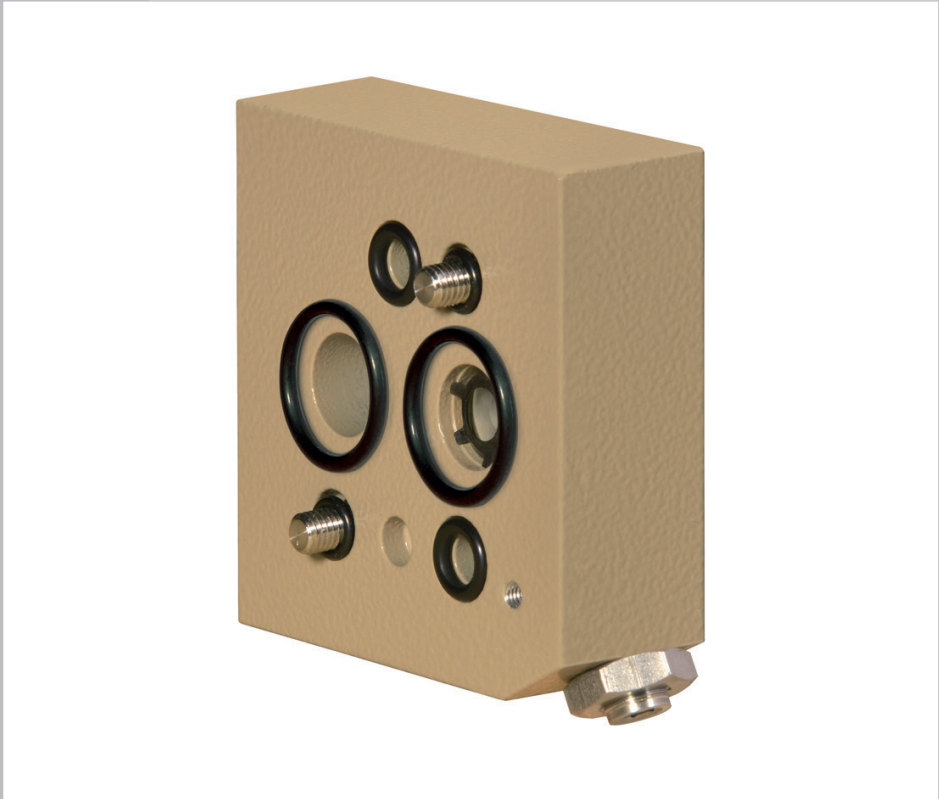


Restrictor Plate



With supply air or exhaust air restrictors to adjust the transit time of pneumatic actuators in safety-instrumented systems according to IEC 61508/IEC 61511



Safety Manual

SH 3967-2 EN

Edition November 2014

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 safety manual

This Safety Manual SH 3967-2 EN contains information which is relevant for the use of the restrictor plate in safety-instrumented systems according to IEC 61508 and IEC 61511. It is intended for staff who install, connect, start up and service the device.



NOTICE

*The safety manual does **not** replace the Mounting and Operating Instructions EB 3967-1 EN supplied with the Type 3967 Solenoid Valve. The instructions on mounting, electric and pneumatic connection, start-up and operation given in these mounting and operating instructions, particularly the safety instructions and warnings, must be strictly observed.*

Referenced documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the Type 3967 Solenoid Valve. You can download these documents from the SAMSOMATIC website (documents marked by an asterisk (*) are supplied with the device in printed form).

Type 3967 Solenoid Valve

- ▶ T 3967 EN: Data sheet
- ▶ EB 3967-1 EN*: Mounting and operating instructions



Note:

In addition to this safety manual, observe the mounting and operating instructions for the pneumatic actuator, valve and other valve accessories. Only use the restrictor plate in combination with components supplied by the SAMSON GROUP.

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1 Scope

General

The restrictor plate is used in combination with a Type 3967 Solenoid Valve to adjust the transit times of pneumatic actuators. It is suitable for attachment to rotary or linear actuators with spring-return mechanism. The safety function of the plate is the emergency venting on demand.

Use in safety-instrumented systems acc. to IEC 61508 and IEC 61511

The restrictor plate is certified with a manufacturer's declaration for the use in safety-instrumented systems according to IEC 61508 and IEC 61511 (see page 13).

Versions and ordering data

The restrictor plate is fitted with either a supply air or exhaust air restrictor and is available in various materials (see table).

The configuration ID and device index are specified on the nameplate.

Versions and ordering data	
Restrictor plate	Order no.
With supply air restrictor, made of AlMgSiPb, powder coated, gray beige RAL 1019, SIL	1402-0139
With supply air restrictor, made of stainless steel 1.4404, SIL	1402-0140
With exhaust air restrictor, made of AlMgSiPb, powder coated, gray beige RAL 1019, SIL	1402-0141
With exhaust air restrictor, made of stainless steel 1.4404, SIL	1402-0142

Attachment to rotary or linear actuators

The restrictor plate can be mounted onto rotary actuators with a NAMUR interface according to VDI/VDE 3845, onto an adapter plate for linear actuators with NAMUR rib according to IEC 60534-6-1 or onto a connection block for the SAMSON Type 3277 Pneumatic Actuator (see table).

Accessories for attachment to linear actuators	
Adapter plate for linear actuators with NAMUR rib according to IEC 60531-6-1	Order no.
Made of AlMgSiPb, powder coated, gray beige RAL 1019, G ¼ connection	1400-9598
Made of AlMgSiPb, powder coated, gray beige RAL 1019, ¼ NPT connection	1400-9599
Made of stainless steel 1.4404, G ¼ connection	1400-9600
Made of stainless steel 1.4404, ¼ NPT connection	1400-9601
Connection block for SAMSON Type 3277 Pneumatic Actuator	Order no.
G ¼ connection	1400-8817
¼ NPT connection	1400-8818

2 Technical data

Technical data	
Version	Restriction/check valve
Restriction function	Supply air or exhaust air
Safety function	SIL ¹⁾
Material	Plate: AlMgSiPb, powder coated, gray beige RAL 1019, or stainless steel 1.4404 Gaskets: Nitrile butadiene rubber, silicone rubber External parts: Stainless steel 1.4305 and zinc-plated spring steel
K_{VS} ²⁾	0.01 to 0.28, adjustable
Operating medium	Instrument air, free from corrosive substances, or neutral gases
Compressed air quality according to ISO 8573-1	Max. particle size and density: Class 4 · Oil content: Class 3 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected
Mounting position	Any desired position
Operating pressure	Max. 10 bar
Pneumatic connection	NAMUR interface 1/4" according to VDI/VDE 3845
Ambient temperature	-45 to +80 °C
Weight	0.190 kg

¹⁾ SIL according to IEC 61508 (see Manufacturer's Declaration HE-1296 on page 13)

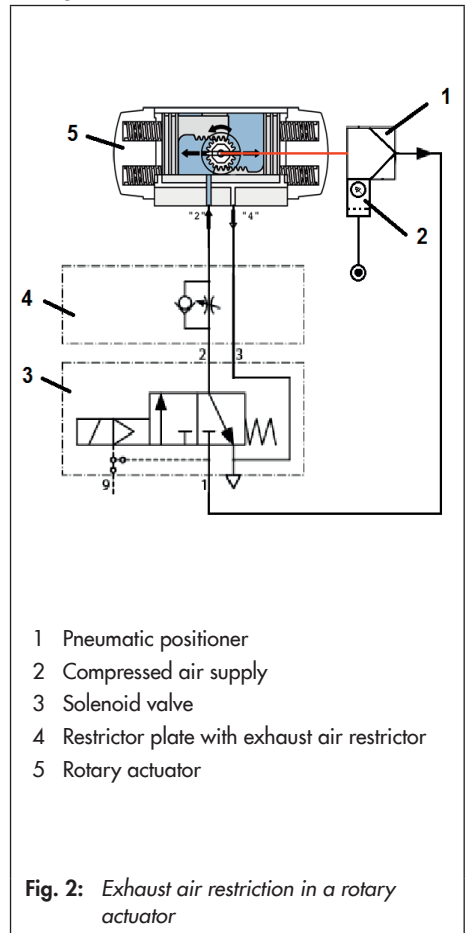
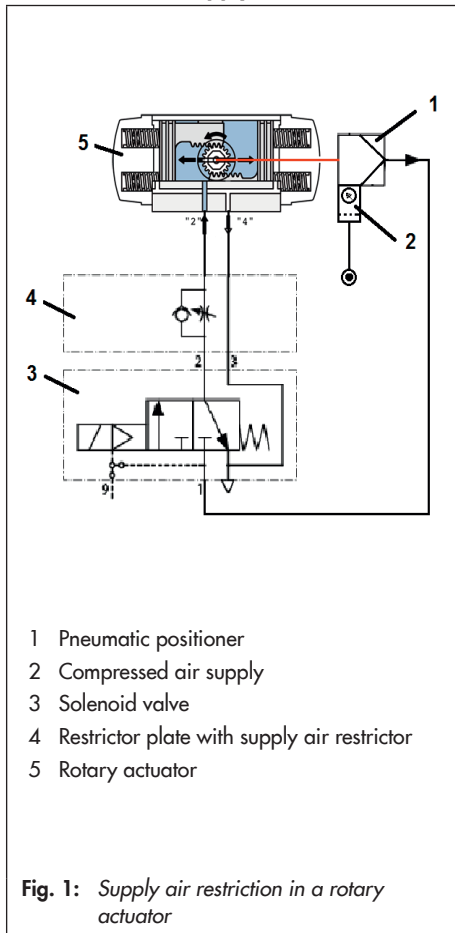
²⁾ The air flow rate when $p_1 = 2.4$ bar and $p_2 = 1.0$ is calculated using the following formula:
 $Q = K_{VS} \times 36.22$ in m^3/h .

3 Functions

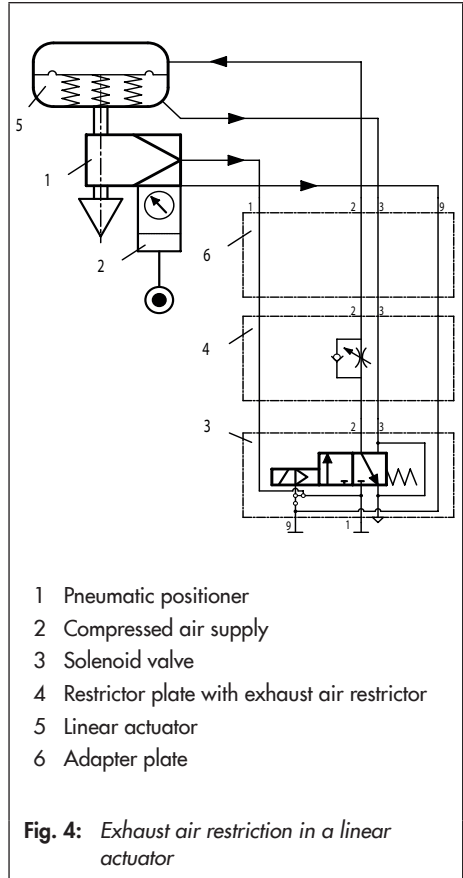
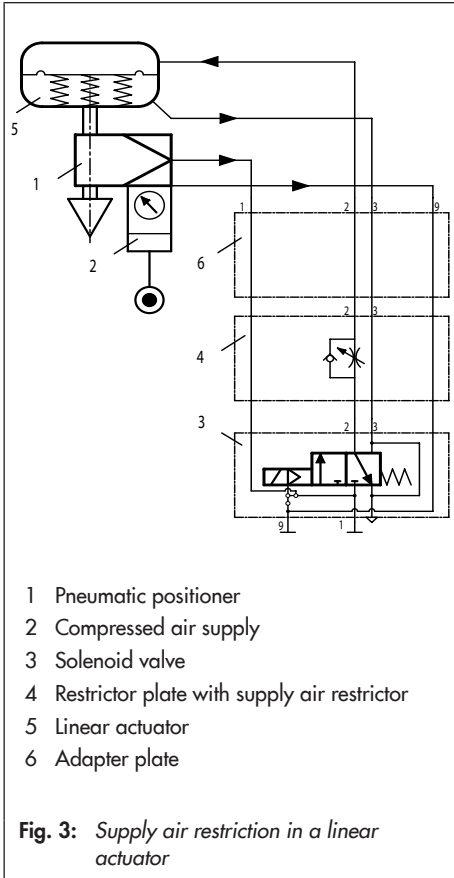
Restriction function

The restrictor plate consists of a manually adjustable supply air or exhaust air restrictor and a check valve connected in parallel. Depending on which restrictor version is used, either the supply air or exhaust air of the actuator is restricted (see Fig. 1 on page 7 to Fig. 4 on page 8).

Restriction of the supply air or exhaust air in a rotary actuator



Restriction of the supply air or exhaust air in a linear actuator



Safety function

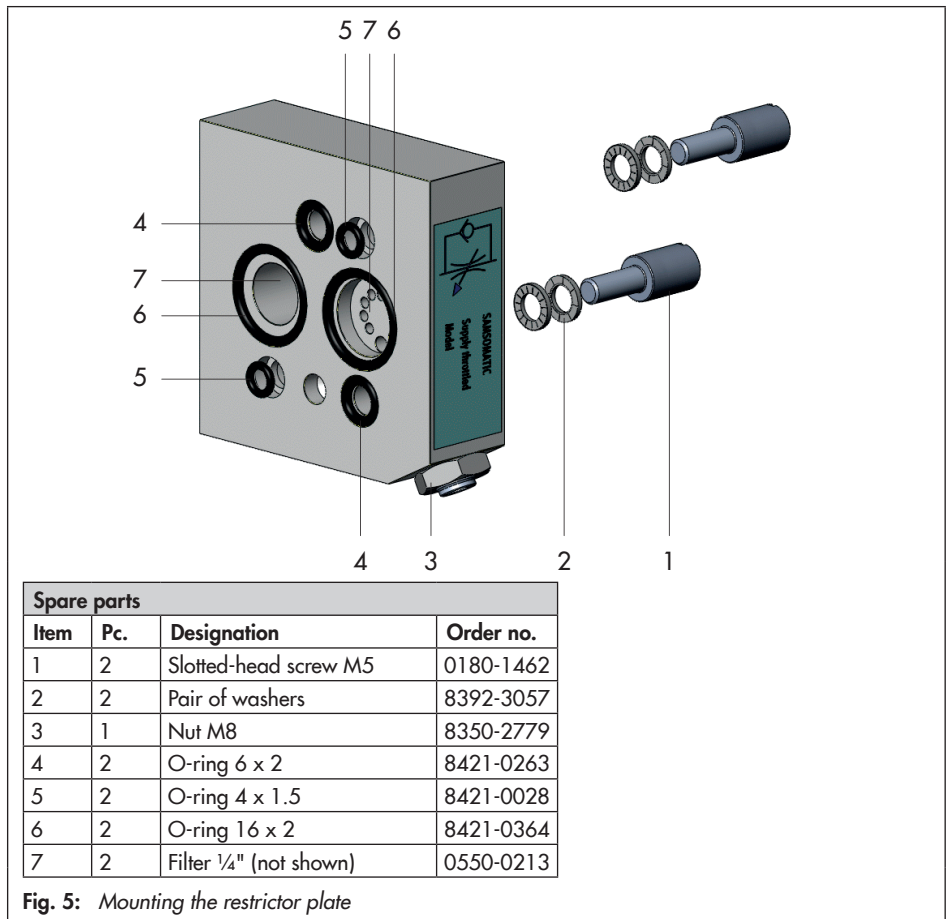
The restrictor plate is designed to ensure the emergency venting of the actuator on demand (the construction inhibits the blocking of the supply air in the actuator).

The check valve connected in parallel guarantees the emergency venting in the restrictor plate with supply air restrictor. In the restrictor plate with exhaust air restrictor, the restrictor spindle guarantees a minimum air flow and, as a result, prevents blocking. This also applies when the restrictor spindle is fully retracted.

4 Installation

The restrictor plate can be mounted onto rotary actuators with a NAMUR interface according to VDI/VDE 3845, onto an adapter plate for linear actuators with NAMUR rib according to IEC 60534-6-1 or onto a connection block for the SAMSON Type 3277 Pneumatic Actuator.

The restrictor plate is fastened using two slotted-head screws (1) with washers (2). Each slotted-head screw (1) is secured by an O-ring (5) to prevent it from falling out. On mounting the restrictor plate, make sure the O-rings (4) and (6) are seated properly (see Fig. 5).



5 Required conditions



WARNING!

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

Do not use control valves in safety-instrumented systems unless the necessary conditions in the plant have been fulfilled. This also applies to the mounted restrictor plate.

Product selection

- The required transit times of the control valve are kept. The transit times to be implemented are determined by the process engineering requirements.
- The OPEN and CLOSED transit times can be manually adjusted at the supply air or exhaust air restrictor.

Mechanical and pneumatic installation

- The restrictor plate is attached properly (see section 4).
- The pneumatic air supply meets the instrument air specifications (see table).

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

- We recommend installing a supply pressure regulator/filter upstream of the actuator.
- The permissible operating pressure of max. 10 bar has been observed.



NOTICE

Risk of failure of the safety function due to contaminated compressed air (e.g. dirt particles from the actuator spring chamber).

We recommend installing filters into the threaded connections of the solenoid valve and actuator.

Operation

- The restrictor spindle on the restrictor plate is secured by a nut (3) (see section 4).

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 (valve does not move to the fail-safe position).

Only use devices in safety-instrumented systems that have passed the proof test.

Diagnostic option

Check the proper functioning by connecting a positioner with integrated EXPERTplus diagnostics (e.g. Type 3730-6).

Function test of the safety-instrumented system

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}).

Safety test of the emergency venting function

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

Perform the safety test as follows:

1. Move the valve clearly away from the fail-safe position (e.g. set point at 50 % in control valves or to the operating position of on/off valves).
2. De-energize (e.g. 0 mA signal) the input at the + and – terminals.
3. Check the effect:
 - Does the valve move to the fail-safe position within the required time?

Visual inspection to avoid systematic failure

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

- Corrosion (destruction, primarily of metals, due to chemical and physical processes)
- Aging (damage caused to organic materials, e.g. plastics or elastomer, 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 (see Fig. 5).*

7 Repairs

Except the replacement of the spare parts listed in Fig. 5, no repair work is permitted on the restrictor plate.

8 Appendix

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MESS- UND REGELTECHNIK

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■ Herstellererklärung

Für folgende Produkte

Drosselplatten gemäß Sicherheitshandbuch SH 3967-2

Hiermit wird bestätigt, dass die o. g. Drosselplatten gemäß IEC 61508 für den Einsatz in sicherheitsgerichteten Kreisen geeignet sind. Die Geräte haben eine HFT von 0 und können nach IEC 61511 bis SIL 2 (einzelnes Gerät, HFT = 0) und SIL 3 (redundante Verschaltung, HFT = 1) eingesetzt werden.

Sicherheitstechnische Kenndaten

$\lambda_{safe, undetected}$	$1,2 \cdot 10^{-7}$
$\lambda_{safe, detected}$	0
$\lambda_{dangerous, undetected}$	$4,0 \cdot 10^{-8}$
$\lambda_{dangerous, detected}$	0
PFD _{avg.} bei jährlicher Prüfung	$1,8 \cdot 10^{-4}$
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	0
Gerätetyp	A
SFF (Safe Failure Fraction)	75 %
MTBF _{gesamt}	713 Jahre
MTBF _{dangerous, undetected}	2850 Jahre

Bestimmungsgemäße Verwendung

- Sicherheitshandbuch
- Anforderungen an Instrumentenluftqualität (siehe Sicherheitshandbuch)

Sicherheitstechnische Annahmen

Die Drosselplatte ist Teil eines Aufbaus zum Entlüften eines pneumatischen Antriebs oder einer Vorrichtung. Es wird angenommen, dass der sichere Zustand durch Entlüften herbeigeführt wird.

■ Manufacturer's Declaration

For the following products

Restrictor plates according to Safety Manual SH 3967-2

We hereby certify that the restrictor plates mentioned above are suitable for use in safety-instrumented systems according to IEC 61508. The devices have an HFT of 0 and can be used up to SIL 2 (single device, HFT = 0) and SIL 3 (redundant configuration, HFT = 1) according to IEC 61511.

Safety-related data

$\lambda_{safe, undetected}$	$1,2 \cdot 10^{-7}$
$\lambda_{safe, detected}$	0
$\lambda_{dangerous, undetected}$	$4,0 \cdot 10^{-8}$
$\lambda_{dangerous, detected}$	0
PFD _{avg.} with annual test	$1,8 \cdot 10^{-4}$
HFT (Hardware Fault Tolerance)	0
DC (Diagnostic Coverage)	0
Device type	A
Safe failure fraction (SFF)	75 %
MTBF _{total}	713 years
MTBF _{dangerous, undetected}	2850 years

Intended use

- Safety manual
- Quality requirements for instrument air (refer to safety manual)

Safety-related assumptions

The restrictor plate is part of a construction to vent a pneumatic actuator. It is assumed that the safe state is reached by venting the actuator.

Manufacturer's Declaration	Changed on:	2014-01-31	2014-11-06	
V/HE-1296-1 DE-EN	Changed by:	SC/Bzr/V74/Tny	SC/Mis/V74/Tny	

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Hinweis

Die ordnungsgemäße Funktion des Entlüftungsstrangs kann durch Betätigung der Entlüftungsfunktion (z. B. durch Betätigung des Magnetventils) überprüft werden. Dabei sollte die Laufzeit gemessen werden. Auch ein nur teilweises Verfahren des angeschlossenen Antriebs (Teilhübstest) und entsprechende Bewertung der Laufzeit kann zur Überprüfung der Funktion herangezogen werden.

Voraussetzungen

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

Note

The proper functioning of the venting line can be verified by triggering the venting function (e.g. by energizing the solenoid valve). It is recommended to measure the actuator's transit time when doing so. The function can also be checked by performing a partial stroke test (moving the actuator through a part of its travel range) and assessing the transit time.

Requirements

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

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Manufacturer's Declaration V/HE-1296-1 DE-EN	Changed on:	2014-01-31	2014-11-06
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