

## SKP Series

### SKP55...U.. Air/Gas Ratio Controlling Gas Valve Actuator with Safety Shutoff Function



ISO 9001 and 14000  
REGISTERED FIRM



Only when assembled to Series VG... Gas valves

#### Description

SKP55... 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 SKP55... actuator controls the pressure difference across a restriction in the gas supply line as a function of the pressure difference across a restriction in the air supply duct so that the air to gas ratio remains constant irrespective of air volume changes. There is no need for an upstream constant pressure regulator when using an SKP55... actuator within the applicable pressure range of the VG... valve body.

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 SKP55... actuator opens slowly and closes immediately when power is interrupted. The modular design allows the SKP55... 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, CSA certified for USA and Canada, 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 for:
  - Recuperative burners with combustion air preheating.
  - Burners with continuously variable air or gas nozzle openings in the burner head.
  - Burners where either the air or gas pressure is not representative of the actual flow.
  - Burners with negative combustion air pressure levels.
- 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.
- 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

SKP55... series actuators are 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).

## 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
SKP55.011U1	110 to 120 Vac	x	–	SPDT
SKP55.012U1		x	x	SPDT SPDT
SKP55.013U1		–	–	
SKP55.012U2	220 to 240 Vac	x	x	SPDT SPDT
SKP55.013U2		–	–	

### Note:

1. European, CE certified models are available (see data sheet 7643)
2. Proof of closure and auxiliary switches cannot be field installed.

<b>Accessories</b>	AGA66 Sealing gasket to provide NEMA 3, 3R, and 4 protection (for VGG.../VGD...valves)	
<b>Specifications</b>	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.
<b>Agency approvals</b>		
<b>Power supply</b>	Operating voltage	110 to 120 Vac + 10% to 15% 220 to 240 Vac + 10% to 15%
	Operating frequency	50 to 60 Hz ± 6%
	Power consumption	13.5 VA
	Duty cycle	Continuous
<b>Operating environment</b>	Ambient operating temperature	5°F to 140°F (-15°C to 60°C)
	Mounting position	Any position except upside down
	Maximum inlet gas pressure	Same as VG... valve
<b>Physical characteristics</b>	Weight	4.2 lb (1.90 kg)
	Enclosure	NEMA 1, 2, 5 and 12 for indoor use NEMA 3, 3R, and 4 with optional AGA66 gasket
	Dimensions	See Figure 5
	Specification for valve bodies	See gas valve <i>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 installation notes)
<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 difference
	Control characteristic	Integral action
<b>Operation/installation</b>	Differential pressure ratio	1:1
	Permissible pressure differences during operation for accurate control	Gas: Minimum 0.1" w.c. Gas: maximum 80" w.c. Air: minimum 0.1" w.c. Air: maximum 80" w.c.
	Minimum time required for high to low fire load changes	5 seconds
	Maximum sensing line pressure	20 psi
	Maximum sensing line vacuum	3 psi
	Minimum diameter of sensing lines	1/4" inside diameter
	Low fire bias range	-0.4 to 0.4" w.c.
	Minimum distance of sensing lines	3 pipe diameters before and 5 pipe diameters after any valve, damper, elbow, coupling, etc.
<b>Auxiliary features</b>	Proof of closure switch	Non-adjustable
	Capacity of auxiliary switch	6 A/250 Vac resistive; 3A/ 20 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.

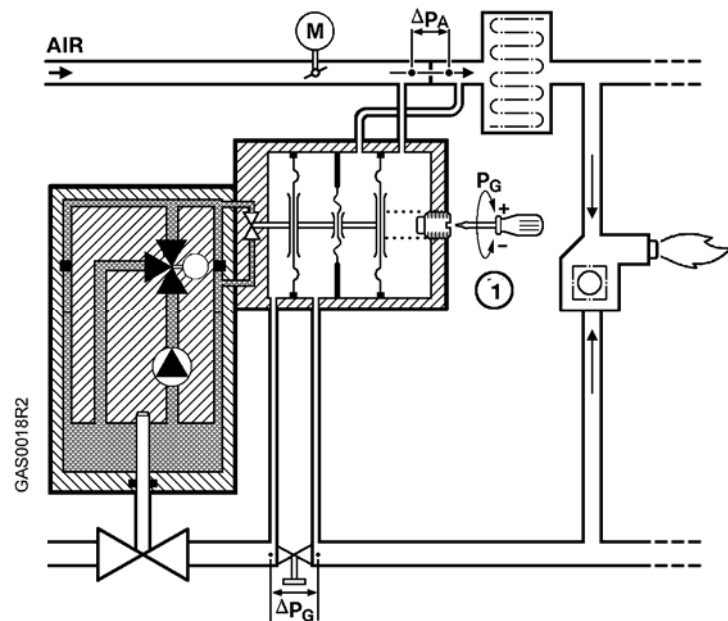


Figure 1. SKP55... Operation.

## Regulating Function

During the burner pre-purge period, when the gas valve is closed, only the air pressure difference acts on the regulator causing the air diaphragm to move to the left and closes the regulating hydraulic bypass valve. When the actuator is powered the gas valve begins to open. The downstream gas pressure difference immediately begins to increase until the gas pressure difference is in balance with the air pressure difference. 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 opens further increasing the differential air pressure. The SKP55... air diaphragm moves to the left, causing the bypass valve to close and the gas valve to open further. The opening of the gas valve increases the differential 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 SKP55... servo operated regulating system displays virtually zero droop (offset) across the turndown range.

**Operation,  
Continued**

**NOTE:** The SKP55.../VG... is a 1:1 differential pressure air/gas ratio controller. This means that the control adjusts the same pressure difference on the gas side as it senses on the air side. Any other gas to air ratio adjustment will require a modification to one of the restrictions or the installation of an adjustable orifice (this is normally an adjustable metering orifice in the gas line). For this purpose the VG... gas valve with manual operation kit AGA61 may be used. See gas valve *Technical Instructions 155-512P25*.

Many burner designs, because of reduced mixing energy at the low fire level, require increased excess air at low fire to maintain optimum combustion parameters. To accommodate this requirement the SKP55... incorporates a bias adjustment, which allows the characteristic of the regulator to be displaced either towards excess air or reduced air.

Pressure fluctuations in the combustion chamber do not influence the performance of the SKP55... air/gas ratio controller. There is no need for any compensation circuit.

- NOTES:**
1. For optimal performance, both the air damper and SKP55... /VG... gas valve must be installed upstream of its pressure differential orifice. For other layouts please consult your authorized Siemens Building Technologies Combustion Products sales representative.
  2. To avoid oscillation, do not oversize the VG... valve body. (See *Technical Instructions 155-512P25*.)

**Installation****WARNING:**

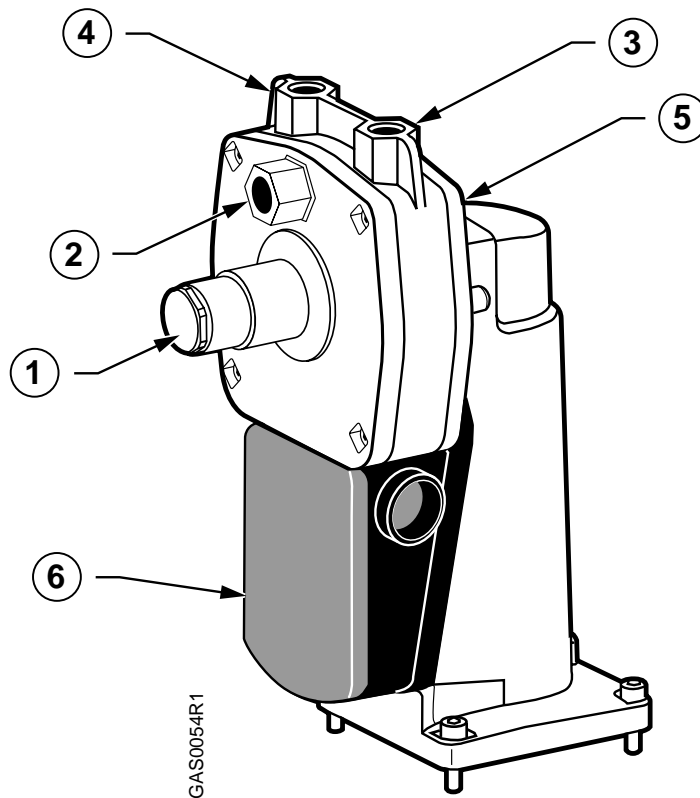
- Personal injury or loss of life may occur if procedures are not followed as specified.
- All installations must be performed by qualified personnel only.
- Do not pull the actuator shaft.
- If minimum gas pressure detection is required, the pressure switch must be mounted upstream of the regulating 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 air flow must also be provided when using the SKP55...
- The gas pressure sensing line connections must be flush with the inner wall of the gas pipe in order to sense turbulence free pressure. The gas sensing line connections should be located at least three pipe diameters upstream and 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 connections since these locations typically have strong turbulence.** All sensing lines should be as short as possible to allow the regulator to react to sudden changes.
- The AGA66 sealing gasket must be installed between the actuator and the gas valve to provide NEMA 3, 3R, and 4 protection rating for VGG... and VGD... valves.
- The SKP55... 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 SKP55... 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 SKP55... actuator has two knock-outs for the installation of 1/2"-14 NPSM conduit connections.
- When conduit routing is connected, flexible conduits must be used.

## Installation, Continued

- 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.

In cases where it is not possible to install an orifice in the air line, (e.g., lack of available air pressure) the SKP55... actuator may be connected to the air pressure upstream of the burner and the combustion chamber pressure, using the pressure differential across the burner orifice. This arrangement is not applicable to installations utilizing combustion air preheating systems.

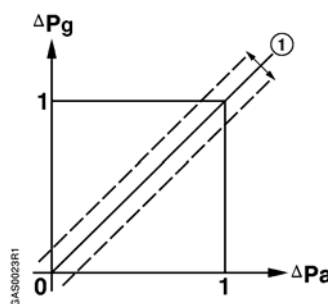


- 1 Adjustment of the bias
- 2 Connection for the air pressure (+) sensing line
- 3 Connection for the air pressure (-) sensing line
- 4 Connection for the gas pressure (-) sensing line
- 5 Connection for the gas pressure (+) sensing line
- 6 Position indication

**Figure 2. Connections and Adjustments.**

**Start-Up****Regulator (See  
Figures 1, 2 and 3)**

1. The setting screw 1 on the SKP55... is factory-adjusted so that the gas to air ratio curve intersects the zero point (no bias). If required, on-site adjustment may be achieved as follows:
  - Turn setting screw 1 counterclockwise until spring becomes completely loose.
  - Shut off gas supply upstream of the SKP55... actuator.
  - Make sure that there is no air pressure working on the SKP55... actuator.
  - Apply power to the SKP55... actuator.
  - Turn the setting screw clockwise until valve starts to open.
2. Set the adjustable orifice to the pre-calculated value so that equal pressure difference on both air and gas side results in approximate stoichiometric combustion.
3. Start the burner and run it at approximately 90% capacity by opening the air damper.
4. Measure the combustion values and correct the flow using the adjustable orifice until optimum values are obtained.
5. Return to low fire position by closing the air damper and check the combustion values. If necessary, correct the working characteristic until optimum values are obtained by rotating the setting screw 1. To obtain more gas: rotate clockwise. To obtain less gas: rotate counter-clockwise.
6. Limit the low fire air damper position.
7. If a substantial bias of the working characteristic was needed the adjustment of the 90% position must be checked and corrected, if necessary, by adjusting the orifice. Repeat the procedure from Step 3.
8. Run the burner to the required high fire position and limit the air damper position.
9. Check flue gas values at several intermediate output levels. If corrections are necessary, note:
  - At high fire, correct with the adjustable orifice
  - At low fire, correct with setting screw 1 on the SKP55... actuator.

**Figure 3. Adjustments.**

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### Start up, Continued



#### WARNING:

When firing at maximum burner capacity, ensure that the SKP55... /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

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### 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 4). 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 interlock functions.
  3. The Proof of Closure Switch is non-adjustable.
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### Service

There are no serviceable parts on the SKP55... series actuators. If inoperative, replace the actuator. Tag wires before servicing.

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### Terminal Designations

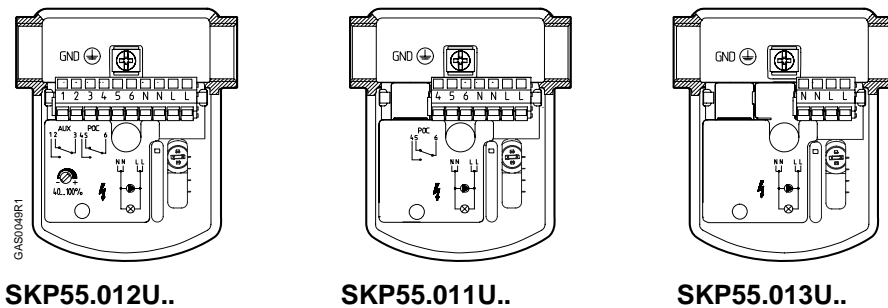


Figure 4. Terminal Designations.

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### Dimensions

(Dimensions in inches;  
 millimeters in parentheses.)

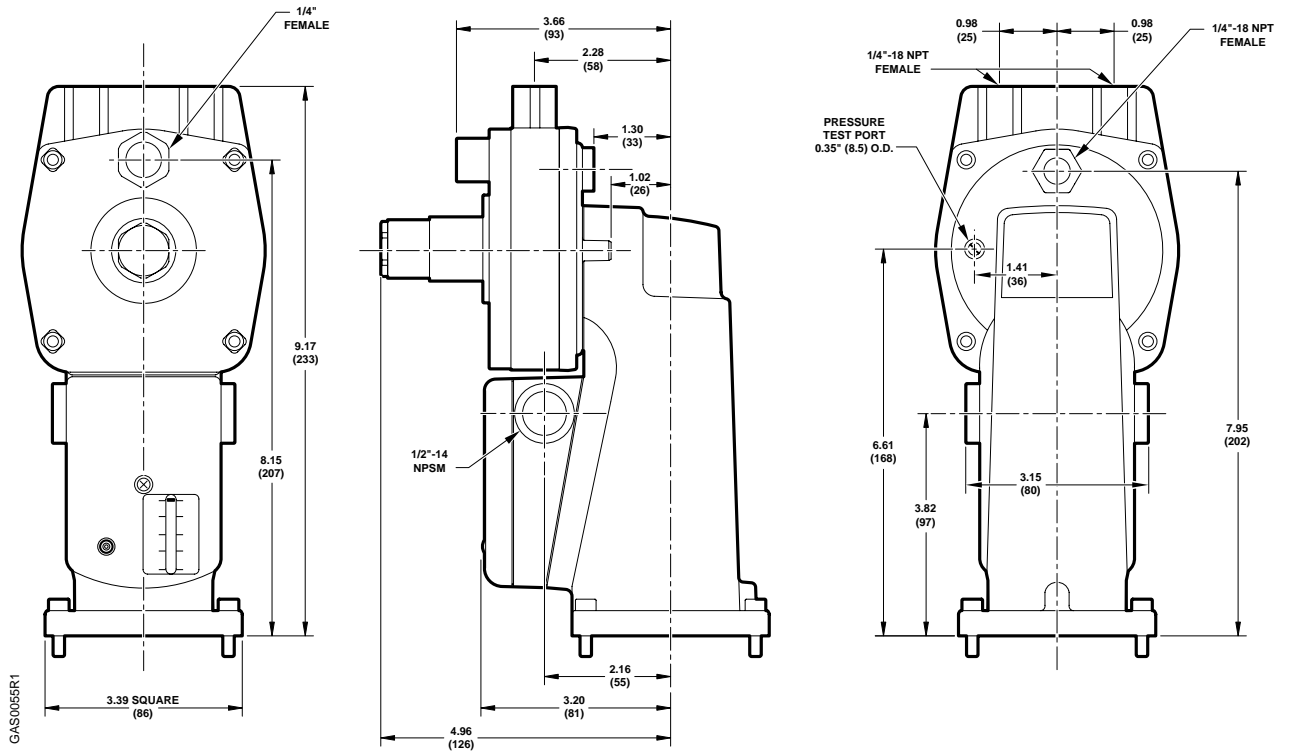


Figure 5. SKP55...U.. Dimensions.

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