SIEMENS

Technical Instructions
Document No. 155-753
SKP55…U..
July 9, 2014

SKP Series

SKP55…U.. Air/Gas Ratio Controlling Actuators With Safety Shutoff Function For Use with Gas Valves VG…

ISO 9001 REGISTERED FIRM

UL LISTED

FM APPROVED

CSA

Description

SKP55… pressure regulating electro-hydraulic actuators combine with VG… series gas valves to provide slow opening, fast closing safety 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 a single valve performs three functions: safety shut-off, constant pressure regulation, and air/gas ratio control, fewer components and fittings are required to assemble a gas train. This significantly reduces both the size and the weight of the gas train. 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 SKP55… actuator to be used in combination with all VG… series gas valves from 1/2-inch to 6-inch in size. The actuator is easily mounted on the square flange of any VG… valve with four bolts. No gaskets or seals are required when mounting the actuator. 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, and 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.
- 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 stroke position indicator.
- Light indicating "power on".
- Optional auxiliary switch available.
- Excellent tracking characteristic.
- Low, 13.5 VA power consumption.

Application

SKP55… series actuators may be combined with 1/2-inch to 6-inch VG… series gas valve bodies. VG… series gas valves are ordered as separate items (See *VG…U.. Technical Instructions* P/N 155-512P25).

Product Numbers

Table 1.

Product Number	Operating Voltage	Proof of Closure Switch	Auxiliary Switch	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		–	–	

Accessories

Table 2.

Product Number	Description
AGA66	Sealing gasket to provide NEMA 3, 3R, and 4 protection (for VGG/D…valves)

Specifications

Agency approvals	As safety shut-off valve	UL/429, FM/7400, ANSI Z21.21/CSA6.5 C/I in combination with VG…U.. series gas valves
	As a pressure regulator	ANSI Z21.18/CSA6.3
Power supply	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	100%
Operating environment	Ambient operating temperature	5°F to 140°F (-15°C to 60°C)
	Mounting position	Optional, with diaphragms in vertical position except upside down
	Maximum inlet gas pressure	Same as VG… valve
Physical characteristics	Weight	4.2 lb (1.90 kg)
	Enclosure	NEMA 1, 2, 5 and 12 for indoor use NEMA 3, 3R, and 4 with sealing gasket AGA66 (only for VGG/F/D… valves)
	Dimensions	See Figure 4
	Specification for valves	See gas valve *Technical Instructions* P/N 155-512P25
Connections	Conduit connection Electrical connection	Two 1/2-inch NPSM threaded knock-outs Spring loaded terminals for 14 AWG wires
	Gas/air pressure connections	1/4” NPT
Operating characteristics	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
Control signal	Reference input signal	Combustion air pressure difference
	Control characteristic	Integral action
Operation/installation	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	Approx. 5 seconds
	Permissible leakage test pressure	20 psi
	Permissible leakage test vacuum	3 psi
	Minimum diameter of impulse pipe	1/4” inside diameter
	Low fire bias range	-0.4 to 0.4" w.c.
	Minimum distance of impulse pipe connections	3 pipe diameters before and 5 pipe diameters after any valve, damper, elbow, coupling, or flow disruption
Auxiliary features	Proof of closure switch	Non-adjustable
	Capacity of auxiliary switch	6 (3) A, 250 Vac
	Setting range of auxiliary switch	40% to 100% of stroke

Operation

(See Figure 1)

The electro-hydraulic actuator consists of a cylinder filled with oil, and 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 pump is interrupted, the relief system opens and the gas valve closes in less than 0.8 seconds.

Safety Shut-off Function

A pointer, visible through the transparent portion of the terminal box cover, indicates the entire stroke range of the actuator. A light, which is visible through the lower left transparent portion of the terminal box 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 of the terminal box, and are visible through the transparent portion of the terminal box cover.

The sealing gasket, AGA66, can be installed between the actuator and the gas valve to provide NEMA 3, 3R, and 4 protection rating for VGG/D valves.

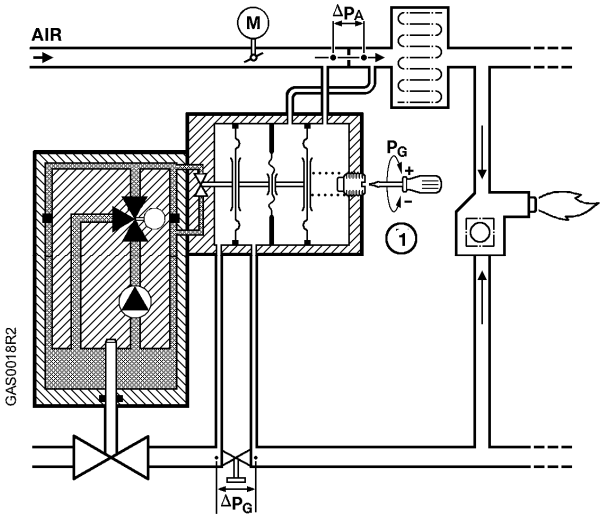


Figure 1. SKP55…U.. Operation.

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 somewhat more air at low fire in order 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… valves. (See *Technical Instructions* 155-512P25.)

Installation

WARNING:

- Personal injury/loss of life may occur if you do not perform a procedure 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.
- Do not use pressure taps on the valve body for connection to the regulator.of the valve
- Air proving safety devices normally required to guarantee minimum air flow must also be provided when using the SKP55...
- The AGA66 sealing gasket must be installed between the actuator and the gas valve to provide NEMA 3, 3R, and 4 protection rating if a liquid-tight conduit connection is used.

- The SKP55… actuator is directly coupled to the VG… series valve body by four bolts.
- The square mounting flange can be rotated in steps of 90^{o} 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 gas valve is under pressure.
- The SKP55… actuator has two knock-out holes for the installation of 1/2" – 14 NPSM conduits.
- When conduit routing is used, flexible conduits must be used.
- The terminal marked GND (located above the wiring terminals must be used for grounding.
- Liquid tight conduit must be used in combination with AGA66 to provide NEMA 3, 3R, and 4 protection.

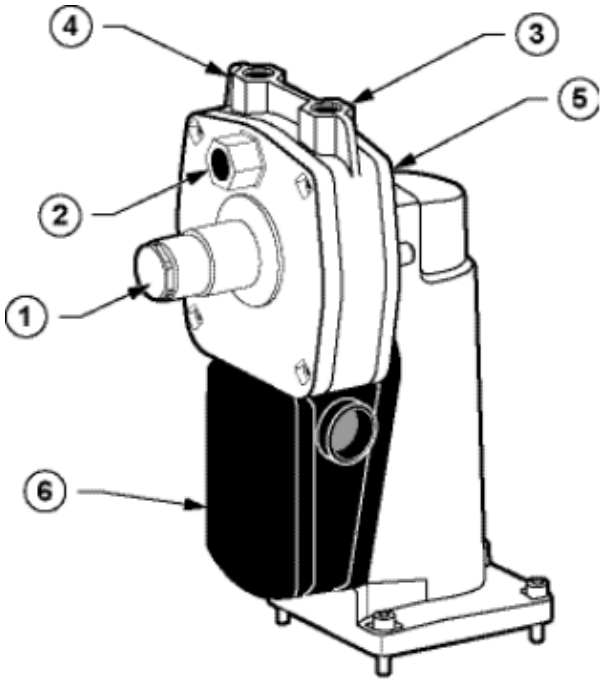
Installation, Continued

NOTES:

1. Wiring must meet all local electrical codes.
2. All pressure connection pipes must be at least 1/4-inch 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 pressure pick-up connections should be located at least five pipe diameters downstream of the valve, damper, elbow, coupling, orifice, or other flow disturbing fitting. **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.

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 Stroke 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.

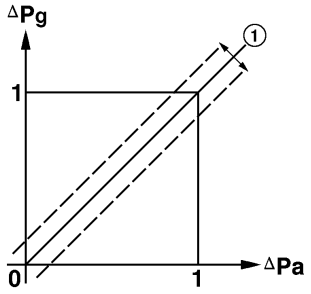


Figure 3. Adjustments.

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

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; both can be connected to other devices.
- Adjust the auxiliary switch (if provided) according to the wiring diagram on the label below the terminals. 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 box cover.

NOTES: 1. The auxiliary switch is adjustable between 40% and 100% of the stroke. The factory setting is at 40%.

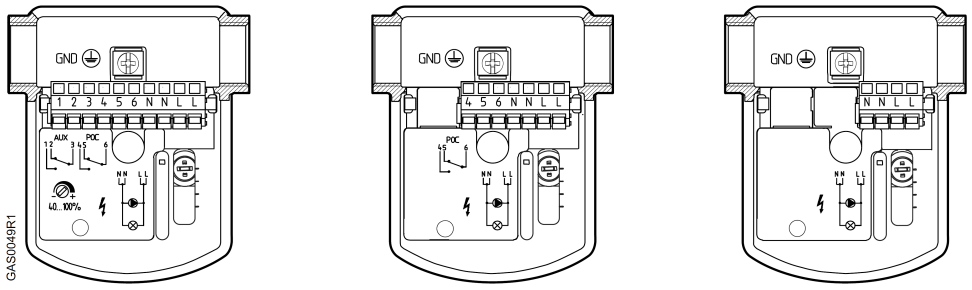
2. The auxiliary switch must not be used for proof of closure detection or other interlock functions.

3. The Proof of Closure Switch is non-adjustable.

Service

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

Terminal Designations



SKP55.012U.. **SKP55.011U..** **SKP55.013U..**

Dimensions

(Dimensions in inches;
millimeters in parentheses.)

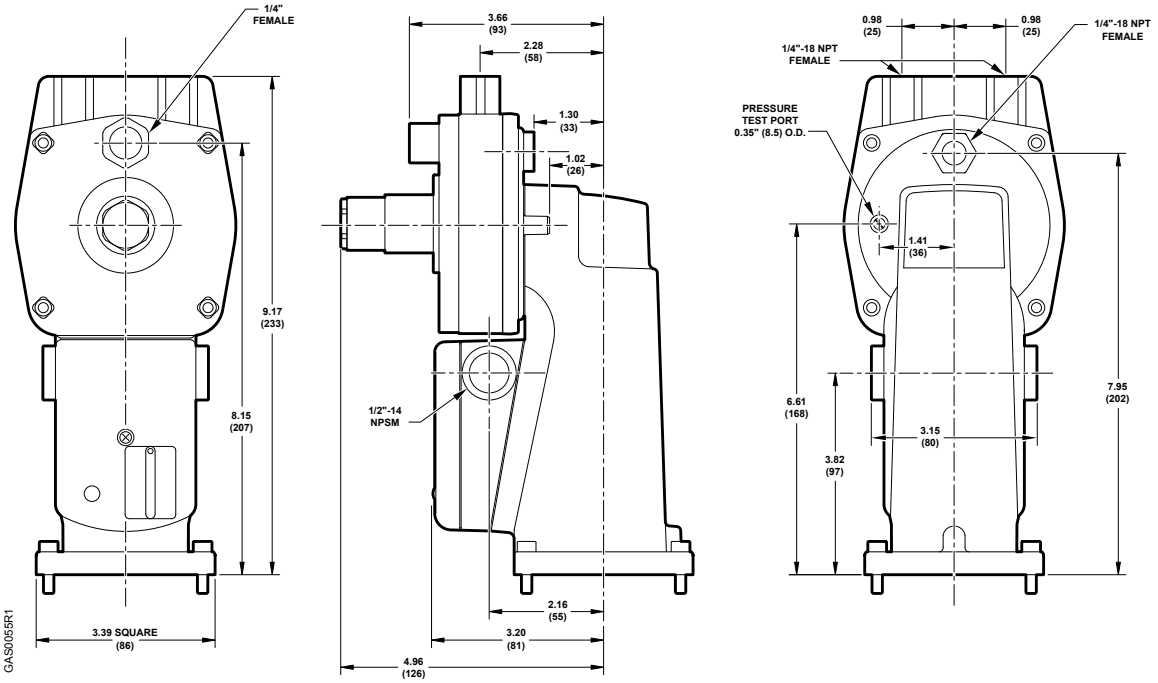


Figure 4. SKP55…U.. Dimensions.