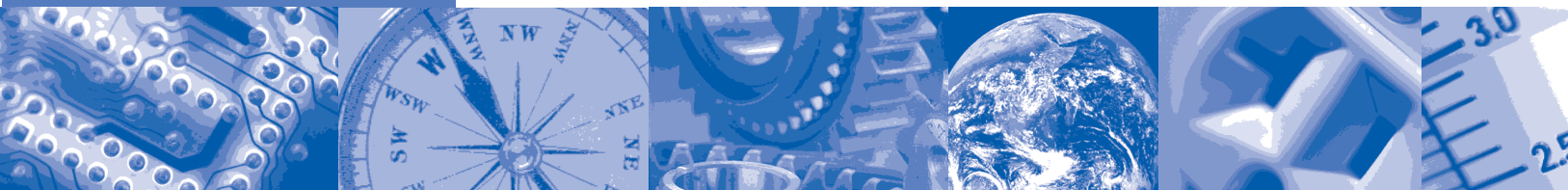


ISA-TR84.00.03 - 2002



Guidance for Testing of Process Sector Safety Instrumented Functions (SIF) Implemented as or Within Safety Instrumented Systems (SIS)



**ISA—The Instrumentation,
Systems, and
Automation Society**

Approved 17 June 2002

ISA-TR84.00.03-2002

Guidance for Testing of Process Sector Safety Instrumented Functions (SIF) Implemented as or Within Safety Instrumented Systems (SIS)

ISBN: 1-55617-801-8

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1 Introduction

The best test of the Safety Instrumented Function (SIF) is the full functional test. Because SIF are designed to act upon an abnormal condition being measured and a corrective action taking place, any test must examine the measurement, logic and final control element activity to be considered a full functional test. This should involve creating an abnormal condition of the measured variable such that the input variable first reaches the alarm state and secondly moves to the interlock point making observations that the rest of the system responds as expected. Any less complete test is necessarily a compromise. Understanding what techniques should be used to ensure that this full functional test is complete is vital.

The sense of well being resulting from this successful test unfortunately deteriorates with time. Therefore, determining when subsequent testing is required to maintain this feeling of comfort is critical. The relative value of the functional test versus the cost of running the test can impact this decision. It is necessary to consider the degree of safety risk caused by a Safety Instrumented Function (SIF) initiated nuisance shutdown and at the same time the safety risk associated with an event not stopped due to a dangerous unrevealed fault in the SIF. Real processes are not ideal. Many systems are at maximum expected risk during startup and shutdown conditions.

NOTE 1 In this document the acronyms SIF and SIS will be used for both singular and plural usage of the term.

NOTE 2 The techniques for testing SIF or SIS described in this document apply to demand mode systems only. Continuous mode systems, which are rare in the process industry, require testing considerations beyond the scope of this document.

SIF applications are normally in a standby mode waiting for an indication of some potentially unsafe condition to occur before taking action. Faults may not become visible until the SIF fails to respond to an unsafe condition in the process. In basic process control loops the sensors and valves are exercised continuously during the Distributed Control System (DCS) and Programmable Logic Controller (PLC) cycles making process or equipment faults visible quickly and rendering them hard to ignore. It is vital that some program of testing and observation of each SIF in the SIS be in place. Any testing scheme, though which is burdensome or difficult has the very real probability of being ignored or bypassed. Where on-line testing techniques are implemented, they should not unnecessarily compromise the process safety integrity during the test. The test equipment and procedure must be carefully evaluated to determine whether the danger of causing an incident due to performing the on-line test is greater than the danger of not discovering the failure. Ill-advised maintenance or troubleshooting might actually increase the process risk.

Effective safety testing is strongly affected by local situations. Hazards differ, resources differ, and even the site conditions differ widely. Rapidly changing technology and ever increasing citizen expectations also impact decisions. Safety incidents can have the political result of closing down entire businesses if the local citizens are sufficiently offended. International competition has put tremendous pressure on manufacturing operations to reduce personnel and costs. Whatever testing schemes are used, they need to be very practical and should minimize maintenance and operating costs while ensuring the integrity of the SIF. The techniques suggested in this document are intended to provide guidance in the development of effective and efficient methods to plan and to manage testing and maintenance of SIF. Users of this document should have a good understanding of the applicable standards or guidelines which apply to SIF and SIS such as ANSI/ISA-84.01-1996, ISA-TR84.00.02-2002, OSHA 1910.119, dIEC 61511, and others.

The records resulting from the testing program should be equally valuable to planned and preventive maintenance and address the requirements of all regulations, as well as quality control and mandated standards.

Another important part of process safety in an operating unit is the knowledge and motivation of the operators and maintenance personnel. It is the responsibility of management to provide training and motivation. Any plan, formula, procedure, or even a standard, which attempts to, or claims to substitute