TÜV Rheinland Functional Safety Program
Functional Safety Engineer Certification

The TÜV Rheinland Functional Safety Program is a unique opportunity to provide evidence of competency in functional safety from an internationally recognised organization.

The certified FS Engineer (TÜV Rheinland) certificate demonstrates competency in the fundamentals of Functional Safety and provides a skill set that is transferable from one work situation to another. It enables staff to fulfill responsibilities and to perform activities to recognised standards of competence on a regular basis, in order to

- *reduce risks*
- *satisfy legal and regulatory requirements*
- *meet the organisation's business objectives*
- *enable the organisation to meet contractual commitments.*

By understanding:

- The principles and concepts of the internationally agreed safety related control system machinery standards IEC 62061, ISO 13849 including ISO 12100 and associated type A, B and C standards
- Risk Analysis methods for the determination of necessary measures for the reduction of risks at machines.
- The requirements of ISO 13849, application areas, restrictions regarding the applicability, software and documentation requirements, use of standard components in safety functions, proof of safety, verification and validation of safety functions. Examples for proof of FS according to ISO 13849-1.
- The requirements of IEC 62061, application areas, lifecycle model and documentation requirements, terminology used in the standard, requirements regarding safety relevant application software, proof of safety, verification and validation of safety functions. Examples for proof of FS according to IEC 62061.

- The selection and application of safety devices, their advantages and disadvantages, installation requirements and configuration requirements.
- Safety functions of Machines, Start/re-start interlock, start functions, Emergency off, emergency switching off, stop categories muting and their realization according to the different safety categories.
- Circuit and schematic requirements for connection of safety devices according to the different safety categories.
- The technical information required on components including extracting reliability data from manufacturers certificates, reports.
- SIL demonstration calculations such as average frequency of dangerous failure per hour (PFH), safe failure fractions and hardware fault tolerance.
- How to identify and calculate the impact of common cause failures (Beta factor) on the reliability of protective systems
- Requirements for validation documentation to demonstrate that systems, (including application software and software and hardware integration) have been fully tested checked and approved.

Course Objectives

Colin Easton, a globally recognised expert in functional safety, leads the course. The course will equip participants with the knowledge for understanding and mastering the application, principles and requirements of the Functional safety of Machinery.

Successful participants, who also have sufficient functional safety experience, will achieve the prestigious FS Engineer (TÜV Rheinland) Functional safety of Machinery certification.

The course will provide three days of classroom tuition and practical guidance, mixed with practical exercises based on real life examples. Day four consists of a four-hour two-part proficiency examination with:

Part 1 = 70 multiple-choice questions

Part 2 = 12 open questions

Day 1 Agenda

Will provide an introduction to the functional safety of machinery standards, the underpinning legislation and the concept of the functional safety lifecycle and competency. Participants will be introduced to the concepts of the international standards that cover this area of machinery risk assessment and risk reduction as well as risk assessment techniques and introduces the detailed concepts in IEC 62061 including Failure, diagnostics, fault tolerance, safe failure fraction, common cause, software, systematic failures, validation and worked examples to underpin the learning with respect to IEC 62061. The topics covered are:

- Legal Regulations, Standards, Categories and Definitions
- Overview of Standards
    - Basic Standards and Sector / Application Standards
- Characteristics of a Safety Function
- Conformity Assessment
- PUWER Assessment
- ISO 12100 Risk Assessment and Risk Reduction
    - Elements of Risk Assessment
    - ISO 13849-1 Performance Level Determination
    - IEC 62061 – Safety Integrity Level Determination
- Standards for Functional Safety of Machinery - IEC 62061
    - Functional Safety Management and Planning to IEC 62061
    - Specification of the Safety Function (SF)
    - Documentation and Information for use
    - Software Design and Development - Software Levels 1 and 2
    - Fault Tolerance, Architectural Constraints and Safe Failure Fraction
    - Process Safety Time
    - Use of predesigned subsystems
    - Basic Subsystem Architectures (A, B, C & D)
    - Average frequency of Dangerous Failure per hour (PFH)
        - Procedure for the calculation of PFH
        - Diagnostic Coverage and test interval
        - Common Cause Failure
        - Useful Lifetime
        - Periodic Testing
        - Determine SIL for the complete Safety Function
    - Example of a structured design of a SCS
    - Worked Examples - IEC 62061 Design Process

Day 2 Agenda

Introduces the detailed concepts in ISO 13849 including Failure Probability, diagnostics, common cause Performance Levels, software, systematic failures, Validation and worked examples to underpin the learning with respect to ISO 13849. The topics covered are:

- Standards for Functional Safety of Machinery
    - ISO 13849-1
        - Determination of Failure Probability
            - Relationship between Performance Level and SIL
            - Hardware Calculations
            - Diagnostic Measures
            - Common Cause Failure
            - Determination of Performance Level
            - Complete Safety Function
            - Special Cases
        - Software
        - Systematic Failures
        - Validation
        - Worked Examples - ISO 13849

Day 3 Agenda

Introduces a selection of the more commonly applied protective devices used on machines and the associated design requirements. The topics covered are:

- Protective Equipment for Machinery
- Safety Distances
- Separating Safety Equipment - Guards
- Interlocking and Guard Locking Devices
- Position and Proximity Switches
- Installation and Application
- Pressure Sensitive Edges, Bars and Bumpers
- Two-hand and Enabling Control Devices
- Circuit Examples Interlocking Devices
- Electro Sensitive Protection Equipment
- Pressure Sensitive Mats and Floors
- Safety Related Functions

- Power Drive Systems
- Start and Restart
- Hold to Run Control
- Emergency Stop, Emergency Switching Off, Stop Categories
- Muting and Muting Override
- Circuit Design
- Exam Preparation

Day 4 Agenda

A four (4) hour two part CLOSED BOOK competency examination compromising:

Part 1 = 70 multiple-choice questions.

Part 2 = 12 open questions.

The pass score criterion is 75%

Who Should Attend?

Control & Instrument, Electrical, Process, Mechanical, Rotating Machinery and Safety Engineers as well as Operating and Maintenance personnel who are involved in any of the Machinery lifecycle phases for functional safety for machines from risk assessment, design through to installation, testing, maintenance and operation of machines.

Participant eligibility requirements

In accordance with the TÜV Functional Safety Program:

- A minimum of 3 to 5 years experience in the field of functional safety.
- University degree or equivalent engineering experience and responsibilities as certified by employer or engineering institution.

Course Provider

Colin Easton Eur Ing, CEng FInstMC MIET, RFSE, CASS RFSA, FS Senior Expert (TÜV Rheinland) PHRA, SIS & FS for Machinery ID 145/09.

Prices: From £1,950 GBP per participant

Contact: Carol Easton, Tel: +44 (0) 1642 715346 or Email: info@efstas.com