



Uni-Geräte E. Mangelmann
Elektrotechnische Fabrik GmbH
Holtumsweg 13, 47652 Weeze, Germany



Safety Manual

Shut-off/blow-off and 3/2-way valves

Fittings

in safety-related systems

EN



+49 (0) 2837/9134-0



info@uni-geraete.com



www.uni-geraete.com



Safety Manual

Table of contents

1.0 General

- 1.1 Appliances in safety-related systems
- 1.2 Application area
- 1.3 Model series with functional safety
 - 1.3.1 Automatic shut-off valves
 - 1.3.2 Automatic blow-off valves
 - 1.3.3 3/2-way valves

2.0 Basics

- 2.1 Functional safety terms and abbreviations
- 2.2 Reference documents and standards

3.0 Responsibilities

- 3.1 Responsibility for safety
- 3.2 Responsibility of persons involved

4.0 Device requirements

- 4.1 Intended purpose of use
- 4.2 Functional safety
 - 4.2.1 Automatic shut-off valves
 - 4.2.2 Automatic blow-off valves
 - 4.2.3 3/2-way valves
- 4.3 SIL capability
- 4.4 Readiness for operation

5.0 Installation and commissioning

- 5.1 Installation
- 5.2 Commissioning

6.0 Operation and maintenance

- 6.1 Operation
- 6.2 Periodic testing
- 6.3 Test performance
- 6.4 Maintenance and repair





Safety Manual

1.0 General

This safety manual contains all of the requirements that are needed for handling and using the valves in safety-related systems in accordance with IEC 61508 / IEC 61511. The manual is intended for persons who are involved in the planning, installation and operation of the safety loop, and also for anyone requiring information about maintaining the Safety Instrumented Function (SIF).

Within the meaning of IEC 61508, valves, together with their actuators, are classified as "actuators" and are referred to here as "the appliance".

Installation and commissioning must be carried out in accordance with the operating instructions of the appliance.

All safety instructions and warnings in the operating instructions must be observed.

1.1 Appliances in safety-related systems

Appliances in safety-related systems fulfil their safety function by controlling the flow rate or direction of the medium. In the event of a hazard, these appliances perform their function and establish a safe condition. A distinction is made between these appliances in accordance with their function as follows:

Automatic shut-off valve:	safe shut-off / interrupt flow
Automatic blow-off valve:	safe blow-off / enable flow
3/2-way valve:	safe switching / change of direction

1.2 Application area

The automatic shut-off/blow-off valves and 3/2-way valves are equipped with an electro-pneumatic or electro-magnetic actuator, and are used to control the flow rate and change the direction of liquid, gaseous, and vaporous media. These appliances can be used in safety-related systems in accordance with IEC 61508 and IEC 61511, up to SIL 2 or SIL 3 with a redundant configuration/arrangement depending on the design.

"Use for intended purpose" plays an important part in SIL systems. A SIL rating only applies under the conditions for which the appliance or safety function was developed, tested and documented.

1.3 Model series with functional safety

The functional safety of automated industrial valves and actuators has been assessed in accordance with DIN EN 17955. The model series with functional safety are classified in accordance with their function and the design of the actuator as follows. The safety manual and the respective operating instructions must be observed. These documents are supplied with the product, and can be viewed or downloaded from the company website.

1.3.1 Automatic shut-off valve

Automatic shut-off valve with electro-magnetic actuator:

Model series	Model series	Model series
EV	EVF	EVSA
EV.W	EKVS	EVC
EVA	EVS	VXI / VX*
EVA.W	EVS.Ü	VS / DVS*

* The model series can be used as individual appliances with a redundant design up to SIL 3.

Automatic shut-off valve with electro-pneumatic actuator:

Model series	Model series	Model series
EPV	EPVA.M.Z	EPVF
EPVA	AEPV	PXI / PX*

* The model series can be used as individual appliances with a redundant design up to SIL 3.





Safety Manual

1.3.2 Automatic blow-off valves

Automatic blow-off valve with electro-magnetic actuator:

Model series	Model series	Model series
EV.R	EVSO	EVC.R
EVF.R	EVS.R	
EVO	EKVS.R	

Automatic blow-off valve with electro-pneumatic actuator:

Model series	Model series	Model series
EPV.R	EPVO	PSO /DPSO
EPVF.R		

1.3.3 3/2-way valve

3/2-way valve with electro-magnetic actuator:

Model series	Model series	Model series
EVD	EVSDu	EVFDu
EVDF	EVSADu	

2.0 Basics

2.1 Functional safety terms and abbreviations

The main functional safety terms and abbreviations are listed in the following table 1.

HFT	Hardware Fault Tolerance
PFD _{AVG}	Average probability of a dangerous failure upon request
λ	Error rate (safe or dangerous, detected or undetected)
SFF	Proportion of safe faults
SIL	Safety Integrity Level One of four levels of safety integrity, whereby SIL 4 is the highest safety integrity level and SIL 1 is the lowest.
SIF	Safety-related function

Table 1

2.2 Reference documents and standards

The operating instructions and data sheets of the respective model series.

The documentation provided by the manufacturer must be observed when using accessories and attachments.

DIN EN 61508 Parts 1-2 and 4-7 Functional safety of safety-related electrical / electronic / programmable electronic systems

DIN EN 17955 Industrial valves - Functional safety of safety-related automated valves

DIN EN ISO 13489-1, Functional safety of machines - Safety-related parts of controllers

DIN EN 13611 Safety and control devices for burners and appliances burning gaseous and/or liquid fuels

DIN EN 161 Automatic shut-off valves for gas burners and gas appliances

DIN EN 16678 Automatic shut-off valves for an operating pressure above 500 kPa up to and including 6300 kPa

DIN EN 16304 Automatic blow-off valves for gas burners and gas appliances

DIN EN ISO 23533-1 Safety, regulation and control devices for oil burners and oil-burning devices

DIN EN ISO 12944-2, Paints and varnishes - Corrosion protection of steel structures by protective paint systems

DIN EN 12266 Part 1, 2, Industrial valves - Testing of metallic valves

The versions of the standards contained within this manual relate to the point in time when it was produced.



Safety Manual

3.0 Responsibilities

3.1 Responsibility for the safety function

The responsibility for safety does not lie with individual persons or organizations alone, but is distributed across the entire safety lifecycle. As a rule, the overall responsibility for the safety of the system lies with the owner/operator.

3.2 Responsibility of persons involved

- **Manufacturers** are responsible for ensuring that their safety components or systems fulfil the specified SIL requirements.
This also includes safe construction and design of the appliances.
This includes the implementation of the requirements from the FMEDA analysis and the SIL classification.
Adherence to the quality standards during the manufacture and testing of the appliance before delivery.
Provision of the SIL classification and significant values to the system owner/operator and all of the required documents such as the safety manual, the operating instructions for the model series and, if necessary, additional documentation for the accessories and attachments of the respective manufacturers.
- **System owners/operators** have the responsibility for safe use, operation, maintenance and regular checking of the systems.
Adherence to the usage limits of the appliance as per the "Intended purpose of use".
Presentation of all required documents.
It must be ensured that only personnel who are familiar with all of the required documents, follow the instructions therein and know how to use fittings have access to the appliance.
The instructions contained within the documentation must be adhered to and observed.
The applicable regulations and guidelines must be complied with, particularly those regarding regular inspections and maintenance of the appliance in accordance with the safety manual and the operating instructions.
- **Planners and integrators** are responsible for the correct design, implementation and validation of the safety functions.
- **Testing and certification bodies** can assess the adherence to the SIL requirements, but do not have operative responsibility for safety.

4.0 Device requirements

4.1 Intended purpose of use

The respective operating instructions must be observed in order to ensure that the appliance is used for its intended purpose. These contain all of the relevant information regarding environmental conditions, functionality, handling, commissioning, operation, and maintenance, and also the operational limits of the appliance. It is therefore important to clarify with the manufacturer whether the appliance is suitable for its intended use, taking all parameters and materials that are used into consideration. It must be ensured that the appliance is integrated into a safety-related system only within its operational limits.



Note:

In addition to the documentation for the appliance, the technical documents for the actuator and the peripheral devices must also be observed.

4.2 Functional safety

The safety function and the required safety level are guaranteed, provided that the appliance is used for its intended purpose.

4.2.1 Automatic shut-off valves

Closing time:

If the power to the actuator is shut off or fails, the appliance must automatically close within one second.





Safety Manual

Tightness in the seat (internal tightness):

The tightness of the actuator must be ensured in the closed position. The space containing the medium between the inlet and outlet of the appliance is thereby tightly sealed, within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.

Tightness of the housing (external tightness):

The appliance must seal off the space containing the medium from the atmosphere within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.

Periodic inspections during operation:

The functional parts of the appliance are subject to wear. In order to maintain the functional safety of the appliance, periodic inspections of the functionality and tightness of the appliance must be performed in accordance with Para. 7.2.

4.2.2 Automatic blow-off valves

Opening time:

If the power to the actuator is shut off or fails, the appliance must automatically open within one second.

Tightness in the seat (internal tightness):

The tightness of the actuator must be ensured in the closed position. The space containing the medium between the inlet and outlet of the appliance is thereby tightly sealed, within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.

Tightness of the housing (external tightness):

The appliance must seal off the space containing the medium from the atmosphere within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.

Periodic inspections during operation:

The functional parts of the appliance are subject to wear. In order to maintain the functional safety of the appliance, periodic inspections of the functionality and tightness of the appliance must be performed in accordance with Para. 7.2.

4.2.3 3/2-way valves

The 3/2-way valves are automatic changeover valves. The appliance has a spring-assisted priority position.

Changeover time:

If the power to the actuator is shut off or fails, the appliance must automatically switch to the priority position within one second.

Tightness in the seat (internal tightness):

The tightness of the actuator must be ensured in the closed position. The space containing the medium between the inlet and outlet of the appliance is thereby tightly sealed, within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.





Safety Manual

Tightness of the housing (external tightness):

The appliance must seal off the space containing the medium from the atmosphere within the permissible leakage rate.

This applies to gaseous media in accordance with DIN EN 13611, para. 7.2 table 3.

Periodic inspections during operation:

The functional parts of the appliance are subject to wear. In order to maintain the functional safety of the appliance, periodic inspections of the functionality and tightness of the appliance must be performed in accordance with Para. 7.2.

4.3 SIL capability

The appliances have a hardware fault tolerance $HFT = 0$, and are suitable for use in a safety-related system in accordance with IEC 61508 up to SIL 2.

With a redundant design with a single appliance or a redundant arrangement of two appliances, the architecture achieves a hardware fault tolerance $HFT=1$. This version is suitable for use in a safety-related system in accordance with IEC 61508 up to SIL 3.

A redundant arrangement is established when two automatic shut-off valves are arranged one after the other in series or two automatic blow-off valves are arranged next to each other in parallel.

The achieved Safety Integrity Level (SIL) of the entire safety chain must be verified by the owner/operator by calculating the PFD_{AVG} value, taking the architecture, the test intervals and their effectiveness, the respective automatic diagnostic devices, the anticipated repair times and the specific failure rates of all devices integrated in the safety chain into consideration.

The SIL suitability of accessories and add-on components must be taken into consideration and evaluated by the owner/operator on the basis of the documentation provided by the respective manufacturer.

Specific details regarding SIL and the PFD_{AVG} values for the appliance concerned can be found in the provided SIL certificate 968/FSP 3196.00/26.

4.4 Readiness for operation

The respective different failure rates were determined by taking the Low Utilization Rate (LUR) and the High Utilization Rate (HUR) operating states and their associated causes of failure into consideration. The appliance is classified in accordance with IEC 61508 for use in Low Demand Mode (LDM) with an annual demand. To maintain operational safety, the manufacturer recommends testing the safety function once per month, or once per annum at the latest, taking the operating conditions into consideration.

5.0 Installation and commissioning

5.1 Installation

Before installation it must be ensured that the appliance is suitable for the requirements of the purpose of use, and also for the demands and the functional safety. A prerequisite for this is that the appliance is in a fault-free, new condition. The appliance must be accessible for inspection and maintenance purposes upon installation. Installation takes place in accordance with the operating instructions.

5.2 Commissioning

The appliance is commissioned in accordance with the operating instructions.





Safety Manual

6.0 Operation and maintenance

6.1 Operation

The appliance must be operated and maintained as described in the operating instructions.

6.2 Periodic testing

The interval of repeated testing and the scope of these tests are the responsibility of the owner/operator. The owner/operator must produce a test plan in which the repeated testing and the test intervals are defined. The owner/operator must document the results of the testing. All faults must be reported to the manufacturer so that its documentation can be validated with regard to operational safety.

6.3 Test performance

During the testing of the tightness of the housing (external tightness), the function and the tightness in the seat (internal tightness), the testing in accordance with DIN EN 12266 must be performed.

6.4 Maintenance and repair

The appliance must be maintained and operated as described in the operating instructions.

Maintenance of attached components

The maintenance of components such as the position indicator (limit switch) and control valves can be found in the documentation provided by the component manufacturer.



Note:

If a malfunction is detected in a component, it will need to be replaced.

Repair and replacement of components

The replacement of functional parts or seals after wear is described in the operating instructions.



Warning:

The SIL rating of the product can be invalidated if the repairs are not carried out using original spare parts from the manufacturer and/or by personnel who are not qualified.

6.5 Service life of the appliance

Details of the service life of the appliance can be found in the operating instructions.

