

## SKP Series

### SKP75...U.. Air/Gas Ratio Controlling Gas Valve Actuator with Safety Shutoff Function



ISO 9001 and 14000  
REGISTERED FIRM  
04-00001112



Only when assembled to Series VG... Gas valves

#### Description

SKP75... pressure regulating electro-hydraulic actuators are used in combination with VG... series gas valve bodies to provide shut-off and air/gas ratio control for industrial and commercial burner applications.

The SKP75... 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 shut-off, constant pressure regulation, and air/gas ratio control can be performed by a single valve, fewer gas train components and fittings are required. This significantly reduces both the size and weight of the gas train. In addition, smaller diameter gas valves can be used.

The compact SKP75... actuator opens slowly and closes immediately when power is interrupted. The modular design allows the SKP75... to be used in combination with all VG... series gas valves bodies from 1/2-inch to 6-inch in size. The actuator is easily mounted on the square flange of any VG... valve with four pre-mounted screws. A visible position indicator on the front of the actuator displays the entire stroke of the valve. A light indicates when the actuator is powered.

#### Features

- UL listed, FM approved, CGA and AGA certified, IRI approvable, ISO 9001 certified; European, Australian and Japanese approved versions available.
- Safety shut-off function, pressure regulating function and air/gas ratio control in one compact unit.
- Proof of Closure with Over Travel (POC) versions are available.
- Optional NEMA 4 protection.
- Simplifies commissioning and reduces start-up time.
- Maintains air/gas ratio when the airflow is disrupted.
- Automatic compensation for combustion chamber back pressure fluctuations.
- No mechanical wear or play that causes drifting.

## Features, Continued

- Compensation for air temperature fluctuations.
- Visual position indication.
- "Power on" indication light
- Quick connect wiring terminals
- Optional adjustable auxiliary switch available.
- Excellent tracking characteristic.
- Modular design with 360° actuator rotation for easy field wiring and installation.
- Low, 13.5 VA power consumption.

## Application

SKP75... series actuators can be combined with 1/2-inch to 6-inch VG... series gas valve bodies. VG... series gas valves must be ordered separately (See *VG...U... Technical Instructions*, P/N 155-512P25).

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

## Product Numbers

Table 1.

Product Number <sup>1</sup>	Operating Voltage	Proof of Closure Switch <sup>2</sup>	Auxiliary Switch <sup>2</sup>	Type of Switch
SKP75.011U1	110 to 120 Vac	x	–	SPDT
SKP75.012U1		x	x	SPDT SPDT
SKP75.013U1		–	–	
SKP75.012U2	220 to 240 Vac	x	x	SPDT SPDT
SKP75.013U2		–	–	

1. European, CE certified models are available (see *data sheet 7643*).

2. Proof of closure and auxiliary switches cannot be field installed.

## Accessories

Table 2.

Product Number	Description
AGA66	Sealing gasket to provide NEMA 3, 3R, and 4 protection (for VGG.../VGD...valves)
AGA78	Air pressure reducing T-fitting

## Specifications

As safety shut-off valve

UL/429, FM/7400, ANSI Z21.21/CGA6.5 C/I Agency marks apply only for SKPxx.xxxU actuators assembled with VGxxx.xxxU series gas valve bodies.

## Agency approvals

### Power supply

Operating voltage

110 to 120 Vac +10%-15%  
 220 to 240 Vac +10%-15%

Operating frequency

50 to 60 Hz ±6%

Power consumption

13.5 VA

Duty cycle

Continuous

<b>Specifications, Continued</b>	Ambient operating temperature	5°F to 140°F (-15°C to 60°C)
	Mounting position	Any position except upside down
	Maximum temperature of air and flue gas at the control connections	140°F (60°C)
	<b>Operating environment</b>	Maximum inlet gas pressure
<b>Physical characteristics</b>	Weight	5.1 lb (2.3 kg)
	Enclosure	NEMA 1, 2, 5 and 12 for indoor use NEMA 3, 3R, and 4 with optional AGA66 gasket
	Dimensions	See Figure 7
	Specification for valve bodies	See <i>gas valve Technical Instructions</i> P/N 155-512P25
<b>Connections</b>	Conduit connection	Two 1/2-inch NPSM threaded knock-outs
	Electrical connection	Spring loaded terminals for 14 AWG wires
	Gas/air pressure connections	1/4" NPT (see <i>Installation Notes</i> )
	Gas pressure test connection	Hose barb with close-off screw
	Combustion chamber pressure test connection	Hose barb with close-off screw
<b>Operating characteristics</b>	Output force	100 lb (450 N)
	Maximum stroke	1 inch (26 mm)
	Opening time for maximum stroke	Varies with valve size, 14 seconds for max. stroke.
	Closing time	<0.8 seconds
<b>Control signal</b>	Reference input signal	Combustion air pressure
	Control characteristic	Integral action
<b>Operation/installation</b>	Setting range of gas to air pressure ratio	Pg/Pa from 0.4:1 to 9:1
	Permissible pressures:	
	Min. air pressure for accurate control	0.2" WC
	Max. air pressure: with setting Pg/Pa <2	20" WC
	Max. air pressure: with setting Pg/Pa >2	12" WC (with higher air pressures use AGA78)
	Min. downstream gas pressure for accurate control	0.4" WC
	Max. downstream gas pressure	40" WC at any Pg/Pa setting during operation
	<b>NOTE:</b> When the combustion chamber pressure Pc is connected, the above pressures should be considered pressure differentials Pg-Pc and Pa-Pc.	
	Maximum gas pressure for leakage testing	20 psi
	Minimum time required for high to low fire load changes	5 seconds
Minimum diameter of sensing lines	1/4" inside diameter	
Minimum distance between gas sensing line and gas valve outlet	5 times the pipe diameter	
<b>Auxiliary features</b>	Proof of closure switch	Non-adjustable
	Capacity of auxiliary switch	6A/250 Vac resistive; 3A/120 Vac pilot duty
	Setting range of auxiliary switch	40% to 100% of stroke

## Operation

(See Figure 1)

## Safety Shut-off Function

The electro-hydraulic actuator consists of a cylinder filled with oil, a piston containing an electric oscillating pump and a relief system. When power is supplied to the actuator the relief system closes, and the pump moves oil from the reservoir into the pressure chamber. This action causes the piston to move downward in the cylinder, opening the gas valve. When power to the actuator is interrupted, the relief system opens and the gas valve closes in less than 0.8 seconds.

A position indicator, visible through the transparent portion of the terminal cover, shows the entire stroke range of the actuator. A light, which is visible through the lower left transparent portion of the terminal cover, indicates when the actuator receives power. An optional, non-adjustable SPDT proof of closure over travel switch signals the closed position after the gas valve has closed. An optional SPDT auxiliary switch is adjustable between 40% and 100% of the stroke. The adjustment screw and scale are located on the right side in the terminal box, and are visible through the transparent portion of the terminal cover.

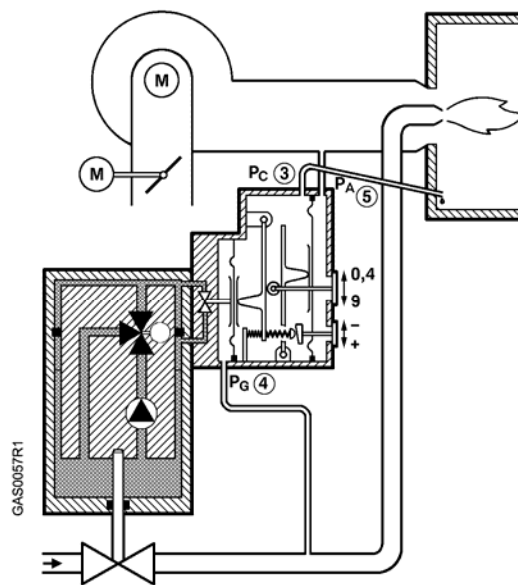


Figure 1. SKP75... Operation.

## Regulating Function

During the burner pre-purge period, when the gas valve is closed, only the air pressure acts on the regulator. This causes 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 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.

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. Unlike conventional direct acting regulators the SKP75... servo operated regulating system displays virtually zero droop (offset) across the turndown range.

## Regulating Function, Continued

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 (if the cross sections of the air and gas orifices in the burner head are fixed). The SKP75... 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 increased excess air at low fire in order to maintain optimum combustion parameters. To accommodate this requirement the SKP75... incorporates a bias adjustment, which allows the characteristic of the regulator to be displaced either towards excess air or reduced air.

**NOTE:** To avoid oscillation, do not oversize the VG... valve body. (See *Technical Instructions*, P/N 155-512P25.)

## Installation



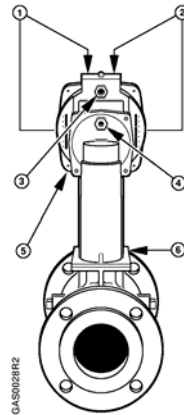
### WARNING:

- Personal injury or loss of life may occur if procedures are not followed as specified.
- All installations must be performed by qualified personnel only.
- Do not pull the actuator shaft.
- 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.
- Air proving safety devices normally required to guarantee minimum airflow must also be provided when using the SKP75...
- The gas pressure sensing line connection must be flush with the inner wall of the gas pipe in order to sense turbulence free pressure. The gas sensing line connection should be located at least five pipe diameters downstream of the valve, elbow, coupling, or other flow disturbing fitting. **Do not use the taps on the valve body for the gas sensing line connection since these locations typically have strong turbulence.** The pressure sensing line should be as short as possible to allow the regulator to react to sudden changes.
- The sensing line for the combustion chamber pressure (if needed) 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.
- All pressure sensing lines must be at least 1/4-inch inside diameter. For gas to air pressure ratios over three, the air and combustion pressure sensing lines must be at least 3/8-inch inside diameter.
- The AGA66 gasket must be installed between the actuator and the gas valve body to provide NEMA 3, 3R, and 4 protection rating for VGG... and VGD... valves.
- The SKP75... does not work in installations with negative air pressure unless a higher negative chamber pressure is connected to the regulator.

## Installation, Continued

- The SKP75... actuator is directly coupled to the VG... series valve body by four pre-mounted, 4 mm Allen key screws.
- The square mounting flange can be rotated in steps of 90° to provide four different mounting positions. The SKP75... actuator can be mounted in any position with the diaphragms vertical, except upside down.
- The actuator can be mounted or replaced while the valve body is under pressure.
- The SKP75... actuator has two knock-outs for the installation of 1/2"-14 NPSM conduit connections.
- When conduit routing is connected, flexible conduit must be used.
- Liquid tight conduit must be used in combination with AGA66 to provide NEMA 3, 3R, and 4 protection.
- The terminal marked GND, located above the wiring terminals, must be connected to the electrical ground.

**NOTE:** Wiring must meet all relevant electrical codes.



- 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 Position indication (on the front).

**Figure 2. Connections and Adjustments.**

## Start-up

### Regulator (See Figures 2 and 3)

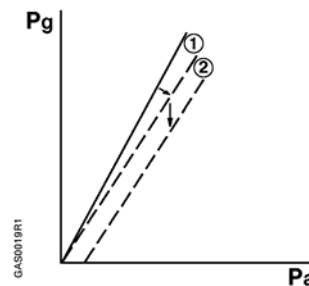
The pressure ratio and bias adjustment screws are located on top of the regulator under a sealable cover plate. The actual settings can be seen through windows on each side of the regulator.

**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.

**Start-up,  
Continued**

1. Set the gas-to-air ratio to the desired value using adjusting screw 1 (coarse setting).
2. Start the burner and run it at approximately 90% of full capacity.
3. Measure CO<sub>2</sub> or O<sub>2</sub> 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 CO<sub>2</sub> or O<sub>2</sub> 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 bias adjustment 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" WC (see *Specifications*), the pressure must be reduced with a pressure reducing T-fitting (AGA78).



**Figure 3. Adjustments.**

**WARNING:**

When firing at maximum burner capacity, ensure that the SKP75... /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.

**Wiring and Switch  
Adjustment**

- The actuator is equipped with spring-loaded wiring terminals for 14 AWG wires.
- Insert one wire into the opening of the terminal while pressing the lever downward with a screwdriver or hard object. Make sure that all strands insert into the opening.
- The actuator has two line and two neutral terminals.
- Adjust the auxiliary switch (if provided) according to the wiring diagram on the label below the terminals (see Figure 6). The adjustment screw and scale are located on the right side of the terminal box, and are visible through the transparent portion of the terminal cover.

- NOTES:**
1. The auxiliary switch is adjustable between 40% and 100% of the stroke. The factory setting is at 40%.
  2. The auxiliary switch must not be used for proof of closure detection or other safety interlock functions.
  3. The Proof of Closure Switch is non-adjustable.

**Service**

There are no serviceable parts on the SKP75... series actuators. If inoperative, replace the actuator. Tag wires before servicing.

**Pressure Reducing T-Fitting AGA78**

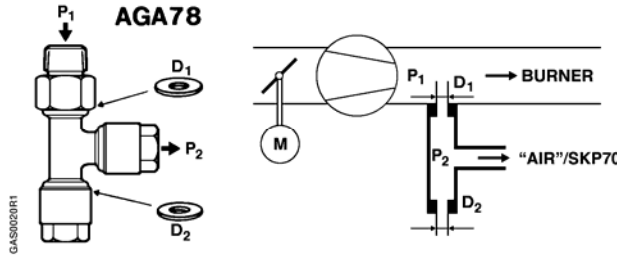


Figure 4. AGA78 Operation.

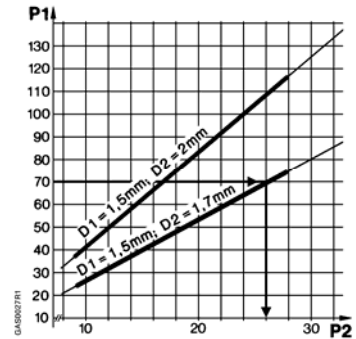


Figure 5. AGA78 Adjustments.

**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 with the actuator.

**Terminal Designations**

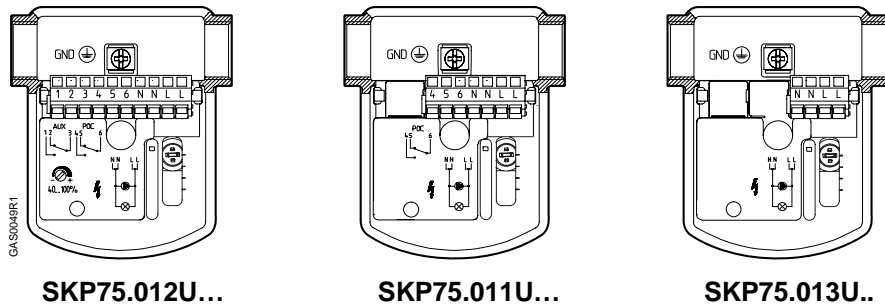


Figure 6. Terminal Designations.



### Dimensions

(Dimensions in inches;  
 millimeters in  
 parentheses.)

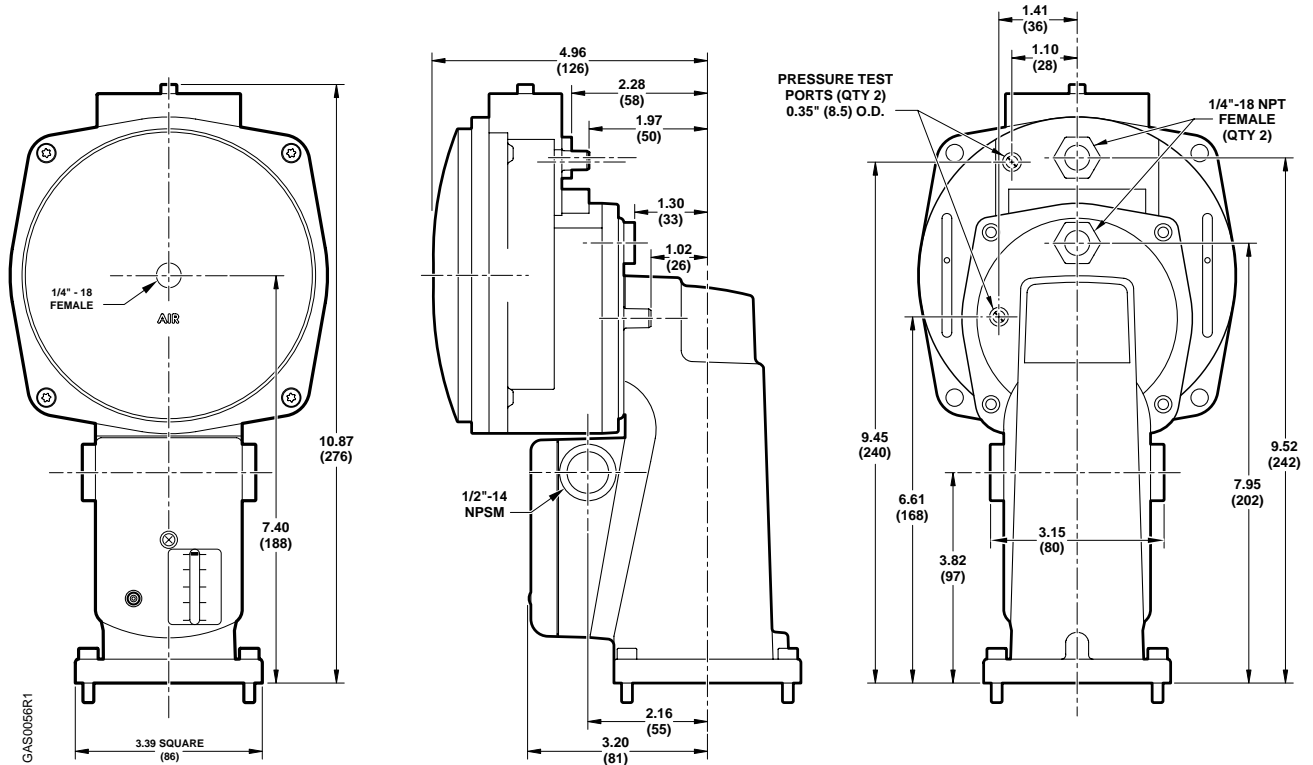


Figure 7. SKP75...U.. Dimensions.

Information in this publication is based on current specifications. The company reserves the right to make changes in specifications and models as design improvements are introduced. Other product or company names mentioned herein may be the trademarks of their respective owners.  
 © 2005 Siemens Building Technologies, Inc.