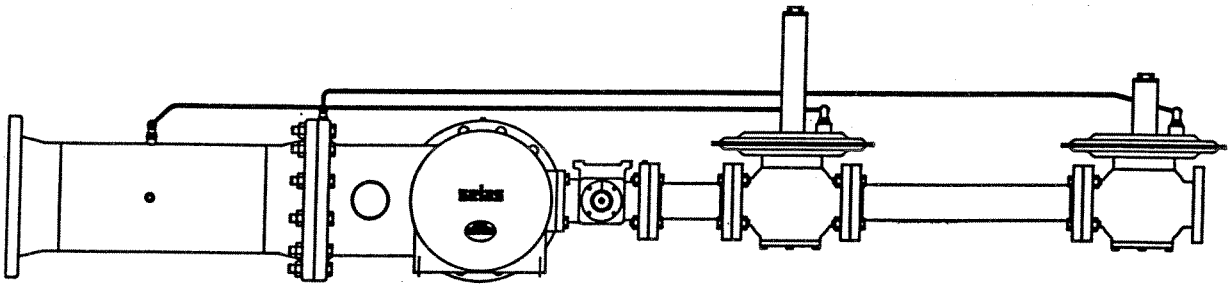
Instructions for:

INSTALLATION • OPERATION • MAINTENANCE

SELAS PosiMix® Series E and F
Mixing Valve Assembly
Push-Thru Arrangement

FOR CAPACITIES:
60,000 to 140,000 CFH
(1700 TO 4000 m^3/hr)



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INTRODUCTION

The Selas PosiMix® System is designed to suppl industrial combustion processes with a precise mixture of fuel gas and atmospheric air. The valve compensates for process flow demands t maintain an accurate combustible mixture over wide range of turn-down.

All components are designed and selected to provide years of trouble free service with a mini mum of maintenance and downtime. The unit can be equipped with various automatic control options to provide additional degrees of precisio in the air/fuel ratio.

CAUTION:

- The Selas PosiMix® System is designed for use with flammable and potentially explosive combustible gas mixtures and should be applied only to its intended function. Proper installation, operation, and maintenance are necessary to promote safety. Read carefully and adhere to manufacturer's instructions before installing and using. Abide by all applicable codes, government regulations, and insurance requirements.

- Because uncontrolled combustible mixtures are hazardous, it is extremely important that:
  - Combustion equipment be placed in a well ventilated area.
  - The care of equipment be assigned to responsible personnel.
  - Routine maintenance checks be established and followed.

- The instructions in this manual apply to Selas Corporation of America Series E and F mixing valve assemblies as supplied for "push-thru" combustion systems.

- Read and save these instructions and any other instructions supplied for sub-components.

- Record all nameplate data and file the information for future reference should the nameplates become illegible.

Figure 1 General Arrangement
(Configuration May Vary Based Upon System Specifications)

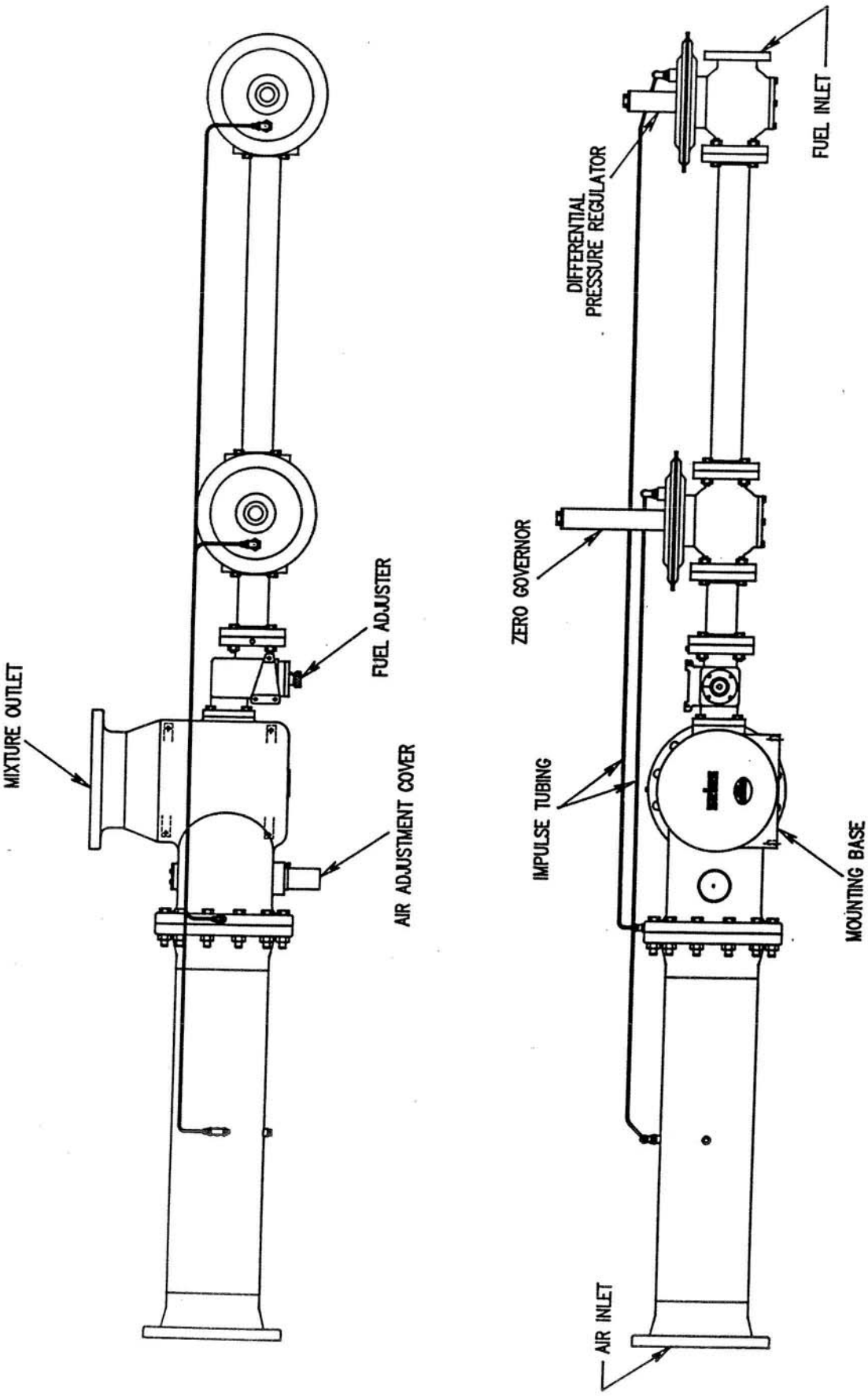


Figure 2   Operation Specifications

ASSEMBLY PART NUMBER ______ VALVE SERIES ______ SERIAL NUMBER ______

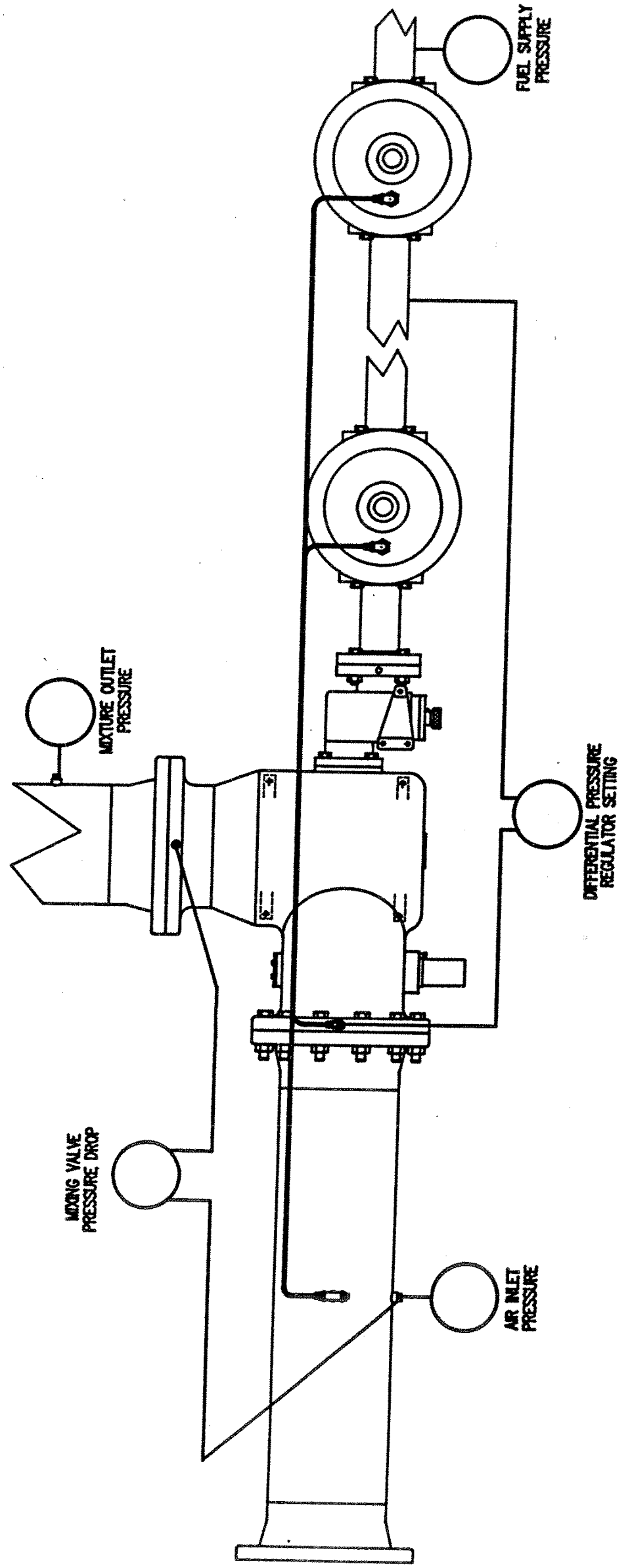
TURNDOWN ______ MIXTURE FLOW RATE ______ MIXTURE OUTLET PRESSURE ______

FUEL ______ FUEL SUPPLY PRESSURE ______ PRODUCTS OF COMBUSTION ______

MIXING VALVE PRESSURE DROP ______ DIFFERENTIAL PRESSURE REGULATOR SETTING ______

AIR SUPPLY PRESSURE ______ (MIXTURE OUTLET PRESSURE PLUS VALVE PRESSURE DROP)

NOTES:



INSTALLATION

REFER TO THESE DRAWINGS TO ASSIST INSTALLATION:

General Arrangement Page 3
Piping Diagram Figure 3 on Page 5

LOCATION

The Selas Mixing Valve Assembly (and other combustion system components) should be placed i a well-ventilated area. Do not install in a pit or depression where any gas leaks might accumulate. Protect against condensate freezing if equipment will be exposed to a cold climate.

HANDLING

Avoid rough handling while unloading and moving th equipment. Do not remove skids until the unit is read for installation. Do not use slings around mixing valv gas inlet piping. Avoid damage to impulse tubing on zero governor.

Remove all packing material. Do not remove thread protectors or flange covers until ready to install connecting piping. Do not discard instruction tags unti installation is complete.

PLACEMENT

Support the mixing valve on the base as shown in th general arrangement drawing and Figure 1. Shims may be required to correctly align the inlet and outlet piping.

PIPING

Connecting piping must be aligned and supported independently; a flexible connection between the air supply and the valve inlet is recommended to preven strain, simplify assembly, and reduce transfer of vibra tion to the valve assembly.

Refer to Figure 3, Piping Diagram for more specific piping installation details.

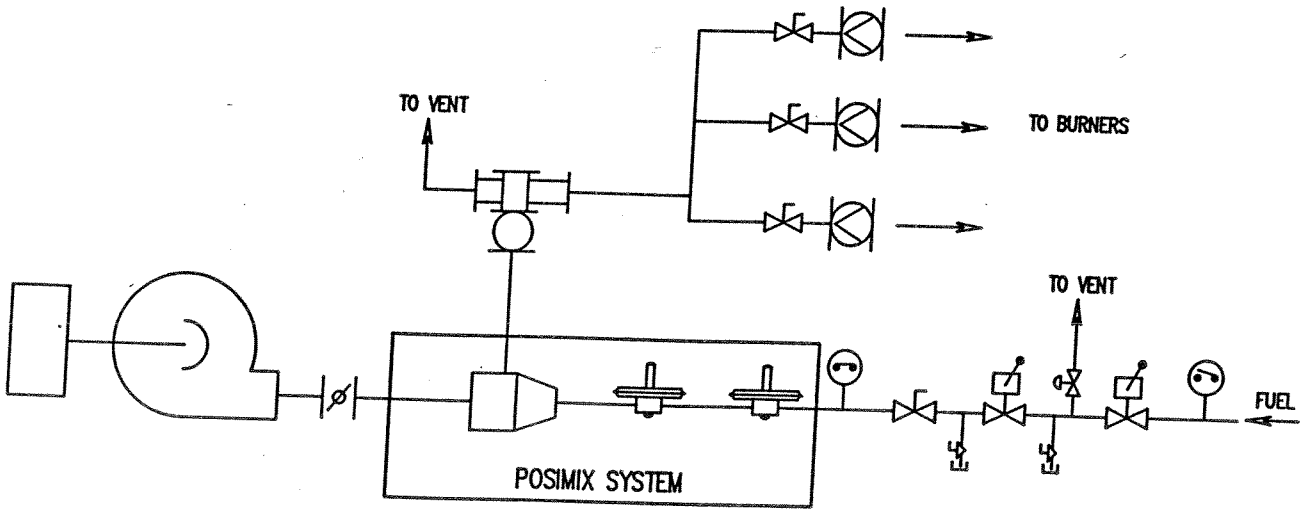


Figure 3 Piping Diagram

TYPICAL SCHEMATICS PIPING DIAGRAM (Figure 3)

The piping diagram shows a typical interrelation among firechecks, blowouts, and major system components. Specific applications may require variations of the basic system. Consult with Selas engineers for the optimum configuration to meet your requirements.

OSHA, underwriter requirements, local regulations, or plant policies may dictate deviations from typical installations.

PIPING

A. The piping between the mixing valve and blowout is generally the same size as the mixing valve outlet.

B. The piping from the blowout must not exceed the size of the blowout discharge connection. Long or complex piping systems may require special sizing.

C. The piping from the main header to the automatic firechecks should be sized with reference to allowable pipeline losses.

A flow velocity of 50 ft/s (15m/sec) is a generally accepted design criteria for most applications.

D. Insurance company regulations specify that the size of the piping from automatic firechecks to burners must not exceed the firecheck outlet size. Maintain or reduce this size according to allowable pressure losses.

E. Always install a manual shut-off valve ahead of each firecheck.

FIRECHECK

Install firechecks in mixture supply line as close to the burners as practical.

A. Type AF-A (without switch) should be used when backfire at one firecheck must not interrupt operation of remaining burners and no signal or alarm is necessary.

B. Type AFS-A (with switch) must be used if alarm or signal is necessary, and/or if all burners of entire system must be shut down in the event of backfire at any section. Switch must be wired to close manual reset valve, allowing air to purge supply piping before compressor shut-down.

BLOWOUT

Install a type SBC blowout for the protection of the system in the event of an explosive backfire. It should be located as close as practical to the compressor and wired to shut off both the compressor and the manual reset valve.

MANUAL RESET VALVE

The manual reset valve shuts off the fuel supply when the electric circuit holding it open is interrupted. The circuit includes pressure switches, blowout, and firechecks.

PRESSURE SWITCHES

High and low pressure switches monitor the incoming gas supply and in some cases, compressor output. Should the gas pressure become too high or low, or the compressor fail, the circuit holding the manual reset valve open is broken and the gas supply is shut off.

FULL PORT SHUT-OFF

Full port shut off valves are required to avoid unnecessary pressure losses and to eliminate flashback hang-ups at the valve instead of at the firechecks.

VENT VALVE

A normally open solenoid valve which remains closed during normal operation, but opens to vent when the manual reset valve is closed.

LEAK TEST ASSEMBLY

The leak test assembly provides a means for periodic testing through manual reset and other shut-off valves.

GAS COCK

Gas cocks function as positive gas shut-off valves when full port valves are not required.

OPERATION

START-UP CONSIDERATIONS

The following procedures are separate from routine start-up, but must be taken into consideration the first time the system is run, after system rework/repair or even after prolonged idle periods.

1. Prove flame safety circuits as applicable.
2. Establish high-fire limits and set controls to not exceed the maximum.
3. Establish a low-fire limit to assure a minimum flow to provide a stable flame at the burner(s) and to operate above the flashback point.

STARTING THE MACHINE

The following instructions are specific only to the Selas PosiMix® valve assembly. More complex systems involving pilot burners, purge timers, supervisory gas cocks, and other interlocking apparatus will require specialized instructions relative to their operation.

1. Verify the following:
   a. Fuel gas supply to machine is closed.
   b. Air supply valve is set to low fire.
   c. All burner valves are closed.
   d. Ratio adjustment setting is adequate for light-off.
2. Prepare ignition means (torch, spark igniter, or pilot burners).
3. Start air compressor.
4. Open gas valve.
5. Light burners as required.
7. If necessary, readjust air/gas ratio to provide optimum combustion for the particular process. Tighten lock screw on ratio adjuster after ratio is set.

RUNNING THE MACHINE

Once started, the combustion system should not require any special attention other than operator awareness of process or system variations. Deviations in fuel gas quality can be accommodated by manually re-adjusting the air/gas ratio dial. Refer to operating instructions for optional automatic ratio control if present. Adjustments should be made in small increments, usually 2-3 degrees at a time with a wait of about 30 seconds for the effect to be seen at either the burners or a combustion analyzer. Any adjustments should be made when the machine is operating above 15% of its rated capacity.

Consult the maintenance section for more detailed procedures relative to adjustment and operation.

Refer to operating instructions on supplemental equipment and instrumentation as provided.

STOPPING THE MACHINE

1. Close the fuel gas supply to the machine inlet.
2. Allow the compressor to run long enough to purge any flammable mixture from the system piping.
3. Turn off the compressor motor.

THE SELAS PosiMix® SYSTEM

The Selas PosiMix® valve incorporates two valves, an air valve set to match the rating of the combustion controller, and an adjustable gas valve. By utilizing an extremely accurate pressure regulation arrangement, the PosiMix® system is capable of maintaining a mixture ratio within ±2% at turndowns exceeding 7:1. For natural gas, this corresponds to ±0.4% excess O_2 in the combustion products or ±0.8% excess combustibles.

The PosiMix® valve offers additional flexibility by providing a means of maximizing the range of turndown based upon system demand. The valve is set at the factory for the specified flow rating. Because combustion systems normally demand less than the rated capacity of the controller, an amount of turndown is lost because the excess capacity is never utilized. By first establishing the flow requirement of the system, then readjusting the valve for a rating at this capacity, the turndown capability can be maximized. The valve rating can be increased or decreased at any time if the system flow requirements are modified.

Figure 2 shows the operational parameters of the assembly as shipped from the factory. Because of the range of fuels, pressures, turndowns, and flow rates that the system is capable of, a serial number is assigned to each unit and the operating parameters are recorded and maintained at the factory.

ADJUSTING THE VALVE RATING

CAUTION: The mixture ratio is preset at the factory per the system specifications. The setting(s) should be adjusted by qualified personnel aware of the fact that excessive changes can cause the burner(s) to extinguish. Any adjustments should be made in small increments while the flame is under observation. Preferably, a combustion analyzer should be used to verify the final air/gas ratio.

The PosiMix® valve is designed to work with a preset pressure drop across it at rated capacity to provide for the specified maximum turn-down capability. If the flow rate demand of the combustion system is less than the factory rating of the controller, the valve operates with a reduced pressure drop and some turn-down capacity is lost. If the additional turndown capability is not required, no adjustment is required, but if maximum turndown capability is required at a rating less than the factory rating, the valve should be adjusted.

Note: Flow capacity of the combustion controller can be increased beyond the factory rated capacity by reducing the pressure drop at the mixing valve and/or reducing the output pressure. This will not damage the valve, but the factory should be consulted to insure the gas regulators and compressor motor are not undersized.

1. During a non-operating period or with the fuel supply turned off, install petcocks at test points per Figure 4 and connect a differential pressure gauge across the two test points.

2. During the next operating period, open petcocks slowly and observe the pressure drop while the combustion system flow is at its maximum. If the pressure drop is less than specified, the valve can be readjusted to provide optimum turn-down.

3. Remove the air valve cover (See Figure 4) to expose the air valve adjustment . Loosen the lock nut to allow rotation of the air valve.

4. Open or close the valve in small increments (2"w.c. maximum) to obtain the required pressure drop. After each incremental opening (or closing) of the air valve, open (or close) the gas valve accordingly to maintain a sufficient air/gas ratio to prevent the flame at the burner(s) from extinguishing. If the ratio is under automatic control, allow sufficient time after each incremental turn of the air knob to allow the controller to read-just the gas valve.

5. After adjusting the air valve, tighten the jam nut to 50-80 ft-lbs and replace the air valve cover and o-ring. Adjust the gas ratio for the combustion process requirement and lock the knob with the lockscrew.

6. The gas valve dial should read between 90° and 310° after adjustment. If the reading is out of range, adjust the spacers in the gas valve, increasing spacer height if below the 90° mark, and decreasing spacer height if above the 310° mark.
   a. Remove the gas valve and o-ring from the PosiMix® body by removing (4) cap screws.
   b. Clamp the adjustment knob in a soft jaw vise and remove the retainer nut, lock washer, spacer(s), key, and adjuster.
   c. Shift the spacers to obtain the correct position of the adjuster. Spacers are sized to provide ¼" increments from 0-1½".
   d. Reassemble the valve and adjust the air/fuel ratio.
   e. The chart in Figure 5 shows the spacer thickness required for different flow rates and fuels at a 28" pressure drop.
   For other fuels or pressure drops, use the natural gas scale and multiply the required fuel flow rate by the following factor:

$$F = \sqrt{\frac{SG}{0.6}} \times \sqrt{\frac{28}{\Delta P}}$$

Where:
SG is the fuel specific gravity
ΔP is the pressure drop

Close petcocks or replace plugs at the end of test.
Never operate the Selas PosiMix® valve with a test connection open to the atmosphere.

Figure 4 Rating Adjustment Arrangement

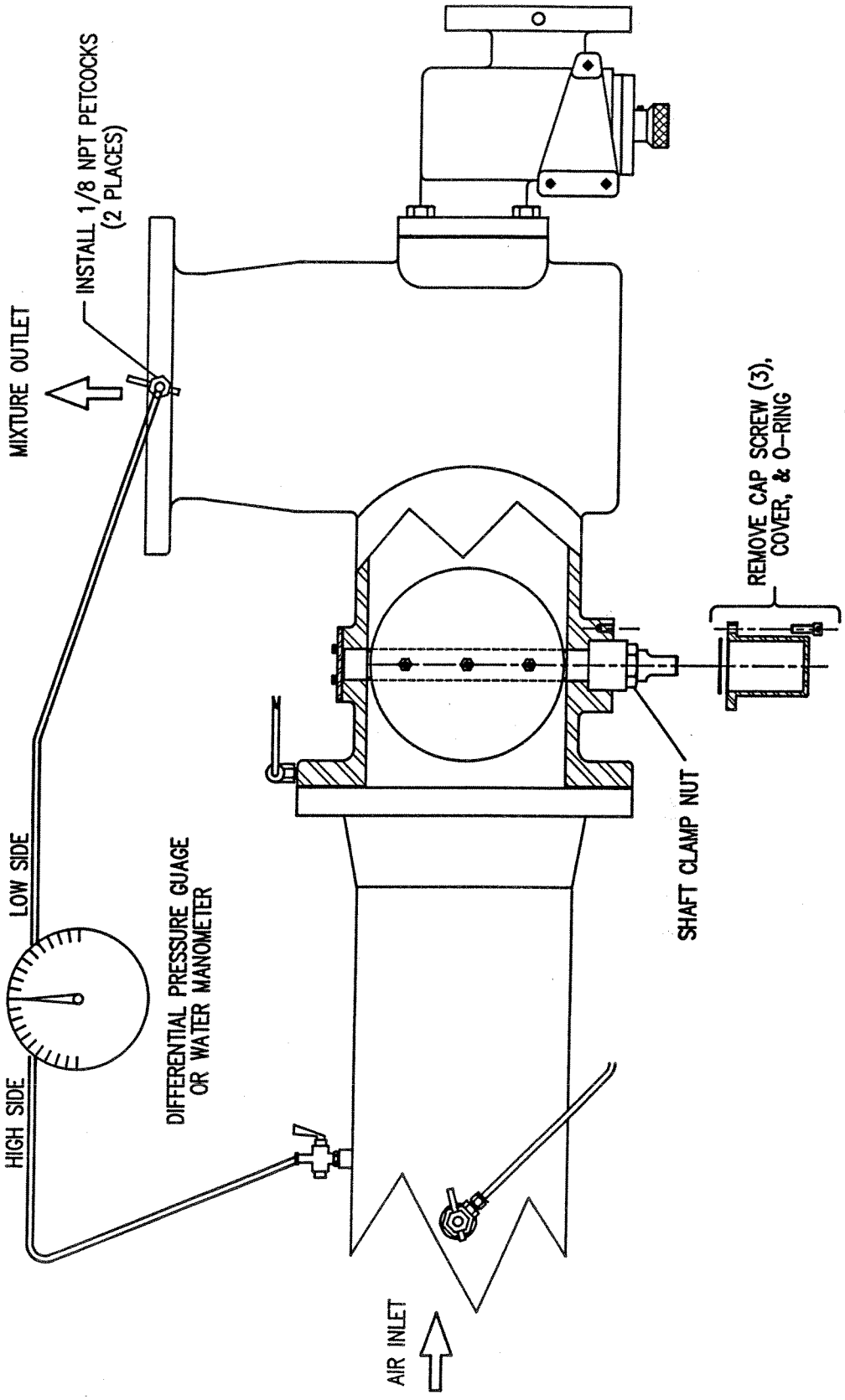
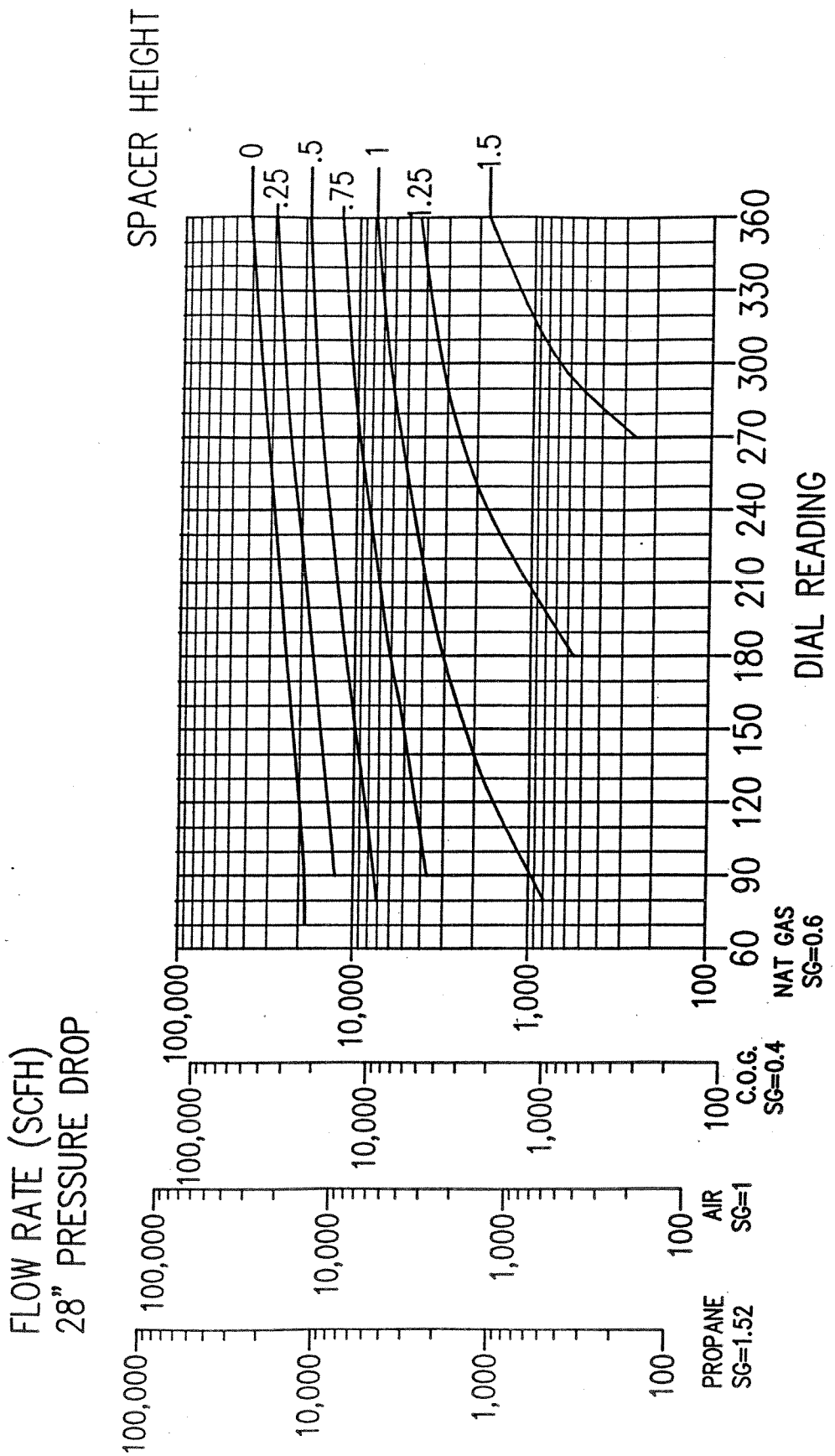


Figure 5 Gas Valve Spacer Selection Chart



PRESSURE BALANCE TEST

Proper performance of the zero gas governor is critical to maintaining a precise air/gas ratio. Figure 6 shows the test arrangement and equipment required to verify the zero governor performance.

The zero governor, located in the fuel supply line closest to the Selas PosiMix® valve, is a precision flow regulator which matches the fuel pressure to the air pressure at the valve inlet.

The differential pressure regulator, located just upstream of the zero governor, provides a constant pressure drop at the zero governor independent of fuel supply pressure and turndown, providing maximum pressure balance accuracy through the full range of system flow demand.

Figure 1 shows the standard mechanical gas governors shipped with the PosiMix® system. Other configurations are available and may be provided as optional equipment with separate documentation.

1. The impulse tubes between the air inlet and the upper diaphragm of the regulators should be examined for leaks with a soap solution.
2. During a non-operating period, replace pipe plugs at test points with petcocks and connect a water a differential pressure gauge across the two test points.
3. During the next operating period, open petcocks slowly and observe the pressure balance while the combustion controller output is varied. The balance should be maintained within 0.5" w.c. at high fire and within 0.08" at low fire. Minor deviation will be tolerable, but large deviations require adjustment replacement of the malfunctioning regulator.

CAUTION:
Close petcocks or replace plugs at the end of test.
Never operate the Selas PosiMix® valve with a test connection open to the atmosphere.

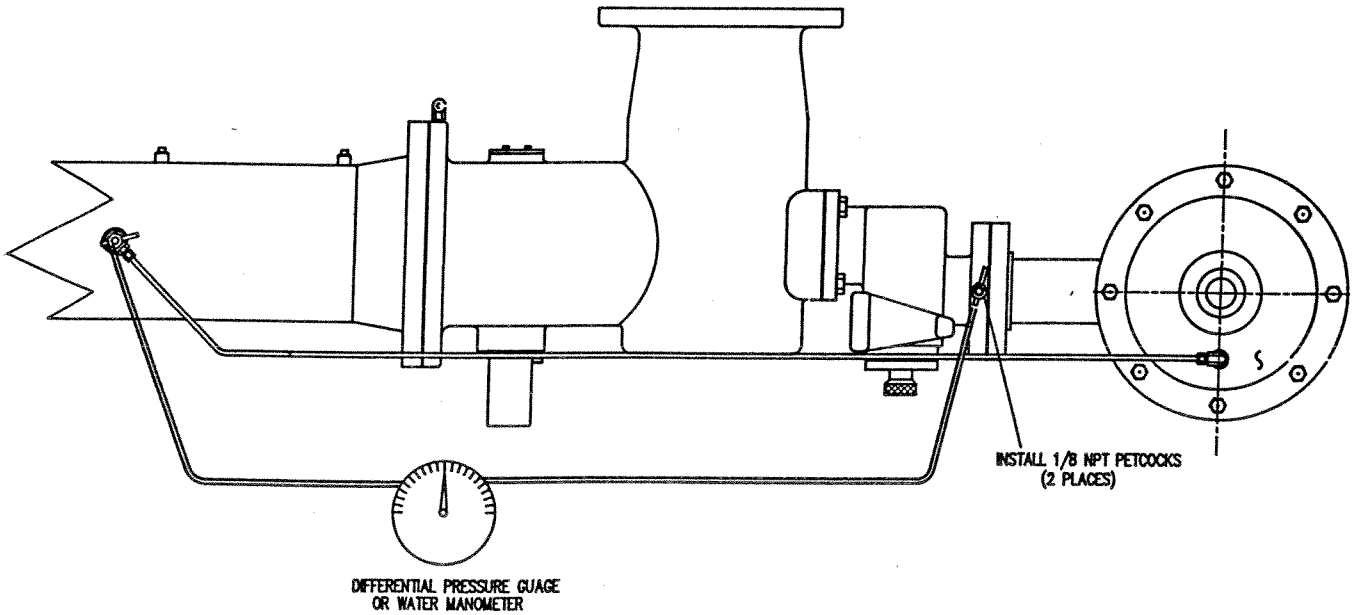


Figure 6 Pressure Balance Test

F VALVE PARTS LIST

1	MIXING TEE HOUSING	13	VALVE PLATE	26	LOCK WASHER (4)
2	GAS VALVE BODY	14	GASKET	27	O-RING
3	HAND KNOB (MANUAL RATIO CONTROL)	15	GAS ADJUSTMENT SHAFT	28	1/4 NPT PLUG
4	COVER PLATE	16	O-RING	29	LOCK WASHER
5	GAS VALVE MOUNT PLATE	17	O-RING	30	FLAT WASHER
6	AIR ADJUSTMENT COVER	18	LOCKING COLLAR	31	HEX NUT
7	DIFFUSER	19	CAP SCREW (4)	32	CAP SCREW (3)
8	SPACER KIT	20	CAP SCREW (4)	33	DIAL COLLAR (AUTO RATIO CONTROL)
9	BEARING SLEEVE	21	DIAL	34	LOCK SCREW
10	AIR ADJUSTMENT SHAFT	22	1/8 NPT PLUG	35	HEX CAP SCREW (4)
11	GAS ADJUSTER	23	CAP SCREW (4)	36	GASKET
12	SQUARE KEY (2)	24	FLAT HEAD SCREW (3)		
		25	SET SCREW		

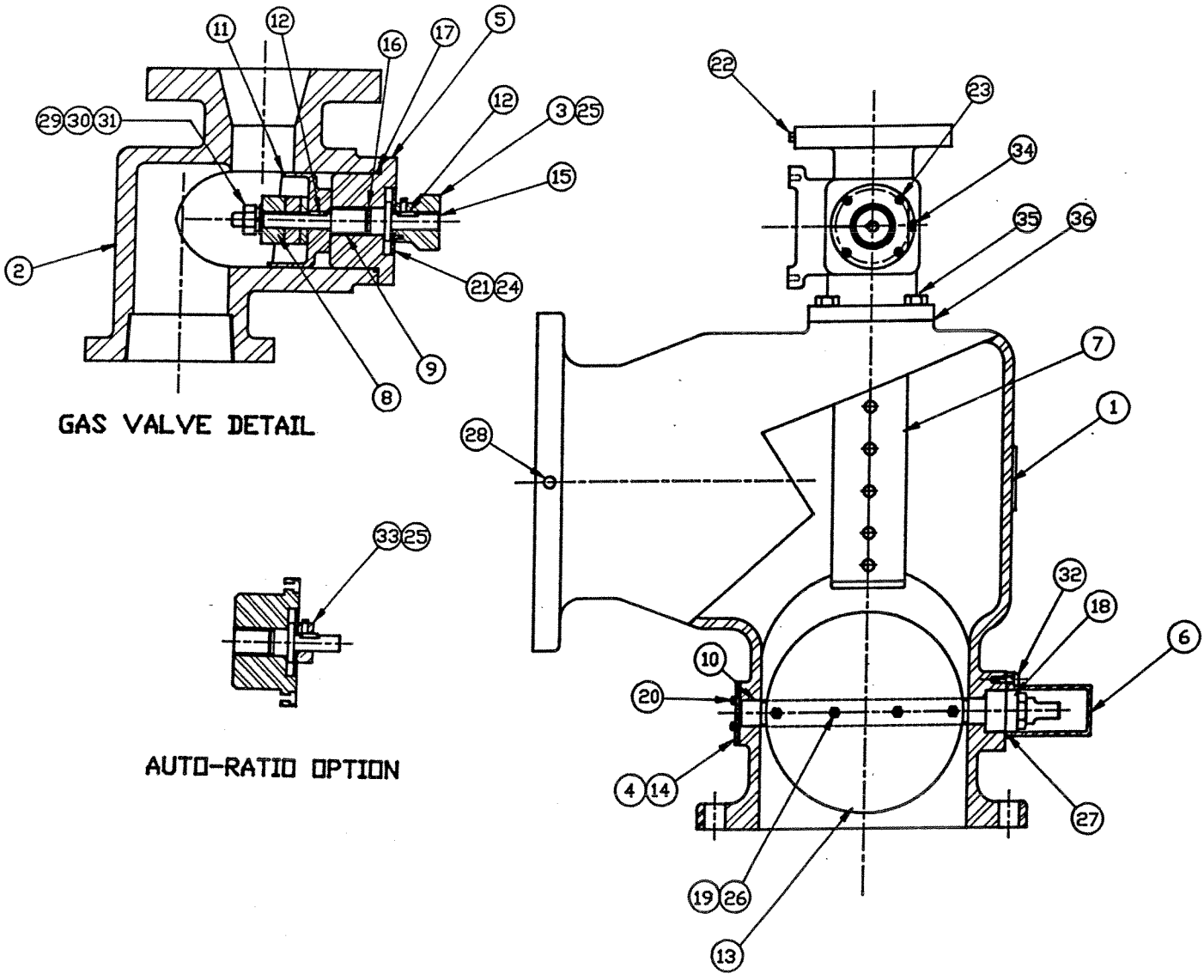


Figure 7 - F Valve Assembly Detail

E VALVE PARTS LIST

1	MIXING TEE HOUSING	13	AIR ADJUSTMENT COVER	26	CAP SCREW (3)
2	GAS VALVE MOUNT PLATE	14	GASKET	27	LOCK WASHER (3)
3	HAND KNOB (MANUAL RATIO CONTROL)	15	LOCKING COLLAR	28	LOCK WASHER
4	DIAL COLLAR (AUTO RATIO CONTROL)	16	1/8 NPT PLUG	29	FLAT WASHER
5	DIAL	17	SQUARE KEY (2)	30	HEX NUT
6	GAS ADJUSTER	18	O-RING	31	SUPPORT BRACKET
7	GAS ADJUSTMENT SHAFT	19	O-RING	32	HEX CAP SCREW (4)
8	SPACER KIT	20	O-RING	33	GAS VALVE BODY
9	BEARING SLEEVE	21	FLAT HEAD SCREW (3)	34	HEX CAP SCREW (4)
10	AIR ADJUSTMENT SHAFT	22	SET SCREW	35	GASKET
11	COVER PLATE	23	CAP SCREW (4)	36	DIFFUSER
12	VALVE PLATE	24	CAP SCREW (4)	37	LOCK SCREW
		25	CAP SCREW (3)	38	1/4 NPT PLUG

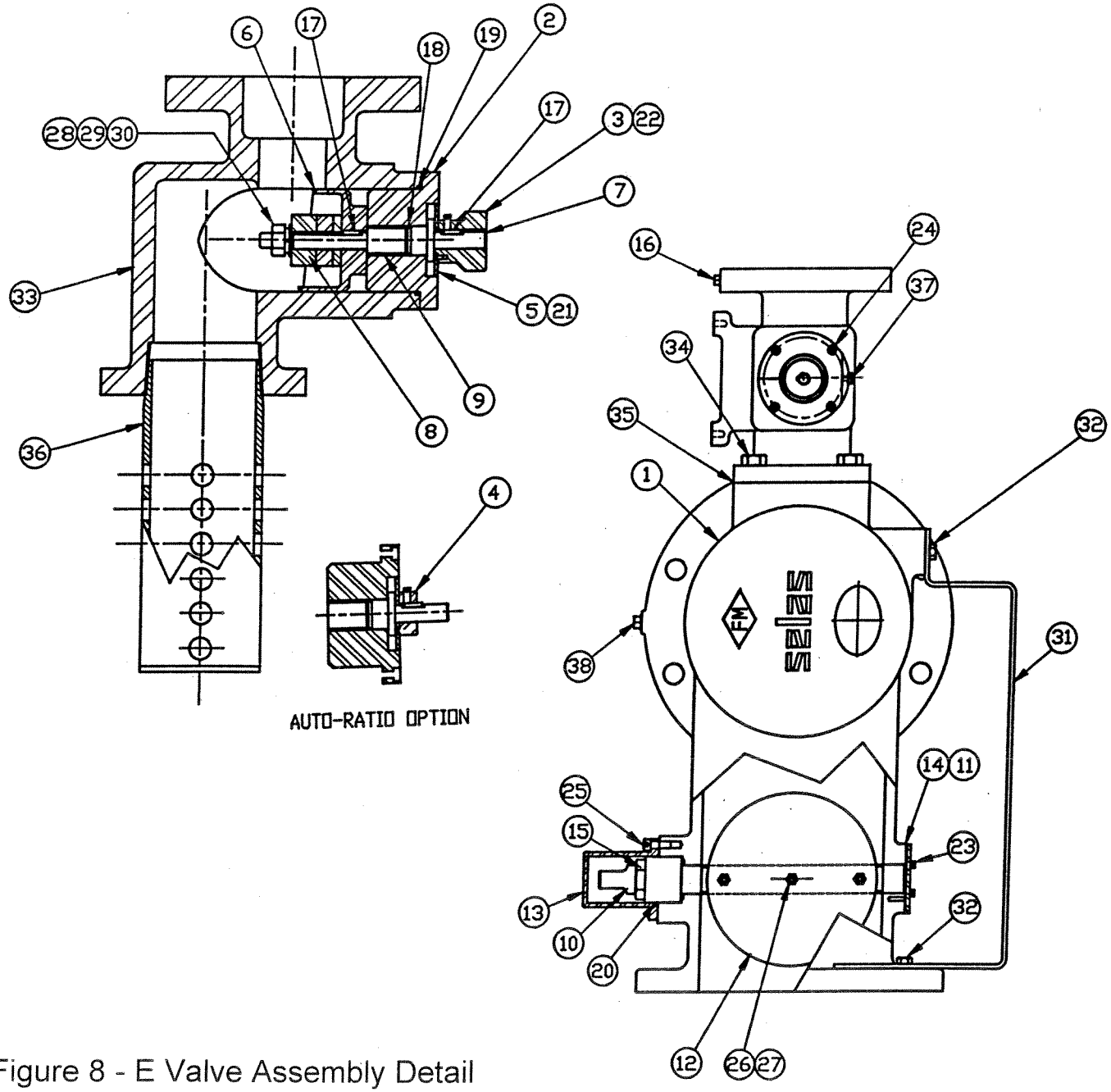


Figure 8 - E Valve Assembly Detail

TROUBLESHOOTING

CHANGE IN MIXTURE RATIO OR INABILITY TO MAINTAIN RATIO

1. Check ratio dial setting to verify that it has not been tampered with. The ratio dial setting as set at the factory is recorded on the spec sheet.
2. Verify that all test ports are closed and/or plugs are installed. Piping and flanges should be tight, especially the fuel supply. The regulator impulse tube connections must be leak free as they are critical to the operation of the valve.
3. Perform balance test on zero governor per the instructions in the maintenance section to verify proper function.
4. Verify consistency of fuel quality. If the fuel supply is subject to variations, a combustion analyzer and automatic control should be installed on the fuel ratio valve to automatically compensate for any changes. (Selas Qual-O-Rimeter® Option)

COMPRESSOR SURGE

At flow rates well below the factory rating, surging can occur when centrifugal compressors are used. Surge is characterized by pulsations in pressure and flow at the compressor outlet. In addition to compressor damage resulting from operation under surge conditions, a pulsating air supply will cause instability in the pressure regulators resulting in poor air/fuel ratio control.

1. Determine if minimum flow can be increased beyond surge limit without interfering with process.
2. Install a dump valve at the compressor outlet to vent excess flow.

INADEQUATE FLOW OR DELIVERY PRESSURE

1. Check rpm and shaft rotation direction on compressor. Most centrifugal compressors run at 3750 rpm, however, the rpm should be verified by referring to both the motor and compressor nameplates.
2. Check for obstructions in piping, clogged air filter element, valves mistakenly left either open or closed, tripped firechecks or blowouts.
3. Check control valve linkage (if applicable) to determine if any adjustments have become loose.
4. Look for any excessive leakage from piping connections, system components, or broken burner tips.

ORDERING INSTRUCTIONS

When ordering replacement parts, always specify:

1. Quantity
2. Part name or index number
3. Figure number and title
4. Serial number
5. Catalogue and model numbers

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