



Machinery Safety Training: ISO 12100 Risk Assessment, ISO 13849 Performance Levels and Guarding



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Introduction:

Machinery safety training on ISO 12100 risk assessment, ISO 13849 performance levels and guarding is a 5-day course for engineers who design, maintain, modify and sign off production machinery, ending with a Machine Risk Assessment and Safeguarding Upgrade Plan for a case production line. Amputations and crush injuries follow when guards are removed, interlocks are bridged and safety circuits are rebuilt after a machine change without anyone recalculating what they must achieve. Nominees already work on factory machines and learn through inspection walkthroughs of case presses, conveyors and cells. CoreConcept Training Center delivers this machinery safety course.

Course Objectives:

- Define the limits of a machine across its life phases and identify mechanical, electrical and other hazards with an ISO 12100 hazard list
- Estimate and evaluate machine risk, then apply the three-step method of inherently safe design, safeguarding and information for use
- Specify fixed, interlocked and adjustable guards, interlocking devices, light curtains and two-hand controls with correct reach and safety distances
- Determine the required performance level for each safety function and calculate the achieved PL from category, MTTFd, DCavg and common cause failure measures
- Assign and verify SIL with PFHd under IEC 62061 and validate safety functions by analysis and test to ISO 13849-2
- Review modified, relocated or second-hand machines and produce a Machine Risk Assessment and Safeguarding Upgrade Plan

Target Audience:

- Engineers responsible for specifying, buying and accepting new production machines and lines
 - Maintenance engineers responsible for guards, interlocks and safety devices on running machinery
 - Automation and controls engineers responsible for safety relays, safety PLCs and drive safety functions
 - Engineers responsible for machine modifications, relocations and integration of second-hand equipment
 - Plant safety engineers responsible for machine risk assessments and safeguarding audits on the shop floor
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Course Outline:

Day 1: Machine Hazards, Limits of the Machine and Plant Safeguarding Baseline

- Machinery Safety Accident Patterns Behind Crush, Shear and Entanglement Injuries
- ISO 12100 Terms for Hazard, Hazard Zone and Safeguard
- Limits of the Machine Across Use, Space and Time
- Machine Life Phases From Transport to Dismantling and Disposal
- Plant Machine Register and Safeguarding Baseline Survey Sheet

Day 2: ISO 12100 Risk Assessment and the Three-Step Risk Reduction Method

- ISO 12100 Hazard Identification List by Hazard Origin
- Risk Elements Severity, Exposure, Hazardous Event and Avoidance
- Inherently Safe Design Measures Eliminating Pinch and Trap Points
- Safeguarding and Complementary Protective Measures Including Emergency Stop
- Information for Use, Warning Signs and Residual Risk Records

Day 3: Guards, Interlocking Devices and Protective Equipment Selection

- Fixed Perimeter Guard Mesh Opening Versus Hazard Distance
- Interlocked Movable Guards With Guard Locking and Coded Switches
- Safety Light Curtains Type 2 and Type 4 With Muting
- Laser Scanners, Pressure-Sensitive Mats and Two-Hand Control Devices
- Approach Speed and Stopping Time for Safety Distance Calculation

Day 4: ISO 13849 Performance Levels, IEC 62061 SIL and Validation

- ISO 13849-1 Risk Graph for Required Performance Level PLr
- Designated Architectures Category B to Category 4 Compared
- MTTFd, DCavg and CCF Score for Achieved PL
- IEC 62061 SIL Assignment and PFHd Subsystem Verification
- ISO 13849-2 Validation With FMEA, Fault Lists and Tests

Day 5: Inspection Walkthrough and Safeguarding Upgrade Plan Build

- Safety PLC, Safety Relay and Safe Torque Off Circuit Review
 - Case Hydraulic Press Walkthrough Against Guarding Checklist
 - Case Conveyor and Palletiser Cell PL Calculation Exercise
 - Modified and Second-Hand Machine Compliance Gap Assessment
 - Machine Risk Assessment and Safeguarding Upgrade Plan Completion
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Skills You Will Gain:

- Machine Hazard Identification
- Machine Risk Estimation
- Guard and Interlock Specification
- Safety Distance Calculation
- Performance Level Calculation
- SIL and PFHd Verification
- Safety Function Validation
- Machine Modification Review

Why Attend This Course:

- Hand the engineering manager and plant safety lead a Machine Risk Assessment and Safeguarding Upgrade Plan for a case production line
- Decide whether an interlock, light curtain or safety relay change still meets the required performance level before the machine restarts
- Avoid bypassed guards, failed acceptance inspections and costly retrofits caused by safeguarding chosen without a calculated basis
- Coach maintenance technicians and controls staff on guard checks, safety distances and the rules for changing safety circuits

Conclusion:

Back at the plant, the participant gives the engineering manager and plant safety lead a Machine Risk Assessment and Safeguarding Upgrade Plan for one production line. Managers use it to rank guard, interlock and control circuit upgrades by residual risk and to approve spending on the gaps that matter most. Controls staff use its PL and SIL worksheets whenever a machine is modified or a safety device is replaced. After the first upgrade is installed, the unit should repeat the validation tests, update the machine register and check that no guard has been bypassed since.

Frequently Asked Questions FAQ:

What should participants know before the machinery safety course on ISO 12100 risk assessment and ISO 13849?

Participants should already work with production machines and read basic electrical and control circuit drawings. No reliability mathematics is required. Bringing photographs, a layout or a circuit drawing of one machine from their own site helps them apply the risk assessment and PL calculation exercises.

How does machinery safety training differ from process functional safety or general workplace safety courses?

This course works on machines: guards, interlocks, light curtains and high-demand safety functions verified by PL and PFHd. Process functional safety courses treat low-demand trip systems on plant vessels, while general workplace safety courses cover hazards across all activities without control system calculations.

When should machinery safety follow ISO 13849 rather than IEC 62061?

Either may be used for machine safety functions. ISO 13849 suits mixed technologies such as electrical, pneumatic and hydraulic parts with designated categories, while IEC 62061 suits electrical, electronic and programmable systems where SIL and PFHd per subsystem are preferred.

What do participants take back from the machinery safety course?

Participants take back a Machine Risk Assessment and Safeguarding Upgrade Plan for a case production line, with a hazard list, risk ratings, guard and safety distance choices, PL and SIL worksheets and a validation checklist ready to adapt to their own machines.
