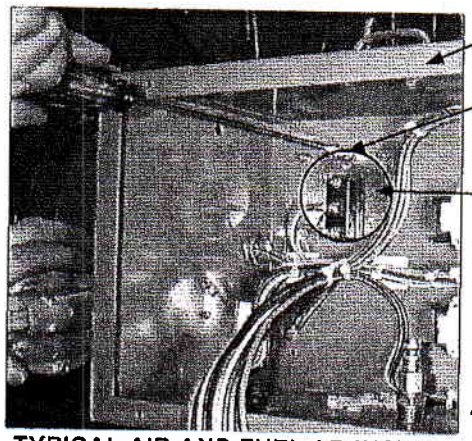
COMBUSTION AIR CONTROL

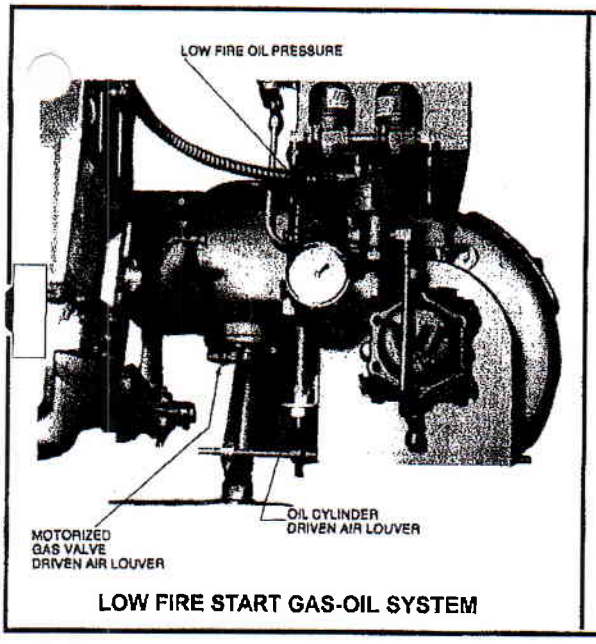


AIR FLOW INTERLOCKING SWITCH

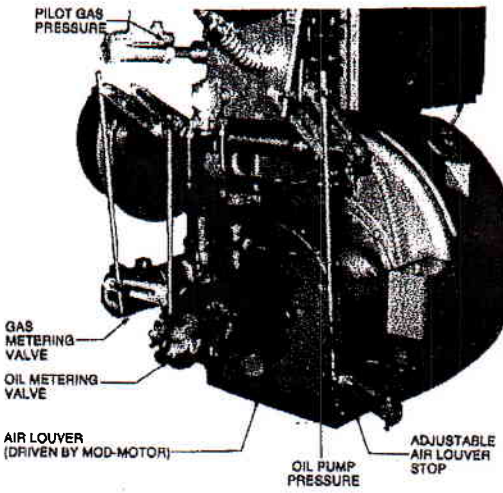
2. AIR PROVING SWITCH

The air proving switch has been adjusted at the factory for an initial setting. If the switch trips during initial start-up, turn the adjustment screw ccw two full turns to reduce the trip pressure setting.

3. TYPICAL AIR AND FUEL ADJUSTMENT LOCATIONS



LOW FIRE START GAS-OIL SYSTEM



MODULATING GAS-OIL SYSTEM

4. Fuel Cam Adjustments (if applicable)

Th uel cam needs to be checked for correct travel and alignment. Positions can change during shipment and installation and they must be reviewed prior to startup. The fuel cams are mounted to the ends of the ackshaft assembly. A cam follower link follows the profile established by the adjusting screws and drives the fuel valve. A thin metal band is used between the screw and cam follower to provide a smooth profile. The adjusting screws are backed by compressed nylon inserts, which provide a resistance to turning.

The cam (Figure G-3) should be checked for the following conditions:

a. At the low fire position, the roller should be between he first two adjusting screws. If not, adjust the position of the cam accordingly, making sure to maintain the same ow fire fuel valve position.

b. When the linkage is modulated from low to high fire, he roller must stay in the center of the adjusting screws within 1/8". If needed, the two cam set screws can be oosened and the cam moved to center it on the roller.

c. At high fire, the roller should be between the last two adjusting screws.

d. The adjusting screws should form a smooth contour with no jumps between the screws.

e. In preparation of startup, the retention plate can be removed temporarily to make it easier to adjust the screws.

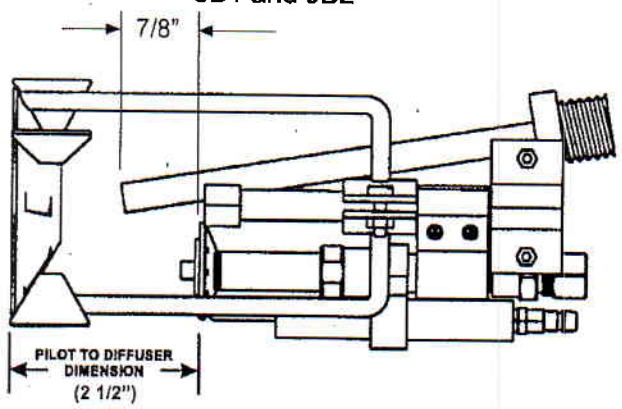
THE RETENTION PLATE MUST BE REPLACED WHEN SETUP IS COMPLETE.

If the unit is equipped with a parallel positioning system (linkageless), the control valves can be positioned and operated in a similar manner, but accomplished through the controller. Refer to the instruction manual for details.

CAUTION

LINKAGE AND ACTUATOR MOUNTINGS CAN BE BENT OR MOVED DURING SHIPMENT AND INSTALLATION. THEY MUST BE CHECKED PRIOR TO OPERATION AND ANY FAULTS CORRECTED. FAILURE TO CORRECT A MISALIGNED CONTROL WILL RESULT IN PREMATURE FAILURE.

Figure H-3



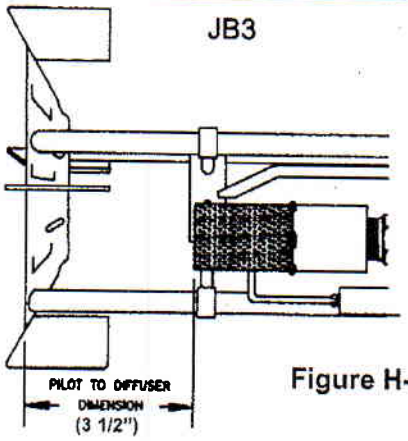
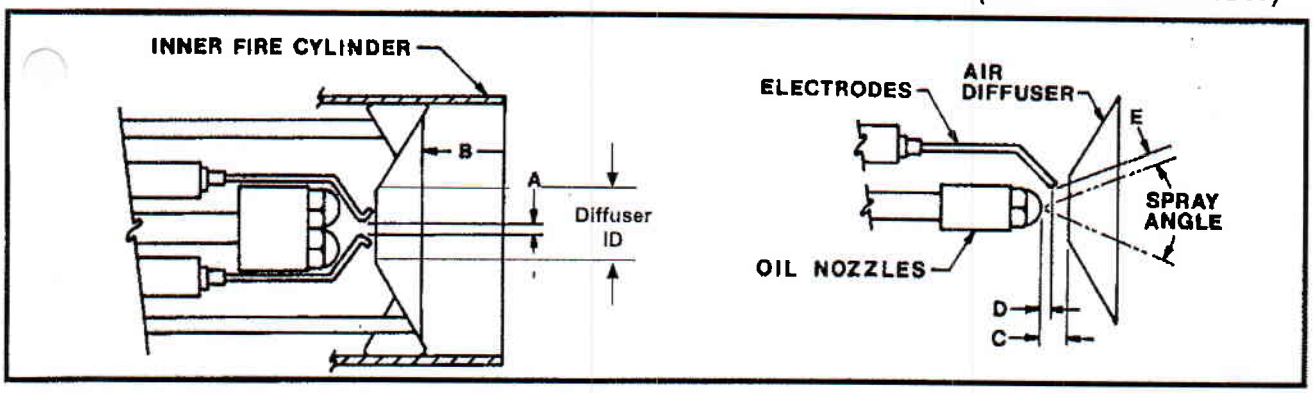


Figure H-4

FIGURE H-5 DIRECT SPARK PRESSURE ATOMIZING OIL IGNITION (SEE TABLE BELOW)



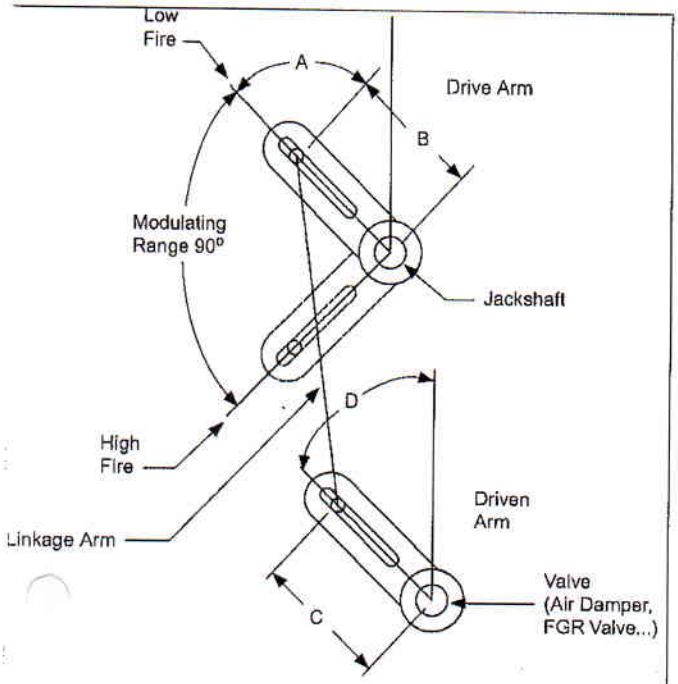
DIRECT SPARK OIL IGNITION FOR DUAL NOZZLE UNIT (See Table Below)

Note: These represent initial nozzle settings. The final position will be determined in the start-up process.

FIGURE H-6

DIMENSION TABLE FOR DIRECT SPARK OIL IGNITION (Pressure Atomizing)

BURNER DATA		NOZZLE DATA		ADJUSTMENT SETTINGS (Inches)				
Model	Diffuser I.D.	Qty.	Spray Angle°	A	B	C	D	E
JB1	1"	1	30	1/8	1/2	1/2	5/16	1/4
		1	45		3/8	3/8		
	1 1/2"	1	30	1/8	1 1/2	7/8	5/16	1/4
		1	45			3/4		
		2	30			1/4		
		2	45			1/4		
JB2	1 3/4"	2	30	1/8	1 1/2	3/4	5/16	1/4
			45			5/8		
			60			1/2		



Dim	Smaller	Larger
Angle A	Slower LF driven arm travel (D)	Faster LF driven arm travel (D)
Length B	Reduce driven arm travel (D)	Increase driven arm travel (D)
Length C	Increase driven arm travel (D)	Reduce driven arm travel (D)

Figure I-1
Linkage Adjustments

b. Decreasing the angle of the drive arm will slow the initial valve travel (and speed up the travel at high fire). This would be done to get the air damper to match the fuel valve action.

3. . uel Cam Adjustments

The cam is used to adjust the intermediate fuel rate with he low and high fire settings done by the linkage connections. The intermediate rates can be adjusted by turning the adjusting screws in the clockwise direction to increase fuel nput and decrease the % O2 level in the flue gases. Turning the adjustment screws counterclockwise will decrease uel input and increase % O2 in the flue gases.

The following guidelines should be used for adjusting the cam:

a. When adjusting the screws, the adjacent screws must also be adjusted to provide a smooth contour from screw to screw. When complete, the flexible strip between the adjusting screws and the roller must come in contact with each screw, providing a smooth transition from low fire to high ire.

b. The end screws (or nuts) can be adjusted to hold the strip against the screws, but should not deform the strip.

c. There should be no upsets in the profile, where the flexible strip is required to move to a screw position where it is initially not in contact with the screw. Also, the movement from one screw to the next cannot be too large (more then 1/8"). This will cause the strip to flex and will lead to premature failure of the strip.

d. The adjusting screws have a limited range of adjustment. They can be turned in until they are flush with the aluminum bar and adjusted out until the side washers of the roller contact the aluminum bar.

e. If any adjusting screw does not turn with some resistance, the cam must be replaced.

f. When the cam adjustment is complete, the retention plate must be installed. The retention plate will help insure that the fuel valve position will not get far from its ideal position, even with interference or sticky valve operation.

WARNING
IF THE CAM ADJUSTING SCREWS DO NOT HAVE RESISTANCE TO TURNING, THE CAM SHOULD BE REPLACED, AS THE SCREWS MAY CHANGE POSITION. FAILURE TO CHANGE A DEFECTIVE CAM MAY RESULT IN INJURY OR DEATH.

CAUTION
LARGE CHANGES FROM ONE ADJUSTING SCREW TO ANOTHER WILL RESULT IN PREMATURE FAILURE OF THE CAM AND MAY PREVENT THE BURNER FROM OPERATING PROPERLY.

g. If the contour has a sharp rise in the cam screw profile, trying to open the valve very quickly in the first few screws, the linkage should be readjusted to cause the air damper to open slower (make the jackshaft drive arm more parallel to the linkage rod). Likewise, the opposite contour can be corrected by speeding up the air damper drive (Figure I-1). The final cam screw profile should be close to the profile of the cam with no abrupt changes.

4. FGR Adjustments

Flue gas is recirculated back into the burner to reduce the flame temperature, which reduces the NOx level. High quantities of flue gas result in lower NOx levels, but can also result in flame instability if there is too much FGR. Natural gas fuel can handle larger quantities of flue gas than oil and can have much lower NOx levels as a result. Generally, the NOx levels only apply to gas firing and oil firing is not adjusted for NOx levels. There may be exceptions to this, and the orders details should be reviewed to identify any special combustion requirements.

Dual fuel units may need additional adjustments and compensation to handle the different FGR rates between natural gas and #2 fuel oil. Units that require gas NOx levels above about 45 ppm can operate with the same quantity of FGR on both fuels and no additional controls or adjustments are needed. Burners

Combination burners, firing both gas and oil, require some compromises in the setup because they share common controls for both fuels. In this case, linkage units must have the gas input adjusted to match the oil inputs because there is little flexibility in adjusting the oil rates. Oil will be setup first and will set the air damper positions to support the low and high fire oil inputs. Follow the procedure outlined in section 11 to complete the oil setup. Then setup the gas input as defined in section 10, using the air damper positions defined by oil, and adjusting the gas input to match the air damper settings.

If the burner is equipped with an optional multiple set-point modulating motor or parallel positioning, the low and high fire rates, as well as lightoff rates, can be set independently for each fuel. In this case, the gas is adjusted first, to set the air damper locations for gas firing, as defined in Section 10. Once gas is set, oil is setup as defined in Section 11, except that the multipoint modulating damper motor is adjusted to bring the low fire air setting to match the oil needs.

There are several different options available that can alter the exact setup details, and these must be evaluated prior to startup so that the procedures can be adjusted accordingly. The procedures given are for linkage systems. Parallel positioning (linkageless) systems allow for much more flexibility in the fuel, air and FGR settings on each fuel, and can be tuned to better match each fuels needs. The setup details for linkageless controls will follow the same general sequence, but differ in specifics for setting the valve positions.

8. Combination Gas and Air Atomized #2 Oil

Combination burners, firing both gas and oil, require some compromises in the setup because they share common controls for both fuels. Air atomized #2 oil firing can have turndowns and air damper positions very similar to gas firing, simplifying the setup. If the burner is equipped with FGR, gas must be started first to set the FGR control valve position to obtain the correct NOx performance. If there is no FGR, either fuel can be started first, however the setup cannot be finalized until both fuels have been reviewed to determine the air damper positions. Follow the setup procedures defined in Section 10 for gas setup and Section 12 for air atomized oil setup.

If the burner is equipped with an optional multiple set-point modulating motor, the low and high fire rates, as well as lightoff rates, can be set independently for each fuel. In this case, the gas is adjusted first, to set the air damper locations for gas firing, as defined in Section 10. Once gas is set, oil is setup as defined in Section 12, except that the multipoint modulating damper motor is adjusted to bring the low fire air setting to match the oil needs.

There are several different options available that can alter the exact setup details, and these must be evaluated prior to startup so that the procedures can be adjusted accordingly. The procedures given are for linkage systems. Parallel positioning (linkageless) systems allow for much more flexibility in the fuel, air and FGR settings on each fuel, and can be tuned to better match each fuels needs. The setup details for linkageless controls will follow the same general sequence, but differ in specifics for setting the valve positions.

9. Combination Gas and Heavy Oil

Combination burners, firing both gas and oil, require some compromises in the setup because they share common controls for both fuels. Heavy oil burners cannot operate with FGR and do not have this adjustment. If the burner does not have a multiple setpoint modulating motor or linkageless control, oil must be set first, as the air damper positions will be determined by this setup. With the multiple setpoint modulating motor, gas must be set first, as it will dictate the damper positions. In either case, setup cannot be finalized until both fuels have been reviewed to determine the air damper positions. Follow the setup procedures defined in Section 10 for gas setup and Section 13 for air atomized heavy oil setup.

There are several different options available that can alter the exact setup details, and these must be evaluated prior to startup so that the procedures can be adjusted accordingly. The procedures given are for linkage systems. Parallel positioning (linkageless) systems allow for much more flexibility in the fuel, air and FGR settings on each fuel, and can be tuned to better match each fuels needs. The setup details for linkageless controls will follow the same general sequence, but differ in specifics for setting the valve positions.

10. Gas Setup

a. Place the burner switch in the "OFF" position
b. Place the "Auto-Manual" switch in the manual position, for modulation or low fire hold, switch in low fire position for Lo-Hi-Lo operation. If this is a combination fuel burner, make sure the fuel selector switch is on "GAS".
c. Place the manual flame control potentiometer in the MIN (low fire) position on modulating units.
d. Close the downstream manual shutoff valve (closest to the burner head) on the gas train.
e. Turn the electrical power on for the burner, boiler and related components.
f. Verify that the gas metering valve is nearly closed, the vent valve (if equipped) is operating and the gas pilot valve is not open (the solenoid will hum and feel warm).
g. If equipped with FGR, verify that the FGR control valve is in the near closed position. A linkage system should have the shutoff FGR valve in the closed position.
h. Turn the burner switch on. This will start the blower motor and initiate the prepurge cycle.
i. When the prepurge sequence is complete and the low fire start switch (if used) is made, the pilot valve will open and the pilot flame should be visible through the sight port.
j. When the pilot flame is established, the flame safeguard will energize the main gas valve (indicated with the Fuel Valve Light). This operation of the main fuel

Figure I-3
O2 levels

	Natural Gas With FGR		Natural Gas No FGR		Oil	
% Rate	Min % O2	Max % O2	Min %O2	Max %O2	Min %O2	Max %O2
30	5.0	7.0	5.0	7.0	3.5	7.5
40	4.0	7.0	4.0	7.0	3.0	7.0
50	3.0	5.0	3.0	5.0	3.0	5.0
100	3.0	5.0	3.0	5.0	3.0	5.0

he highest expected gas pressure.

With a gauge or manometer at the same location as the ıigh gas pressure switch, modulate the burner to determine the firing rate with the highest gas pressure.

At the highest gas pressure, adjust the high gas pressure setting down until the switch opens and causes the ɔurner to shutdown.

From the scale reading of the switch, adjust the setting to a pressure that is 10% higher than the shutdown ɔre- ure. For example, if the switch opened at 10 inches as indicated on the high gas pressure switch, the switch should be adjusted to a reading of 11 inches.

Remove the gauge or manometer and plug the opening.

Cycle the burner on and off to determine if the limit works ɔroperly.

If the limit causes nuisance shutdowns because of small ɔressure changes during startup, increase the pressure setting an additional 5%.

:. The burner should be operating at low fire to adjust he air proving switch. Turn the adjusting screw cw (in) ıntil the burner trips out (shutdown caused by the air flow switch). Turn the adjustment screw ccw (out) 1 1/2 turns rom the point of shutdown. Check the operation at higher ates.

11. Pressure Atomized Oil Setup

The pressure atomized oil system has a limited range of ıdjustment for low and high fire, dictated by the operation ɔf t. oil nozzle. The combustion air and FGR must be ıdjusted to match these rates.

f the burner is equipped with FGR, and is a linkage system, the type of FGR control must be determined prior ɔ starting. If this is a dual fuel burner, the FGR rate is :etermined by the NOx performance on gas. A 60 ppm ɔurner will operate with the same FGR rate on gas and oil. ١ 30 ppm unit will use the limiting potentiometer to slightly educe the FGR rate on oil firing. For Oil only combustion, he NOx level will be given on the burner detail sheet, and ıhould be used to set the FGR control valve.

ı. Place the burner switch in the "OFF" position.

ɔ. Place the "Auto-Manual" switch in the manual position ɔr low fire hold switch in the low fire position fo LO-HI-LO ɔperation. If this is a combination fuel burner, make sure ne fuel selector switch is on "OIL".

:. Place the manual flame control potentiometer in the ıin (low fire) position on modulation units.

l. Turn the electrical power for the burner, boiler and re-ated components on.

e. Verify that the oil metering valve is nearly opened (the valve will be closed at high fire).

f. Turn the burner switch on. This will start the blower motor and initiate the purge cycle.

g. When the prepurge sequence is complete and the low fire start switch (if used) is made, the pilot valve will open and the pilot flame should be visible through the burner sight port.

h. When the pilot flame is established, the flame safeguard will energize the main oil valves (indicated with the Fuel Valve Light), and the burner should ignite at low fire. This operation of the main fuel valves must be visually checked by observing the valve stem moving up with a motorized valve or hearing the clicking noise from a solenoid valve.

NOTE: If the burner is not operating as indicated, follow the troubleshooting steps to determine the problem and corrective action.

i. The main flame may not light on the first attempt, because it must fill the oil lines before providing oil to the nozzle. Press the reset button on the flame safeguard to restart the burner.

WARNING
DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED, WHEN THE UNIT IS FULL OF VAPOR, OR WHEN THE COMBUSTION CHAMBER IS HOT.

j. After a few seconds, the combustion analyzer should have an accurate reading of the O2 in the stack. The O2 level should be between 4% and 7%, and the nozzle oil pressure should be between 50 and 70 PSIG return line pressure for the JB3. JB1 and JB2 burner low fire oil pressure should be 100 psig. Do not attempt to fine tune combustion until the high fire has been set.

If the burner is equipped with FGR, the FGR control valve should be set for the approximate NOx level required.

1. Turning the cam screw in will add fuel, making it richer and reducing the O2 level.

2. Turning the cam screw out will reduce the fuel input, increasing the O2 level.

3. The air damper should be positioned for the correct low fire settings.

k. Operate the burner until the boiler is warmed up, and near the operating pressure or temperature.

l. Increase the firing rate, using the manual potentiometer or put the low fire hold switch in auto position, while monitoring and adjusting the O2 level. Adjust the cam as needed to reach the high fire input.

If the burner is equipped with FGR, adjust the FGR control valve as required to maintain the NOx level.

Gal start = gallons at start of the test
Measured sec = measured time of test
GPH = Gallons of oil per hour

n. If equipped with FGR, adjust the NOx level to be about 10% below any guaranteed NOx performance or if no performance guarantee exists adjust the FGR to provide some added turbulence but not high enough to impact flame stability. A balance of the FGR control valve and air damper are required to obtain the final result, as each can impact the other. If this is a 30 ppm system, the FGR limiting pot should be adjusted to reduce the FGR rate for stable combustion, with the FGR control valve set when firing gas. If this is a 60 ppm system, no adjustment is necessary.

o. Modulate the burner to low fire, adjusting the O2 level as the burner modulates.

p. Adjust the low fire input, using the fuel cam and air damper adjustments.

q. If the burner is equipped with FGR, adjust the NOx level according to the type of system (limiting potentiometer or making gas).

r. Re-adjust the midfire points for the correct O2 levels. The linkage may need to be readjusted to obtain the correct relationship between the fuel valve and air damper. See Figure I-1.

s. If equipped with FGR, adjust the NOx levels at low and midfire rates to be about 10% under the guaranteed levels or as required for the gas firing.

t. The burner should be operating at low fire to adjust the air proving switch. Turn the adjusting screw cw (in) until the burner trips out (shutdown caused by the air flow switch). Turn the adjustment screw ccw (out) 1 ½ turns from the point of shutdown. Check the operation at higher rates.

FIGURE I-4
Typical Atomizing Air Pressure

% Rate	Minimum
20	10 - 25
30	12 - 30
40	15 - 35
50	20 - 40
100	25 - 60

3. Heavy Oil Setup

CAUTION
WHEN WORKING WITH HEATED OIL, PROTECTIVE CLOTHING, INCLUDING GLOVES, SHOULD BE WORN TO PROTECT FROM BURNS.

The air atomized heavy oil system requires the additional adjustment of oil temperature in the burner setup. The temperature is adjusted to improve the viscosity for good atomization. Typically, this will be about 150°F for #4 oil, 180°F for #5 oil and 200°F for # 6 oil.

a. Prior to startup, the oil system must be operating with the oil temperature to the burner (before the trim heater) within 20°F of the final temperature.

b. Place the burner switch in the "OFF" position. If this is a combination fuel burner, make sure the fuel selector switch is on "OIL" and that the oil pump is running.

c. Place the "Auto-Manual" switch in the manual position.

d. Place the manual flame control potentiometer in the MIN (low fire) position.

e. Turn the electrical power on for the burner, boiler and related components.

f. The oil may take some time to get up to temperature. If the oil is cool, the ball valve downstream of the N.O. oil return valve (Figure B-7) can be opened to make it easier for the oil to circulate and reach operating temperature.

g. Verify that the oil metering valve is at the nearly closed position.

h. Turn the burner switch to "ON". This will start the blower motor and initiate the prepurge cycle.

WARNING
DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED, WHEN THE UNIT IS FULL OF VAPOR, OR WHEN THE COMBUSTION CHAMBER IS HOT.

i. When the prepurge sequence is complete and the low fire start switch is made, the pilot valve will open and the pilot flame should be visible through the burner sight port.

j. When the pilot flame is established, the flame safeguard will energize the main oil valves (indicated with the Fuel Valve Light), and the burner should ignite at low fire. This operation of the main fuel valves must be visually checked by observing the valve stem moving up with a motorized valve or hearing the clicking noise from a solenoid valve.

k. After a few seconds, the combustion analyzer should have an accurate reading of the O2 in the stack. The O2 level should be between 4% and 7% (See Figure I-3 for O2 rates) and the nozzle oil press should be between 10 and 20 PSIG. Do not attempt to fine tune combustion until the high fire input has been set.

- Turning the cam screw in will add fuel, making it richer and reducing the O2 level.
- Turning the cam screw out will reduce the fuel input, increasing the O2 level.
- The air damper should be positioned for the correct low fire settings.
- The atomizing air pressure can be adjusted using the air bleed valve (Figure I-4).
- The oil temperature can be adjusted to obtain the best atomization.

l. Operate the burner until the boiler is warmed up and near the operating pressure or temperature.

m. Increase the firing rate, using the manual potentiometer, while monitoring and adjusting the O2 level. Adjust the cam, oil and atomizing air pressure and oil temperature as needed to reach the high fire input.

n. At high fire (end of the modulating motor travel), adjust the high fire input to match the maximum input listed on the rating label. Using a flow meter, the fuel input may

he location of the pilot and scanner, as shown in section H". This may also indicate a faulty scanner or amplifier.

17. Burner Shutdown

Normal operation of the burner will allow the operating controls to shut the burner down when the load demand is satisfied. If the burner needs to be shut down for any reason, the "ON-OFF" switch can be used to quickly turn the burner off. This will instantly cause the fuel valves to close and start a post purge cycle to remove any unburned fuel from the vessel.

In an emergency shutdown, all fuel and electrical power should be de-energized or turned off to secure the burner. This would include the main power disconnect, the manual gas shutoff valve at the drop down line and if equipped, the manual oil valve to the nozzle.

It is recommended that the burner be manually driven to low fire before turning the burner off, as this reduces the dynamic and thermal stress. If the burner will remain off for some time, the manual fuel valves, fuel pumps and power supply should be turned off.

CAUTION
ALWAYS KEEP THE FUEL SUPPLY VALVE SHUT OFF WHEN THE BURNER IS SHUT DOWN FOR AN EXTENDED PERIOD OF TIME.

18. Restarting after Extended Shutdown

Extended shutdowns require the same startup process as those outlined above. In addition, the following advanced cleaning must be done,

a. The air atomized oil nozzle should be removed and cleaned, if pressure atomized they should be replaced. Use care in cleaning to preserve the sharp edges of the nozzle, which are required to maintain good atomization.

b. The oil filter and strainer must be removed and cleaned prior to starting.

CAUTION
DO NOT START THE BURNER UNLESS ALL CLEANOUT DOORS ARE SECURED IN PLACE.

No.	System	Cause	Correction
	High CO at low fire (con't)	High stack draft (especially at low fire)	Stabilize draft
	(firing gas)	Poor air flow distribution (off center flame)	Adjust air straightener blade
		Diffuser not in optimum position	Adjust diffuser position in or out
		Fluxuating gas pressure (regulator not holding pressure)	Check regulator pressure, sensing line and supply pressure: sized properly
10	Gas combustion noise	Input too low for burner components	Check input, compare to rating label
	(rumbling)	Improper excess air	Readjust excess air
		Fluxuating gas pressure (regulator not holding pressure)	Check regulator pressure and supply
		High stack draft (especially at low fire)	Stabilize draft
		Diffuser not in optimum position	Adjust diffuser position in or out
		Poor air flow distribution (off center flame)	Adjust air straightener blade
11	Oil combustion smoking	Oil nozzle dirty or plugged	Clean oil nozzle
		Improper excess air	Readjust excess air
		Input too low for burner components	Check input, compare to rating label
		High stack draft (especially at low fire)	Stabilize draft
		Incorrect nozzle position	Adjust the nozzle to diffuser position
		Fluxuating oil pressures (regulator not holding)	Check regulator pressure and oil supply
		Poor air flow distribution (off center flame)	Adjust air straightener blade
		Too much FGR (if equipped)	Reduce FGR rate
12	Fuel-Air-Ratios are	Linkage flexing	Realign linkage, straighten rods
	not consistent	Linkage slip	Check linkage and tighten all joints
		Fuel cam screws have moved	Replace fuel cam
		Fuel line plugged	Check and clean lines, strainers & filters
		Fuel supply pressure changing	Check and/or replace pressure regulator
		Combustion air temperature changed	Retune burner
		Draft condition changed	Check draft and outlet damper
		Plugged or leaky FGR line	Clean / repair
		Gas control valve - low fire stop not set (if used)	Adjust low fire stop
13	Fuel-Air-Ratios have changed	Linkage wear	Check linkage and tighten all joints
	over time	Fuel cam screws have moved	Replace fuel cam
		Air damper seal worn	Replace air damper seals
		Fuel lines plugged	Check and clean lines, strainers & filters
		Fuel control valve worn	Replace fuel control valve
		Gas orifices or gas manifold plugged	Clean and/or replace
		Combustion air temperature changed	Retune burner
		Draft condition changed	Check draft and outlet damper
		Vessel plugged	Clean vessel
		Plugged or leaky FGR valve	Clean / repair
14	Cannot obtain capacity on	Wrong spring range in regulator	Install higher spring range
	gas	Too many elbows before control valve	Rework piping to reduce elbows
		Gas line too small, high pressure drop	Use larger pipe size
		Supply pressure lower then stated	Increase supply pressure
		Supply pressure drops too low at high fire	Use larger gas line sizes / orifice in service regulator
		Regulator too small for flow and pressure	Change regulator
15	Cannot obtain rated input on	Oil nozzles plugged	Replace nozzles
	oil firing (pressure atomized)	By-pass seal on nozzle leaking	Replace nozzles

K. GENERAL MAINTENANCE AND CARE

1. General

This burner has been designed to provide many years of trouble free operation. The reliability can be greatly improved with some simple inspection and maintenance programs.

One of the best tools for a good maintenance program is to keep a log on the key parameters of the burner and boiler. The log would include operating temperatures, pressures, inspections and preventative maintenance activities. This document can be used to detect any changes in the operating characteristics of the burner, which can be used for preventative maintenance.

The maintenance schedule can be used to help generate this log. There are also many other good references that can be use to help develop your log. Adding check points for other equipment into a common log can help. It is common to integrate the boiler and burner log, so that all components are checked at the same time.

The frequency of inspection given in the following charts is only a guideline. Initial results should be used to adjust the time intervals to be more frequent when problems or potential problems are observed.

2. Physical Inspection

Listening and looking at the burner can detect many problems. For example, leakage can usually be seen early with a small buildup of oil . Valve and linkage problems can usually be detected early on by simply watching the movement and detecting rough uneven changes. The jackshaft, linkage and valve movement should occur smoothly with no rough jerks.

The flame condition can often be a good indicator of the firing head. If the flame does not look correct, there may be a problem with the hardware. The firing head is exposed to the high temperatures of combustion and can have reduced life due to the thermal stress. In particular, the diffuser, oil nozzle, gas orifices, gas manifold, refractory and burner mounting plate should all be inspected.

3. Fuel-Air-Ratio Controls

The fuel-air-ratio controls must be maintained in good operating condition. Over time, these items will wear and may not operate smoothly. Corrective action must be taken.

There are several different types of controls and the corrective action of each could be different. The following general guidelines can be used for initial steps.

Linkage based controls should be inspected for wear. If there is any noticeable play in the linkage rod ends or shaft bearing, they should be replaced. Likewise, any control valves that exhibit sloppy or hard to turn movement should also be replaced.

Fuel cams should have adjusting screws that are held firmly in position and can not move due to normal vibrations. The moving parts must be in good condition with no noticeable wear or play. Worn connections will result in hysteresis and reduced combustion efficiency.

The cam and jackshaft should be visually checked on a frequent or daily basis for obvious problems, including free movement, no loose parts and correct position of components.

On a monthly basis, the linkage and cams should be inspected for wear and loose parts. Annually, the cam and linkage should be operated manually to check the movement of all components and valves. Any worn parts should be replaced immediately.

4. Gas Fuel System

The safety interlocks must be checked at regular intervals to ensure that they provide the proper safety. See the Inspection and Maintenance Schedule Chart (Figure 8) for frequencies.

The drip leg should be cleaned annually.

Monitoring the outlet gas pressure from the regulator will verify this control is working properly.

5. Oil Fuel System

The oil system has additional components that require regular maintenance, depending on the type of system used.

a. Oil added to air compressor. The air compressor has a visual sight glass showing the oil level. This must be inspected every shift (while operating).

b. Air compressor belt tight and in good condition

c. The oil strainer should be checked and cleaned periodically. A high vacuum reading on the suction side of the pump (over 10") is a good indication that the strainer needs to be cleaned. Strainers provided by Webster will use a wire mesh basket inside a canister. After turning the pump off (and making sure there is no pressure on the strainer), unscrew the yoke to gain access to the basket. The canister does not need to be drained. Be careful with the gasket when removing or replacing the cover to insure

8 - Inspection and Maintenance Schedule

Frequency								Performed By	
Daily	Weekly	Monthly	Seasonal	Annual	Annual As Required	Component / Item	Recommended Action or Test	Boiler Operator	Trained Burner Technician
X						Burner Flame	Visual inspection of burner flame.	X	
X						Jackshaft and Linkage	Visual inspection for smooth and free travel.	X	
X						Air Damper	Visual inspection for smooth and free travel.	X	
X						Fuel Metering Valves	Visual inspection for smooth and free travel.	X	
X						Draft Controls (Stack)	Visual inspection for smooth and free travel.	X	
X						Gas Fuel Pressure	Record in log book, compare trends.	X	
X						Oil Pressure	Record in log book, compare trends.	X	
X						Atomizing Air Pressure	Record in log book, compare trends.	X	
X						Pilot	Visually inspect pilot flame, check and record flame signal strength if metered.	X	
	X					Flame SafeGuard - Pilot Test	Close manual fuel valve on pilot during cycle and check for safety shutdown, recording time.	X	
						Flame SafeGuard - Main Flame	Close manual fuel valve on pilot during cycle and check for safety shutdown, recording time.	X	
		X				Flame SafeGuard	Check flame safeguard components, including scanner.		X
				X		Flame SafeGuard	Replace flame safeguard components in accordance with manufacturers instructions.		X
				X	X	Pilot Turndown Test	Conduct pilot turndown test annually or after any component change.		X
				X	X	Hot Refractory Test	Conduct hot refractory hold in test. This test is required annually or after any component change.		X
		X				Oil Pressure and Temperature Interlocks	Check oil pressure and temperature switch for smooth operation and correct action.		X
		X				Atomizing Air Pressure	Check air atomizing pressure interlock switch for smooth operation and correct action.	X	
		X				Interlock Controls	Check other interlocks that may be used on the burner for smooth operation and correct action.		X
			X			Firing Rate Control	Check firing rate control and verify settings.		X
			X			Combustion Tuning	Conduct a combustion test, verify setting and NOx emission levels.		X
	X					Pilot and Main Fuel Valves	Make visual and manual check for proper sequencing of valves.		X
				X		Pilot and Main Fuel Valves	Check all coils, diaphragms, interlock switch & other parts of all safety shutoff valves.		X
				X		Pilot and Main Fuel Valves	Perform leak tests on all safety shutdown control valves.		X
				X		Low Pressure Air Switch	Test low air pressure switch for proper operation and adjustment.		X
				X		Mod Damper Switch	Check damper low fire proving switch per manufacturers instructions.		X
				X		Linkage and Fuel Cams	Check linkage and cams for wear and replace any items with wear indication or stress cracks.		X
X						FGR Control Valve	Visual inspection for smooth and free travel.	X	
			X			FGR Control Valve	Clean and lubricate FGR control valve.	X	
	X					FGR Shutoff Valve	Visually inspect for smooth and complete travel.	X	
			X			FGR Shutoff Valve	Clean and lubricate FGR shutoff valve	X	
X						FGR Condensate Drain	Open FGR condensate drains, remove all condensate.	X	
					X	FGR Shutoff Valve Switch	Check operation of shutoff FGR valve for full rotation and position proving switch.		X
					X	FGR Duct	Inspect and clean FGR duct.	X	
					X	Combustion Air Fan	Clean combustion air fan and housing		X
X	X					Burner Components	Visually check the burner components for signs of cracks, deformation, slippage or other unusual indication.	X	
		X				Burner Mounting	Check burner mounting clamps and brackets for tightness.	X	
		X				Refractory and Seals	Check burner refractory for cracks or signs of leakage.	X	
		X				Oil Nozzle	Check and clean oil nozzle.	X	
X						Air Compressor	Check air compressor for lubrication oil and air filter.	X	
				X		Air Compressor	Check air compressor relief valve operation.		X

WARRANTY VALIDATION FIELD START-UP REPORT

CUSTOMER: _____ W.O. _____

BURNER MODEL: _____ BOILER MODEL: _____

CONTROL CIRCUIT COMPONENT OPERATIONAL TESTING (Check if Okay)

Primary LWCO _____ High Limit _____ Firing Rate Control _____
Secondary LWCO _____ Operational Control _____ Low Fire Start Switch _____
High Gas Press. Switch _____ Oil Press. Switch _____ High Fire Purge Switch _____
Low Gas Press. Switch _____ Air Flow Switch _____ Other _____

FIELD COMBUSTION SETTINGS	OIL FIRED			GAS FIRED		
	Low	Med.	High	Low	Med.	High
Firing Rate						
CO_2						
O_2						
Smoke or CO (ppm)						
NOx (ppm)						
Stack Temp. Net °F						
Room Temperature °F						
Overfire Draft " WC						
Breeching Draft " WC						
Water Temp. °F/Steam Press.						
Air Inlet Shutter (" Open)						
Flame Signal Pilot						
Flame Signal Main						
Oil Noz. Press/Man. Gas Pres.						
By-Pass Oil Pressure						
Atomizing Air Pressure						
Combustion Efficiency						
Running Motor Amps & Volts	L1		L2		L3	

Comments:

Having read the Manufacturer's service manual as to the proper installation, start-up and service of the unit above, I verify that the burner has been put into operation as specified, and that the above information and checks are complete and correct.

START-UP BY _____ Date _____

Company _____ Phone No. _____

Address _____

NOTE: Warranty Validation - Field Start-up report must be completed, signed, dated and the top copy sent to Webster Engineering & Manufacturing Co., Winfield, KS 67156, to validate equipment warranty.

NOTES