

OL1 SERIES OIL BURNER

I - INTRODUCTION

The oil burner provides an atomized oil vapor mixed with the correct proportion of air to the combustion chamber where it is ignited. Oil burners are usually rated at a minimum and maximum value as listed on the unit nameplate. A shutter assembly allows proper air adjustment for these ratings.

OL1 burners were produced in several styles. Current O11R production units use the OL1-70 series burner, while O12 and future O12R units will use the OL1-80 series. Figure 1 explains the OL1 model number designation.

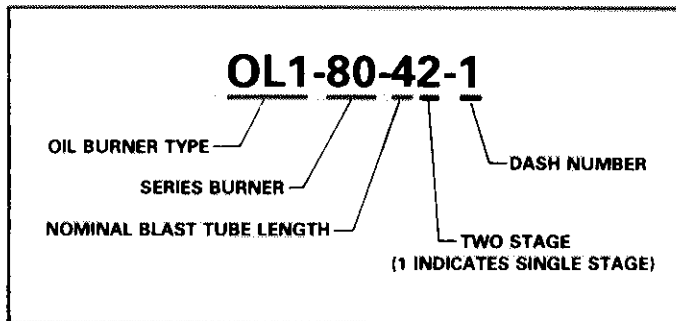


FIGURE 1

II - COMPONENTS

Figure 2 shows a cutaway of a typical OL1.

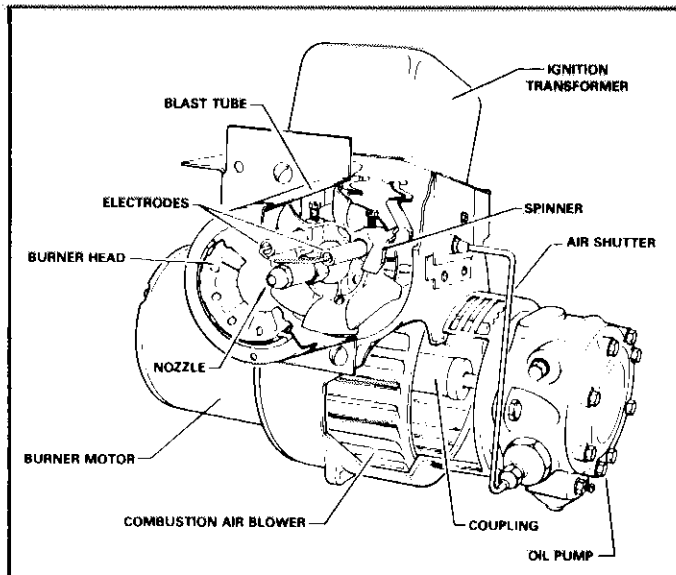


FIGURE 2

A - Burner Motor

The burner motor is powered by the primary control. A combustion air blower is mounted on the motor shaft. The motor shaft also connects to the oil pump through a coupling. OL1-70 burners use a 1/8 H.P. motor that runs at 1725 RPM while OL1-80 burners use a 1/7 H.P. motor that runs at 3450 RPM.

Burner motors are equipped with overload protection. In the

event of excessive motor temperature or current, the overload opens to de-energize motor. The push button must be manually reset after motor temperature has dropped to normal.

All burner motors are split phase with a centrifugal starting switch. Keep motor clean to prevent starter switch from sticking. If switch sticks open the motor will not run, and if it sticks closed the start windings will burn out. Do not over lubricate motor. Follow lubrication instructions on burner motor.

B - Oil Pump

Figure 3 identifies the oil pump ports. As the oil burner is shipped from factory, it is set up for a single line system. To convert to a two line system, remove the 1/4 inch plug from return port and install the 1/16 inch by-pass plug that is in the attached bag assembly.

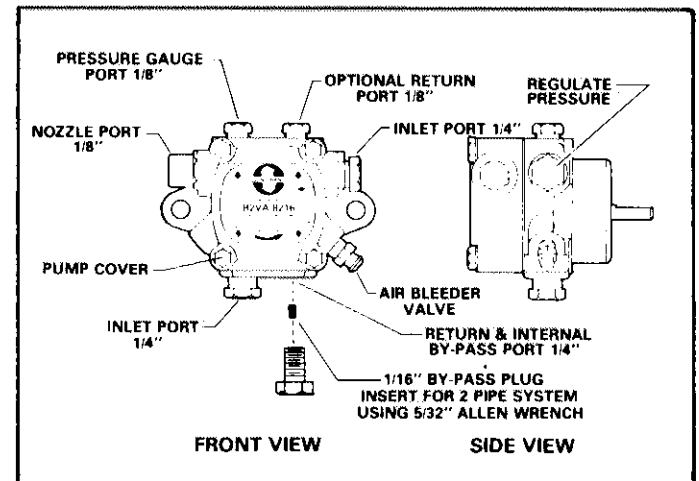


FIGURE 3

1 - **Air Bleed Valve** - On single line applications, the oil line must be initially bled to prime the pump. Open air bleed valve 1 turn CCW and start burner. A hose may be attached to valve to direct oil into a container. Bleed pump for 15 seconds after last air bubble is seen. Hurried bleeding will impair efficient unit operation. To stop bleeding, turn valve CW until tight. Single line installations must be absolutely air tight or leaks or loss of prime may result.

On two line applications, air bleeding is automatic. Opening air bleed valve allows a faster bleed if desired. The return line back to tank must run to within 3 inches of bottom. Failure to do this may introduce air into the system and could result in loss of prime.

2 - **Vacuum Check** - A vacuum gauge may be installed in either the 1/4 in. inlet port or the 1/8 in. return port (on single pipe installations). See Figure 4. The OL1-80 oil burner pump should not exceed 10" hg. vacuum.

3 - **Pressure Check** - Use the gauge port or nozzle port to check operating pressure. The pump is factory set at 100

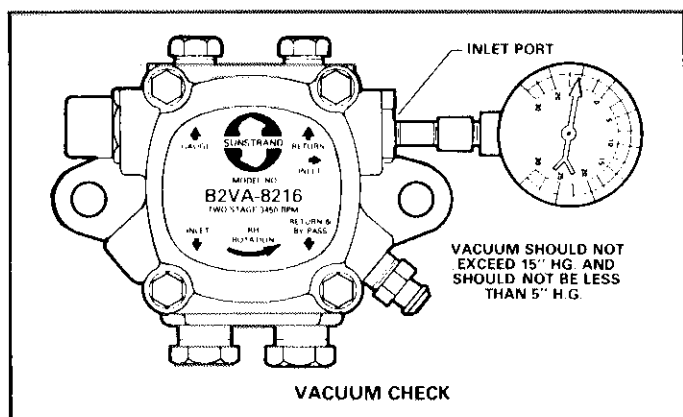


FIGURE 4

psig but is adjustable. See Figure 3. Never exceed 110 psig operation.

Average nozzle cutoff pressure is 80 psig. To check cutoff pressure, install pressure gauge in nozzle port. Run burner for a short period and then turn off. Gauge shows cutoff pressure. See Figure 5.

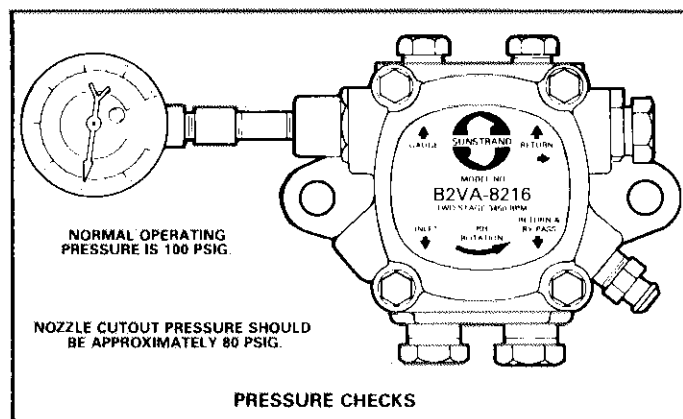


FIGURE 5

- 4 - Strainer Access** - An internal strainer removes any sediment or foreign material from oil before it reaches pump. Remove screws securing pump cover for access. See Figure 3.

C - Ignition Transformer

The ignition transformer provides the needed hot spark at the electrodes to ignite the fuel mixture. The transformer has 120V primary and 10,000V secondary windings. The center of the secondary winding is grounded. Each secondary terminal is 5000V and the total voltage between the electrodes is 10,000V. The hinged transformer closes against a set of electrode buss bars.

D - Cad Cell

Together the cad cell and primary control prove the burner flame. The cad cell senses the presence of burner light to close a circuit to primary control. A White Rodgers style cad cell is used on all OL1 burners except the OL1-83-42. This particular model uses a Robertshaw cad cell.

E - Gun Assembly

The gun assembly receives the oil from the oil pump and

feeds it to the nozzle. The nozzle converts liquid oil into a coned shape, fog like mist that is discharged into the combustion chamber. When combustion takes place, the flame will be cone shaped as a result.

A static disc is mounted to the gun assembly. The correct size disc must be installed for desired rating. Refer to unit information sections for specific data.

III - DISASSEMBLING BURNER

NOTE - Before disassembling any part of burner, turn off power and oil supply to unit.

A - Removing Ignition Transformer

- 1 - Loosen screws securing top of transformer. Refer to Figure 6.
- 2 - Swing transformer plate back and remove transformer wiring leads from wire nuts.
- 3 - Remove screws securing transformer hinge to burner box. See Figure 6.

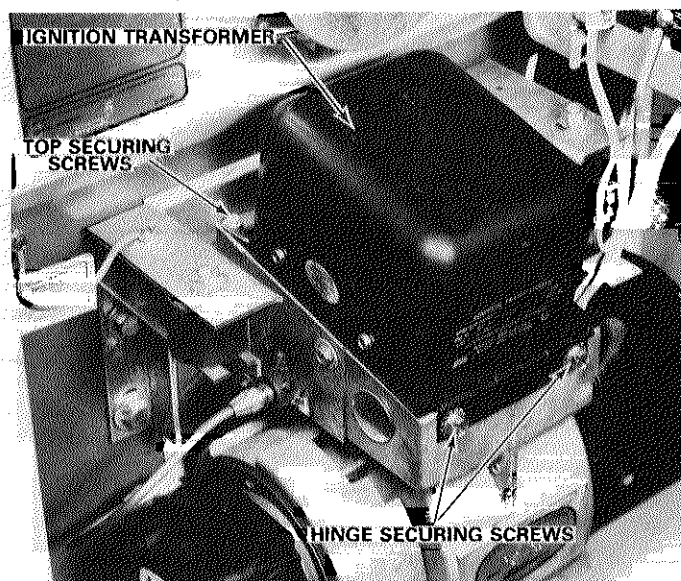


FIGURE 6

B - Removing Cad Cell

- 1 - Lift cad cell mounting bracket from slots at top of burner box and remove wiring leads. Refer to Figures 7 and 8.

C - Removing Gun Assembly

- 1 - Disconnect oil line at gun assembly.
- 2 - Remove screw securing gun assembly in place. See Figures 7 and 8.

CAUTION - Do not loosen gun stop screws. If gun stop is loose refer to section "IV - Servicing Burner."

- 3 - Remove gun assembly from burner.

D - Replacing Static Disc

- 1 - Loosen set screw and remove gun mounting plate. Refer to Figure 9.
- 2 - Remove buss bars from electrodes.
- 3 - Remove screws securing static disc and remove static disc.
- 4 - Install replacement static disc, replace buss bars, and replace gun mounting plate.

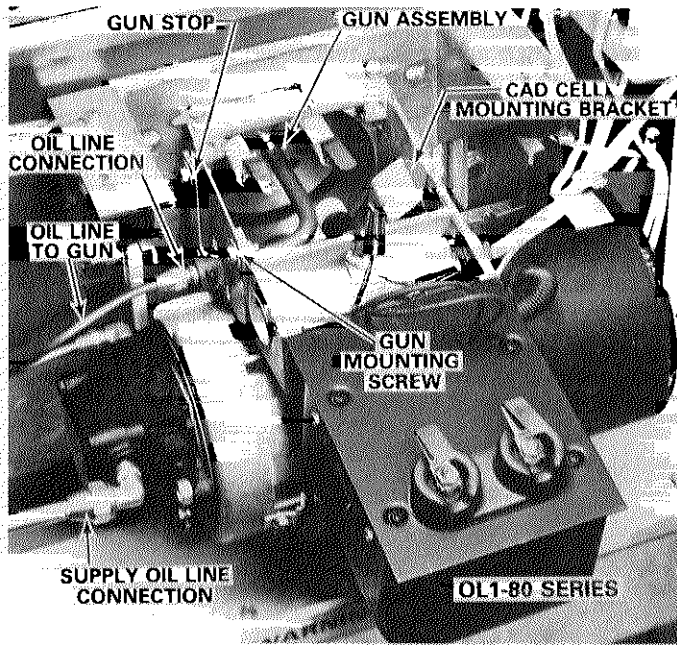


FIGURE 7

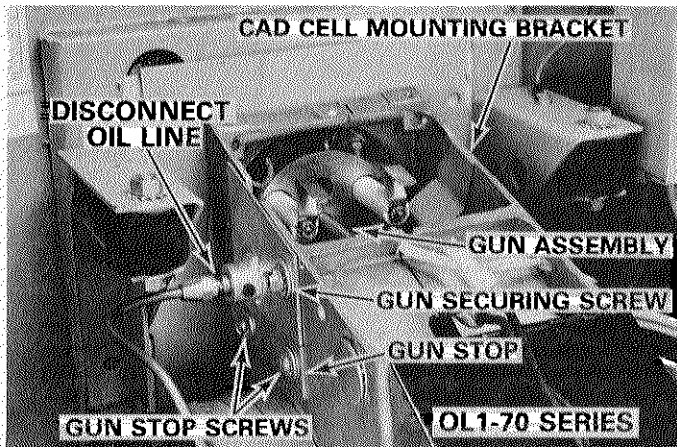


FIGURE 8

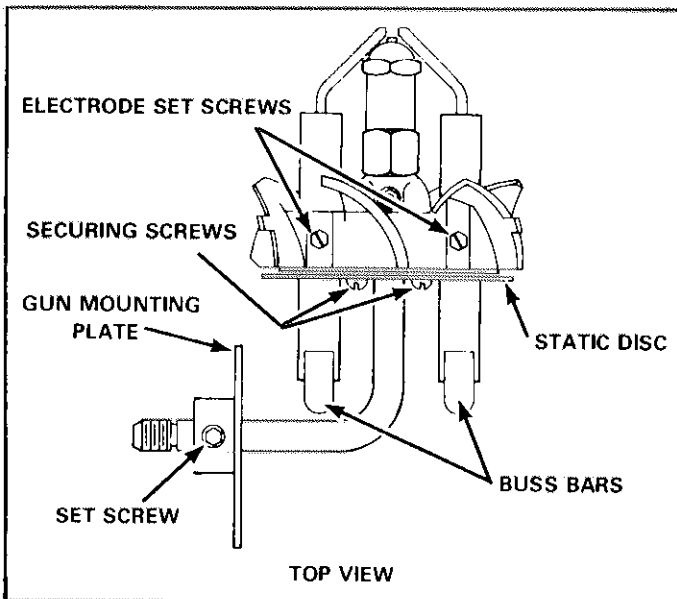


FIGURE 9

5 - Check electrode settings per section "IV - Servicing Burner."

E - Installing Gun Assembly

- 1 - Insert gun assembly into housing with gun mounting plate firmly against gun stop and tighten gun mounting screw. Refer to Figures 7 and 8.
- 2 - Connect oil line to gun assembly using caution not to overtighten fitting.
- 3 - Check gun position per section "IV - Servicing Burner."

F - Removing Oil Pump

- 1 - Disconnect supply oil line at pump and oil line at gun assembly.
- 2 - Remove bolts securing pump to burner box. Pull pump from burner box as shown in Figure 10.

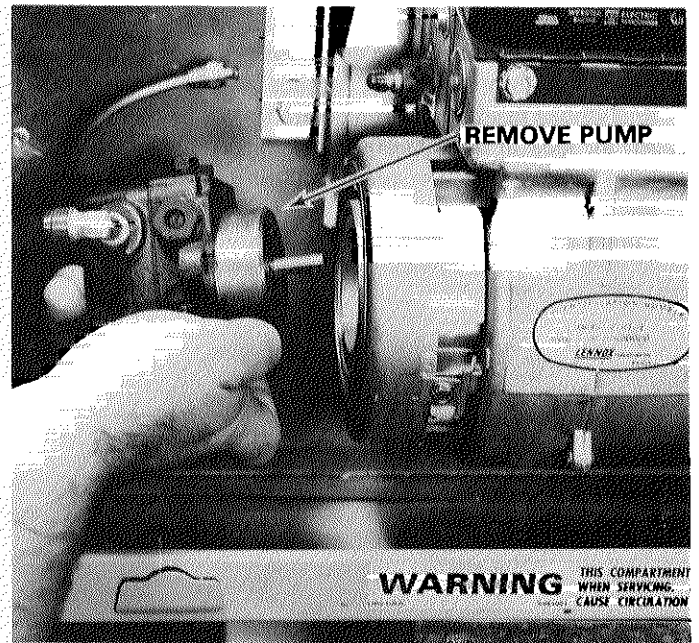


FIGURE 10

G - Removing Motor and Combustion Air Blower Assembly

- 1 - Disconnect motor wiring harness.
- 2 - Remove bolts securing combustion air blower to burner

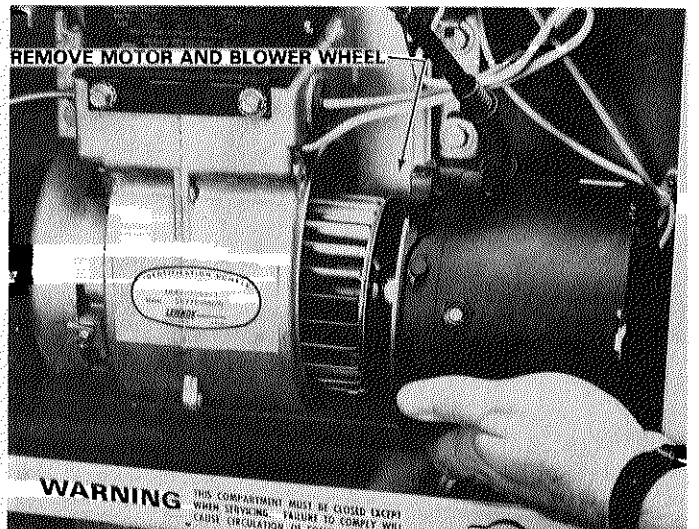


FIGURE 11

box. Pull motor and blower wheel from burner box as shown in Figure 11.

IV - BURNER ADJUSTMENT

Refer to unit information section for nozzle information and combustion ratings. The proper way to adjust an oil burner is with a CO₂ analyzer and a smoke gun. A properly adjusted burner will result in a quiet, clean fire at 8.5% to 9% CO₂, with zero smoke. Too high CO₂ setting will result in a noisy, smokey fire. Too low CO₂ setting will give incomplete combustion.

Before making final burner adjustment, allow burner to operate continuously for five to ten minutes. This will purge the fuel lines and level out combustion. Take readings and make adjustments as follows:

1 - Make sure any inspection openings are closed tightly and any fitting joints between furnace and point where CO₂ and smoke readings are taken are tightly sealed or taped. An air leak at inspection openings or fitting will cause false CO₂ readings because of diluting the flue gases with air.

2 - Punch a 5/16" (7.9 mm) diameter service hole in the flue



FIGURE 12

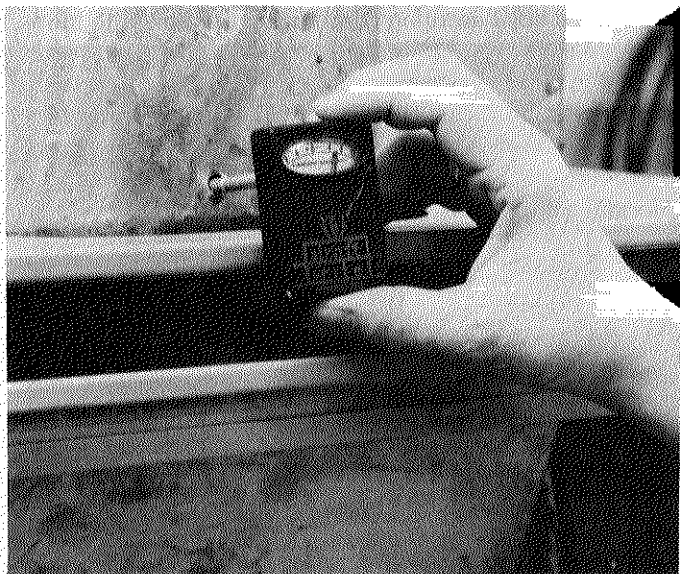


FIGURE 13

outlet **between the furnace and the draft control**. Draft readings, CO₂ and smoke test should be taken from this point.

3 - Adjust barometric draft control in the stack for correct draft. See Figure 12.

Draft should be measured with a draft gauge at the service hole in stack and set for .03 in. (0.76 mm) to .035 in. (0.89 mm) W.C. draft. See Figure 13.

4 - Loosen the Air Control locking screw (See Figures 14 and 15) and rotate the air control until the fire appears clean. The air is decreased by turning the control counter-clockwise and increased by turning clockwise.

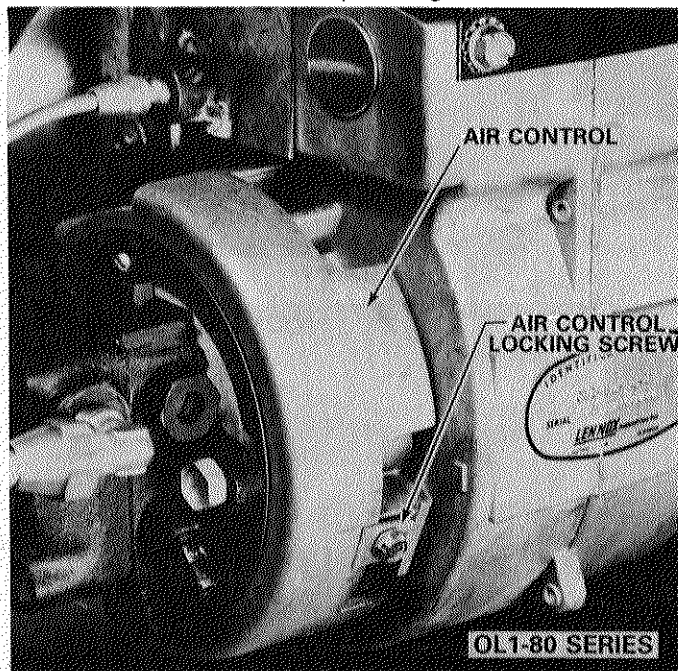


FIGURE 14

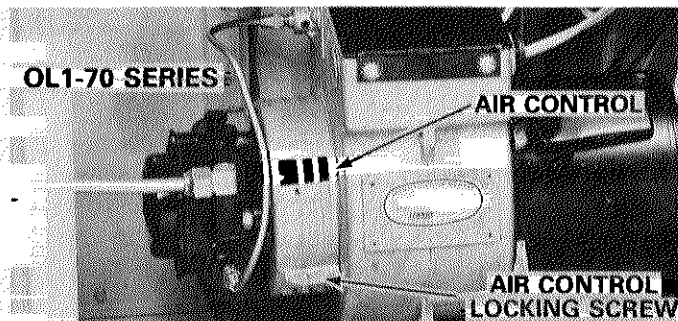


FIGURE 15

5 - Before taking CO₂ readings, tighten air control locking screw. Take CO₂ reading at service opening in stack using Fyrite CO₂ indicator or other standard CO₂ analyzers. Refer to Figure 16. Carefully follow instructions packed with CO₂ analyzer for correct operation. If CO₂ reading is between 8.5% to 9% the setting is correct. If not, loosen air control locking screw and rotate air control. Recheck until CO₂ reading falls within the 8.5% to 9% range. Retighten air control locking screw.

6 - Take a smoke reading in the same sampling hole used for the CO₂ reading. Refer to Figure 17. Use a standard smoke

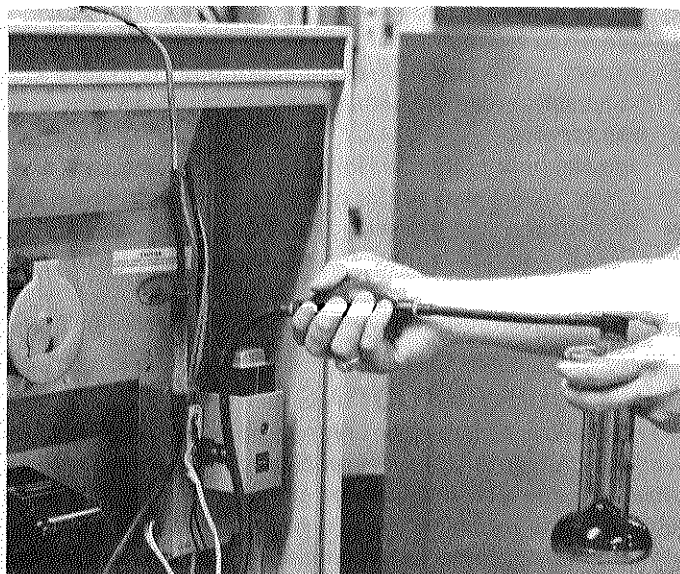


FIGURE 16

tester such as the Bacharach true spot tester. The smoke reading at 8.5% to 9% CO₂ should be zero spot. If smoke is evident, it could be caused by a poor nozzle or combustion setting. In some cases, it may be caused by a difference in oil or an unusual condition of the installation. Rotate combustion air control until a zero smoke indication is obtained. Recheck CO₂ to make sure it is 8% or more. If CO₂ is less than 8%, check for a bad nozzle or improper setting of the burner gun assembly.

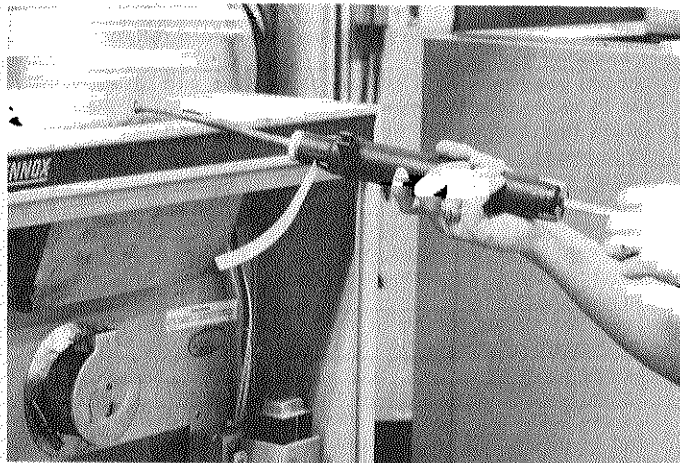


FIGURE 17

V - SERVICING BURNER

- 1 - As a routine performance check, check the fuel line filter and the oil pump strainer. Remove the pump cover and clean the strainer using a brush and clean fuel oil or kerosene. Replace or clean the cartridge in the line filter if necessary.
- 2 - Check for abnormally high intake vacuum. Also check operating pressure and nozzle cutout pressure. Normal operating pressure should be 100 psig and must never exceed 110 psig.
- 3 - Fire burner and check test readings according to "Burner Adjustments." Also observe fire. This check may reveal a

plugged or bad nozzle, poor ignition because of bad or improperly set electrodes, pump whine, etc. Note these items for special attention while servicing burner.

- 4 - Turn off power and oil supplies to unit. Remove gun assembly.
- 5 - Remove cad cell and check surface of cell for an accumulation of dust or soot. If cell is dirty, clean carefully with a soft cloth, then resecure in place.
- 6 - Clean gun assembly being extremely careful not to wipe dirt or line into nozzle orifice. Clean electrode insulators and make sure buss bars on end of electrodes make good contact with ignition transformer terminals. Check electrode setting as shown in Figure 18. Electrodes may be adjusted by loosening set screws in spinner.

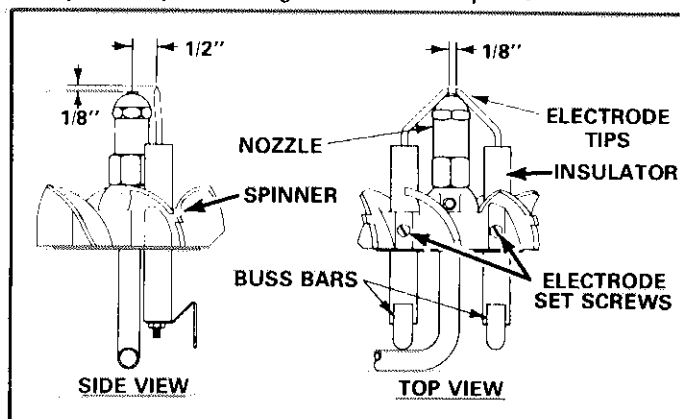


FIGURE 18

- 7 - Check position of nozzle and burner head with gun assembly in place in burner housing. Refer to Figures 19 and 20. If position is not correct, loosen gun adjusting and stop screws, locate nozzle in proper position and tighten adjusting screw. Position stop against gun assembly and tighten stop screws.

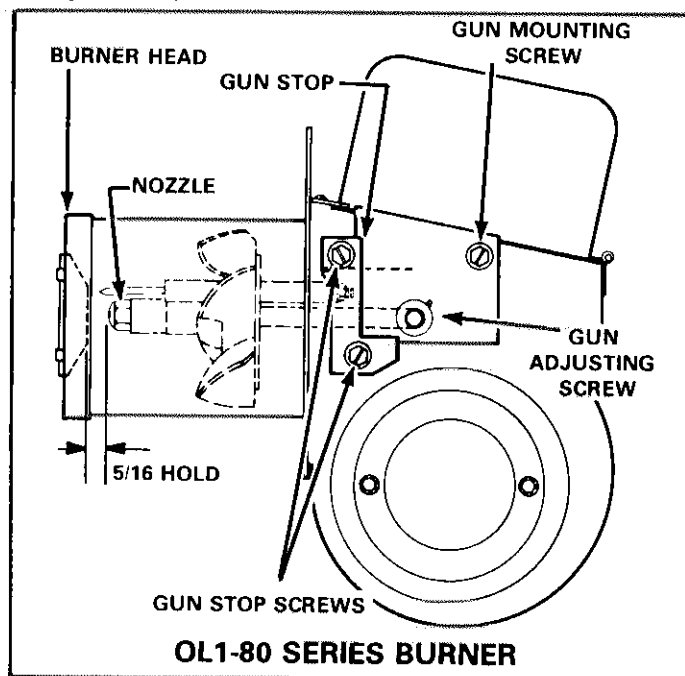
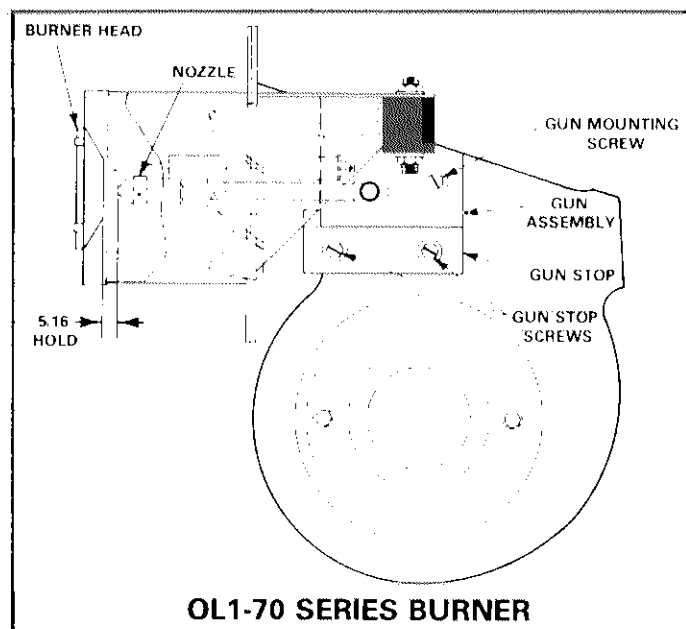


FIGURE 19



OL1-70 SERIES BURNER

FIGURE 20

8 - Wipe inside of draft tube. Inspect burner head by shining

flashlight down the burner tube. Clean any carbon formation from holes or slots with brush or length of wire, using caution to avoid any damage to burner assembly.

9 - Inspect combustion chamber carefully. If cracks are noticeable, recement with a good grade of high temperature cement.

10 - Inspect heat exchanger for soot and clean if necessary.

11 - Clean blower wheel. Lint or dirt on blades cut down the efficiency of the blower.

12 - Check electrical wiring for damage to insulation and proper routing.

13 - Reassemble burner and return unit into working condition.

VI - TROUBLESHOOTING

Burner failure or improper unit operation can be caused by various problems. Often the problem can be pin-pointed by observing the type of failure and giving some thought before attacking the problem. Other times the cause can only be determined by a process of elimination. Table 1 lists specific oil pump troubleshooting procedures while Table 2 lists general oil burner procedures. Check the simplest and more obvious items before progressing to the other checks.

TABLE 1

OIL PUMP TROUBLESHOOTING		
CONDITION	CAUSE	REMEDY
NO OIL FLOW AT NOZZLE	Oil level below intake line in supply tank	Fill tank with oil.
	Clogged strainer or filter	Remove and clean strainer. Replace filter element.
	Clogged nozzle	Replace nozzle.
	Air leak in intake line	Tighten all fittings in intake line. Tighten unused intake port plug. Check filter cover and gasket.
	Restricted intake line (High vacuum reading)	Replace any kinked tubing and check any valves in intake line.
	A two pipe system that becomes air bound	Check for and insert by-pass plug. Make sure return line is below oil level in tank.
	A single-pipe system that becomes airbound	Loosen gage port plug or easy flow valve and bleed oil for 15 seconds after foam is gone in bleed hose. Check intake line fittings for tightness. Check all pump plugs for tightness.
OIL LEAK	Slipping or broken coupling	Tighten or replace coupling.
	Frozen pump shaft	Replace pump.
	Loose plugs or fittings	Dope with good quality thread sealer. Retighten.
	Leak at pressure adj. screw or nozzle plug	Washer may be damaged. Replace the washer or O Ring.
	Blown seal (single-pipe system)	Check to see if by-pass plug has been left in unit. Replace oil pump.
	Blown seal (two pipe system)	Check for kinked tubing or other obstructions in return line. Replace oil pump.
	Seal leaking	Replace oil pump.
NOISY OPERATION	Cover	Tighten cover screws or replace damaged gasket.
	Bad coupling alignment	Loosen fuel unit mounting screws slightly and shift fuel unit in different positions until noise is eliminated. Retighten mounting screws.
	Air in inlet line	Check all connections. Use only good flare fittings.
PULSATING PRESSURE	Tank hum on two pipe system and inside tank	Install return line hum eliminator in return line.
	Partially clogged strainer or filter	Remove and clean strainer. Replace filter element.
	Air leak in intake line	Tighten all fittings.
IMPROPER NOZZLE CUT-OFF	Air leaking around cover	Be sure strainer cover screws are tightened securely. Check for damaged cover gasket.
	To determine the cause of improper cut off, insert a pressure gage in the nozzle port of the fuel unit. After a minute of operation shut burner down. If the pressure drops from normal operating pressure and stabilizes, the fuel unit is operating properly and air is the cause of improper cut off. If, however, the pressure drops below 80 psig, oil pump should be replaced.	
	Filter leaks	Check face of cover and gasket for damage.
	Strainer cover loose	Tighten 4 screws on cover.
	Air pocket between cut-off valve and nozzle	Run burner, stopping and starting unit, until smoke and after fire disappears.
	Air leak in intake line	Tighten intake fittings. Tighten unused intake port and return plug.
	Partially clogged nozzle strainer	Clean strainer or change nozzle.
	Leak at nozzle adaptor	Change nozzle and adaptor.

TROUBLE	SOURCE	PROCEDURE	CAUSES	CORRECTION
BURNER FAILS TO START	Thermostat	Check thermostat settings	Thermostat in "Off" or "Cool"	Switch to "Heat"
			Thermostat set too low	Turn thermostat to higher temp.
	Safety Overloads	Check burner motor, primary safety control, and auxiliary limit switch.	Burner motor overload tripped	Push motor overload reset button
			Primary control tripped on safety	Reset safety switch lever
			Auxiliary limit switch tripped on safety	Push auxiliary limit switch reset button
	Power	Check furnace disconnect switch and main disconnect switch	Switch open	Close switch
			Blown fuse or tripped breaker	Replace fuse or reset breaker
	Thermostat	Touch jumper wire across thermostat terminals on primary control. If burner starts then fault is in thermostat circuit	Broken or loose thermostat wires	Repair or replace wires
			Loose thermostat screw connection	Tighten connection
			Dirty thermostat contacts	Clean contacts
			Thermostat not level	Level thermostat
			Faulty thermostat	Replace thermostat
	Cad Cell	Disconnect flame detector wires at primary control. If burner starts, fault is in detector circuit	Flame detector leads shorted	Separate leads
			Flame detector exposed to light	Seal off false source of light
			Short circuit in flame detector	Replace detector
	Primary Control	Place trouble light between the black and white leads. No light indicates no power to the control.	Primary or auxiliary control switch open	Check dial adjustment. Set to maximum stop setting. Jumper terminals; if burner starts switch is faulty, replace control.
			Open circuit between disconnect switch and limit control	Trace wiring and repair or replace
		Place trouble light between the orange and white leads. No light indicates control faulty	Low line voltage or power failure	Call Power Company
			Defective internal control circuit	Replace control
	Burner	Place trouble light between the black and white leads to burner motor. No light indicates no power to burner motor	Blown fuse	Replace fuse
			Binding burner blower wheel	Turn off power and rotate blower wheel by hand. If seized free wheel from binding or replace fuel pump
		Place trouble light between the black and white leads to burner motor. Light indicates power to motor and a burner fault.	Seized fuel pump	Turn off power and rotate blower wheel by hand. If seized free wheel from binding or replace fuel pump
			Defective burner motor	Replace motor
BURNER STARTS BUT NO FLAME IS ESTABLISHED	Oil Supply	Check tank gauge or use dip stick	No oil in tank	Fill tank
		Coat dip stick with litmus paste and insert to bottom of tank	Water in oil tank	If water depth exceeds 1" pump out water or drain out
		Listen for pump whine	Tank shut-off valve closed	Open valve
	Oil Filters and Oil Line	Listen for pump whine	Oil line filter plugged	Replace filter cartridge
			Kinks or restriction in oil line	Repair or replace oil line
			Plugged fuel pump strainer	Clean strainer or replace pump
	Oil Pump	Install pressure gauge on pump and read pressure. Should not be less than 100 psig.	Air leak in oil supply line	Locate and correct leak Tighten all connections
			Pump partially or completely frozen—No pressure and motor locks out on overload	Replace pump
			Coupling disengaged or broken—No pressure	Reengage or replace coupling
	Nozzle	Disconnect ignition leads. Observe oil spray (gun assembly must be remove from unit). Inspect nozzle for plugged orifice or carbon build-up around orifice	Fuel pressure too low	Adjust pressure to 100 psig.
			Nozzle orifice plugged	Replace nozzle with same size, spray angle and spray type
			Nozzle strainer plugged	
	Ignition Electrodes	Remove gun assembly and inspect electrodes and leads	Poor or off center spray	Replace nozzle with same size, spray angle and spray type
			Fouled or shorted electrodes	
			Dirty electrodes and leads	Clean electrodes and leads Dress up electrode tips and reset gap to 1/8" and correctly position the tips
			Eroded electrode tips	
			Improper electrode gap spacing	
			Improper position of electrode tips	
			Bad buss bar connection	
			Cracked or chipped insulators	Retension and align Replace electrode
			Cracked or burned lead insulators	Replace electrode leads

TABLE 2 CONTINUED

TROUBLE	SOURCE	PROCEDURE		CAUSES	CORRECTION	
CONTINUED BURNER STARTS BUT NO FLAME IS ESTABLISHED	Ignition Transformer	Connect ignition leads to transformer. Start burner and observe spark. Check line voltage to transformer primary		Low line voltage	Check voltage at power source Correct cause of voltage drop or call Power Company	
				Burned out transformer windings	Replace transformer	
				No spark or weak spark	Properly ground transformer case	
	Burner Motor	Motor does not come up to speed and trips out on overload. Turn off power and rotate blower wheel by hand to check for binding or excessive drag		Low line voltage	Check voltage at power source Correct cause of voltage drop or call Power Company	
				Pump or blower overloading motor	Correct cause of overloading	
				Faulty motor	Replace motor	
BURNER STARTS AND FIRES BUT LOCKS OUT ON SAFTEY	Poor Fire	After burner fires immediately jumper across flame detector terminals at primary control	If burner continues to run. Fault may be due to poor fire. Inspect fire	Unbalanced fire	Replace nozzle	
				Too much air—lean short fire	Reduce combustion air—check combustion	
				Too little air—long dirty fire	Increase combustion air—check combustion	
				Excessive draft	Adjust barometric damper for correct draft	
				Too little draft or restriction	Correct draft or remove restriction	
	Flame Detector	If fire is good, fault is in flame detector. Check detector circuit	If burner locks out on safety fault is in primary control	Dirty cad cell face	Clean cad cell face	
				Faulty cad cell—exceedes 1500Ohms	Replace cad cell	
				Loose or defective cad cell wires	Secure connections or replace cad cell holder and wire leads	
	Primary Control			Primary control circuit defective	Replace primary control	
	BURNER STARTS, FIRES BUT LOOSES FLAME AND LOCKS OUT ON SAFTEY	Poor Fire	After burner fires immediately jumper across flame detector terminals at primary control	If burner continues to run (does not lock out on safety). Fault may be due to poor fire (marginal). Inspect fire	Unbalanced fire	Replace nozzle
Too much air—lean short fire					Reduce combustion air—check combustion	
Too little air—long dirty fire					Increase combustion air—check combustion	
Excessive draft					Adjust barometric damper for correct draft	
Too little draft or restriction					Correct draft or remove restriction	
Flame Detector		If fire is good fault is in flame detector. Check detector circuit	If burner loses flame (does not lock out on safety). Fault is in fuel system	Dirty cad cell face	Clean cad cell face	
				Faulty cad cell—exceedes 1500Ohms	Replace cad cell	
				Loose or defective cad cell wires	Secure connections or replace cad cell holder and wire leads	
Oil Supply		Listen for pump whine		Pump loses prime-- air slug	Prime pump at bleed port	
				Pump loses prime—air leak in supply line	Check supply line for loose connections and tighten fittings	
				Water slug in line	Check oil tank for water (over 1") pump out water or drain out	
				Partially plugged nozzle or nozzle strainer	Replace nozzle	
		Restriction in oil line		Clear restriction		
		Plugged fuel pump strainer		Clean strainer or replace pump		
		Cold oil—outdoor tank		Change to number 1 oil		

TABLE 2 CONTINUED

TROUBLE	SOURCE	PROCEDURE		CAUSES	CORRECTION	
BURNER STARTS AND FIRES BUT SHORT CYCLES (TOO LITTLE HEAT)	Thermostat	Check thermostat		Heat anticipator set too low	Correct heat anticipator setting	
				Vibration at thermostat	Correct source of vibration	
				Thermostat in warm air draft	Shield thermostat from draft or relocate thermostat	
	Limit Control	Connect voltmeter between line voltage connections to primary control (black and white leads). If burner cycles due to power interruption, it is cycling off limit		Dirty air filters (furnace)	Clean or replace filter	
				Blower running too slow	Speed up blower for 85° to 95° temperature rise	
				Blower motor seized or burned out	Replace motor	
				Blower bearings seized	Replace bearings and shaft	
				Blower wheel dirty	Clean blower wheel	
				Blower wheel in backwards	Reverse blower wheel	
				Wrong motor rotation	Replace with motor of correct rotation	
Restrictions in return air or supply air system				Correct cause of restriction		
Power	If voltage fluctuates then fault is in power source. Recheck voltage at power source.		Adjustable limit control set too low	Reset limit to maximum stop setting.		
			Loose wiring connection	Locate and secure connection		
			Low or fluctuating line voltage	Call Power Company		
BURNER RUNS CONTINUOUSLY (TOO MUCH HEAT)	Thermostat	Disconnect thermostat wires at primary control	If burner turns off, fault is in thermostat circuit	Shorted or welded thermostat contacts	Repair or replace thermostat	
				Stuck thermostat bimetal	Clear obstruction or replace thermostat	
				Thermostat not level	Level thermostat	
				Shorted thermostat wires	Repair short or replace wires	
				Thermostat out of calibration	Replace thermostat	
	Primary Control	If burner does not turn off, fault is in primary control	Thermostat in cold draft	Correct cause of draft or relocate thermostat		
			Defective primary control	Replace primary control		
BURNER RUNS CONTINUOUSLY (TOO LITTLE HEAT)	Combustion	Check burner combustion for CO ₂ , stack temperature and smoke		Low CO ₂ less than 8%	Too much combustion air	Reduce combustion air
					Air leaks into heat exchanger around inspection door, etc.	Correct cause of air leak
					Excessive draft	Adjust barometric damper for correct draft
					Incorrect burner head adjustment	Correct burner head setting
				High smoke reading more than No. 1 smoke	Dirty or plugged heat exchanger	Clean heat exchanger
					Insufficient draft	Readjust burner
					Incorrect burner head adjustment	Increase draft
					Too little combustion air	Correct burner head setting
				High stack temperature more than 550°F Net.	Too little blower air	Increase combustion air
					Too little blower air	Speed up blower for 85° to 95° temperature rise
					Blower belt too loose and slipping	Tighten blower belt
					Dirty or plugged heat exchanger	Clean heat exchanger
					Dirty blower wheel	Clean blower wheel
					Dirty air filter (furnace)	Clean or replace filter
	Restricted or closed registers or dampers	Readjust registers or dampers				
		Nozzle and Oil Pressure	Inspect fire, check nozzle size and check oil pressure		Partially plugged or defective nozzle	Replace nozzle
					Nozzle too small	Increase nozzle size
Oil pressure too low (less than 100 psig).	Increase oil pressure to 100 psig.					