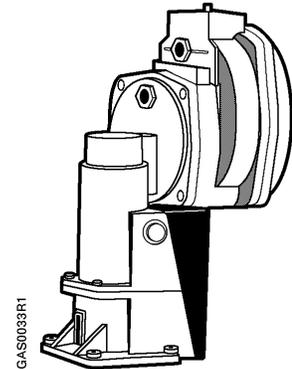


SKP Series

SKP70...U.. Air/Gas Ratio Controlling Actuators
With Safety Shutoff Function—
For Use With Gas Valves VG...



Quality Assurance Services



LISTED



APPROVED



CGA 3.9



AGA Z 21.21

Description

SKP70... pressure regulating electro-hydraulic actuators are used in combination with VG... series gas valves to provide slow opening fast closing shutoff and air/gas ratio control for industrial and commercial burner applications.

The SKP70... controls the burner manifold gas pressure as a function of the combustion air pressure without the need for an additional constant gas pressure regulator.

Since three functions, safety shutoff, constant pressure regulation and air/gas ratio control can be performed by a single valve, fewer components and fittings are required to assemble a gas train reducing both the size and the weight of the gas train significantly. The total pressure drop across the gas train arrangement is reduced, allowing for the use of smaller diameter gas trains in most applications.

The modular design allows the SKP70... to be used in combination with all VG... series gas valves from ½-inch to 5-inch in size. The actuator is easily mounted on the square flange of any VG... valve by means of four bolts contained in the terminal box of the actuator. No gaskets or seals are required when mounting the actuator. The valve position is shown by a visible position indicator displaying the entire stroke range of the actuator.

Features

- UL listed, FM approved, CGA and AGA certified, IRI approvable, ISO 9001 certified; European, Australian and Japanese approved versions available.
- Safety shutoff function, pressure regulating function and air/gas ratio control in one compact unit.
- Simplifies commissioning and reduces startup time.
- Maintains air/gas ratio when the air flow is disrupted.
- Automatic compensation for combustion chamber back pressure fluctuations.
- No mechanical wear or play that causes drifting.
- Compensation for air temperature fluctuations.
- Visual stroke position indicator.
- Can be mounted in any location.
- Optional auxiliary switches available.
- Excellent tracking characteristics

Application

SKP70... series actuators can be combined with ½-inch to 5-inch VG... series gas valve bodies. VG... series gas valves are ordered as separate items (See VG...U.. Technical Instruction No. 155-512P25).

If the combustion air pressure exceeds the permissible value of 12" or 20" w.c. (See Specifications), the pressure must be reduced by means of a pressure reducing T-fitting (See Figure 4, AGA78).

A motorized pressure reducing control (SQN37...) can also be installed in the air impulse line to continuously optimize combustion when used in conjunction with an oxygen trim system.

Product Numbers

Table 1. Product Numbers

Order Number	Operating Voltage	Proof of Closure & Auxiliary Switch	Type of Switch
SKP70.110U17	110-120 Vac	No	—
SKP70.111U17	110-120 Vac	Auxiliary	SPDT
SKP70.191U17	110-120 Vac	Proof of Closure	SPST
SKP70.192U17	110-120 Vac	Proof of Closure & Auxiliary	SPST SPST
SKP70.110U27	220-240 Vac	No	—
SKP70.111U27	220-240 Vac	Auxiliary	SPDT
SKP70.192U27	220-240 Vac	Proof of Closure & Auxiliary	SPST SPST
AGA78	Air pressure reducing T-fitting		

Installation Convention

WARNING:		Personal injury/loss of life may occur if a procedure is not performed as specified.
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Specifications

Agency approvals	As safety shut-off valve	UL/429, FM/7400, CGA/3.9, AGA/Z 21.21 in combination with VG...U.. series gas valves UL recognized when used with other valves.	
Power supply	Operating voltage	110 to 120 Vac + 10%-15% 220 to 240 Vac + 10%-15%	
	Operating frequency	50 to 60 Hz \pm 6%	
	Power consumption	20 VA	
	Duty cycle	100%	
Operating environment	Ambient operating temperature	15° to 140°F (-10° to 60° C)	
	Mounting position	Optional, with diaphragms in vertical position but not upside down	
	Maximum temperature of air and flue gas at the control connections	140°F (60°C)	
	Maximum inlet gas pressure	Same as VG... valve	
Physical characteristics	Weight	5.5 lb (2.5 kg)	
	Enclosure	NEMA 1, 2, 5 and 12 for indoor use	
	Dimensions	See Figure 6	
	Specification for valves	See gas valve Technical Instruction No. 155-512P25	
Connections	Conduit connection	½-inch NPSM adapter	
	Gas/air/combustion chamber pressure connections	¼" NPT	
Operating characteristics	Output force	100 lb (450 N)	
	Maximum stroke	0.7" (18 mm)	
	Opening time for maximum stroke	12 s	
	Closing time	< 0.8 s	
Control signal	Reference input signal	Combustion air pressure	
	Control characteristic	integral action	
Operation/installation	Setting range of gas to air pressure ratio	0.4:1 to 9:1	
	Permissible pressures during operation for accurate control	Min. air pressure: 0.2" w.c. Max. air pressure: with Pg/Pa <2; 20" w.c. Max. air pressure: with Pg/Pa >2; 12" w.c. with higher air pressures use AGA78 Min. downstream gas pressure: 0.4" w.c. Max. downstream gas pressure: 40" w.c.	
	Minimum time required for high to low fire load changes	Approx. 5 s	
	Permissible leakage test pressure	20 psi	
	Permissible leakage test vacuum	3 psi	
	Minimum diameter of impulse pipes	¼" inside diameter (See Installation)	
	Minimum distance between gas impulse pipe connection and gas valve outlet	5 x pipe diameter	
	Auxiliary features	Capacity of auxiliary switch	6 (3) A, 250 Vac
		Setting range of auxiliary switch	Full stroke

Operation (See Figure 1)

- Safety Shutoff Function** The electro-hydraulic actuator consists of a cylinder filled with oil and a piston containing an electric oscillating pump and a hydraulic relief system. When power is supplied to the actuator, the pump located at the base of the piston moves oil from the reservoir (through an orifice) into the pressure chamber. The oil flow from the pump through the orifice creates a pressure difference moving the diaphragm and the attached spring loaded plug to the left, closing the return flow path from the pressure chamber to the reservoir. This action causes the piston to move downward in the cylinder opening the gas valve. When power to the pump is interrupted, the pressure difference across the orifice instantly reduces to zero. The plug is immediately pushed to the right allowing the oil to flow back from the pressure chamber into the reservoir, closing the valve in less than 0.8 seconds. This unique hydraulic relief system provides definite closure of the associated gas valve guaranteeing fail safe operation.
- A visible disk fitted to the pump shaft indicates the entire stroke range of the actuator. The disk also operates optional potential free switches via a set of levers. The switching position of the auxiliary switch is adjustable over the entire stroke. The proof of closure switch is non-adjustable.
- Regulating Function** During the burner pre-purge period, when the gas valve is closed, only the air pressure acts on the regulator causing the air diaphragm to move to the left and close the regulating hydraulic bypass valve. When the actuator is powered the gas valve begins to open. The downstream differential gas pressure immediately begins to increase until the downstream gas pressure is in balance with the air pressure (in accordance with the pressure ratio adjusted on the regulator). The bypass valve is now partially open so that the oil flow supplied by the pump is identical to the return flow. Unlike conventional direct acting regulators the SKP70... servo operated regulating system displays virtually zero droop (offset) across the turndown range.
- If, for example, heat demand increases, the air damper would open further increasing the air pressure. The air diaphragm would move to the left, causing the bypass valve to close and the gas valve to open further. The opening of the gas valve increases the downstream gas pressure moving the gas diaphragm to the right until balance is restored and the flow supplied by the pump is once again identical to the return flow through the regulator bypass.
- The gas to air pressure ratio is adjustable from 0.4:1 to 9:1. The setting is visible through a window in the regulator. Once set, the gas to air pressure ratio remains constant over the entire output range. The gas to air flow ratio will remain constant (provided that the cross sections of the air and gas orifices in the burner head are fixed). The SKP70... is not recommended for use with burners incorporating a sliding/continuously adjustable head arrangement.
- Many burner designs, because of reduced mixing energy at the low fire level, require somewhat more low fire air in order to maintain optimum combustion parameters. To accommodate this requirement the SKP70... incorporates a bias spring parallel displacement adjustment which allows the characteristic of the regulator to be displaced either towards excess air or reduced air.

Operation, cont'd.

The SKP70... also has the ability to compensate for pressure disturbances in the combustion chamber. Typically in installations where the resistance in the combustion chamber and the stack is constant, the combustion chamber pressure changes in proportion to the gas and air pressures as the burner output is varied. Under these circumstances it is generally not necessary to compensate for the combustion chamber pressure. If however, the combustion chamber pressure does not change in proportion to the gas or air pressure (as is the case with flue gas dampers or flue gas fans), connection of the combustion chamber pressure to the regulator is necessary. This compensation circuit should also be employed when pressure shocks or vibrations disrupts the burner startup phase.

The SKP70... regulator gas diaphragm incorporates an additional safety diaphragm. In the event of a gas diaphragm rupture, the reinforced safety diaphragm serves to prevent excessive leakage of gas. With the SKP70..., leakage due to diaphragm rupture stops when the burner shuts off and the valve is closed. (Conventional regulators continue to leak and therefore have to be vented to the outdoors.)

Note: To avoid oscillation, do not oversize the VG... valve. (See Technical Instruction No. 155-512P25.)

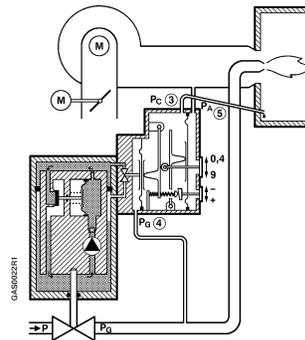


Figure 1. SKP70...U.. Operation.

Installation**WARNING:**

All installation must be carried out by qualified personnel only.

The SKP70... actuator is directly coupled to the VG... series valve body by four bolts found in the terminal box of the actuator. The square mounting flange can be rotated in steps of 90° providing four different mounting positions. The actuator can be mounted in any position with the diaphragm vertically oriented but cannot be mounted in the upside down position. The actuator can be mounted or replaced while the gas valve is installed and under pressure. The actuator should be mounted so that the stroke position indicator is clearly visible.

The SKP70... actuator packing contains an electrical conduit adapter to match with ½"-14 NPSM conduit. If the actuator is equipped with an auxiliary or proof of closure switch, two such adapters are included.

Note: Wiring must conform with local electrical codes.

Installation, cont'd.

All pressure connection pipes must be at least 1/4-inch inside diameter. For air to gas pressure ratios over three, the air and combustion pressure connection pipes must be at least 3/8" inside diameter. The pressure pick up connections must be flush with the inner wall of the pipe or housing in order to sense turbulence free pressures. The gas pressure pick up should be located at least five pipe diameters downstream of the valve. **Do not use the taps on the valve body for gas connection to the regulator since these places may show turbulence.** The pressure connection pipes should be as short as possible to allow the regulator to react to sudden changes. The connection pipe for the combustion chamber pressure must be installed so that condensing flue gases cannot enter into the regulator but run back into the combustion chamber. If necessary, a water separator must be installed.



WARNING:

If minimum gas pressure detection is required, the pressure switch must be mounted upstream of the regulating gas valve to ensure sufficient gas pressure before starting the burner. If maximum gas pressure detection is required the pressure switch must be mounted downstream of the valve.



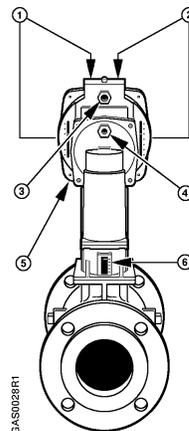
WARNING:

Air proving safety devices normally required to guarantee minimum air flow must also be provided when using the SKP70...



WARNING:

In installations with negative air pressure the SKP70... does not work unless a higher negative chamber pressure is connected to the regulator.



- ① Adjustment and indication of the gas to air ratio
- ② Adjustment and indication of the bias
- ③ Connection for the combustion chamber pressure sensing line
- ④ Connection for the gas pressure sensing line
- ⑤ Connection for the air pressure sensing line
- ⑥ Stroke indication

Figure 2. Connections and Adjustments.

Start up

Regulator (See Figures 2 and 3)

The pressure ratio and bias adjustment screws are located on top of the regulator under a sealable cover plate. The actual settings can be seen through windows on each side of the regulator.

Note: The burner capacity is controlled by the position of the air damper. The combustion quality (air/gas ratio) is controlled by the settings on the regulator (the + and – indications relate to the change in gas flow). Adjustment in clockwise direction decreases the gas flow.

1. Set the gas to air ratio to the desired value using the adjusting screw ① (coarse setting).
2. Start the burner and run it at approximately 90% of full capacity.
3. Measure CO₂ or O₂ content in the flue gases and correct the ratio by adjusting screw ① until optimum values are obtained (fine setting).
4. Return to low fire and measure the CO₂ or O₂ content in the flue gases. If necessary, correct the setting by adjusting screw ② until optimum values are obtained.
5. Limit the damper position for low fire operation. If considerable parallel displacement was necessary to achieve optimum combustion, repeat the procedure from step 3.
6. Run the burner to the required high fire position and limit the air damper position.
7. Check the flue gas values at several intermediate output levels. If corrections are necessary, note the following:
 - Adjust the pressure ratio screw ① at high fire operation only.
 - Adjust the bias screw ② at low fire operation only.

If the air pressure exceeds the maximum value of 12" or 20" w.c. (See Specifications), the pressure must be reduced by means of a pressure reducing T-fitting (AGA78).

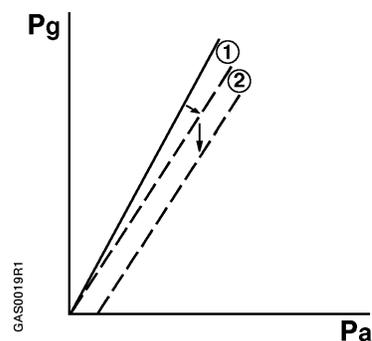


Figure 3. Adjustments.

Start up, cont'd.



WARNING:

When firing at maximum burner capacity, ensure that the SKP70... /VG... is **not** in the fully open position. If this is the case, either the gas valve is sized too small or the gas supply pressure is too low.

Auxiliary and Proof of Closure Switch (See Terminal Designations)

Adjust the auxiliary switch (if provided) according to the wiring diagram located on the inside of the terminal box cover. The proof of closure switch is non-adjustable.

Service

There are no serviceable parts on the SKP70... series actuators. If inoperative, replace the actuator. Tag wires before servicing.

Pressure Reducing T-Fitting AGA78

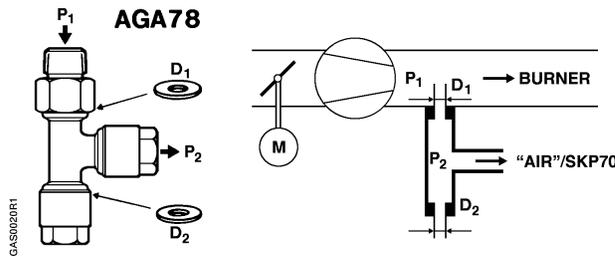


Figure 4. AGA78 Operation.

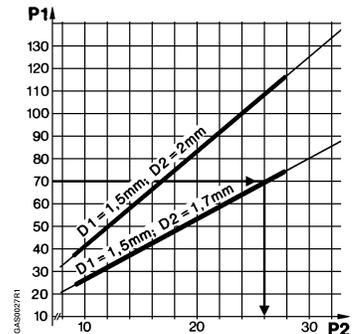


Figure 5. AGA78 Adjustments.

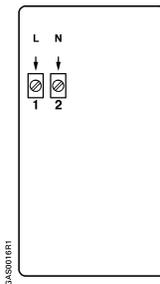
Function

The air is blown out continuously into the atmosphere through the restrictor D_2 . The air undergoes a drop in pressure across the restrictor D_1 . The relationships are shown in the diagram (Figure 5).

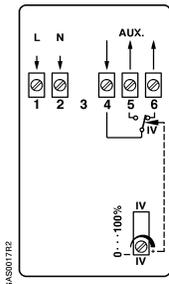
Example: Given $p_1 = 70$ mbar, $D_1 = 1.5$ mm, $D_2 = 1.7$ mm
 Find: Pressure signal P_2 for SKP70...
 $P_2 = 26$ mbar

Reducing T-fitting AGA78 is supplied ready for mounting, complete with $D_1 = 1.5$ mm and $D_2 = 1.7$ mm. An additional restrictor D_2 with a diameter of 2 mm is included in the packing.

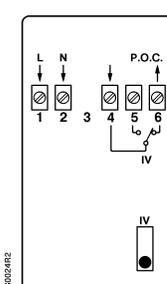
Terminal Designations



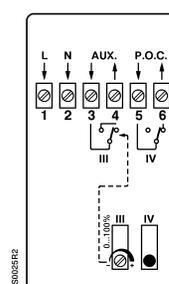
SKP70.110U..



SKP70.111U..



SKP70.191U..



SKP70.192U..

Dimensions

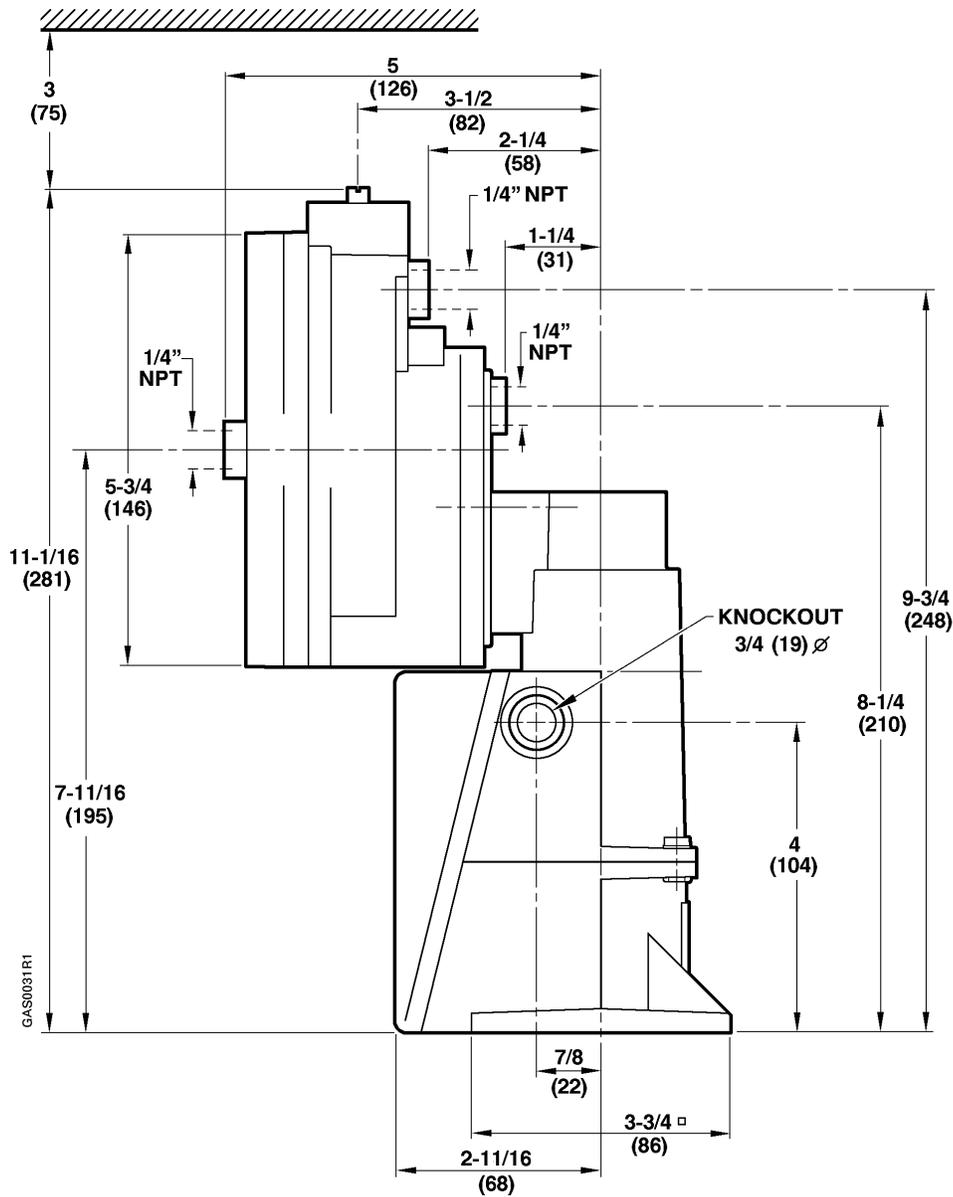


Figure 6. SKP70...U.. Dimensions.

(Dimensions given in inches; millimeters shown in parentheses.)

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