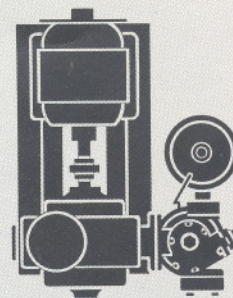


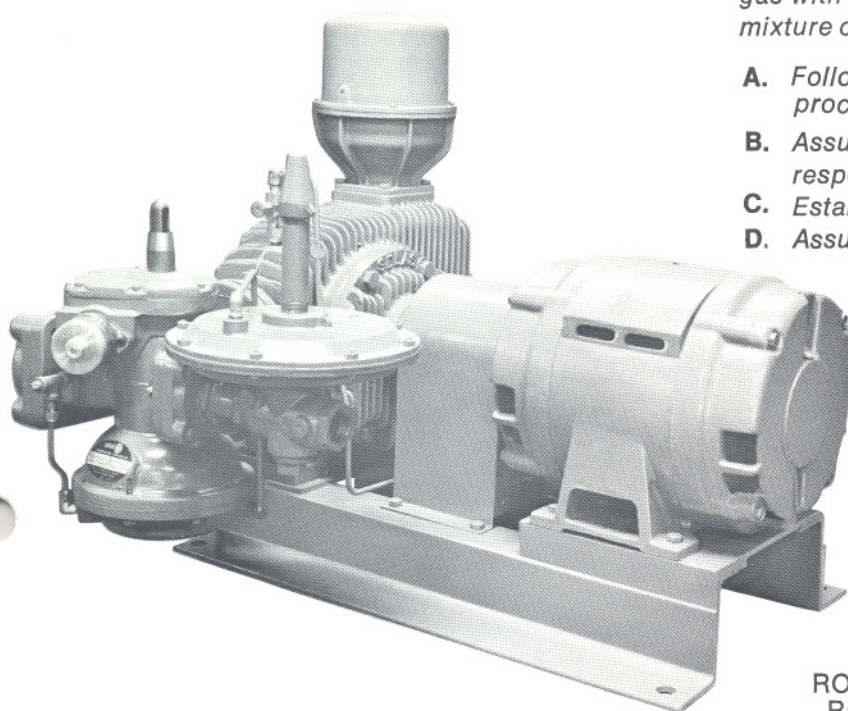
Instructions for INSTALLATION OPERATION • MAINTENANCE

of the SELAS COMBUSTION CONTROLLER SERIES 40-CA



WARNING: *The Selas Combustion Controller is designed to blend fuel gas with air in a controlled way. Since uncontrolled mixture can prove to be hazardous, it is important to:*

- A. *Follow all installation and operation procedures.*
- B. *Assure that care of equipment is assigned to responsible people.*
- C. *Establish routine maintenance checks.*
- D. *Assure adequate ventilation.*



ROTARY POSITIVE DISPLACEMENT TYPE
Rated Capacity 4000 cfh (113.26 M³/HR) of
Mixture. Max. Pressure 3 psig (20.7 kPa)

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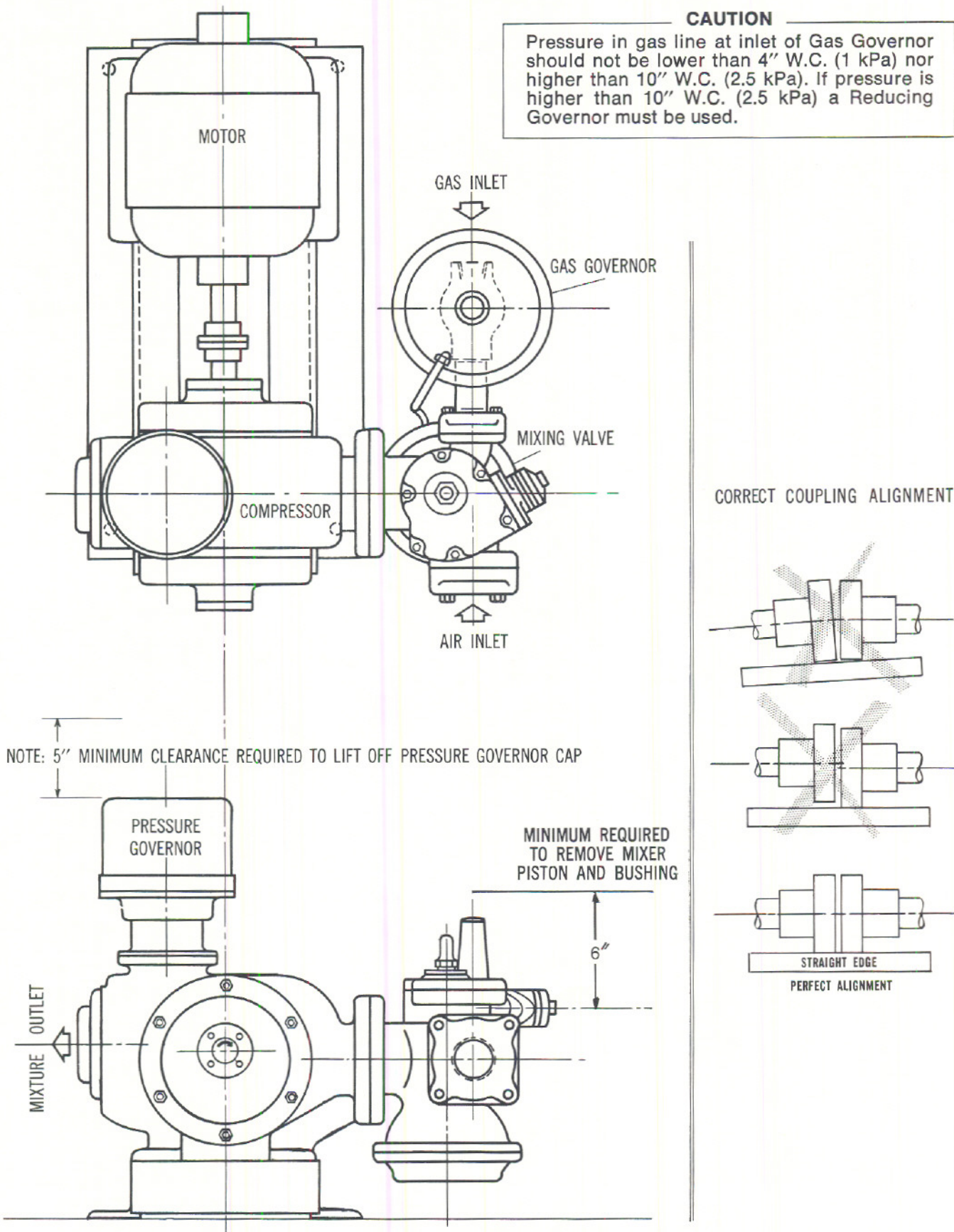
PARTS LIST

Compressor and Pressure Governor	12
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FIGURE 1: General Installation Arrangement of 40-CA Combustion Controller



INSTALLATION

(See Figure 1)

LOCATION

Install in an area which will permit frequent air changes to occur. Adequate ventilation is important to the safe operation of this unit.

HANDLING

Avoid rough handling while unloading and moving to location. Do not use sling around shafts.

UNPACKING

Remove crating but do not remove skids until machine is placed in final position ready for installation. Remove packing material from inside of pressure governor cap. See Fig. 8 and tag wired to machine. Do not discard instruction tags until installation is completed.

LEVELING

Machine must be installed on level foundation. Grout surface to a finished level where necessary. Do not bolt base plate tightly to foundation.

PIPING CONNECTIONS

(Figures 2a, 2b, 2c)

All piping must be thoroughly cleaned. Pipe flanges and threaded connections must be properly aligned to avoid straining or distortion of castings. Support piping independently of the machine. Use gaskets between flanges.

GAS CONNECTION

Remove all thread protector caps. Install a flanged or union connection, and a full ported shut-off valve in the raw gas line close to the gas governor on the machine.

CAUTION:

Pressure in gas line at the inlet of the gas governor should not be lower than 4" W.C. (1 kPa) nor exceed a maximum of 10" W.C. (2.5 kPa). If pressure in gas supply line is higher, a reducing regulator must be used. This regulator must be located upstream a minimum of ten feet (3.05 m). Consult with Selas if pressure is only slightly higher than 10" W.C. (2.5 kPa).

MIXTURE CONNECTION

Remove thread protector cap. Install a full ported shut-off valve in the mixture line leading from the machine.

AIR CONNECTION

Air filter may be mounted in any direction. If located outdoors, the inlet openings must be weather-protected. Air supply should be clean and dry. Steam,

corrosive, hot and dirty atmospheres are harmful to the Combustion Controller. Where it is necessary to have a long run of piping to reach clean, dry air, use oversized pipe and a minimum of elbows to reduce pressure drops.

ELECTRICAL CONNECTIONS

(Figures 3a, 3b, 3c)

CAUTION:

Motor coupling is shipped disconnected. Do not assemble coupling until electrical connections are made. Serious damage may result if machine is run backwards. See tag wired to machine.

Make proper electrical connections to motor, making sure that motor rotates in direction indicated by arrows on machine (clockwise when looking at shaft end of motor).

If automatic lubricator is furnished, wire solenoid valve and control timer as instructed.

COUPLING MOTOR

Do not assemble until electrical connections are made. The coupling used is a taper-lock (disc-type). It requires no lubrication. On machines shipped with bushings attached, install center disc and slide coupling flanges together until flanges are $\frac{5}{8}$ " (16 mm) apart and flush with shaft ends. Tighten screws on taper-lock bushings. Check alignment using straight-edge across the two flanges (Fig. 1).

Coupling discs can be removed by loosening flanges on shafts (see "REPLACING PARTS—MOTOR COUPLINGS—REMOVAL") and sliding flanges apart on shafts.

TRIAL RUN

If unit has been in storage, rotate compressor a few revolutions by hand to free moving parts. Make a test run of machine using air only. Start machine with gas inlet valve and mixture outlet valve closed. (Fig. 2a) With motor running, lubricate machine according to instructions in chapter title "MAINTENANCE-LUBRICATION".

Lubrication instructions are for machines supplied with or without automatic lubricator.

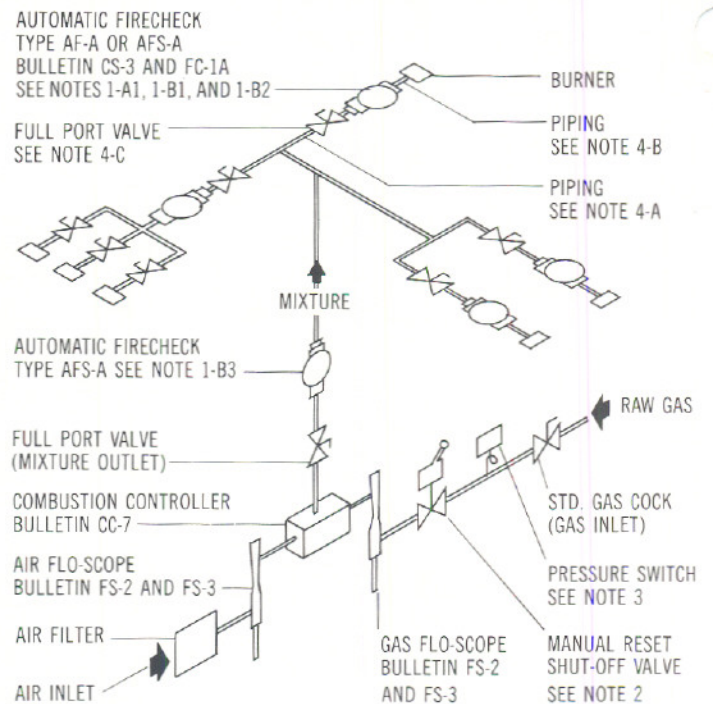
NOTE: Rotary seals are used in place of a packing gland on this unit.

For proper installation of oil seals, see "MAINTENANCE—CLEANING OF MACHINE—COMPRESSOR, NOTE 3".

CAUTION

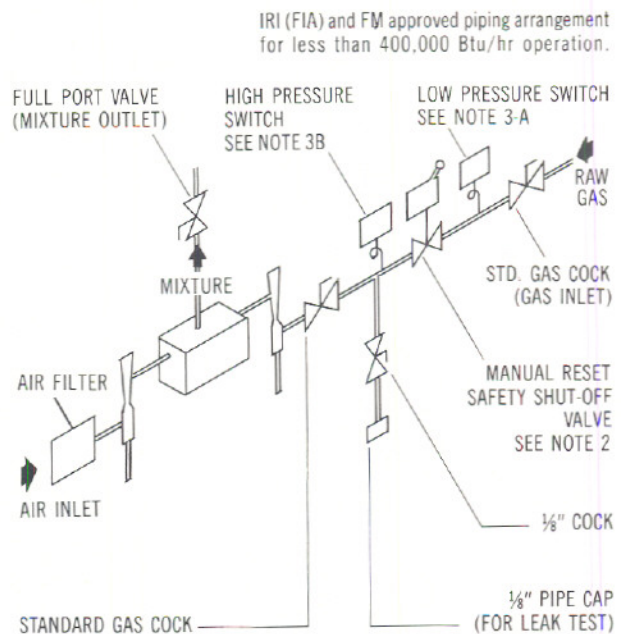
Complete premix gas-air is explosive. A flash-back or leak can be dangerous. It is important that the system include the safety devices described and that their specific Instruction Bulletins be understood and followed by responsible operating personnel.

FIGURE 2a: Basic Piping Arrangement



These diagrams are intended to show the relative positions of Combustion Controller and auxiliary equipment. The notes on page 4 can be used as general installation guides. Refer to installation bulletin for each piece of equipment for complete instructions.

FIGURE 2b: FM Approved Arrangement of Gas Inlet Piping



[Refer to current FM publications for complete information concerning approved safety equipment.]

NOTES to Piping Diagrams (Figures 2a, 2b, 2c)

1. AUTOMATIC FIRECHECKS

A. Type AF-A (without micro switch)

1. Install type AF-A when backfire at one Firecheck must not interrupt operation of remaining burners and no signal or alarm is necessary.

B. Type AFS-A (with micro switch)

1. Install type AFS-A if alarm or signal is necessary.
2. Install type AFS-A if all burners of entire system must shut down in event of backfire at any section. Micro switch should be wired to close manual reset shut-off valve and allow air to purge line before stopping Controller motor.
3. If burners and their Firechecks are ten feet or more from Controller, or if only one Firecheck is used, install an AFS-A type Firecheck for protection of Controller. Wire its micro switch to shut off raw gas and stop Controller motor in case of backfire.

2. MANUAL RESET SHUT-OFF VALVES

Install a manual reset shut-off valve to shut off the

gas supply in case of backfire, high pressure or low pressure.

3. PRESSURE SWITCH

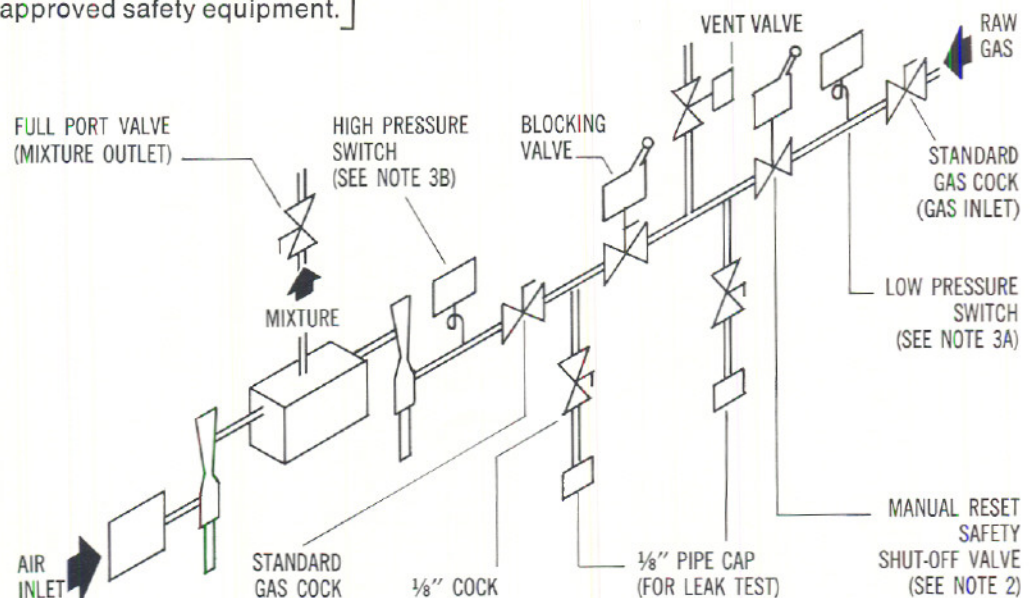
- A. The low pressure switch is wired to the safety shut-off valve. In case of low gas line pressure, the valve is actuated by the switch, thereby closing off the gas supply.
- B. The high pressure switch is wired to the safety shut-off valve. In case of excessive gas line pressure, the valve is actuated by the switch, thereby closing off the gas supply.

4. PIPING

- A. The piping from the Controller to the take-off points is generally the same size as the Controller discharge connection depending on allowable pipe line losses and with reference to size of Firecheck or Firechecks being supplied.
- B. Insurance company regulations specify that the piping from Automatic Firecheck to burners must not exceed the Firecheck size. Maintain or reduce this size with reference to allowable pressure losses.
- C. Always install a manual shut-off valve ahead of each Firecheck.

FIGURE 2c: IRI (FIA) Approved Arrangement of Gas Inlet Piping.

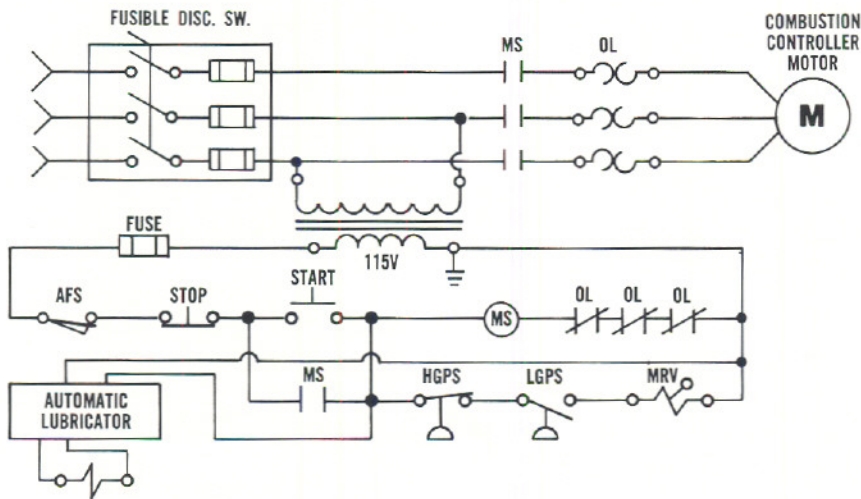
[Refer to current IRI (FIA) publications for complete information concerning approved safety equipment.]



This diagram is intended to show the relative positions of Combustion Controller and auxiliary equipment. The above notes can be used as general installation guides. Refer to installation bulletin for each piece of equipment for complete instructions.

WIRING DIAGRAMS

FIGURE 3a: Wiring Diagram for FM Approved Gas Inlet Piping

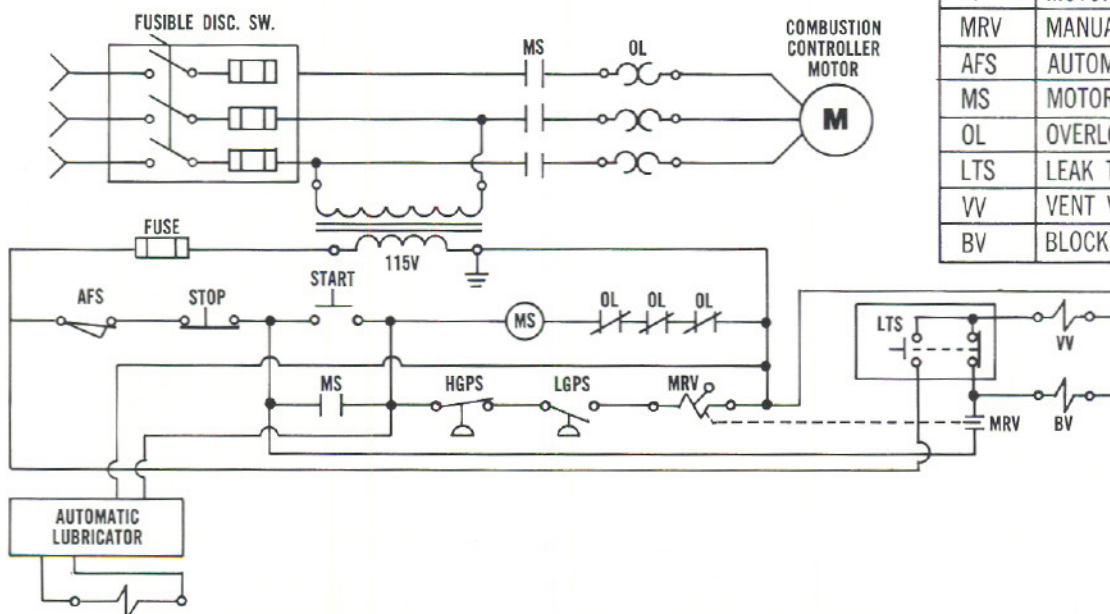


LEGEND	
DESIG	DESCRIPTION
HGPS	HIGH GAS PRESSURE SWITCH
LGPS	LOW GAS PRESSURE SWITCH
M	MOTOR (COMB. CONT.)
MRV	MANUAL RESET VALVE
AFS	AUTOMATIC FIRECHECK SWITCH
MS	MOTOR STARTER
OL	OVERLOAD

Operation Features of Combustion System Using Firecheck with micro switch, pressure switch and solenoid valve

CONDITION	MOTOR	GAS SAFETY VALVE
FLASH BACK	STOPS	CLOSES
LOW VOLTAGE OR MOTOR OVERLOAD	STOPS	CLOSES
PRESSURE FAILURE IN RAW GAS LINE	RUNS	CLOSES

FIGURE 3b: Wiring Diagram for IRI (FIA) Approved Gas Inlet Piping



LEGEND	
DESIG	DESCRIPTION
HGPS	HIGH GAS PRESSURE SWITCH
LGPS	LOW GAS PRESSURE SWITCH
M	MOTOR (COMB. CONT.)
MRV	MANUAL RESET VALVE
AFS	AUTOMATIC FIRECHECK SWITCH
MS	MOTOR STARTER
OL	OVERLOAD
LTS	LEAK TEST SWITCH
VV	VENT VALVE
BV	BLOCKING VALVE

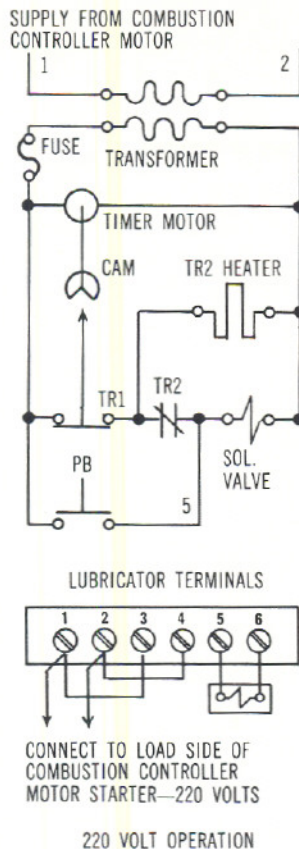
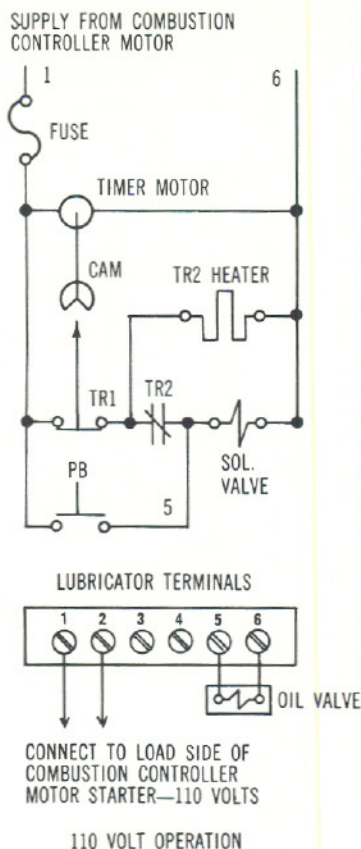
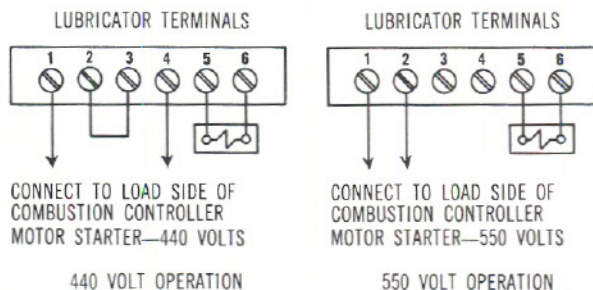


FIGURE 3c: Wiring Diagram for Automatic Lubricator

NOTE: If two oil valves are used in parallel, connect to line side of starter or to separate supply



OPERATION

STARTING the MACHINE

Many installations, often adapted to the system or process to be served, require special instructions which frequently involve a purge interval and/or the use of safety cocks. In addition to following the specific instructions developed for the installation, several general rules should be observed prior to start-up to avoid delivering mixture to areas not prepared for ignition.

INSURE THAT:

1. Gas supply to machine is shut off.
2. Mixture outlet valve is fully closed.
3. All mixture valves at burner position are closed.

NOTE: At initial start-up, adjust the mixer to deliver approximately the gas-air ratio required. (Refer to "OPERATION—ADJUSTING THE MACHINE.")

Follow established starting procedure; or if none is indicated, proceed as follows:

4. Prepare the lighting torch, standing pilot and all ignition devices for the burners.
5. Start motor.
6. Open lubricating sight feed oil valve No. 3 (Fig. 8) on top of compressor and allow 30 drops of oil to drop into compressor through the valve. (Repeat after every 8 hours running time.) If an automatic lubricator is installed and controls only one compressor, the compressor will be

oiled automatically at each start-up. If the automatic lubricator controls more than one unit, the initial oiling must be done manually by using button on cover of automatic lubricator (Fig. 12).

7. Open gas valve.
8. Open mixture outlet.
9. Light burners as required.
10. Where necessary, readjust air-gas ratio setting to produce desired burning characteristic. (Refer to "OPERATION—ADJUSTING THE MACHINE.")

STOPPING the MACHINE

There are two general procedures to follow in shutting down, depending on the type of mixtures used.

A. When operating with mixture within explosive range, and it is desirable to purge all lines of mixture before shut-down, proceed as follows (Fig. 2):

1. Close gas inlet valve on main gas supply to machine inlet.
2. Allow machine to run long enough to clear all pipes of air-gas mixture and then stop motor.
3. Close all valves at burners connected to machine.
4. Close mixture outlet valve at machine outlet.

B. When operating with a mixture within non-explosive range and where it is desirable to maintain mixture in the lines, proceed as follows:

1. Close all valves at burners connected to machine.
2. Close mixture outlet valve at machine outlet.
3. Stop motor.
4. Close gas inlet valve on main gas supply to machine inlet.

NOTE: Where operating conditions appear to warrant a starting and stopping procedure other than listed, consult **Selas Corporation of America** for special instructions.

CAUTION

If unit is used for stand-by purposes, it is essential that machine be run at regular intervals to keep parts properly lubricated and free moving.

IMPORTANT: To prevent damage to the machine, do not allow temperature of bearing housing or discharge side of compressor housing to rise above the recommended temperature of 212°F (100°C). This temperature is generally reached when machine is operating at approximately 5% of the rated capacity for extended periods. If temperature exceeds recommended figure, discharge volume must be increased. If low flow must be continued, water-cooled bearing brackets should be installed.

ADJUSTING THE MACHINE

MIXING VALVES (Figure 9)

Mixer adjustment for convenience should be made at approximately 50% capacity. However, you may make this adjustment anywhere between 5% and 100% of the Combustion Controller range.

Setting of the range-of-port-opening scale No. 48 is done at our factory and position "O" Gas indicates the gas port closed and the air port positioned at its maximum opening. Any desired air-gas ratio mixture may be obtained by turning the adjustment knob index 50 (Figure 9).

CHECK VALVE (Figure 9) Index No. 8

The check valve is an integral part of the mixing valve. It is not intended as a positive shut-off, but is installed to protect the mixing valve and its diaphragm from sudden back pressure.

GAS GOVERNOR (Figure 10)

The Balanced Zero Regulator reduces incoming gas

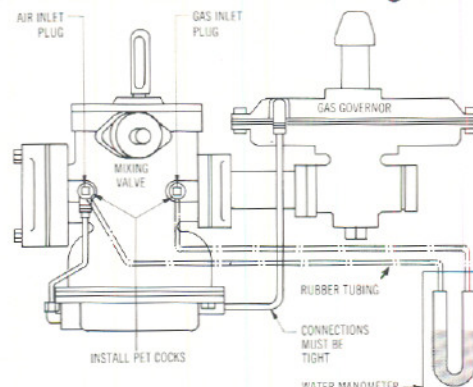
pressure to zero or atmospheric. Flow occurs as demanded by the suction created in the Combustion Controller. Typical size used on this machine has 1" NPT inlet and outlet.

PRESSURE BALANCE TEST (Figure 4)

To function properly, a pressure balance must be maintained across the mixing valve. Proceed as follows to check this balance between the mixer air and gas inlet positions:

1. Remove the two 1/8" NPT pipe plugs (#37) (Figure 9); one on the mixer body air inlet and the other on the mixer body gas inlet. Install a water manometer to these connections with pet cocks.
2. Open gas inlet valve on gas supply and open mixture outlet valve until machine is delivering at least 5% of its capacity. (The mixture should be burned off at some burner position.)
3. Open the pet cocks simultaneously. The water manometer should show a balance in pressure of $\pm 1/8$ " W.C. (31 Pa) max. If it does not, refer to Figure 10.
4. After pressure test is completed, make sure the water manometer is disconnected and the 1/8" NPT pipe openings are closed with plugs.

FIGURE 4: Pressure Balance Test Arrangement



PRESSURE GOVERNOR (Figure 8)

The discharge pressure of Selas positive displacement Combustion Controllers can be adjusted to a nominal 1, 2 or 3 psi (6.9, 13.8 or 20.7 kPa) by changing the number of weights atop the pressure governor. Replace cap to protect weights and pressure governor after adjustments are made.

IDENTIFYING DIFFICULTIES

In case of change in mixture ratio check for:

1. Dirty mixer piston, gas governor valve or air filter element.
2. Leaky diaphragms in mixing valve or gas governor.
3. Dirty or clogged orifice in mixing valve.
4. Dirty or clogged balancing line or equalizing tube in gas governor.
5. Broken or leaking mixing valve sight glass tube.

In case of abnormal discharge pressure check for:

1. Dirty pressure governor piston.
2. Dirty or clogged orifices in pressure governor.
3. Leaky diaphragm in pressure governor.
4. Exceeding rated machine capacity.

In case of loss of machine capacity check for:

1. Leaks in piping or connections.
2. Reduced motor RPM.
3. Worn or sticky pressure governor piston.
4. Worn blades.

MAINTENANCE

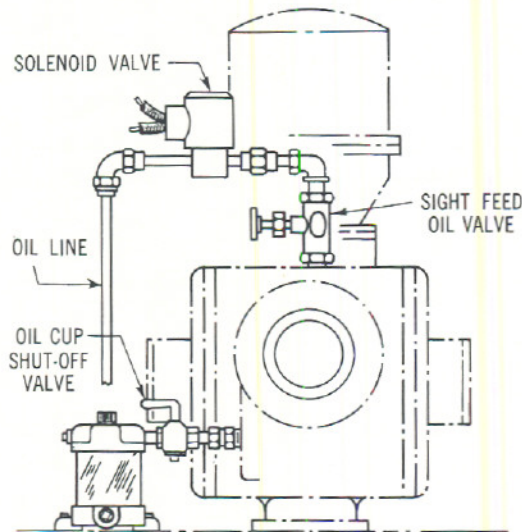
LUBRICATION COMPRESSOR

The compressor oil cup was filled at the factory with 100% Pennsylvania Motor Oil SAE #20. Oil level in cup should be maintained at all times with this oil or equivalent.

To properly lubricate the compressor, the following steps must be taken (Refer to Figure 5).

1. With motor running, open oil cup shut-off valve fully.
2. Open sight feed oil valve at top of compressor, allowing 30 drops of oil to drop into the compressor every 8 hours. The sight feed oil valve must be closed tight after each oiling (too much oil will clog up the burners).
3. If automatic lubricator is used, set sight feed oil valve to drop the equivalent of 30 drops of oil in 5 seconds time, by pressing push button on control for 5 seconds. After proper setting is established, tighten gland on valve to prevent tampering.
4. Oil cup shut-off valve should remain open during normal operation.

FIGURE 5: Lubrication Connections



On continuous 24 hour operation and normal oiling (30 drops through valve every 8 hours), the oil cup No. 32, Figure 8 should be refilled every 2 months or when required.

For method of refilling oil cup, refer to "MAINTENANCE-CLEANING OF MACHINE-COMPRESSOR."

AUTOMATIC LUBRICATOR

The automatic lubricator provides and controls proper lubrication to the compressor of the Combustion Controller. This electrically operated lubricator consists of a timer assembly and a solenoid valve (Fig. 12). For wiring instructions, see applicable wiring diagram Fig. 3c.

INDIVIDUAL CONTROL—Normal Operation

When an automatic lubricator controls the oiling of one compressor, wire to load side of motor starter. Compressor will be oiled on each start and at 8 hour intervals during continuous operation. Timer cam is adjustable for more frequent oiling if necessary.

INDIVIDUAL CONTROL—Frequent Starts

On short-cycle operations or on laboratory installations, because of frequent off-on conditions, it is undesirable to oil the compressor at each start. On such installations, change the micro switch connection (in timer assembly) to the N.C. (normally closed) circuit and connect the timer to the load side of the motor starter. On initial daily start-up, lubricate compressor manually by push-button on cover of control.

COMPRESSOR BEARINGS

The compressor bearings were lubricated and pre-sealed by manufacturer. No lubrication is necessary for life of bearing. (See Fig. 7 for method of installation.)

WARNING: Do not put grease fittings on bearing covers!

MOTOR

Lubricate motor as directed by motor manufacturer.

CLEANING OF MACHINE

AIR FILTER (Figure 11)

The air filter should be cleaned each month. During cleaning, the machine can be operated without the filter. Do not oil the filter screen.

The type "DM" dry filter can be serviced in the field without using special cleaning fluids and equipment. When dirty, the unit may be cleaned by washing in hot or cold water. A mild detergent in the water will assist in cleaning where the collected dirt may contain grease or oil. It is *not recommended* that other cleaning fluids be used. When washing fails to restore the element or if the element is ruptured or otherwise damaged, it should be replaced.

PRESSURE GOVERNOR (Figure 8)

To clean pressure governor, remove cap No. 5 and weights No. 16, 17, and 53. Unbolt pressure governor housing No. 4 and lift off carefully. This will also remove pressure governor piston No. 9. Wipe piston No. 9, spindle No. 11 and pressure governor bore clean with a cloth, using a solvent if necessary. The pressure orifice No. 31 can be cleaned by unscrewing pipe plug No. 49 on pressure governor housing No. 4. Clean orifice No. 31 with wire of approximately $\frac{1}{8}$ " diameter and blow dirt out. Replace all parts, using paper gasket No. 29 between compressor body No. 1 and pressure governor housing No. 4. Make sure that piston No. 9 and spindle assembly No. 11 move freely up and down before replacing weights No. 16, 17 and 53 and protection cap No. 5. Discharge pressure is

varied by adding or removing weights No. 16, 17 and 53 from top of the diaphragm No. 19.

MIXING VALVE (Figure 9)

Mixer piston No. 3 and internal surface of mixer bushing No. 2 should be cleaned each month. To expose the internal parts, unscrew socket hd. machine screws No. 27 and remove cover No. 6. Unscrew and remove upper spindle extension No. 66 and remove piston lock nut No. 13 from mixer spindle No. 14. Remove piston No. 3.

Thoroughly clean all parts, including mixer body No. 1 and guide sleeve No. 4 using a cloth saturated with solvent. Do not overlook orifice opening located in mixer body and remove any obstruction.

Remove loose grit and dirt from the mixer piston No. 3 and mixer bushing No. 2 and carefully inspect surfaces for corrosion and abrasions. Remove with crocus cloth dipped in a solvent.

It is important during this cleaning operation not to mar or deform in any way the sharp metering edges of both piston and bushing ports. This cleaning must be a preventative maintenance function and the frequency is dictated by the severity of your particular application.

Apply a light film of dry slide to outer surface of piston and carefully line up with guide sleeve No. 4, being careful not to cock or force while sliding into bushing.

Under no conditions should either the mixer piston No. 3 or the internal surfaces of mixer bushing No. 2 be oiled or greased, as this will tend to attract abrasive impurities from the gas or air supply. This will eventually cause sticking or excessive wear.

Remove balancing line tubing No. 7 and clean by blowing high pressure air through the tube. (Make sure that both ends of balancing lines are disconnected.)

A drain plug No. 44 is located in the diaphragm cap No. 16 and should be removed to drain excessive condensation from the mixing valve.

Ordinarily it is not necessary to remove the mixer bushing No. 2 for cleaning. However, if it does not rotate easily in mixer body No. 1, disassemble as follows.

Remove two cap screws No. 28 and unscrew ratio adjustment assembly No. 9 from adjustment pivot No. 15. Lift out mixer bushing No. 2 from mixer body No. 1, carefully using a steady vertical lift in order to prevent binding. Clean thoroughly as indicated above.

Before reassembling mixer bushing No. 2 in mixer body No. 1, coat mating surface of each with Unirex-N2 grease. (Remove all grease from port area.) Replace all parts with care.

Do not use force to reassemble parts.

Reinstall piston as instructed above.

After replacing upper spindle extension No. 66 and piston locknut No. 13 pull up on upper spindle extension until upward travel is complete. Then release al-

lowing the mixer piston No. 3 to return to the "down" position.

RESETTNG RANGE-OF-PORT-OPENING SCALE (Figure 9 and Figure 6)

It is now necessary to reset the range-of-port-opening scale No. 48, since the ratio adjustment assembly No. 9 was disengaged from the mixing valve during disassembly.

Rotate knurled adjustment knob No. 50 until gas port scribemarks on the piston No. 3 and bushing No. 2 are matched.

This position must indicate 100% air 0% gas on the range-of-port-opening scale No. 48. Any deviation must be corrected with the following steps.

Remove roll pin No. 60 and retract adjustment knob No. 50 and internal gear mount and gear assembly No. 47, thereby disengaging them from the idler gear No. 65.

Rotate internal gear mount and gear assembly No. 47 so the "O" gas position on the range-of-port-opening scale No. 48 is aligned with the air-gas pointer No. 63.

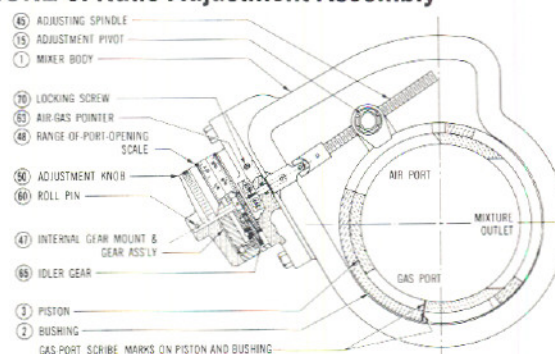
Re-engage internal gear mount and gear assembly No. 47 with idler gear No. 65.

Reassemble adjustment knob No. 50 in proper position. Replace roll pin No. 60 and select air-gas ratio for proper combustion.

NOTE: A locking device has been provided on the ratio adjustment assembly No. 9. After setting ratio, tighten locking screw No. 70 with Allen wrench. Locking screw to be hand tight only (see attached tag).

Complete reassembly of mixing valve.

FIGURE 6: Ratio Adjustment Assembly



CHECK VALVE (Figure 9)

The spring loaded check valve is located in the mixture outlet of the mixing valve. To remove it, disconnect mixing valve. Disassemble check valve by removing round head machine screws No. 26. Clean the valve parts with a cloth saturated in a solvent and reassemble.

COMPRESSOR (Figure 8)

The compressor is cleaned by flushing with a solvent.

Shut down machine (refer to "Operation—Stopping the Machine"). Stop compressor. With oil cup shut-off valve No. 18 closed and oil drain plug No. 51 removed, drain oil. Replace oil drain plug No. 51.

Remove oil fill plug No. 52 (in oil cup assembly No. 32) and fill cup with a solvent. Replace plug No. 52 and run compressor several minutes with oil cup shut-off valve No. 18 and sight feed oil valve No. 3 full open. Drain completely through drain plug opening (in oil cup assembly No. 32) with compressor running.

Close shut-off valve No. 18. Replace drain plug No. 51 and remove fill plug No. 52. Replace oil in oil cup assembly No. 32 and replace fill plug No. 52. Close sight feed oil valve No. 3 and open shut-off valve No. 18. Proceed with normal oiling as described under "Maintenance—Lubrication".

NOTE 1. If automatic lubricator is installed, open the sight feed oil valve No. 3 and use manual button repeatedly.

Once or twice a year, the compressor should be opened and the compressor blades No. 13 carefully inspected. The bearing bracket No. 2 opposite the motor should be taken off by removing the fixed end bearing cover No. 7 and unscrewing the locknut No. 24, clamping the ball bearing No. 23 to the drum and shaft No. 10. Bearing No. 23, oil seal No. 22 (2), and bearing bracket No. 2 can then be removed from drum and shaft No. 10 by using jack screw holes on bearing bracket No. 2.

NOTE 2. The bearing brackets No. 2 extend $\frac{1}{8}$ " into the bore of compressor body No. 1.

To remove the drum and shaft No. 10 disconnect shaft from motor coupling and separate floating end bearing cover No. 8 from bearing bracket No. 2 by unscrewing six socket head screws No. 44. Unscrew

locknut No. 24 holding bearing No. 23 to shaft No. 10. The drum and shaft No. 10 can then be moved from the compressor body No. 1. All internal parts should be thoroughly cleaned, and if the compressor blades No. 13 are badly worn and have rough edges, they should be replaced. (See "Replacing Parts—Rotor Blades".)

NOTE 3. Oil seals No. 22 (Fig. 8) should be assembled two at each end of shaft No. 10, placed in bearing brackets No. 2 with faces as shown in Fig. 7 and 8. Slip "collar" supplied with unit over shaft No. 10 before assembling bearing bracket together with oil seals onto shaft No. 10. After assembly remove collar.

CAUTION

Be sure to align coupling on reassembly.

GAS GOVERNOR (Figure 10)

The gas governor, a balanced zero regulator, has been set and sealed at the factory and should not be disturbed.

If a pressure balance of $\pm\frac{1}{8}$ " W.C. (± 31 Pa) across the mixing valve cannot be obtained, check for the following:

1. Diminishing gas supply pressure.
2. Loose or leaking balancing line.
3. Blocked air inlet.

Replace defective regulator with a new, factory tested unit.

MAINTENANCE CHECK LIST

Based on Normal Use—8 Hours Per Day

	8 Hrs.	1 Mo.	3 Mos.	6 Mos.	1 Yr.
Lubricate Compressor	●				
Check Oil Level	●				
Clean Air Filter		●			
Clean Mixer Piston and Bushing		●			
Check Coupling Alignment			●		
Flush Compressor & Clean Pressure Governor				●	
Clean Entire Machine (Internally)					●
Check Oil Seals					●
Check Blades for Wear etc.					●

The above schedule is prepared as a guide only. Definite maintenance schedule will depend on installation, surrounding conditions and operation.

REPLACING PARTS

DIAPHRAGMS

When installing a new diaphragm, be sure to allow sufficient slack for full movement of parts. Too little or too much will affect the proper control. Coat outer surface or hole area of diaphragm with a good quality

grease before reassembling. When installing a new diaphragm, carefully center the spindle and evenly space the folds before clamping. Do not allow more than one fold at any one point under the clamping surface.

PRESSURE GOVERNOR (Figure 8)

The pressure governor diaphragm No. 19 (Fig. 8) can be replaced by removing cap No. 5, & weights, two spindle nuts No. 39, upper diaphragm plate No. 15 and diaphragm ring No. 12.

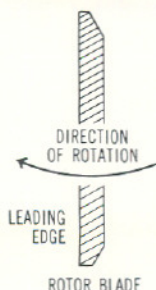
When replacing diaphragm No. 19, be sure to assemble with one vellumoid gasket No. 20 and one vellumoid washer No. 21 on top of diaphragm and one of each on the bottom of diaphragm.

MIXING VALVE (Figure 9)

Disconnect tubing fitting No. 38. Detach mixing valve from compressor and governor. Unscrew hex head machine screws No. 31 and remove diaphragm cap No. 16. Unscrew hex nut No. 33, removing diaphragm assembly No. 19, diaphragm plates No. 17 and diaphragm washers No. 18. Replace diaphragm. Reassemble plates, washers and gaskets. Lift diaphragm cap No. 16 into position and fasten to mixer body No. 1 with machine screws No. 31.

ROTOR BLADES WORN BLADES (Fig.8) Index 13

Blades should be replaced when dimension across width measures $2\frac{3}{4}$ " (55.6 mm) or less. To replace worn blades No. 13 remove fixed end bearing cover No. 7, locknut No. 24 and bracket No. 2. After removing worn blades, thoroughly cover new blades with a thin coat of 100% Pennsylvania SAE 20 motor oil and install them with square cornered leading edges facing in the direction of rotation.



BROKEN BLADES

When blades break, small pieces may lodge in corners and sometimes travel back into the check valve in mixing valve (Fig. 9). (Likely "hiding" places are shown by small arrows in Fig. 8). Because these small pieces sometimes work back into the revolving rotor to break the next set of blades, it is absolutely necessary that all pieces, large and small, be removed from corners and recesses before new blades are installed.

In addition to fully exposing the compressor bore, it is advisable to remove the check valve in mixing valve (Fig. 9) and a short section of the compressor discharge piping for inspection. After removing all pieces of broken blades, install new blades as described.

NEW BLADES

After new blades are installed and reassembly of compressor is completed, operate the Combustion Controller for 20 to 30 minutes with all valves closed. This will cause compressor and blades to heat up and expand. If pounding occurs, stop the compressor and file 0.003" to 0.005" off the length of each blade. Repeat the performance until the compressor runs quietly when heated. (Maximum allowable temperature 212°F. (100°C.)).

MOTOR COUPLINGS REMOVAL

1. Remove screws. Oil thread and point of screws.
2. Insert one screw in hole shown thus ● in diagram. Note that one screw in each hub is left over and is not used in this loosening operation.
3. Tighten screw until bushing is loosened in hub.

INSTALLATION

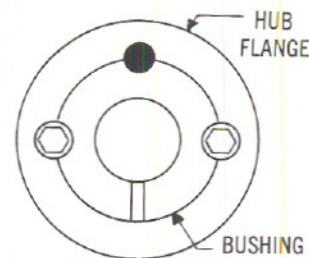
1. Clean shaft, bore and outside of bushing, and bore of hub (taking bushing from hub if already assembled). Remove any oil, lacquer or dirt. Place bushing in hub.

2. Oil thread and point of screws. Place screws loosely in holes shown thus ● in diagram.

3. Make sure bushing is free in hub. Slip assembly onto shaft and locate bushing flush with end of shaft.

4. Tighten screws alternately and evenly until they are pulled up very tightly. Use a wrench torque of 175 lb.-in. (20 n-m).

5. Hammer against large end of bushing using hammer and block or sleeve to avoid damage. Screws can now be turned a little more using the specified wrench torque. Repeat this alternate hammering and screw retightening until the specified wrench torque no longer turns the screws after hammering. Fill other hole with grease to exclude dirt.



BEARINGS

The bearings No. 23 (Fig. 8) in the compressor are hand-press fitted. The inner race must be tightly locked to the shaft No. 10 by locknut No. 24. The fixed end bearing cover No. 7 retains the outer race of bearing No. 23 securely to end bearing bracket No. 2. This permits drum and shaft assembly No. 10 to expand away from fixed end position when subjected to rising temperatures.

The bearing at the opposite or floating end is assembled with sufficient clearance between the outer race and floating end bearing cover No. 8, permitting drum and shaft assembly No. 10 to expand freely.

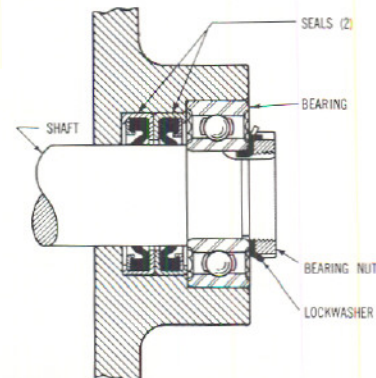
CAUTION
DO NOT USE GREASE FITTINGS. The bearings have been lubricated and pre-sealed by the manufacturer. No additional lubrication is necessary for the life of the bearing.

Bearing life is reduced by abnormal conditions such as:

1. Continuous operation.
2. Reduced output for extended periods, causing excessive temperatures at bearing.
3. High surrounding temperatures.

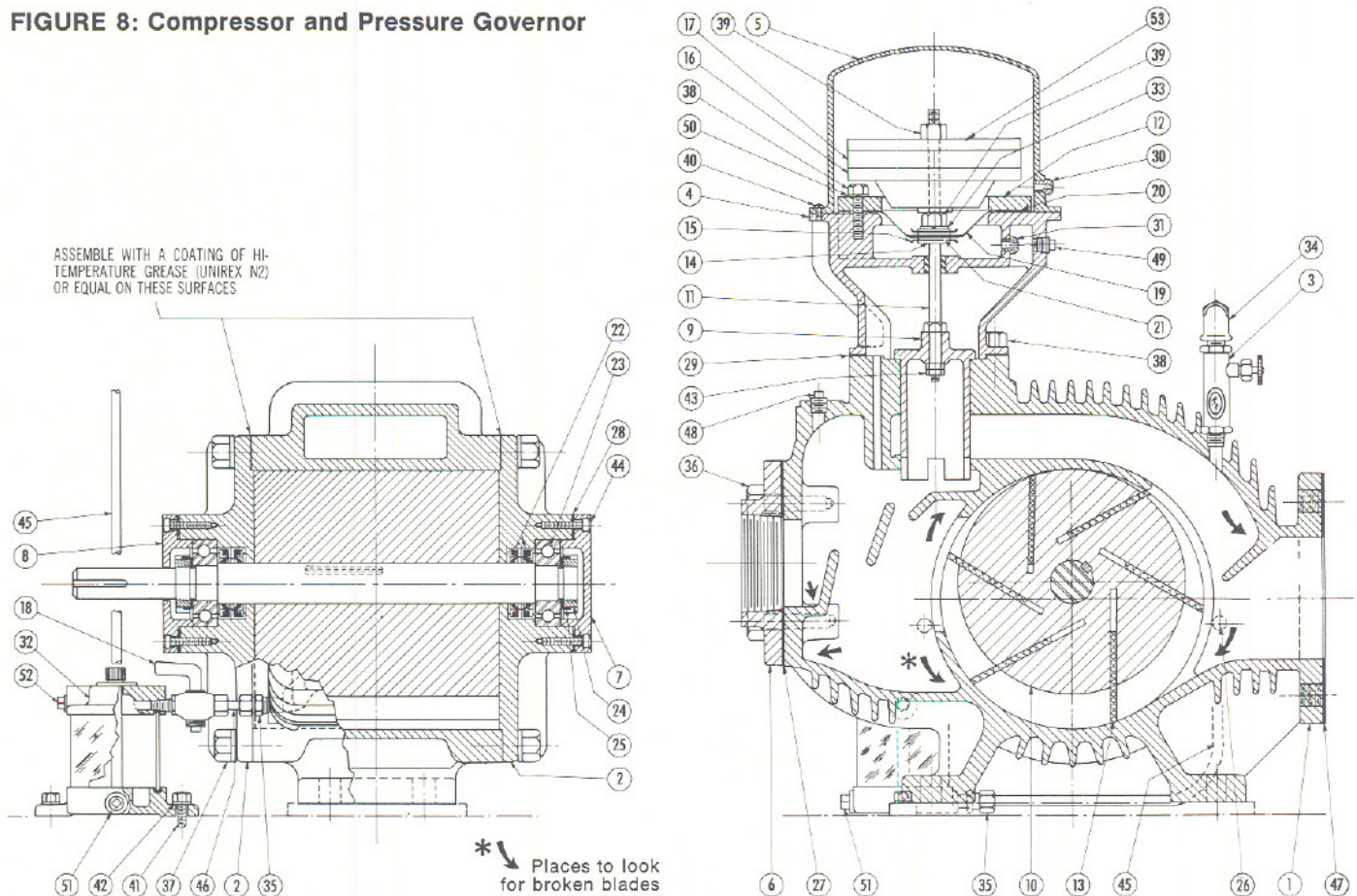
FIGURE 7:

Bearing
Installation
Details



PARTS LIST

FIGURE 8: Compressor and Pressure Governor



INDEX

NO.	QTY.	PART
1	1	COMPRESSOR BODY
2	2	END BEARING BRACKETS
3	1	SIGHT FEED OIL VALVE
4	1	PRESSURE GOVERNOR HOUSING
5	1	PRESSURE GOVERNOR CAP
6	1	OUTLET FLANGE
7	1	FIXED END BEARING COVER
8	1	FLOATING END BEARING COVER
* 9	1	PRESSURE GOVERNOR PISTON
10	1	DRUM & SHAFT ASSEMBLY
11	1	SPINDLE
12	1	DIAPHRAGM RING
±13	6	COMPRESSOR BLADES
14	2	WASHER
15	2	DIAPHRAGM PLATE
16	1	WEIGHT
17	1	WEIGHT
18	1	OIL CUP SHUT-OFF VALVE
±19	1	DIAPHRAGM
±20	2	DIAPHRAGM GASKET
±21	2	DIAPHRAGM WASHER
±22	4	OIL SEALS
±23	2	BALL BEARING
24	2	LOCKNUT
25	2	LOCKWASHER
26	4	DOWEL PINS

* PISTON TO BE SUPPLIED OVERSIZE AND LAP FITTED

± INDICATES RECOMMENDED SPARE PARTS

INDEX

NO.	QTY.	PART
27	1	OUTLET FLANGE GASKET
28	2	BEARING COVER GASKET
29	1	PRESSURE GOVERNOR GASKET
30	1	COVER ORIFICE
31	1	BODY ORIFICE
32	1	OIL CUP ASSEMBLY
33	1	3/8" STD. LOCKWASHER
34	1	TUBING FITTING
35	2	TUBING CHECK VALVE FITTING
36	4	1/2"-13 x 1 1/4" LG. HEX HD. CAPSCREW
37	12	1/2"-13 x 1 1/4" LG. HEX HD. CAPSCREW
38	10	3/4"-18 x 3/4" LG. HEX HD. CAPSCREW
39	2	3/8"-18 HEX NUT
40	4	#10-24 x 3/8" LG. FILL. HD. MACHINE SCREW
41	2	1/4"-20 x 3/4" LG. HEX HD. CAPSCREW
42	2	1/4" SIZE LOCKWASHER
43	2	1/4"-20 STD. JAM NUT
44	12	1/4"-20 x 3/4" LG. SOCKET HD. CAPSCREW
45	1	1/4" O.D. COPPER TUBING
46	1	1/4" O.C. COPPER TUBING
47	1	OUTLET GASKET
48	1	1/8" STD. PIPE PLUG
49	1	3/8" STD. PIPE PLUG
50	6	3/4" STD. LOCKWASHER
51	1	OIL DRAIN PLUG
52	1	OIL FILL PLUG
53	1	WEIGHT

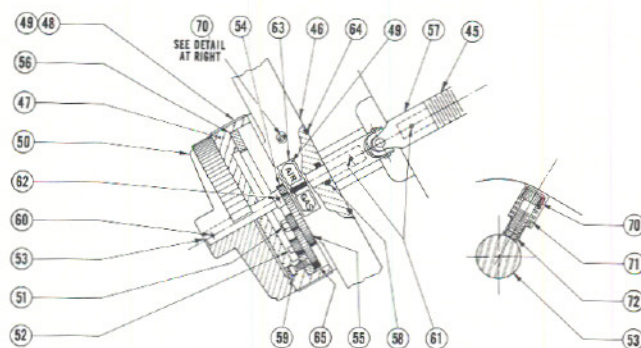
FIGURE 9: Mixing Valve

INDEX NO.	NO.	REQ'D	PART
1	1		MIXER BODY
2	1		BUSHING
3	1		PISTON
4	1		GUIDE SLEEVE
5	1		GUIDE SLEEVE SCREW
6	1		COVER
7	1		BALANCING LINE TUBING
8	1		CHECK VALVE ASSEMBLY CONSISTING OF NOS. 39 TO 42
9	1		RATIO ADJUSTMENT ASSEMBLY CONSISTING OF NOS. 45 TO 65 AND 70 TO 72
10	1		SIGHT GLASS HOUSING
†11	1		"O" RING
†12	1		SIGHT GLASS TUBE
13	1		PISTON LOCK NUT
14	1		MIXER SPINDLE
15	1		ADJUSTMENT PIVOT
16	1		DIAPHRAGM CAP
17	2		DIAPHRAGM PLATES
18	2		DIAPHRAGM WASHER
†19	1		DIAPHRAGM ASSEMBLY
20	2		DRIVE SCREWS
21	1		GAS INLET FLANGE
22	1		AIR INLET FLANGE
23	1		GAS INLET GASKET
24	1		AIR INLET GASKET
25	4		HEX. HEAD CAP SCREW
26	3		ROUND HEAD MACHINE SCREW
27	—		SOCKET HEAD MACHINE SCREW
28	2		1/4"-20 x 1/2" LG. HEX. HD. CAP SCREW
29	4		PLAIN WASHER
30	1		3/8" BURR WASHER
31	12		3/4"-16 x 1" LG. HEX HD. CAP SCREW
32	1		RETAINING RING
33	1		3/4"-16 HEX NUT
34	1		1/4" x 1 1/2" LONG NIPPLE
35	1		RETAINING RING
36	1		1/4" N.P.T. STRAIGHT TEE
37	2		1/8" N.P.T. PIPE PLUG
38	3		TUBING FITTING
39	1		CHECK VALVE BODY
40	1		CHECK VALVE DISC AND STEM ASS'LY
41	1		CHECK VALVE SPRING
42	1		CHECK VALVE LOCK RING
43	1		NAMEPLATE
44	1		PIPE PLUG
45	1		ADJUSTING SPINDLE
46	1		MOUNTING FLANGE
47	1		INTERNAL GEAR MOUNT
48	1		RANGE OF PORT OPENING SCALE
49	4		DRIVE SCREW
50	1		ADJUSTMENT KNOB
51	1		GEAR MOUNTING SHAFT
52	1		GEAR MOUNTING SHAFT
53	1		ADJUSTMENT SHAFT
54	1		DRIVE GEAR
55	1		IDLER GEAR
56	1		INTERNAL GEAR
57	1		UNIVERSAL JOINT
58	2		"O" RING
59	3		FILLISTER HEAD MACHINE SCREW
60	1		ROLL PIN
61	2		ROLL PIN
62	1		ROLL PIN
63	1		AIR-GAS POINTER
64	1		"O" RING
65	1		IDLER GEAR
66	1		UPPER SPINDLE EXTENSION
67	1		FELT PAD
68	4		HEX HEAD CAP SCREW
69	4		WASHER
70	1		LOCKING SCREW
71	1		LOCKING SPRING
72	1		LOCKING PLUG

† INDICATES RECOMMENDED SPARE PARTS

RATIO ADJUSTMENT SUB ASSEMBLY

Index #9 of Figure 9



RANGE-OF-PORT-OPENING SCALE Index #48

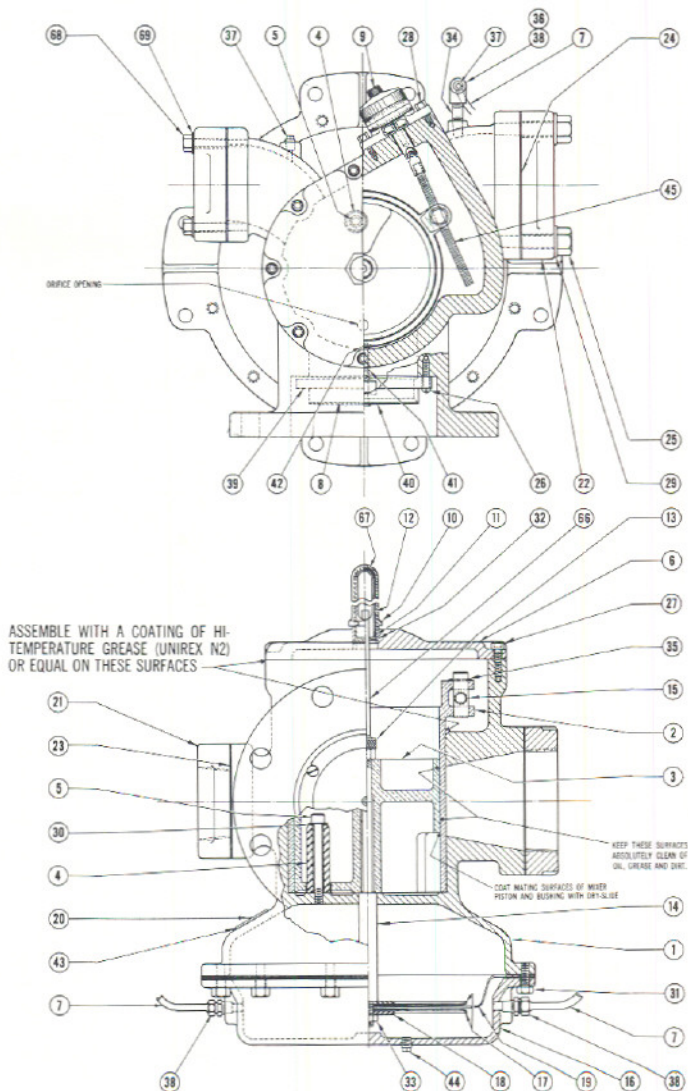
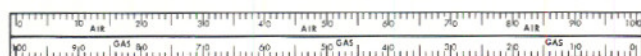
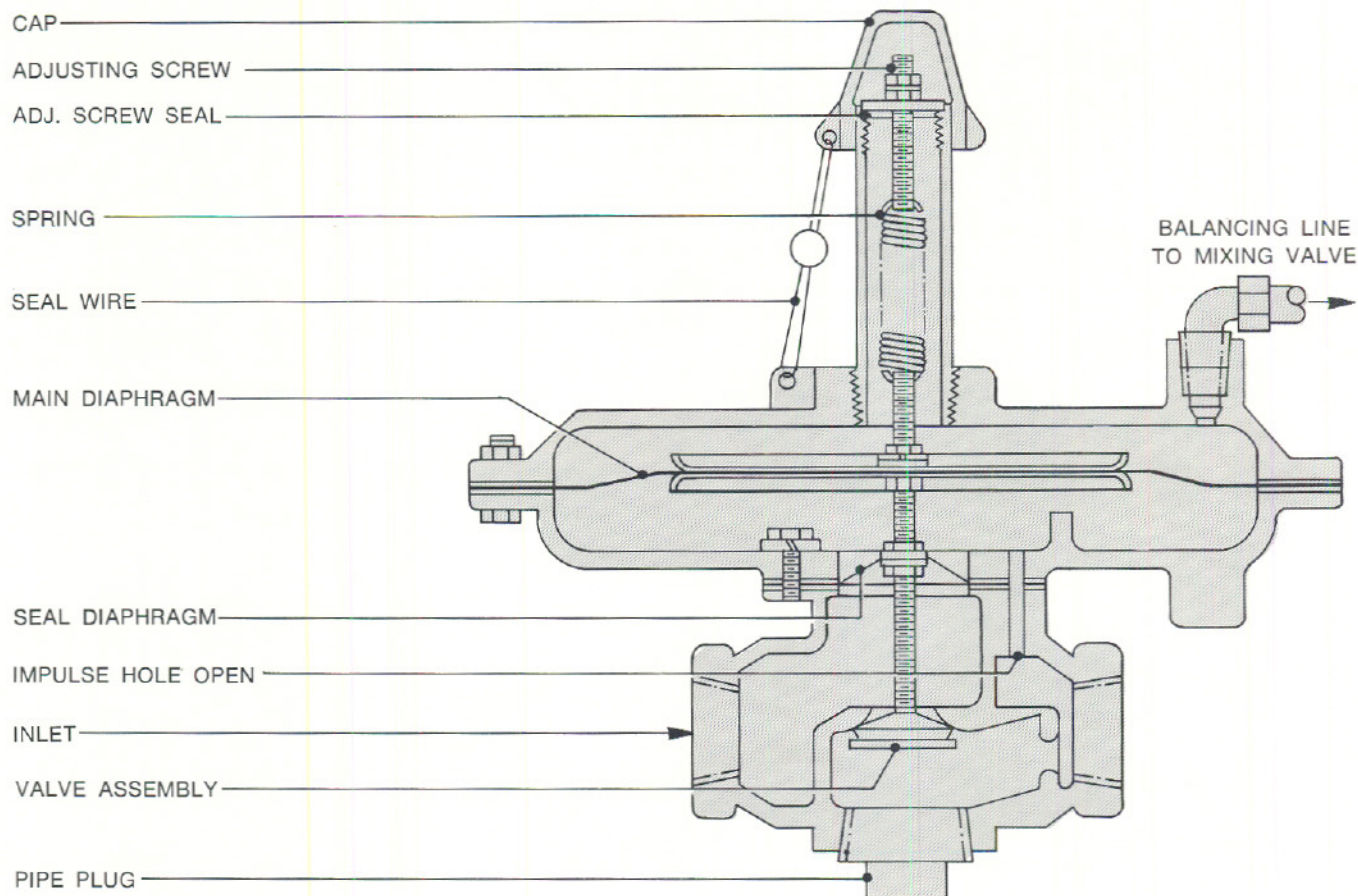


FIGURE 10: Gas Governor Type BZR



OPERATION

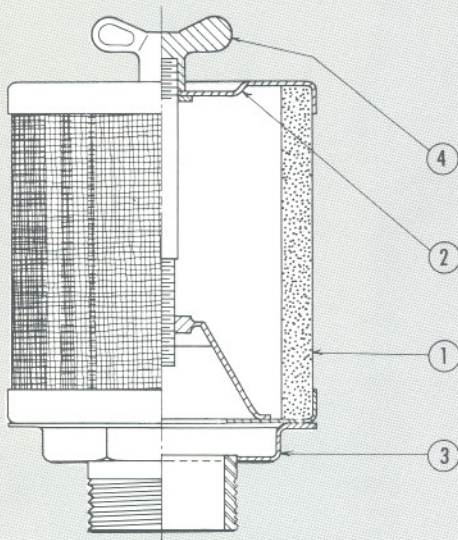
The Balanced Zero Regulator reduces incoming gas pressure to zero or atmospheric. Flow occurs as demanded by the suction created in the Combustion Controller.

A sensitive spring maintains the valve normally closed by precisely balancing the weight of all internal parts. The sealing diaphragm is set so that its area equals the effective area of the valve disc. Fluctuations in the inlet pressure are thus counterbalanced by these two equal areas.

The lower diaphragm chamber reacts to changing load conditions by means of an impulse hole. The upper diaphragm is connected to the air inlet side of the mixing valve in order to compensate for varying inlet conditions, i.e., filter, piping, and flow changes. With equal pressures in two chambers the valve remains closed. When the mixer begins to operate the resulting suction decreases the pressure in the lower diaphragm chamber. The pressure differential across the main diaphragm moves the valve down allowing gas flow. The gas flow increases until the outlet pressure equals the pressure in the upper diaphragm chamber.

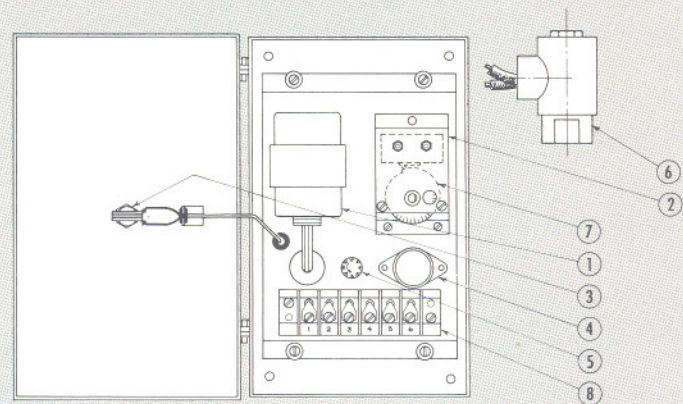
selas®
The Heat Technology Company

FIGURE 11: Air Filter



INDEX NO.	PART
1	ELEMENT
2	COVER
3	ADAPTER
4	WING NUT

FIGURE 12: Automatic Lubricator and Solenoid Valve



INDEX NO.	PART
1	TRANSFORMER
2	CYCLE TIMER
3	PUSHBUTTON
4	TIME DELAY RELAY
5	LITTLE FUSE
6	SOLENOID VALVE
7	ADJUSTABLE CAM ASSEMBLY (8 HOUR, 4 HOUR & 2 HOUR OILING CYCLE)
8	TERMINAL STRIP

ORDERING INSTRUCTIONS

When ordering parts, the following information must be supplied in order to accurately identify the items requested.

Information found on COMBUSTION CONTROLLER NAMEPLATE:

1. Catalog number
2. Reference number
3. SERIAL NUMBER

Information found in COMBUSTION CONTROLLER INSTRUCTION BULLETIN:

4. Instruction bulletin number
5. Figure number and title
6. Part name and index number
7. Quantity