Documentation
Safety Manual

IMI Herion Valves:

Serie 2413309

Serie 24011xx

Serie 24010xx

Serie 97105xx

Serie 98015xx

Serie 98025xx

Serie 80400xx

C	11.02.2025	CZ010547	Important note added and address changed	acervinek	tsehon
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1 Introduction

This Safety Manual provides information necessary to design, install, verify and maintain a Safety Instrumented Function (SIF) utilizing IMI Herion Valves. This manual provides necessary requirements for meeting the IEC 61508 or IEC 61511 functional safety standards.

1.1 Terms and Abbreviations

Safety:
Freedom from unacceptable risk of harm.

Functional Safety:
The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system.

Basic Safety:
The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.

Safety Assessment:
The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems.

Safe State:
State where the solenoid valve is de-energized and the spring is extended.

Fail-Safe State:
Failure that causes the valve to go to the defined fail-safe state without a demand from the process.

Fail Dangerous:
Failure that does not respond to a demand from the process (i.e. being unable to go to the defined fail-safe state).

Fail Dangerous Undetected:
Failure that is dangerous and that is not being diagnosed by automatic stroke testing.

Fail Dangerous Detected:
Failure that is dangerous but is detected by automatic stroke testing.

Fail Annunciation Undetected:
Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic and is not detected by another diagnostic.

Fail Annunciation Detected:
Failure that does not cause a false trip or prevent the safety function but does cause loss of an automatic diagnostic or false diagnostic indication.

Fail No Effect:
Failure of a component that is part of the safety function but that has no effect on the safety function.

Low Demand mode:
Mode, where the frequency of demands for operation made on a safety-related system is no greater than twice the proof test frequency.

1.2 Akronyms

HFT:
Hardware fault tolerance.

MOC Management of Change:
These are specific procedures often done when performing any work activities in compliance with government regulatory authorities.

PFDavg:
Average Probability of Failure on Demand.

SFF Safe Failure Fraction:
The fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.

SIF Safety Instrumented Function:
A set of equipment intended to reduce the risk due to a specific hazard (a safety loop).

SIL Safety Integrity Level:
Discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.

SIS Safety Instrumented System:
Implementations of one or more components in a system specifically dedicated to the fail safe or maintain safe operation of the process in the event of a dangerous failure.

1.3 Product Support

Please refer to the local IMI Precision Engineering technical sales representative for support details.

1.4 Guidelines and Standards

For development, testing and certification the following guidelines and standards are taken as a basis:

DIN EN 61508 (IEC 61508):
Functional safety of electrical/electronic/programmable electronic safety-related systems

DIN EN 61511 (IEC 61511):
Functional safety - Safety instrumented systems for the process industry sector

VDI/VDE 2180:
Safeguarding of industrial process plants by means of process control engineering

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

DIN 3394-1:
Automatic control valves

Pressure Equipment Directive (PED)

EMC Directive

Low Voltage Directive

ATEX Directive

2 Designing a Safety Instrumented Function using a IMI Herion Valve

Although IMI can, and often does, provide general guidelines, it is obviously not possible to provide application specific data and warnings for all conceivable applications. The purchaser/end-user must therefore assume the ultimate responsibility for the proper selection, installation, operation and maintenance of the products.
Read the appropriate operating and maintenance instruction supplied with the product, or obtain a copy from the local IMI representative, before installing, operating or repairing any valve. The purchaser/end user should fully train its employees and/or contractors in the safe handling and use of IMI Herion products in connection with the purchaser's manufacturing processes.

2.1 Safety Function

When de-energized, the IMI Herion valve moves to its fail-safe position. A pneumatic actuator connected to valve port 2 will be exhausted.
IMI Herion valves are intended to be part of a final element subsystem as defined per IEC 61508 and the achieved SIL of the designed function must be verified by the designer.

Important:
Under no circumstances should the movement to its fail-safe position be blocked by mechanical equipment such as a locking-type manual override!

2.2 Environmental limits

The designer of a SIF must check that the product is rated for use within the expected environmental limits. Refer to the IMI Herion product datasheets or IMI technical support for environmental limits.

Table 1 – Basic technical features of valves

Series	Pressure	Temperature range [1, 2]	Product Datasheet
2413309	0…10 bar	-10°C …+60°C	N_en_5_4_375
24011xx	0…10 bar	-10°C …+60°C -25°C …+60°C -40°C …+60°C	N_en_5_4_306
24010xx	0…10 bar	-25°C …+60°C	N_en_5_4_309
98015xx	0…10 bar	-25°C …+60°C	N_en_5_4_369
98025xx	2…8 bar	-25°C …+60°C	N_en_5_4_370
97105xx	2,5…8 bar	-25°C …+65°C 0°C …+80°C -40°C…+40°C	N_en_5_4_285 N_en_5_4_520 N_en_5_4_530
80400xx	2…10 bar	-60°C …+80°C	N_en_5_4_389

2.3 Application limits

The materials of construction of an IMI Herion valve are specified in the appropriate product datasheet. It is especially important that the designer checks for material compatibility considering the on-site chemical contaminants and air supply conditions. If the valve is used outside of the stated operating parameters or with incompatible materials, the reliability data provided becomes invalid.

2.4 Design Verification

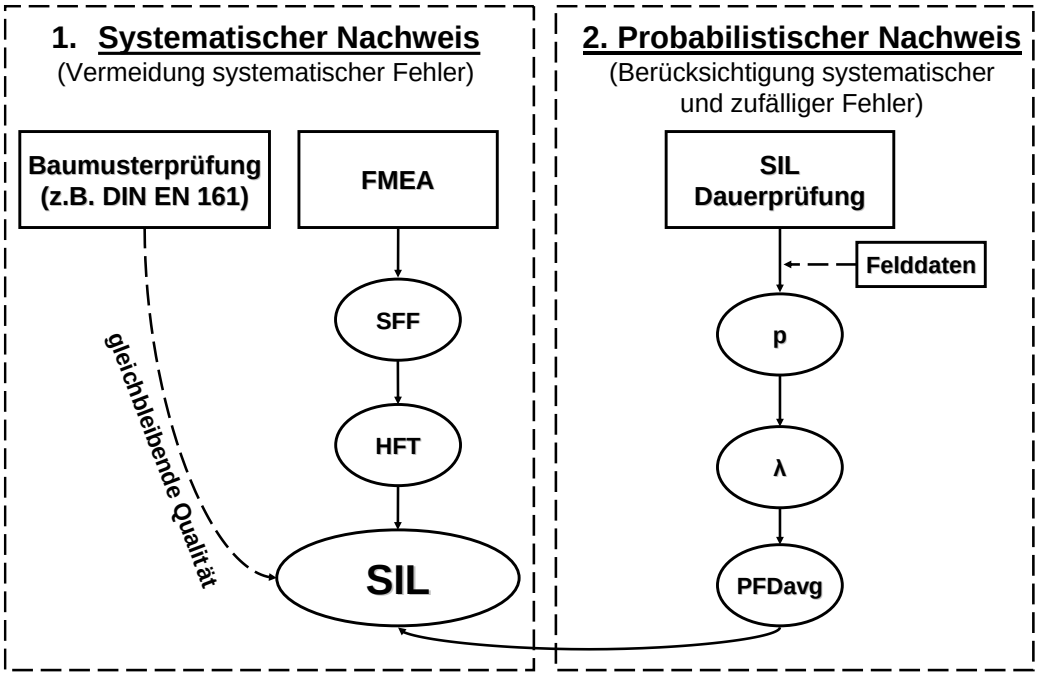
The achieved Safety Integrity Level (SIL) of an entire Safety Instrumented Function (SIF) design must be verified by the designer via a calculation of PFDavg considering architecture, proof test interval, proof test effectiveness, any automatic diagnostics, average repair time and the specific failure rates of all products included in the SIF. Each subsystem must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements.

[1] Please consider temperature range of respective solenoids (see datasheets).

The failure rate data is only valid for the useful lifetime of the valve. The failure rates will increase sometime after this time period.

2.5 SIL Capability

The procedure for IMI Herion valves to prove SIL Capability is shown in the diagram below. Systematic Integrity is proved by a standardised design process. The essential parts are the Type Examination and FMEA.
Random Integrity is proved by a SIL endurance test at worst-case conditions and confirmed with an analysis of field data. Hereby systematic failures were also considered.



The achieved failure rates enable use in safety-related systems up to SIL 3 according to IEC 61508.
Constraints regarding the necessary Hardware Fault Tolerance (HFT) from the relevant application standard (e.g. IEC 61511) must be considered.

When the final element assembly consists of many components (Ball Valve, actuator, etc.) the SIL must be verified for the entire assembly using failure rates from all components. This analysis must account for any hardware fault tolerance and architecture constraints.

Safety Parameters
For detailed failure rate information refer to the TÜV SIL Suitability Report for the IMI Herion valves.

2.6 General Requirements

All SIS components including the IMI Herion valve must be operational before process start-up.

Users shall verify that the IMI Herion valve is suitable for use in safety applications by confirming the IMI Herion valve's nameplate is properly marked. Any personnel performing maintenance, repairs and testing on the IMI Herion valve must be competent to do so.
Refer to the TÜV SIL Suitability Reports for information regarding the useful life of the IMI Herion valves.

2.7 Important Note

The IEC 61508 Safety Integrity Level (SIL) certification is ONLY valid for such combinations of valves and solenoids that are in a published list of SIL certificates released for appropriate valve series. An instruction manual intended for given valve series shall be followed in order to ensure proper safety function of resulting valve and solenoid assembly. Further, every valve on the list of given SIL certificates has the following mark on a product label: "IEC 61508 SIL". However, if these valves are combined with any solenoids that are NOT on the list of given SIL certificates, the SIL certificate is NOT valid for such combinations, even it is stated on the valve product label. Each SIL certificate together with the revision list can be found in IMI web site.

3 Installation and Commissioning

3.1 Installation

Read the appropriate IMI Herion valve operating and maintenance instruction, as supplied with the valve, before installing, operating or repairing any valve. The purchasers/end-user should fully train its employees and/or contractors in the safe use of IMI Herion products in connection with the purchaser's manufacturing processes. The physical environment must be checked to verify that conditions do not exceed the stated operating parameters of the valve.

3.2 Physical Location and Placement

Read the appropriate IMI Herion valve operating and maintenance instruction, as supplied with the valve, before installing, operating or repairing any valve. The IMI Herion valve should be accessible with sufficient room for physical inspection and proof testing. With regards to the valve actuating, allow for a sufficient dimensional envelope for connections and supply piping.
In order to avoid systematic failures, which can lead to a loss of the safety function, ensure the appropriate quality of compressed air. Especially at temperatures below +2°C compressed air must be free from humidity and lubricants. Furthermore, the ingress of liquids or dust particles and blocking of the exhaust pipe must be avoided.

4 Operation and Maintenance

4.1 Proof test

The objective of proof testing is to reveal potentially dangerous faults within the valve that have not been detected before. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of proof testing, or the proof test interval, is to be determined in reliability calculations for the safety instrumented functions. The proof tests must be performed more frequently than or as frequently as specified in the calculation in order to maintain the required safety integrity of the safety instrumented function.

The following proof test is recommended. The results of the proof test should be recorded and any failures that are detected that compromise functional safety should be reported to IMI Precision Engineering immediately. The suggested proof test consists of a full stroke of the valve. The person(s) performing the proof test of a valve should be trained in SIS operations, valve maintenance and company Management of Change.

4.2 Repair and replacement

Repair procedures for the IMI Herion valve are located in the operating and maintenance instruction, as supplied with the valve, or a copy can be obtained from the regional IMI office.
The mean time to repair (MTR) is 75 hours.

4.3 Useful Life

Based on general data, proper use and correct maintenance, the useful life of the IMI Herion valves is on average 6-12 years (+2 years of storage). The exact values for the given valve series are given in the Table 2.

Table 2 – Time of usage overview

Series	Time of usage *(+2 years of storage)*
2413309	6 years
24011xx	12 years
24010xx	6 years
98015xx	6 years
98025xx	6 years
97105xx	6 years
80400xx	6 years

Refurbishment will extend the product life.
Further information can be found in the TÜV SIL Suitability Reports and SIL Certificates.

4.4 IMI Notification

Any failures that are detected and that compromise functional safety should be reported to IMI immediately.

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The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The given information does not release the user from the obligation of own judgement and verification. It must be remembered that our products are subject to a natural process of wear and ageing.

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