

SH 8091 EN

Translation of original instructions



Type 3510 Micro-flow Valve

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

i Note

Additional information

💡 Tip

Recommended action

Purpose of this manual

The Safety Manual SH 8091 EN contains information relevant to the use of the device listed below in safety-instrumented systems according to IEC 61508/IEC 61511. The safety manual is intended for planners, constructors and operators of safety-instrumented systems.

Device: **Micro-flow valve Type 3510**

ⓘ 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.*
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Further documentation

The documents listed below contain descriptions of the device. Operating personnel must read and understand the referenced mounting and operating instructions before operating or working on the device (e.g. service and repair work).

You can download these documents from

▶ www.samsongroup.com > DOWNLOADS > Documentation.

Type 3510 Micro-flow valve

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

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

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1 Scope

1.1 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. The micro-flow valve is suitable for controlling low flow rates, e.g. in pilot plants and technical research facilities.

1.2 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.

i Note

The architecture and the interval between proof tests must be considered in order to achieve the safety integrity level.

💡 Tip

The diagnostic coverage can be increased and, as a result, the probability of failure on demand reduced by mounting a positioner with diagnostic capabilities on the control valve.

1.3 Versions and ordering data

Valves 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.

Stroking times

Control valves suitable for use in safety-instrumented systems are configured and sized by SAMSON based on the stroking time specifications submitted at the ordering stage. The valves are tested during final acceptance testing to verify that these stroking time specifications are met. The test results are documented. If no stroking times are specified at the ordering stage, SAMSON uses standard values depending on the valve nominal size for testing and documentation.

1.4 Attachment

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

2 Technical data

Table 1: Technical data for Type 3510 · DIN version

| Connection | Female thread | Welding ends | Flanges |
|---|---|-----------------------|-----------------------|
| Nominal 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 · On/off | | |
| 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 DIN EN 60534-4 | Metal seal: IV · High-performance metal seal: V | | |
| Conformity | CE | | |

¹⁾ Higher temperatures on request

Table 2: Technical data for Type 3510 · ANSI version

| Connection | Female thread | Welding ends | Flanges |
|--|---|-----------------|---------------------------|
| Nominal 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 · On/off | | |
| Rangeability | 50:1 · <50:1 with $C_v < 0.12$ | | |
| Temperature range ¹⁾ | 14 to 428 °F (-10 to +220 °C) · With insulating section: -325 to +842 °F (-196 to +450 °C) | | |
| Leakage class according to DIN EN 60534-4 or ANSI FCI 70-2 | Metal seal: IV · High-performance metal seal: V | | |
| Conformity | CE | | |

¹⁾ Higher temperatures on request

3 Safety-related functions

3.1 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.

3.2 Fail-safe action

The signal pressure is normally applied to the actuator. The actuator is vented upon demand as part 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.

3.3 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.

- ⇒ SAMSON recommends installing the valve with the actuator upright and on top of the valve. If another mounting position is used that is less favorable, the plant operator must ensure that the functional safety is not impaired as a result. This can be achieved, for example, by changing the test plan accordingly or shortening the intervals between tests.
- ⇒ Tilting or tipping over of the valve is prevented.

 **Tip**

SAMSON recommends checking the installation and start-up based on a checklist. Examples of such checklists are included in VDI 2180-2 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 control valves in safety-instrumented systems if the necessary conditions in the plant are fulfilled.

💡 Tip

SAMSON recommends checking the necessary conditions based on a checklist. Examples of such checklists are included in VDI 2180-2 and the SAMSON brochure WA 236 (Functional Safety of Globe Valves, Rotary Plug Valves, Ball Valves and Butterfly Valves).

5.1 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.

5.2 Mechanical and pneumatic installation

- ⇒ The valve is installed properly into the pipeline as described in the mounting and operating instructions and the actuator is 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 strainer must be installed when the process medium contains solids, which could block the valve.

⚠ WARNING

The strainer may block the medium flow in a control valve assembly with "actuator stem retracts" fail-safe action.

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

5.3 Operation

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

5.4 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 'Servicing' chapter of the associated valve documentation.

💡 Tip

Contact SAMSON's After-sales Service concerning any work not described in the 'Servicing' chapter 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. The user is responsible for analyzing the test results and taking appropriate action.

NOTICE

Risk of dangerous failure due to malfunction in the event of emergency (actuator is not vented and/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.

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}).

To test the safety-instrumented function properly, the following requirements must be met:

- Valve and actuator are assembled together properly.
- The control valve is installed properly into the plant.

Tip

SAMSON recommends performing the proof tests based on a checklist. Examples of such checklists are included in the SAMSON brochure WA 236 (Functional Safety of Globe Valves, Rotary Plug Valves, Ball Valves and Butterfly Valves).

6.1 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.

6.2 Function testing

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

Note

Record any positioner faults and send them to SAMSON at the following e-mail address: aftersaleservice@samsongroup.com

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.

6.3 Proof test coverage (PTC)

The proof test coverage (PTC) depends on the application in which the control valve is used and on the valve accessories mounted on the control valve.

⇒ Contact SAMSON for the proof test coverage (PTC).

Go to the SAMSON website (▶ www.samsongroup.com) to find your local SAMSON subsidiary.

7 Repairs

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

NOTICE

Safety-instrumented function will be impaired if repair work is performed incorrectly.

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

Mean time to repair

The mean time to repair depends on the repair work required. Contact SAMSON's After-sales Service concerning any repair work not described in the valve documentation. SAMSON's After-sales Service also provides information on the mean time required to repair for individual cases.

Safety-related data

8 Safety-related data

The Type 3510 Valve is suitable for use in safety-instrumented systems according to IEC 61508 and IEC 61511. It 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 proven-in-use data combined with an FMEA.

Safety-related data

| | |
|--|-----------------------|
| $\lambda_{\text{safe, undetected}}$ | 2790 FIT |
| $\lambda_{\text{safe, detected}}$ | 0 FIT |
| $\lambda_{\text{dangerous, undetected}}$ | 178 FIT |
| $\lambda_{\text{dangerous, detected}}$ | 0 FIT |
| PFD _{avg.} with annual test | 7.81×10^{-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 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 (proven in use).

Intended use

- See the mounting and operating instructions for the valve:
 - ▶ EB 8091 Mounting and operating instructions (DIN version)
 - ▶ EB 8091-1 Mounting and operating instructions (ANSI version)
- Quality requirements for instrument air: see mounting and operating instructions or operating manual for mounted valve accessories (e.g. positioner, solenoid valve)

Safety-related assumptions

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

Note

A positioner can be used to perform sophisticated diagnostics while the process is running. Depend-

ing on the application, this may result in a diagnostic coverage for dangerous failures of ≥ 70 %.

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.



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