MERCURY

IEC 61511 Functional Safety and Safety Instrumented Systems Training

20 – 24 December 2026
Online



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IEC 61511 Functional Safety and Safety Instrumented Systems Training

Ref: 44_1082613 **Date:** 20 – 24 December 2026 **Location:** Online **Fees:** 1900 Euro

The IEC 61511 Functional Safety and Safety Instrumented Systems Training is a one-week course for instrumentation engineers, process safety specialists, automation designers, and asset integrity professionals. Working with process risk assessment data, safety integrity calculations, and hardware fault tolerance models, you assemble a Safety Instrumented System Lifecycle Dossier. Mercury Training Center delivers this course to help you build reliable protection layers across your operational assets.

About This Course

Inadequate safety requirement definitions, unverified risk reduction factors, and improper proof testing lead to dangerous operational failures and costly plant shutdowns. To follow this course, you must already evaluate hazard scenarios, interpret piping and instrumentation diagrams, or configure process control interlocks. Through loop calculations and design reviews, you practice executing safety lifecycle activities.

Who It Is For

- Professionals responsible for leading hazard identification reviews and defining process risk mitigation strategies
- Professionals responsible for specifying, designing, and integrating emergency shutdown systems and interlocks
- Professionals responsible for executing reliability calculations, safety integrity verifications, and architectural modeling
- Professionals responsible for maintaining process instrumentation, scheduling proof tests, and managing operational bypasses

This course is not for entry-level calibration technicians seeking basic measurement wiring instruction, who are better suited to introductory instrumentation courses, nor is it for corporate business analysts requiring general operational risk summaries, who would benefit more from introductory enterprise risk management courses.

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Competencies You Will Build

- Safety Lifecycle Execution: Implementing functional safety management frameworks and tracking verification activities across all engineering stages.
- Integrity Level Allocation: Applying layer of protection analysis and risk graphs to determine required safety integrity targets.
- Requirement Specification Authoring: Writing safety requirement specifications detailing functional logic, response times, and failure actions.
- System Architecture Verification: Calculating dangerous failure probabilities and evaluating hardware fault tolerance configurations for instrument loops.
- Operational Integrity Management: Formulating proof-testing protocols, managing overrides, and evaluating modification impacts on running systems.

What You Will Be Able to Do

By the end of the course you will be able to:

- From hazard and operability study worksheets, identify instrumented safeguards and establish target risk reduction requirements.
- Given calibrated risk graphs and layer of protection analysis sheets, allocate safety integrity levels to safety instrumented functions.
- Using operational process parameters and emergency shutdown logic, draft functional safety requirement specifications for field implementation.
- From failure rate datasets and architectural topologies, verify average probability of failure on demand and hardware fault tolerance compliance.
- Given asset maintenance records and operating runtimes, calculate optimal proof-test intervals and specify bypass management procedures.
- Using verified loop calculations and safety requirement sheets, assemble a complete Safety Instrumented System Lifecycle Dossier.

Course Content

Day 1: Functional Safety Concepts and Hazard Analysis

- Core Framework of IEC 61511 and IEC 61508 Lifecycle Foundations
- Functional Safety Management Planning and Competency Tracking Systems
- Hazard and Operability Linkage to Safety Instrumented Safeguards
- Failure Modes and Effects Analysis for Process Equipment
- Allocation of Independent Protection Layers and Boundary Definitions

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Day 2: Target Integrity Determination and Allocation

- Layer of Protection Analysis for Target Risk Reduction Estimation
- Calibrated Risk Graph Methods for Safety Integrity Selection
- Continuous and Low-Demand Mode Classification for Process Safeguards
- Spurious Trip Rate Estimation and Operational Reliability Trade-Offs
- Tolerable Risk Criteria Application to Overpressure and Release Scenarios

Day 3: Safety Requirement Specifications and System Architecture

- Safety Requirement Specification Formulation for Emergency Isolation Loops
- Logic Solver Technology Selection and Application Software Verification
- Hardware Fault Tolerance Evaluation and Subsystem Redundancy Rules
- Common Cause Failure Mitigation Using Beta Factor Estimation Models
- Dangerous Undetected Failure Rate Determination for Field Transmitters

Day 4: Loop Verification and Lifecycle Operations

- Average Probability of Failure on Demand Calculations for 1oo1, 1oo2, and 2oo3 Architectures
- Proof-Test Interval Determination and Testing Effectiveness Factor Modeling
- Bypass Management Protocols and Compensatory Safety Controls
- System Modification Procedures and Impact Analysis for Operating Units
- Functional Safety Assessment Audits and Operational Readiness Validation

Day 5: Lifecycle Verification and Portfolio Assembly

- Exercise on Layer of Protection Analysis and Integrity Target Allocation
- Exercise on Safety Requirement Specification Logic and Timing Synthesis
- Exercise on Architectural Probability Verification and Fault Tolerance Modeling
- Exercise on Proof-Test Protocol Formulation and Bypass Risk Management
- Final Assembly and Review of the Safety Instrumented System Lifecycle Dossier

Case Studies and Exercises

These suggested activities provide practical application of safety lifecycle methods across different operating environments:

- Case study: A petrochemical fractionation facility where you evaluate distillation column overpressure scenarios, establish target integrity levels using layer of protection analysis, and define isolation logic.
- Case study: An offshore oil and gas production platform where you assess emergency depressuring valve architectures, calculate common cause failures, and establish testing frequencies.
- Exercise: A chemical polymer reactor where you draft safety requirement specifications, review voting configurations, and resolve redundant transmitter discrepancies.
- Exercise: A gas compression plant where you analyze high-temperature shutdown loops, calculate average probability of failure on demand, and define bypass protocols.

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What You Take Back

The Safety Instrumented System Lifecycle Dossier provides structured engineering templates, reliability calculation models, and specification guidelines to support functional safety verification and design tasks immediately during your first month back at work. You will use it to audit protection systems, verify loop compliance, and manage lifecycle documentation.

- Safety requirement specification templates containing functional parameters and trip criteria
- Safety integrity allocation matrices and layer of protection analysis calculation sheets
- Reliability verification worksheets with hardware fault tolerance and failure rate calculators
- Proof-testing schedule planners and operational bypass authorization checklists

Quick Answers FAQ

What background is required before attending the IEC 61511 Functional Safety and Safety Instrumented Systems Training?

You need working familiarity with process engineering, instrumentation, or industrial control systems. Practical experience reading piping and instrumentation diagrams, reviewing process hazard assessments, or commissioning field instruments ensures you can complete the analytical calculations and design exercises.

How does this course differ from introductory industrial automation courses?

Introductory industrial automation courses teach general programmable logic controller programming, signal wiring, and basic supervisory control. This course focuses specifically on functional safety lifecycle governance, quantitative safety integrity determination, architectural redundancy verification, and standardized safety requirement specifications.

Why is hardware fault tolerance essential in safety instrumented systems?

Hardware fault tolerance defines the number of dangerous faults a subsystem tolerates without losing its safety function. Complying with architectural constraints ensures that random hardware failures do not cause catastrophic protection loss, regardless of numerical probability calculations.

What work product do you take back from the IEC 61511 Functional Safety and Safety Instrumented Systems Training?

You take back the Safety Instrumented System Lifecycle Dossier. This package includes functional safety management checklists, safety requirement specification templates, layer of protection analysis models, reliability calculation worksheets, and operational proof-testing protocols.

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For Your Manager

Your team member will be able to lead safety integrity allocation studies, draft rigorous safety requirement specifications, and verify instrument loop reliability against international standards. They take back a complete Safety Instrumented System Lifecycle Dossier containing field-ready calculation tools and templates. These assets will be deployed immediately in your upcoming process hazard reviews, loop verifications, and system audits.