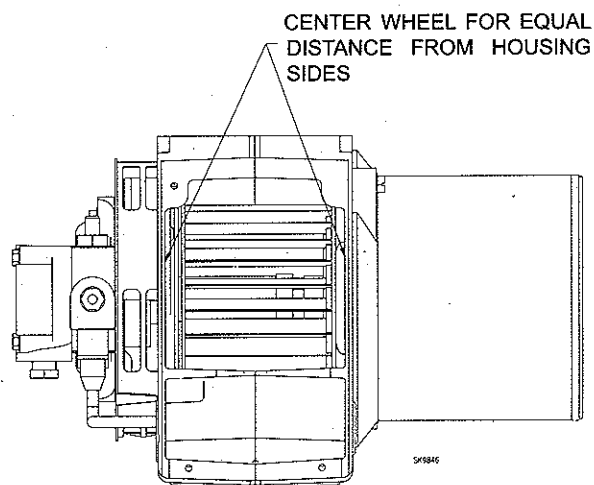
- Do not tamper with the burner or controls or make any adjustments unless you are a trained and qualified service technician.
- To ensure continued reliable operation, a qualified service technician must service this burner annually.
- More frequent service intervals may be required in dusty or adverse 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 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.
- ☐ 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 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.

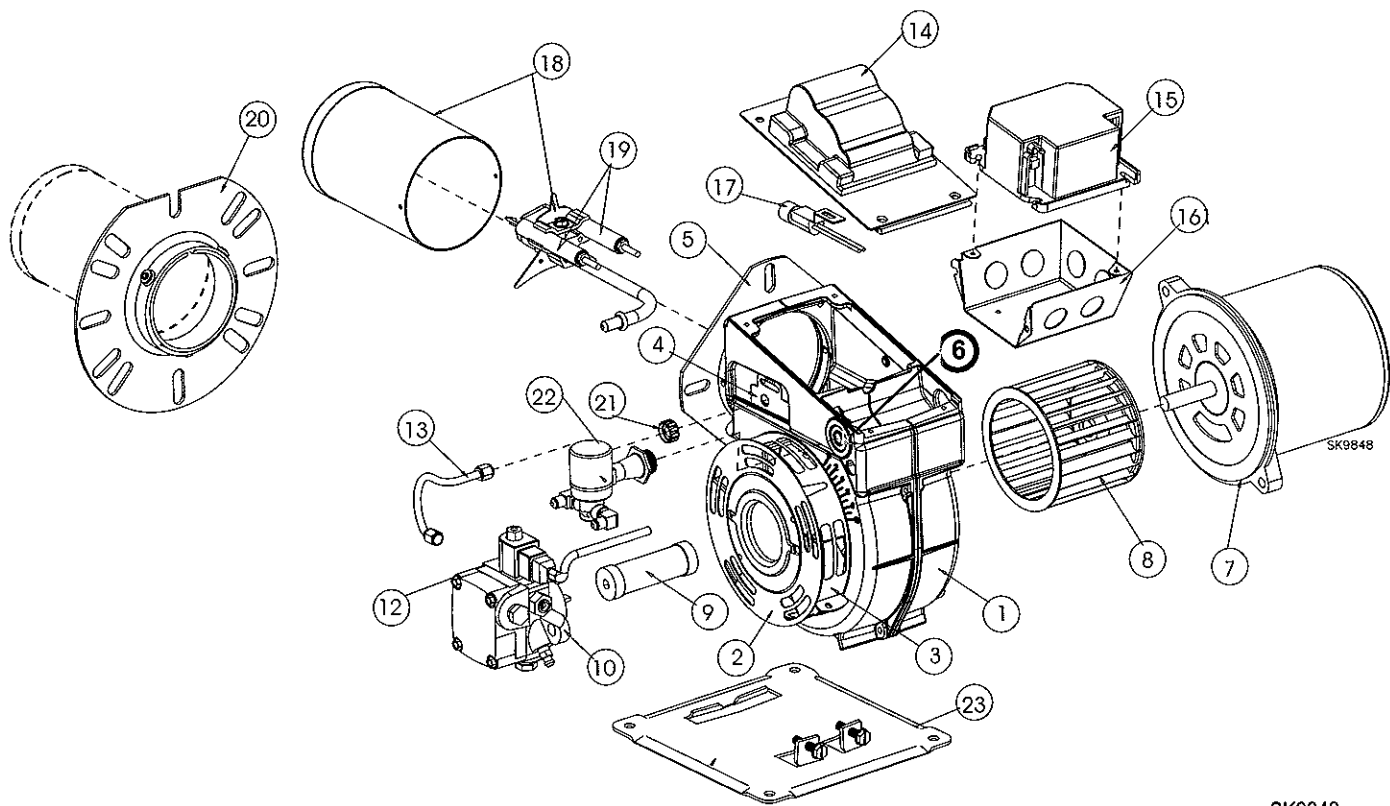
### • Replacing the blower wheel:

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



**Figure 6. Blower Wheel Assembly**

## Burner Parts Diagram



SK9848

For best performance specify genuine *Beckett* replacement parts

#	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
Not Shown	3416	Air Tube Gasket
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'
12	2256	Pump outlet fitting
	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	7455U	R7184A - Interrupted Ignition
	7456U	R7184B - Pre-purge
	7457U	R7184P - Pre and Post-purge
	7458U	R7184P w/ Alarm Contacts
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.



# 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, AFII, 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.

### R.W. BECKETT CORPORATION

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12/06



**Beckett**  
COMMERCIAL

**CF1400**  
**CF2300**

**OIL BURNER MANUAL**

**Operation: Low/High**

**Rate: CF1400: 4.0 to 13.6 GPH**

**CF2300: 7.0 to 19.9 GPH**



**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.

## Before you begin . . .

*The following resources will give you additional information for your installation. We suggest that you consult these resources whenever possible. Pay particular attention to the appliance manufacturer's instructions.*

**Appliance manufacturer's instructions** -Always follow the appliance manufacturer's instructions for burner installation, equipment and set-up.

**1-800-OIL-BURN** - Beckett's technical services hot-line.  
**www.beckettcorp.com** - Beckett's website.

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.

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# Hazard definitions



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



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



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

## NOTICE

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

*Note: 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.*

## Specifications

Fuels	#1 or #2 Fuel Oil
Firing Range	BCF1400 - 4.0 to 13.6 gph BCF2300 - 7.0 to 19.9 gph
Motor	<b>CF1400:</b> 1/2 HP 3450 rpm 120/60 Hz Standard 6.5 amps @ 120 VAC  <b>CF2300:</b> 3/4 HP 3450 rpm 120/60 Hz Standard 12.5 amps @ 120 VAC  <b>Optional Voltages</b> (CF1400 & CF2300): 240 VAC/1-PH, 208, 240, 480 VAC/3-PH, 50 Hz
Ignition Trans.	Continuous Duty, 120V/12,000V
Housing	Cast aluminum
Fuel Unit	100 to 300 psig
Oil Nozzle	45° to 70° Solid
Dimensions	Refer to Figure 7.

## Agency approvals



- UL listed to comply with ANSI/UL296 and certified to CSA B140.0.
- Accepted by N.Y.C. M.E.A.
- Other approvals may be available and must be specified at time of order.

## Owner's Responsibility:



### WARNING

#### Follow These Instructions Exactly



***Failure to follow these instructions, misuse, or incorrect adjustment of the burner could lead to equipment malfunction and result in asphyxiation, explosion or fire.***

Contact a professional, qualified service agency for the installation, adjustment and service of your oil burning system. Thereafter, have your equipment adjusted and inspected at least annually to ensure reliable operation. 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 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.

## Professional Installer/Service Agency Responsibility:



### WARNING

#### Follow These Instructions Exactly



***Failure to follow these instructions could lead to equipment malfunction and result in asphyxiation, explosion or fire.***

- Please read all instructions before proceeding. Follow all instructions completely.
- This equipment must be installed, adjusted and started by a qualified service agency that is licensed and experienced with all applicable codes and ordinances and responsible for the installation and commission of the equipment.
- The installation must comply with all local codes and ordinances having jurisdiction and the latest editions of the NFPA 31 and CSA-B139 & B140 in Canada.

### NOTICE

50 Hz Motors - The burner ratings, air settings and nozzle ratings are based on standard 60 Hz motors (at 3450 rpm). Derate all ratings 20% when using 50 hz motors. Consult factory for specific application data.

### NOTICE

High altitude installation - Accepted industry practice requires no derate of burner capacity up to 2000 feet above sea level. For altitudes higher than 2000 feet, derate burner capacity 2% for each 1000 feet above sea level.

## Pre-installation checklist

### ☐ Combustion air supply



### 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.

The burner requires combustion air and ventilation air for reliable operation. Assure that the building and/or combustion air openings comply with National Fire

Protection Standard for Oil-Burning Equipment, NFPA 31. For appliance/burner units in confined spaces, the room must have an air opening near the top of the room plus one near the floor, each with a free area at least one square inch per 1,000 Btu/hr input of all fuel burning equipment in the room. For other conditions, refer to NFPA 31 (CSA B1139-M91 in Canada).

If there is a risk of the space being under negative pressure or of exhaust fans or other devices depleting available air for combustion and ventilation, the appliance/burner should be installed in an isolated room provided with outside combustion air.

### ☐ Clearances

With the burner installed in the appliance, there must be adequate space in front of and on the sides of the burner to allow access and operation. Verify that the clearance dimensions comply with all local codes and with the appliance manufacturer's recommendations.



## ❑ Fuel supply



### 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*.
- Do not install valves in return line.
- 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 # 21789) in the pump/nozzle discharge tubing to provide backup oil flow cut-off protection.

- The fuel supply piping and tank must provide #1 or #2 fuel oil at pressure or vacuum conditions suitable for the fuel unit (oil pump) on the burner. Refer to fuel unit literature in the literature envelope in the burner carton to verify allowable suction pressure.

#### If fuel supply is level with or higher than fuel unit —

- When the fuel unit is not required to lift the oil, the installation is usually suitable for either a one-pipe or two-pipe oil system. The oil pressure at the inlet of the fuel unit must not exceed 3 psig.
- The fuel unit is shipped with the by-pass plug installed. Leave the by-pass plug installed for all low/high firing burners, regardless whether one-pipe (with by-pass loop) or two-pipe. See **Figure 9** for installation of the by-pass loop required for one-pipe fuel supply installations. See **Figure 10** for connections to the fuel unit for two-pipe fuel supply installations.

#### When fuel supply is below the burner fuel unit —

- Use a two-pipe oil system when the fuel unit must lift the oil more than 8 feet. The return line provided by the two-pipe system is needed to minimize the effects of air-related problems during operation.

## ❑ Nozzle pressure



### 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.
- This burner utilizes pressures higher than 100 psig, so the actual nozzle flow rate will be greater than the gph stamped on the nozzle body. (Example: A 8.00 gph nozzle at 150 psig = 9.80 gph and at 300 psig = 13.86 gph)

For typical nozzle flow rates at various pressures see accompanying chart.

- The fuel unit nozzle port pressure is factory set at 300 psig. Some original equipment manufacturer burner applications may call for a lower pressure to obtain a required firing rate. Do not change this pressure unless directed to do so by the appliance manufacturer.

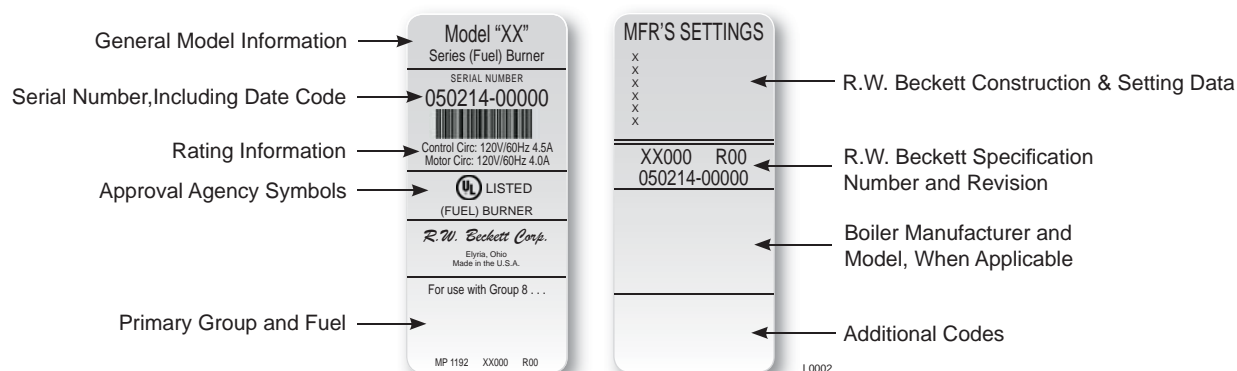
## ❑ Electrical supply

Verify that the power connections available are correct for the burner. Refer to **Figure 1**. All power must be supplied through fused disconnect switches.

## ❑ Vent system

The flue gas venting system must be in good condition and must comply with all applicable codes.

**Figure 1 – Typical Nameplate**



## ❑ Verify burner components —

- Burner nameplate (*figure 1*), Model CF1400 or CF2300A
- Air tube assembly
- Mounting flange kit
- Pedestal mounting assembly kit (recommended)
- Oil nozzle, per *Table 1* — Use only 45° to 70° solid pattern nozzles unless otherwise shown by appliance manufacturer or on the burner nameplate rating label.

Find the required firing rate in the 300 psig column (high fire rate).

Select the corresponding nozzle from column 1 (*Rated gph @ 100 psig*).

(Example: a 500 gph nozzle @ 300 psi = 8.66 gph)

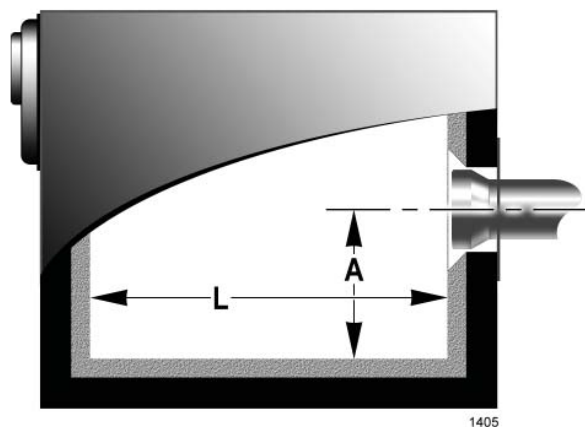
**Table 1 - Nozzle capacities**

Rated gph @ 100 psig	Pressure - Pounds per square inch							
	125	140	150	175	200	250	275	300
3.00	3.35	-	3.67	3.97	4.24	4.74	4.97	5.20
3.50	3.91	-	4.29	4.63	4.95	5.53	5.80	6.06
4.00	4.47	-	4.90	5.29	5.66	6.32	6.63	6.93
4.50	5.04	5.32	5.51	5.95	6.36	7.11	7.46	7.79
5.00	5.59	5.92	6.12	6.61	7.07	7.91	8.29	8.66
5.50	6.15	6.51	6.74	7.27	7.78	8.70	9.12	9.53
6.00	6.71	7.10	7.35	7.94	8.49	9.49	9.95	10.39
6.50	7.26	7.69	7.96	8.60	9.19	10.28	10.78	11.26
7.00	7.82	8.28	8.57	9.25	9.90	11.07	11.61	12.12
7.50	8.38	8.87	9.19	9.91	10.61	11.86	12.44	12.99
8.00	8.94	9.47	9.80	10.58	11.31	12.65	13.27	13.86
8.50	9.50	10.06	10.41	11.27	12.02	13.44	14.10	14.72
9.00	10.06	10.65	11.02	11.91	12.73	14.23	14.93	15.59
9.50	10.60	11.24	11.64	12.60	13.44	15.02	15.75	16.45
10.00	11.18	11.83	12.25	13.23	14.14	15.81	16.58	17.32
10.50	11.74	12.42	12.86	13.89	14.85	16.60	17.41	18.19
11.00	12.30	13.02	13.47	14.55	15.56	17.39	18.24	19.05
12.00	13.42	14.20	14.70	15.88	16.97	18.97	19.90	20.79

## ❑ Verify firing rate

Refer to appliance manufacturer's instructions (if available) for firing rate and nozzle selection. Otherwise, the maximum recommended firing rate for the burner depends on the length of the firing chamber and the distance from the burner center to the chamber floor. Verify that the chamber dimensions are at least as large as the minimum values given in *Figure 2*. If the appliance dimensions are smaller than recommended, reduce the firing rate accordingly.

**Figure 2 – Chamber Dimensions**



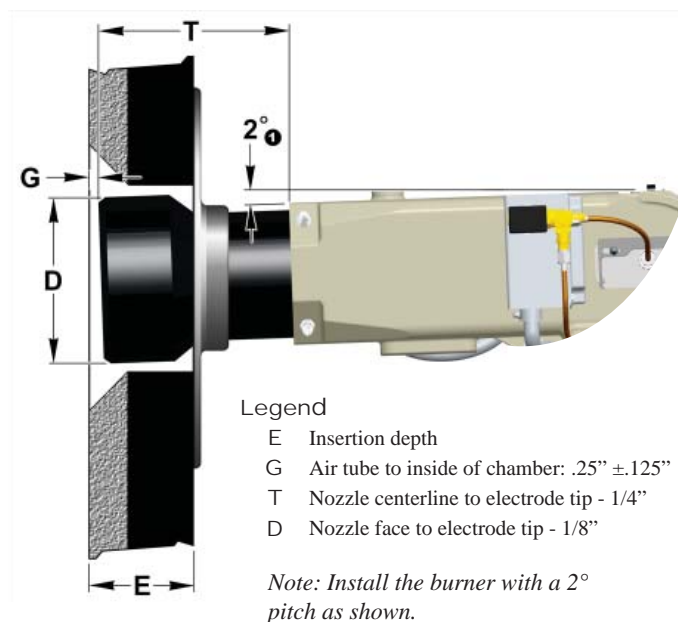
Model	Firing Rate (gph)	Minimum Dimensions			
		Refractory Lined		Wet-based Boilers	
		A	L	A	L
CF1400	0 to 5	7.0"	25.0"	7.0"	25.0"
	5 to 10	8.0"	35.0"	8.0"	40.0"
CF2300	5 to 10	8.0"	35.0"	8.0"	40.0"
	10 to 15	9.0"	40.0"	9.0"	50.0"
	15 to 20	11.0"	55.0"	11.0"	60.0"

## ❑ Verify air tube

The information in this section may be disregarded if the air tube is supplied by the appliance manufacturer.

- On the **CF1400**, there are two tube arrangements available –  
Tube A — 4.0 to 11.0 GPH per Table 2  
Tube B — 7.0 to 13.6 GPH per Table 2
- The **CF1400** maximum firing capacity depends on the firebox pressure. Use *Table 2* to verify the correct air tube type for the firing rate required. Use Tube B only when Tube A cannot provide the firing rate required.
- On the **CF2300**, there are two tube arrangements available –  
Tube A — 7.0 to 19.9 GPH per Table 2  
Tube B — 10.0 to 19.9 GPH per Table 2
- The **CF2300** maximum firing capacity depends on the firebox pressure. Use *Table 2* to verify the correct air tube type for the firing rate required. Use Tube B only when Tube A cannot provide the firing rate required.
- See *Figure 3* to verify the correct air tube length and air tube combination code.

**Figure 3 – Air tube mounting dimensions**



Air Tube Combination Codes					
Model	Tube	Dimension T	Dimension D	Code	Dimension E
CF1400	A	6.75"	5.5"	CF 66 KD	-
		10.25"	5.5"	CF 102 KD	-
		13.75"	5.5"	CF 136 KD	-
		17.75"	5.5"	CF 176 KD	-
	B	6.75"	5.75"	CF 66 KE	-
		10.25"	5.75"	CF 102 KE	-
		13.75"	5.75"	CF 136 KE	-
		17.75"	5.75"	CF 176 KE	-
CF2300	A	6.75"	6.5"	CF 66 KG	2.94"
		10.25"	6.5"	CF 102 KG	2.94"
		13.75"	6.5"	CF 136 KG	2.94"
		17.75"	6.5"	CF 176 KG	2.94"
	B	6.75"	8.125"	CF 66 KS	3.69"
		8.375"	8.125"	CF 86 KS	3.69"
		11.0"	8.125"	CF 110 KS	3.69"
		14.5"	8.125"	CF 144 KS	3.69"
		18.5"	8.125"	CF 184 KS	3.69"

**Table 2 - Air tube capacity Versus firebox pressure**

Air Tube Capacity vs Firebox Pressure				
Model	Tube	Firebox Pressure (In W.C.)	No Reserve Air	10% Turndown* (GPH)
CF1400	A	0.0	11.0	10.0
		0.2	10.5	9.45
		0.4	10.1	9.10
		0.6	9.6	8.64
		0.8	9.2	8.30
		1.0	8.7	7.83
	B	0.0	13.6	12.20
		0.2	13.1	11.70
		0.4	12.5	11.20
		0.6	12.0	10.80
CF2300	A	0.0	19.9	19.90
		0.2	19.2	19.10
		0.4	18.5	18.30
		0.6	17.9	17.60
		0.8	17.2	16.80
		1.0	16.5	16.00
	B	0.0	19.9	19.90
		0.2	19.7	19.60
		0.4	19.5	19.30
		0.6	19.4	19.10
		0.8	19.2	18.80
		1.0	19.0	18.50

**Note:** 10% turndown indicates sufficient reserve air to reduce the CO<sub>2</sub> in the flue to 90% of its value. The above ratings may vary 5% due to variations in actual job conditions.

**\*CF2300** can fire higher but is limited by UL requirements



## ❑ Stray light



### Protect Against Stray Light Lockout

**Failure to follow these instructions could cause loss of burner operation resulting in no heat, an unplanned process interruption, work stoppage and the potential for frozen plumbing or other cold weather property damage.**

- The control must detect a dark, no-flame condition in order to start the burner or it will hold in the stray light lockout mode.
- Shield the burner view window from direct exposure to intense light.

## ❑ Dust and Moisture



### Protect Against Dust and Moisture

**Wet, dusty environments could lead to blocked air passages, corrosion damage to components, impaired combustion performance and result in asphyxiation, explosion or fire.**

- This burner is designed for clean, dry installations.
- Electrical controls are not protected against rain or sprayed water.
- Keep the installation clear of dust, dirt, corrosive vapors, and moisture.
- Protective covers and more frequent maintenance may be required.

# Mount the burner

## ❑ Mount flange(s) on air tube



### Protect the Air Tube From Overheating

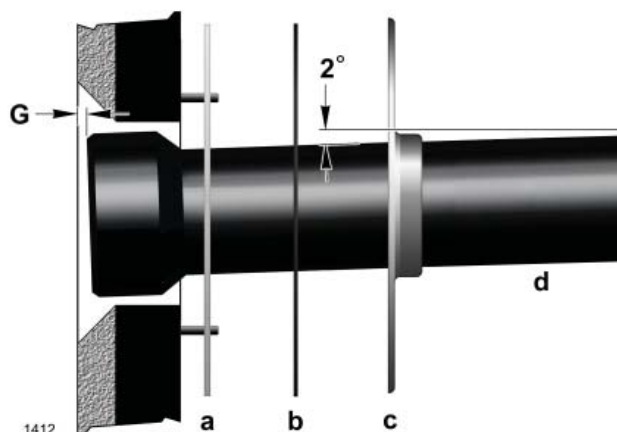
**Overheating could cause damage to the air tube and other combustion components leading to equipment malfunction and impaired combustion performance.**

- The end of the air tube must not extend into the combustion chamber unprotected unless it has been factory-tested and specified by the appliance manufacturer.
- Position the end of the air tube 1/4" back from flush with the refractory inside entry wall to prevent damage from overheating.

the air tube as shown. Wrap ceramic fiber rope (not shown) around the air tube and press tightly into the inside diameter of the flange (item c).

- Slide the air tube (item d) into position in the appliance front. Tighten the flange-mounting-stud nuts. Set the insertion of the air tube so dimension G is 1/4" nominal.
- Pitch the air tube at 2° from horizontal as shown and secure the flange to the air tube.

**Figure 4 – Mount flange(s) on air tube**



This section does not apply to burners with welded flanges.

- Do not install air tube on burner.
- For non-pressure firing flange, refer to **Figure 4**: Install gasket (item a) and flange (item c). Ignore the next paragraph.
- For pressure-firing flange, refer to **Figure 4**: Slide gasket (item a) onto the air tube, making sure the top of the air tube is up. Predrill holes in the pressure firing plate (item b) to match the appliance studs. Slide the pressure firing plate (item b) and flange (item d) onto

## □ Mount air tube to burner

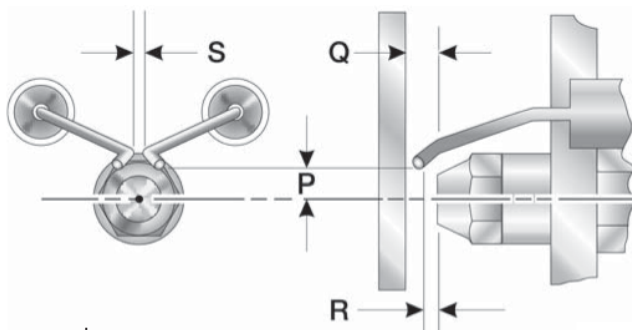
- Remove the rear access door from the back of the burner for improved access to the interior.
- Attach the air tube to the burner with the bolts and acorn nuts provided. The acorn nuts must go on the outside of the burner, with the bolts inserted from the inside.

## □ Install nozzle

See **Figure 5**. Install the oil nozzle in the nozzle adapter. Use a  $\frac{3}{4}$ " open-end wrench to steady the nozzle adapter and a  $\frac{5}{8}$ " open-end wrench to turn the nozzle. Tighten securely but do not overtighten.

Check, and adjust if necessary, the critical dimensions **P**, **Q**, **R** and **S** shown in the drawing. Verify that the oil tube assembly and electrodes are in good condition, with no cracks or damage.

**Figure 5 – Nozzle and nozzle line assembly**



### Legend

- S Electrode spacing -  $\frac{3}{32}$ "
- Q Nozzle to head -  $\frac{1}{4}$ "
- P Nozzle centerline to electrode tip -  $\frac{1}{4}$ "
- R Nozzle face to electrode tip -  $\frac{1}{8}$ "

## □ Check electrode settings

### **WARNING** Maintain Electrode Specifications

**Failure to properly maintain these specifications could cause ignition malfunction, puff-back of hot gases, heavy smoke, asphyxiation, explosion and fire hazards.**

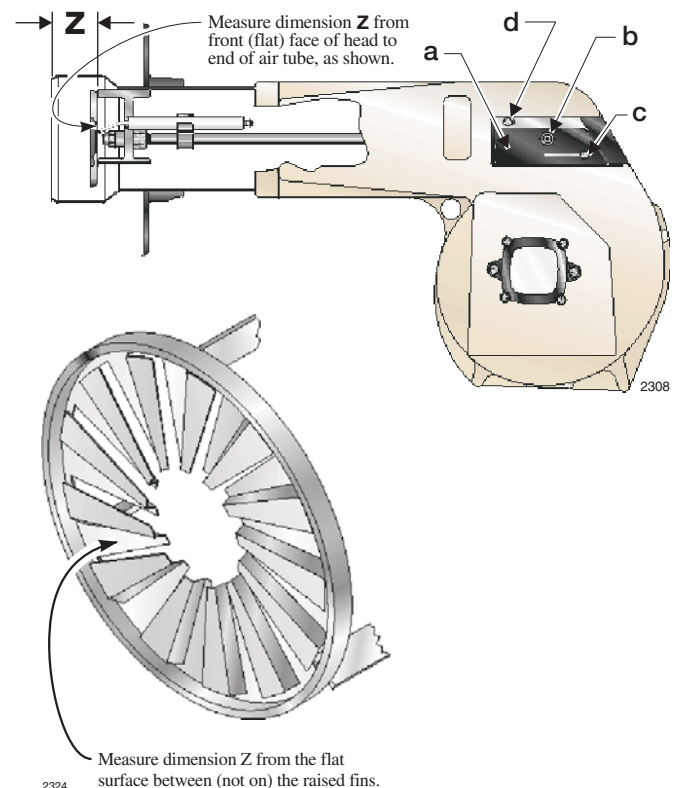
- Adjust the electrode gap and position in relation to the nozzle to the specifications shown in **Figure 5**.

Check, and adjust if necessary, the critical dimensions shown in **Figure 5**. Verify that the oil tube assembly and electrodes are in good condition, with no cracks or damage.

## □ Install nozzle line assembly

- Insert the nozzle line assembly into the burner air tube as in **Figure 6**.
- See **Figures 6 and 7**. Assemble the adjusting plate assembly per the instructions in the assembly packet.
- Slide the secondary adjusting plate (item **f**) completely to the left on the indicator adjusting plate (item **e**). Finger-tighten acorn nut (item **c**) to secure the two plates together. Slide both plates completely to the left on the primary adjusting plate (item **g**) and finger-tighten acorn nut (item **d**).
- Slide the completed adjusting plate assembly over the nozzle line end. Move the plate assembly and the nozzle line so the plate assembly fits into position as shown in **Figure 6**.
- Install the spline nut (**Figure 6**, item **b**) on the end of the nozzle line, leaving the nut loosely placed so the plates can be moved.
- Connect the high-voltage leads from the ignition transformer to the electrodes.

**Figure 6 – Nozzle line assembly in burner**



$$Z = 1\text{-}\frac{3}{4}\text{' } \pm \frac{1}{16}\text{'}$$

### Legend (Figure 6)

- a Adjusting plate assembly
- b Spline nut for securing nozzle line
- c Bottom acorn nut
- d Top acorn nut (for setting dim. Z only)

## ❑ Set dimension Z

- Replace the rear access door on the burner, making sure that the adjusting plate assembly is now securely in the groove.
- Loosen acorn nut (item **d**) in *Figure 5*. Slide the nozzle line and plate assembly until dimension Z in *Figure 5* is **1-3/4 ±1/16"** (CF1400 and CF2300). When dimension Z (from end of air tube to flat area of front face of head) is correctly set, tighten acorn nut (item **d**). Verify that the adjusting plate assembly is properly seated in the groove.
- Attach the oil line from the oil valve to the nozzle line end. Tighten securely.
- Before proceeding, check dimension Z once again. Loosen acorn nut (item **d**) if necessary to reposition the nozzle line. Once dimension Z is set, **do not loosen acorn nut** (item **d**) again.

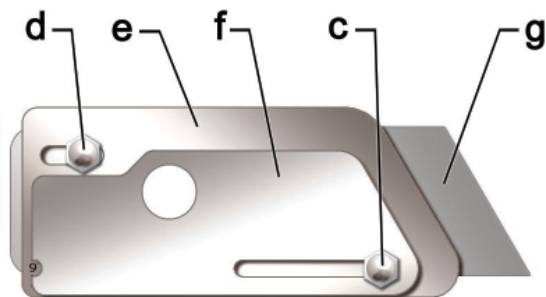
## ❑ Insert burner

- Position the burner in the front of the appliance and loosely tighten the nuts on the mounting studs. The burner should be pitched downward 2° as shown in *Figures 4 and 8*.
- See *Figure 8*. Install the pedestal support kit (recommended) by attaching the 3/4" npt flange (item **a**) to the bottom of the burner using the (4) #10 screws provided. Cut and thread (one end only) a 3/4" pipe nipple (item **b**) with length **11 inches less than dimension D** in *Figure 8*. Thread the pipe into the flange. Then slip the pipe end into the floor flange (item **c**).
- Secure the burner to the appliance by tightening the nuts on the burner flange mounting studs. Then secure the pedestal support floor flange set screw to the pipe.

**Figure 7 – Adjusting plate assy.**

### Legend

- a Adjusting plate assembly
- b Spline nut for securing nozzle line
- c Bottom acorn nut
- d Top acorn nut (for setting dim. Z only)
- e Indicator adjusting plate
- f Secondary adjusting plate
- g Primary adjusting plate



**Figure 8 – Burner installed in appliance front**

### Legend

- H Housing total length (CF1400 - 18", CF2300 - 18.5")
- J Center to bottom of housing (CF1400 - 10.88", CF2300 - 10.5")
- K Overall housing height (CF1400 - 13.63", CF2300 - 15.63")

