

Type 3510 Micro-flow Valve

SAMSON



Mounting and Operating Instructions

SH 8091 EN

Edition August 2017

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 8091 contains information relevant for the use of the Type 3510 Micro-flow Valve 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 installation or start-up of the device.
Refer to the mounting and operating instructions on how to install and start-up the device.
Observe the warnings and safety instructions written in the mounting and operating instructions.*

Further documentation

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

Type 3510 Micro-flow Valve

- ▶ T 8091 Data sheet (DIN)
- ▶ T 8091-1 Data sheet (ANSI)
- ▶ EB 8091 Mounting and operating instructions (DIN)
- ▶ EB 8091-1 Mounting and operating instructions (ANSI)

i Note

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

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1 Field of application

General

The SAMSON Type 3510 Micro-flow Valve in combination with an actuator (e.g. Type 3271 or Type 3277 Pneumatic Actuator) is designed to regulate the flow rate, pressure or temperature of liquids, gases or vapors.

Use in safety-instrumented systems

The valve can be used in safety-instrumented systems according to IEC 61508 and IEC 61511. The valve 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 valve 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

Valve combined with actuators with travel stop and/or handwheel are **not** suitable for use in safety-instrumented systems. All other versions are suitable for use in safety-instrumented systems.

Mounting

The valve and actuator are normally delivered already assembled by SAMSON.

2 Technical data

Table 1: DIN version

Connection	Female thread	Welding ends	Flanges
Valve size	G 1/8 · G 1/4 · G 3/8 G 1/2 · G 3/4 1/8 NPT, 1/4 NPT, 3/8 NPT, 1/2 NPT, 3/4 NPT	DN 10 · DN 15 · DN 25	DN 10 · DN 15 · DN 25
Pressure rating	PN 40 to 400		
Seat-plug seal	Metal seal		
Characteristic	Equal percentage with $K_{VS} \geq 0.01$ · Linear · Quick opening		
Rangeability	50:1 · < 50:1 with $K_{VS} < 0.1$		
Temperature range ¹⁾	-10 to +220 °C · With insulating section: -196 to +450 °C		
Leakage class according to IEC 60534-4	Metal seal: IV · High-performance metal seal: V		
Compliance	ERC		

¹⁾ Higher temperatures on request

Table 2: ANSI version

Connection	Female thread	Welding ends	Flanges
Valve size	G 1/8 · G 1/4 · G 3/8 G 1/2 · G 3/4 1/8 NPT, 1/4 NPT, 3/8 NPT, 1/2 NPT, 3/4 NPT Rc 1/8 · Rc 1/4 · Rc 3/8 · Rc 1/2 · Rc 3/4	NPS 1/2 · NPS 1	NPS 1/2 · NPS 3/4 · NPS 1
Pressure rating	Class 150 to 2500		
Seat-plug seal	Metal seal		
Characteristic	Equal percentage with $C_v \geq 0.012$ · Linear · Quick opening		
Rangeability	50:1 · Lower than 50:1 with $C_v < 0.12$		
Temperature range ¹⁾	14 to 428 °F (–10 to +220 °C) · With insulating section: –325 to +824 °F (–196 to +450 °C)		
Leakage class according to ANSI/ FCI 70-2	Metal seal: IV · High-performance metal seal: V		
Compliance	ERC		

¹⁾ Higher temperatures on request

3 Safety-related functions

Safety-related fail-safe action

The valve, in combination with a pneumatic actuator, controls the process medium flowing through it. When the signal pressure acting on the actuator is changed, the springs in the actuator move the actuator stem downward or upward to close or open the valve. The fail-safe action is triggered when no signal pressure is applied to the actuator.

Fail-safe action

The signal pressure is normally applied to the actuator. The actuator is vented upon demand of the safety-instrumented function. 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. The valve is completely open or completely closed.

Depending on the actuator's direction of action (see the associated actuator documentation), the valve has one of the following fail-safe positions:

- "Actuator stem extends" fail-safe action: in the event of emergency, the springs move the actuator stem downward and close the valve.
- "Actuator stem retracts" fail-safe action: in the event of emergency, the springs move the actuator stem upward and open the valve.

Protection against unauthorized changes to the configuration

The valve's fail-safe position depends on the mounted actuator's direction of action. The actuator's direction of action can be reversed. However, this is not possible while the process is running.

4 Installation and start-up

The valve is delivered ready to install and can be installed into the pipeline without the need for any additional installation work. Refer to the valve documentation on how to install and start-up the valve.

Tip

We recommend checking the installation and start-up 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).

5 Required conditions

WARNING

Risk of malfunction due to incorrect selection or wrong installation and operating conditions. Only use valves in safety-instrumented systems after the necessary conditions in the plant have been 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 (pressure, temperature) has been checked.
- ➔ The valve materials are suitable for the process medium.
- ➔ The actuator is correctly sized based on the required transit time and thrust.

Mechanical and pneumatic installation

- ➔ The valve is installed properly into the pipeline as described in the mounting and operating instructions and the actuator mounted on it. Valve accessories are mounted correctly.
- ➔ The prescribed direction of flow is observed. The arrow on the valve indicates the direction of flow.
- ➔ The control valve is configured with the correct fail-safe position (stem extends or retracts).
- ➔ The tightening torques (e.g. for the flanged joints) are observed.
- ➔ A filter must be installed when the process medium contains solids which could block the valve.

WARNING

The flow of the process medium is blocked by the filter for a valve with "actuator stem retracts" fail-safe action.

Valves with "actuator stem retracts" fail-safe action must not be fitted with a filter.

Operation

- The plug stem is not blocked.
- The medium flow through the valve is not blocked.
- The valve is only used in applications 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.
- Maintenance is performed as described in the section on servicing or maintenance in the associated valve documentation.



Tip

Contact SAMSON's After-sales Service department concerning any work not described in the section on servicing or maintenance in the associated valve 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 (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:

- Valve and actuator are assembled together properly.*
 - 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 valve regularly. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

- Blockage of plug stem
- Corrosion (destruction primarily of metals due to chemical and physical processes)
- Material fatigue
- Wear induced by the process medium
- Abrasion (material removed by solids contained in the process medium)
- Medium deposits
- 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 valve and inform SAMSON of them in writing.

Safety-related fail-safe action

1. Supply the actuator with the signal pressure to allow the valve to move to the end position (completely open or closed).
2. Disconnect the signal pressure. This must cause the valve to move to its fail-safe position.
3. Check whether the valve reaches the end position within the required time.
4. Check whether the maximum permissible leakage is observed.

Safety-instrumented function of valve accessories

- Check the safety-instrumented function of valve accessories. Refer to the associated safety manuals.

7 Repairs

Only perform the work on the valve described in the valve documentation.

ⓘ NOTICE

Fail-safe action impaired due to incorrect repair.

Service and repair work must only be performed by trained staff.

HERSTELLERERKLÄRUNG

Für folgende Produkte

Mikroventil Typ 3510

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

Das Gerät ist geeignet für den Einsatz in sicherheitsgerichteten Anwendungen bis SIL 2 (einzelnes Gerät) und SIL 3 (redundante Verschaltung) gemäß IEC 61508.

Der Nachweis erfolgte auf der Basis der Betriebsbewährtheit (proven in use) kombiniert mit einer FMEA.

Sicherheitstechnische Kenndaten

$\lambda_{safe, undetected}$	2790	FIT
$\lambda_{safe, detected}$	0	FIT
$\lambda_{dangerous, undetected}$	178	FIT
$\lambda_{dangerous, detected}$	0	FIT
PFD _{avg.} bei jährlicher Prüfung	$7,81 \cdot 10^{-4}$	
HFT (Hardware Fault Tolerance)	0	
DC (Diagnostic Coverage)	0	
Gerätetyp	A	
SFF (Safe Failure Fraction)	94 %	
MTBF _{gesamt}	41 Jahre	
MTBF _{dangerous, undetected}	640 Jahre	

1 FIT = 1 Ausfall pro 10^9 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 Betriebsbewährung des Anwenders ergibt.

Bestimmungsgemäße Verwendung

- Bedienungsanleitung
- Anforderung an Instrumentenluft-Qualität (Sicherheitshandbuch, soweit vorhanden).

MANUFACTURER'S DECLARATION

For the following products

Type 3510 Micro-flow Valve

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

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

The evidence is based on prior use (proven in use) combined with an FMEA.

Safety-related data

$\lambda_{safe, undetected}$	2790	FIT
$\lambda_{safe, detected}$	0	FIT
$\lambda_{dangerous, undetected}$	178	FIT
$\lambda_{dangerous, detected}$	0	FIT
PFD _{avg.} with annual test	$7,81 \cdot 10^{-4}$	
HFT (Hardware Fault Tolerance)	0	
DC (Diagnostic Coverage)	0	
Device type	A	
Safe failure fraction (SFF)	94 %	
MTBF _{total}	41 years	
MTBF _{dangerous, undetected}	640 years	

1 FIT = 1 failure per 10^9 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/proven-in-use).

Intended use

- Operating instructions
- Quality requirements for instrument air (safety manual if available)



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

A blue ink signature of Michael Kiener, written over a horizontal line.

ppa. Michael Kiener
Zentralabteilungsleiter
Verkauf International
Head of Central Department
International 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.

A blue ink signature of Dirk Hoffmann, written over a horizontal line.

i.V. Dirk Hoffmann
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SH 8091 EN

2017-12-06 · English