Safety manual for Fisher™ 377 Trip Valve for Safety Instrumented System (SIS) Solutions

When the Fisher 377 trip valve is used in a Safety Instrumented System (SIS) the design process should follow a safety lifecycle as described in several international standards (IEC61508, ANSI/ISA 84.01, etc.) The following must be thoroughly reviewed and implemented as part of the safety lifecycle. This is in addition to regular installation procedures and warnings listed in the latest version of the Fisher 377 trip valve instruction manual (D200319X012).

⚠ WARNING

This instruction manual supplement is not intended to be used as a stand-alone document. It must be used in conjunction with the following manual:
Fisher 377 Trip Valve Instruction Manual (D200319X012).

Failure to use this instruction manual supplement in conjunction with above referenced manual could result in personal injury or property damage. If you have any questions regarding these instructions or need assistance in obtaining this document, contact your Emerson sale office or Local Business Partner.

A. Definitions, Acronyms and Abbreviations

1. FIT - Failure In Time ($1x10^{-9}$ failures per hour)
2. FMEDA - Failure Modes, Effects, and Diagnostics Analysis
3. Low Demand Mode - Mode, where the demand interval for operation mode on a safety-related system is greater than twice the proof test interval.
4. PFD_{AVG} - average Probability of Failure on Demand
5. PVST - Partial Valve Stroke Test
6. SIF - Safety Instrumented Function
7. SIL - Safety Integrity Level
8. SIS - Safety Instrumented System

B. Related Literature

1. D200319X012 - Fisher 377 Trip Valve (Instruction Manual)
2. Exida FMEDA Report for Fisher 377 Trip Valve - Report no. EPM 11/08-109 R001

C. Product/ System Properties

1. The product is for control applications where a specific valve/ actuator action is required when supply pressure falls below a specific point. When the supply pressure rises above the trip point, the 377 trip valve automatically resets, allowing the system to return to normal operation.
2. The fail-safe state for the 377 trip valve is to move the associated actuator to fail up, lock in the last position, or fail down when the supply pressure falls below the trip point.

3. The 377 trip valve is a Type A device having a hardware fault tolerance of 0 (HFT = 0). The 377 trip valve is limited to a Low Demand Mode of the SIS applications.
4. The 377 trip valve is suitable for use in application to a maximum Safety Integrity Level of 3 (SIL3).
5. The failure rates for the 377 trip valve are listed below. Consult the exida FMEDA report no. EPM11/08-109 R001, available from your Emerson sale office or Local Business Partner, for a detailed list of the assumptions used in the analysis.

Failure Category	Failure Rate (FIT)	
	377D & U	377L
Fail Safe Detected	0	0
Fail Safe Undetected	239	217
Fail Dangerous Detected	0	0
Fail Dangerous Undetected	379	387
No Effect	603	618

6. Safety Instrumented Function (SIF) design verification must be done for all components in the SIF including the 377 trip valve. The SIF must fulfill the requirements according to the Safety Integrity Level (SIL). Each subsystem must be checked to assure compliance with minimum hardware fault tolerance (HFT) requirements.
7. When using a 377 trip valve in a redundant configuration, a common cause factor of at least 5% should be included in safety integrity calculations.

D. Installation/ Configuration/ Commissioning

1. The 377 trip valve complies with the requirements of ATEX Group II Category 2 Gas and Dust.
2. The ambient temperature capabilities can be -40 to 82°C (-40 to 180°F) and -18 to 104°C (0 to 220°F) depending on the elastomeric material selection per 377 instruction manual.
3. The supply pressure will be within 3.8 to 10.3 bar (55 to 150 psig). The supply medium must be clean, dry air that meets the requirements of ISA 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable.
4. The 377 trip valve can be top-mounted on a manifold, yoke-mounted, or bracket-mounted to match the application requirements. 377 trip valves are used with all types of piston actuators.
5. A supply regulator, if used, must have a flow capacity greater than the required combined capacity of the trip valve and actuator. A regulator with insufficient capacity may allow supply pressure to droop, which can cause the trip valve to trip again and begin a trip-reset cycle.
6. The safety function of the SIF must be tested after installation.

E. Operations, Maintenance and Decommissioning

1. Personnel operating the 377 trip valve and performing maintenance must be competent to do so.
2. Use lock-out procedures and select the appropriate maintenance procedures as defined in instruction manual.
3. A conservative approach is taken in estimating the service interval for the 377 trip valve in Safety Instrumented System. For SIS applications, preventive maintenance must be performed on the 377 trip valve at ten year intervals from the date of shipment. If the instrument is exposed to the upper or lower extremes of the environmental limits, the interval for the preventative maintenance may need to be reduced.
4. If air leakage from the 377 trip valve is detected when at steady-state conditions, take immediate corrective action by replacing the 377 trip valve. It is to maintain the intended actuator fail mode upon loss of supply pressure. To ensure continuous improvement and accurate reliability prediction, the user must also work with their local Emerson service representative to see that all failures are reported.

F. Periodic Inspection, Test and Repair

Periodic proof testing is an effective way to reduce the PFD_{avg} of the 377 trip valve as well as the valve and actuator it is connected to. Results of periodic inspections and tests should be recorded and reviewed.

⚠ WARNING

To avoid personal injury or property damage appropriate measures must be taken to ensure the safety of the process any time the SIF needs to be disabled, such as to perform a proof test or to take corrective actions.

1. Bypass the safety function and take appropriate action to avoid a false trip.
2. Interrupt or change the process signal to the 377 trip valve to force the associated actuator and valve to the fail-safe state and confirm that the safe state was achieved and within the correct time.
3. Re-store the process signal to the 377 trip valve and inspect the 377 trip valve for any leaks, visible damage or contamination and confirm that the normal operating state was achieved.
4. Remove the bypass and otherwise restore normal operation.
5. For the test to be effective the movement of the valve must be confirmed. To confirm the effectiveness of the test both the travel of the valve and slew rate must be monitored and compared to expected results to validate the testing.

To ensure corrective action, continuous improvement, and accurate reliability prediction, the user must also work with their local Emerson service representative to see that all failures are reported.

Emerson Automation Solutions
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Cernay, 68700 France
Dubai, United Arab Emirates
Singapore 128461 Singapore

www.Fisher.com