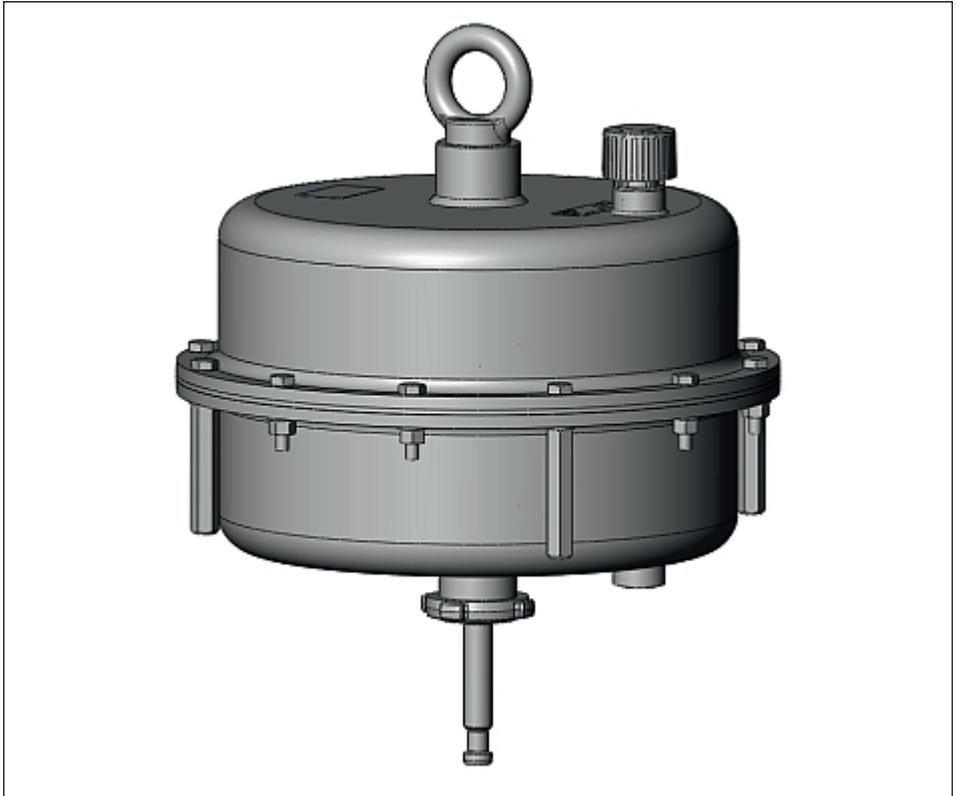




SH 8310 EN

Translation of original instructions



Types 3271 and 3277 Pneumatic Actuators

Definition of signal words

DANGER

Hazardous situations which, if not avoided, will result in death or serious injury

WARNING

Hazardous situations which, if not avoided, could result in death or serious injury

NOTICE

Property damage message or malfunction

Note

Additional information

Tip

Recommended action

Purpose of this manual

The Safety Manual SH 8310 contains information relevant for the use of the Type 3271 and Type 3277 Pneumatic Actuators in safety-instrumented systems according to IEC 61508 and IEC 61511. The safety manual is intended for planners, constructors and operators of safety-instrumented systems.

! NOTICE

Risk of malfunction due to incorrect mounting, connection or start-up of the device.

- ➔ *Refer to Mounting and Operating Instructions EB 8310-X for details on how to mount the device, perform the pneumatic connections as well as start up the device.*
 - ➔ *Observe the warnings and safety instructions written in the Mounting and Operating Instructions EB 8310-X.*
-

Further documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the pneumatic actuators. You can download these documents from the SAMSON website.

Type 3271 and Type 3277 Pneumatic Actuators up to 750v2 cm² actuator area

- ▶ T 8310-1: Data sheet
- ▶ EB 8310-1: Mounting and operating instructions (120 cm²)
- ▶ EB 8310-4: Mounting and operating instructions (355v2 cm²)
- ▶ EB 8310-5: Mounting and operating instructions (175v2, 350v2 and 750v2 cm²)
- ▶ EB 8310-6: Mounting and operating instructions (240, 350 and 700 cm²)

Type 3271 Pneumatic Actuator, 1400-60 cm² actuator area

- ▶ T 8310-3: Data sheet
- ▶ EB 8310-3: Mounting and Operating Instructions

Type 3271 Pneumatic Actuator, 1000, 1400-120, 2800 and 2 x 2800 cm² actuator areas

- ▶ T 8310-2: Data sheet
 - ▶ EB 8310-2: Mounting and operating instructions (1000 cm²)
 - ▶ EB 8310-7: Mounting and operating instructions (1400-120, 2800, 2 x 2800 cm²)
-

i Note

In addition to the actuator documentation, observe the technical documentation for the valve and valve accessories.

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1 Scope

General

The Type 3271 and Type 3277 Pneumatic Actuators are single-acting linear actuators with spring return mechanism for mounting on valves. The actuators are used to move the valve plug.

Use in safety-instrumented systems

The pneumatic actuators can be used in safety-instrumented systems according to IEC 61508 and IEC 61511. The actuators can be used in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) on observing the requirements of IEC 61508.

The safety-instrumented function of the actuators is to be regarded as a Type A element in accordance with IEC 61508-2.

Note

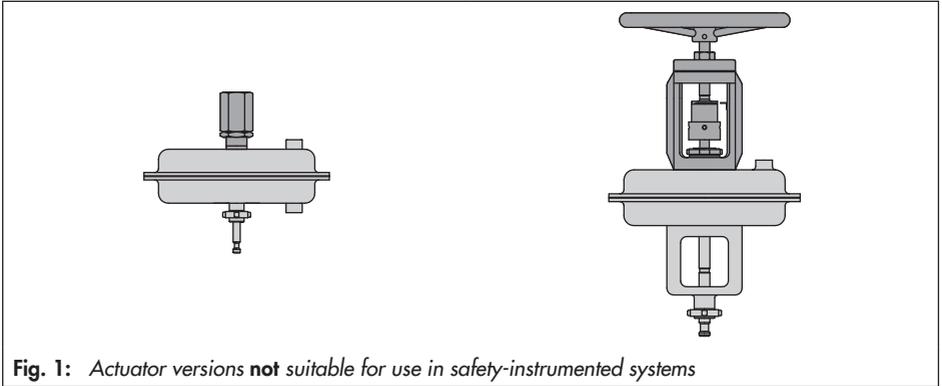
The architecture and the interval between proof tests must be considered concerning the safety integrity level.

Tip

Through the use of a positioner with diagnostic features on the control valve, the diagnostic coverage can be increased and, as a result, the probability of failure on demand reduced.

Versions and ordering data

Type 3271 and Type 3277 Pneumatic Actuators are suitable for safety-instrumented systems, provided they do not have a travel stop or handwheel. Actuators with travel stop or handwheel can be identified by the mounted construction on the top diaphragm case (see Fig. 1).



Mounting

The pneumatic actuators are mounted on valves as described in the associated actuator documentation.

2 Technical data

Table 1: Technical data for actuator areas up to 750v2 cm²

Actuator area	cm ²	240 · 350 · 700	175v2 · 350v2 · 355v2 · 750v2	120 Type 3271-5/ Type 3277-5
Max. supply pressure		6 bar ¹⁾		
Permissible ambient temperatures		Diaphragm material NBR: -35 to +90 °C ^{2) 4)}		Diaphragm material NBR: -35 to +80 °C ²⁾
		Diaphragm material EPDM: -50 to 120 °C ^{3) 4)}		
	-	Diaphragm material PVMQ: -60 to +90 °C ⁴⁾		
Degree of protection		IP 54 ⁶⁾		
Materials				
Actuator stem		1.4404		1.4305
Actuator stem sealing		NBR		NBR
		EPDM		
Enclosure		1.0332/1.0335 Sheet steel, painted Ambient temperature ≥-50 °C	1.0976/1.0982 Sheet steel, painted Ambient temperature ≥-60 °C	Die-cast aluminum, painted
		1.4301 · Stainless sheet steel · Ambient temperature ≥-60 °C ⁵⁾		

1) Observe supply pressure restrictions.

2) In on/off service, lowest temperature restricted to -20 °C

3) In on/off service, lowest temperature restricted to -40 °C

4) Install vent plug (▶ AB 07) for temperatures below -20 °C.

5) 1.4301 not available for 355v2 cm²

6) The pneumatic actuators do not pose any risk in the sense of the protection requirements described in DIN EN 60529. The IP rating depends on the connecting parts used on the pressurized side and the spring chamber side of the actuator. In this case, components (air vents as well as valves accessories, such as solenoid valves, positioners etc.) must be used that comply with the requirements. The maximum rating that can be achieved with the standard air vent is IP 54

▶ AB 07. Depending on the IP rating of the valve accessories, a maximum rating of IP 66 can be achieved for an actuator with air purging of the actuator spring chamber.

Table 2: Technical data for 1000, 1400-120, 2800 and 2 x 2800 cm² actuator areas

Actuator area	cm ²	1000	1400-120	2800	2 x 2800
Max. supply pressure		6 bar ¹⁾			
Permissible ambient temperatures		Diaphragm material NBR: -35 to +90 °C ^{2) 3)}			
		Diaphragm material PVMQ: -60 to +90 °C ³⁾			
Degree of protection		IP 54 ⁵⁾			
Materials					
Actuator stem		1.4548.4	1.4404	1.4548.4	
Actuator stem sealing		NBR	NBR		
		EPDM	PVMQ		
Housing and associated ambient temperature		1.0982 S460 MC Sheet steel, painted ≥-60 °C	EN-JS1030 (GGG-40) ⁴⁾ Spheroidal graphite iron Max. 100 °C		
			1.5638/A352 LC3 Painted cast steel ≥-60 °C		

- 1) Observe supply air restrictions.
- 2) In on/off service, lowest temperature restricted to -20 °C
- 3) Install vent plug (▶ AB 07) for temperatures below -20 °C.
- 4) Not with diaphragm material PVMQ
- 5) The pneumatic actuators do not pose any risk in the sense of the protection requirements described in DIN EN 60529. The IP rating depends on the connecting parts used on the pressurized side and the spring chamber side of the actuator. In this case, components (air vents as well as valves accessories, such as solenoid valves, positioners etc.) must be used that comply with the requirements. The maximum rating that can be achieved with the standard air vent is IP 54 ▶ AB 07. Depending on the IP rating of the valve accessories, a maximum rating of IP 66 can be achieved for an actuator with air purging of the actuator spring chamber.

Technical data

Table 3: Technical data for 1400-60 cm² actuator area

Actuator area	1400-60 cm ²
Max. supply pressure	6 bar ¹⁾
Permissible ambient temperatures	Diaphragm material NBR: -35 to +90 °C ²⁾
	Diaphragm material EPDM: (with air free of oil and grease): -50 to +120 °C ³⁾
Degree of protection	IP 54 ⁴⁾
Materials	
Rolling diaphragm	NBR (nitrile butadiene rubber) Butyl with fabric reinforcement
	EPDM with fabric reinforcement
Actuator stem	1.4404
Actuator stem sealing	NBR (nitrile butadiene rubber)
	EPDM
Diaphragm cases	Sheet steel, plastic-coated

¹⁾ Observe supply pressure restrictions.

²⁾ In on/off service, lowest temperature restricted to -20 °C.

³⁾ In on/off service, lowest temperature restricted to -40 °C.

⁴⁾ The pneumatic actuators do not pose any risk in the sense of the protection requirements described in DIN EN 60529. The IP rating depends on the connecting parts used on the pressurized side and the spring chamber side of the actuator. In this case, components (air vents as well as valves accessories, such as solenoid valves, positioners etc.) must be used that comply with the requirements. The maximum rating that can be achieved with the standard air vent is IP 54
 ► AB 07. Depending on the IP rating of the valve accessories, a maximum rating of IP 66 can be achieved for an actuator with air purging of the actuator spring chamber.

3 Safety-related functions

Emergency venting

The signal pressure creates a force at the diaphragm surface, which is opposed by the springs in the actuator. Depending on which direction the signal pressure is applied, the actuator stem retract or extends, opening or closing a globe valve. The fail-safe action is triggered when no signal pressure is applied to the actuator.

Fail-safe action

The actuator is vented. As soon as the actuator is vented (signal pressure = atmospheric pressure), the spring forces cause the actuator stem to move to the fail-safe position.

Depending on how the springs are arranged in the valve, the actuator's direction of action is either "actuator stem extends" or "actuator stem retracts".

Protection against unauthorized changes to the configuration

The actuator's direction of action can be reversed. However, this is not possible while the process is running.

4 Mounting, connection and start-up

Refer to Mounting and Operating Instructions ► EB 8310-X for details on how to mount, perform the pneumatic connections as well as start up the pneumatic actuator.

5 Required conditions

WARNING

Risk of malfunction due to incorrect selection or wrong installation and operating conditions.

→ Only use actuators in safety-instrumented systems if the necessary conditions in the plant are fulfilled.

Tip

We recommend checking the necessary conditions using a checklist. Examples of such checklists are included in VDI 2780-5 and the SAMSON brochure WA 236 (Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves).

Selection

- The suitability of the entire control valve assembly (valve, actuator, valve accessories) for the intended use has been checked.
- The thrust is sufficiently large to keep the prescribed actuating time and to move the valve to the end position in the event of emergency despite the prevailing pressure.
- The actuator is suitable for the ambient temperature (see Table 1, Table 2 and Table 3).
- The temperature limits are observed.
- The actuator does not have a travel stop or handwheel.

Mechanical and pneumatic installation

- The actuator is mounted properly as described in the mounting and operating instructions and connected to the air supply.
- The actuator is configured with the correct direction of action (stem extends or retracts).
- The pneumatic air supply meets the instrument air specifications.

Particle size and quantity	Oil content	Pressure dew point
Class 4	Class 3	Class 3
$\leq 5 \mu\text{m}$ and $1000/\text{m}^3$	$\leq 1 \text{ mg}/\text{m}^3$	$-20 \text{ }^\circ\text{C}$ or at least 10 K below the lowest ambient temperature to be expected

- The supply air line and vent plug are designed in such a way that the functioning of the control valve is ensured. The minimum cross section of the supply air line is observed. The vent plug is not sealed.
- The supply pressure does not exceed the maximum limit. The supply pressure restrictions are observed.
- The tightening torques are observed.

Operation

- The actuator stem is not blocked.
- The medium flow through the valve is not blocked.
- The actuator is only used in operating conditions that meet the specifications used for sizing at the ordering stage.

Maintenance

- Maintenance is only performed by fully trained, qualified operating personnel.
- Only original parts are used for spare parts.
- Service work is performed as described in the section on servicing or maintenance in the associated actuator documentation.



Contact SAMSON's After-sales Service Department concerning any work not described in the section on servicing or maintenance in the associated actuator documentation.

6 Proof testing

The proof test interval and the extent of testing lie within the operator's responsibility. The operator must draw up a test plan, in which the proof tests and the interval between them are specified. We recommend summarizing the requirements of the proof test in a checklist.

WARNING

Risk of dangerous failure due to malfunction in the event of emergency (actuator is not vented or the valve does not move to the fail-safe position).

→ Only use devices in safety-instrumented systems that have passed the proof test according to the test plan drawn up by the operator.

NOTICE

Malfunction due to a non-observance of the required inspection requirements.

To test the fail-safe action properly, the following requirements must be met:

- The actuator is mounted properly on the valve.
 - The control valve is installed properly into the plant.
-

Regularly check the safety-instrumented function of the entire SIS loop. The test intervals are determined, for example on calculating each single SIS loop in a plant (PFD_{avg}).

Tip

We recommend performing the proof tests based on a checklist. An example of such a checklist is included in the SAMSON brochure WA 236 (Functional safety of globe valves, rotary plug valves, ball valves and butterfly valves).

Visual inspection to avoid systematic failure

To avoid systematic failure, inspect the actuator regularly. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

- Dirt blocking the pneumatic connections
 - Actuator stem blocked
 - Corrosion (destruction primarily of metals due to chemical and physical processes)
-

- Material fatigue
- Aging (damage caused to organic materials, e.g. plastics or elastomers, by exposure to light and heat)
- Chemical attack (organic materials, e.g. plastics or elastomer, which swell, leach out or decompose due to exposure to chemicals)

⚠ NOTICE

Risk of malfunction due to the use of unauthorized parts.

➔ *Only use original parts to replace worn parts.*

Function testing

Regularly check the safety function according to the test plan drawn up by the operator.

i Note

Record any faults in the actuator and inform SAMSON of them in writing.

Emergency venting

1. Apply supply air within the permissible range to the actuator which allows the valve to move to the maximum travel.
 2. Adjust the supply pressure so that the valve moves to approx. 50 % of its travel.
 3. Shut off supply pressure. This must cause the valve to move to its fail-safe position.
 4. Check whether the actuator is fully vented within the demanded time.
-

💡 Tip

Connect a pressure gauge to check that the actuator has completely vented.

7 Repairs

Only perform the work on the pneumatic actuator described in ► EB 8310-X.

! NOTICE

Safety-instrumented function impaired due to incorrect repair.

→ *Only allow trained staff to perform service and repair work.*

HERSTELLERERKLÄRUNG

Für folgende Produkte

Pneumatische Antriebe Typen 3271 und 3277 mit Antriebsfläche [cm²]: 120, 175v2, 240, 350, 350v2, 700, 355v2, 750v2, 1000, 1400-120, 2800 und 2x2800

Hiermit wird bestätigt, dass die o. g. Geräte für die Verwendung in sicherheitsgerichteten Systemen nach IEC 61508 und IEC 61511 einsetzbar sind.

Die Geräte sind geeignet für den Einsatz in sicherheitsgerichteten Anwendungen bis SIL 2 (einzelnes Gerät) und SIL 3 (redundante Verschaltung) gemäß IEC 61508 (Systematische Eignung SC 3).

Der Nachweis erfolgte auf der Basis der Betriebsbewährtheit kombiniert mit einer FMEA.

Sicherheitstechnische Kenndaten

$\lambda_{safe, undetected}$	301 FIT
$\lambda_{dangerous, undetected}$	19,2 FIT
$\lambda_{dangerous, detected}$	0 FIT
PFD _{avg} bei jährlicher Prüfung	$8,42 \cdot 10^{-5}$
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	0
Gerätetyp	A
SFF (Safe Failure Fraction)	94 %
MTBF _{gesamt}	356 Jahre
MTBF _{dangerous, undetected}	5940 Jahre

1 FIT = 1 Ausfall pro 10⁹ Stunden

Nutzbare Lebensdauer

Nach IEC 61508-2 Abschnitt 7.4.9.5 können acht bis zwölf Jahre angenommen oder ein Wert benutzt werden, der sich durch frühere Verwendung (Betriebsbewährung) des Anwenders ergibt.

Bestimmungsgemäße Verwendung

- Bedienungsanleitung, Sicherheitshandbuch
- Anforderung an Instrumentenluft-Qualität

MANUFACTURER'S DECLARATION

For the following products

Types 3271 and 3277 Pneumatic Actuators with actuator areas [cm²]: 120, 175v2, 240, 350, 350v2, 700, 355v2, 750v2, 1000, 1400-120, 2800, and 2x2800

We hereby certify that the above mentioned devices can be used in safety-instrumented systems according to IEC 61508 and IEC 61511.

The devices are suitable for use in safety-instrumented systems up to SIL 2 (single device) and SIL 3 (redundant configuration) according to IEC 61508 (Systematic Capability SC 3).

The evidence is based on prior use combined with an FMEA.

Safety-related data

$\lambda_{safe, undetected}$	301 FIT
$\lambda_{dangerous, undetected}$	19.2 FIT
$\lambda_{dangerous, detected}$	0 FIT
PFD _{avg} with annual test	$8,42 \cdot 10^{-5}$
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	0
Device type	A
Safe failure fraction (SFF)	94 %
MTBF _{total}	356 years
MTBF _{dangerous, undetected}	5940 years

1 FIT = 1 failure per 10⁹ hours

Useful lifetime

According to IEC 61508-2, section 7.4.9.5, a useful lifetime of eight to twelve years can be assumed. Other values can be used based on the user's previous experience (prior use).

Intended use

- Operating instructions, safety manual
- Quality requirements for instrument air



Sicherheitstechnische Annahmen

Im Störfall wird der Antrieb entlüftet, dadurch fährt das Ventil in die Sicherheitslage.

Hinweis

Durch Einsatz eines Stellungsreglers kann eine umfangreiche Diagnose auch im laufenden Betrieb durchgeführt werden. Damit kann sich je nach Einsatzfall ein Diagnosegrad (diagnostic coverage factor) für gefährliche Fehler von $\geq 70\%$ ergeben.

Voraussetzungen

Die Reparaturzeit ist klein gegenüber der mittleren Anforderungsrate. Durchschnittliche Beanspruchung in industrieller Umgebung durch Medien und Umgebungsbedingungen. Der Anwender ist für bestimmungsgemäßen Gebrauch verantwortlich.

SAMSON AG


 i.V. Dr. Michael Heß
 Zentralabteilungsleiter
 Product Management and Technical Sales

Director
 Product Management and Technical Sales

Safety-related assumptions

In case of failure, the actuator is vented, causing the valve to move to its fail-safe position.

Note

A positioner can be used to perform extensive diagnostics while the process is running. Depending on the application, this may result in a diagnostic coverage for dangerous failures of 70 % or higher.

Requirements

Short mean time to repair compared to the average rate of demand. Normal exposure to industrial environment and fluids. The user is responsible for ensuring that the device is used as intended.

SAMSON AG


 i.V. Dirk Hoffmann
 Zentralabteilungsleiter
 Entwicklungsorganisation

Director
 R&D Organization

SH 8310 EN



SAMSON AKTIENGESELLSCHAFT
Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
samson@samsongroup.com · www.samsongroup.com