



## Meeting Global Safety Requirements with PL-c, PL-d or PL-e Compliant Solutions



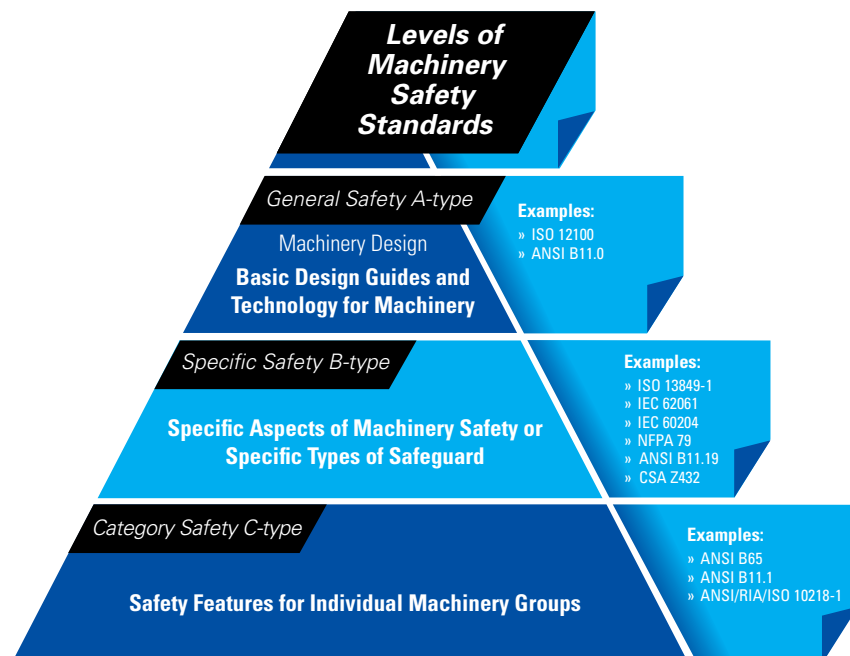
### IMPORTANCE OF FUNCTIONAL SAFETY

Protecting the test equipment and specimen is vital to the success of a test, yet the paramount concern is to create a safe environment for the test operator. With the power to apply significant force at startling velocities, a test system needs to function in an accurate and safe manner to maintain a safe operating environment. Unplanned actuator movement or unexpected hydraulic pressure states must be detected and controlled quickly to provide the best possible environment for human safety.

Functional safety is a term that typically applies to electrical, electronic and programmable electronic systems, and it is defined as a system or equipment that is operating correctly in response to its inputs. Meeting functional safety requirements requires active systems to detect potentially dangerous conditions. It also requires the activation of a protective or corrective device or mechanism to prevent hazardous events or reduce escalating consequences.

### MACHINERY SAFETY STANDARDS

There are many standards that address machinery safety, and they can be classified into three basic categories: standards that describe machinery design requirements and general safety principles; standards that outline specific safety requirements; and standards that prescribe safety requirements for individual machinery groups.



## DETERMINING APPROPRIATE SAFETY PERFORMANCE LEVEL

### 2006/42/EC MACHINERY DIRECTIVE

EN ISO 13849 Safety of machinery – Safety related parts of control systems – General principles for design

- » EN ISO 13849 is an international standard common in the EU
- » Defines required Performance Level (PL) for safety function
- » Categorizes five Performance Levels; a through e, with e being the highest level
- » Test equipment used in the EU will typically comply with the standard
- » Applies to EU countries and countries with trade ties to the EU

### GLOBAL SAFETY STANDARDS

- » Many regional safety standards, such as ANSI B11 and CSA Z432, reference ISO 13849

Although human safety is a primary concern to most organizations, there is a great deal of confusion about best practices and compliance requirements for safe operation of machinery. ISO 13849 offers clear guidelines to define the potential safety risk to humans and to determine the required Safety Performance Level for each situation. This international standard is a common end-user requirement in the EU and is referenced in many other regional safety standards.

Three factors influence the required Performance Level:

1. Potential severity of injury
2. Frequency of exposure
3. Possibility of limiting the hazard

### Severity of Injury

*Slight or Serious*

The two options for classifying equipment in the severity of injury category are: slight, indicating the possibility for a reversible injury; and serious, indicating the possibility for irreversible injury or death. Due to the potential for irreversible injury or death when operating test equipment, mechanical test systems are considered to be in the serious classification, which requires a minimum of Performance Level c (PL-c) for compliance.

Slight	Serious
» Possible reversible injury	» Possible irreversible injury or death
» Not applicable to mechanical test systems	» Most mechanical test systems would be classified in this category
» May require up to PL-c	» Requires minimum of PL-c



## Frequency and/or Duration of Exposure

*Seldom or Frequent*

For test equipment, the frequency of exposure is defined as access to the specimen area. Access typically occurs in specimen loading/unloading, alignment etc. The two options for classifying equipment in the frequency of exposure category are seldom and frequent. With respect to exposure time, “seldom” is defined as accessing the specimen area no more than once in 15 minute intervals and the accumulated exposure time does not exceed 1/20 of the overall operating time. Per this definition, the rating would be “F1” for exposure. If the test operator is accessing the specimen more than once every 15 minutes or this exposure exceeds 1/20 of the overall operating time, it is considered frequent exposure. This would be an “F2” rating for exposure. Frequent exposure of an “F2” rating requires a minimum Performance Level d (PL-d) for compliance. Seldom exposure could require a Performance Level of c or d, depending on the possibility of avoiding or limiting the hazard.

Seldom	Frequent
<ul style="list-style-type: none"> <li>» Access to the test specimen area once in fifteen minute or greater intervals AND exposure less than 1/20 total time</li> <li>» Requires minimum of PL-c if severity = S2</li> </ul>	<ul style="list-style-type: none"> <li>» Access to the test specimen area more than once every fifteen minutes OR exposure more than 1/20 total time</li> <li>» Requires a minimum of PL-d if severity = S2</li> </ul>

## Possibility of Limiting the Hazard

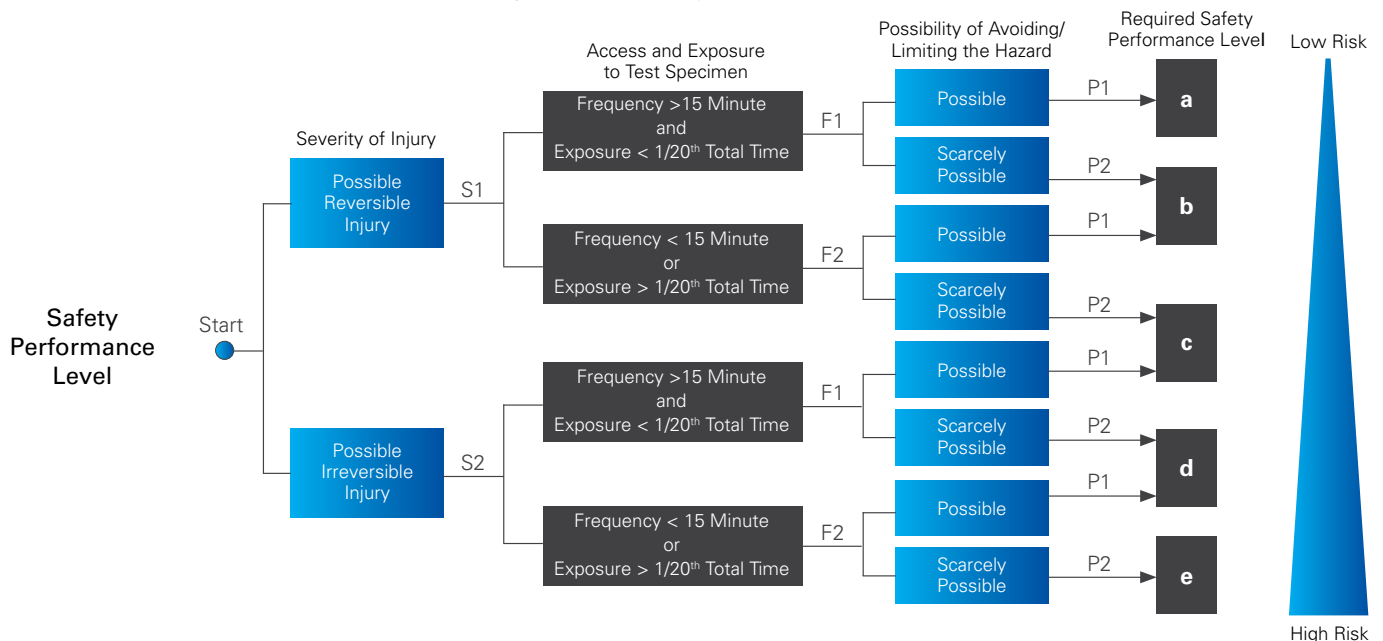
*Possible or Scarcely Possible*

There are two categories for possibility of limiting hazard: possible under specific conditions or scarcely possible. Since hazard limitation, or risk mitigation is usually possible, most test systems can meet this requirement. If there is a use case in which the possibility of limiting the potential hazard is considered scarcely possible and severity = S2, then this case would require a minimum of Performance Level d. If in this same case, the frequency of exposure = F2, then it would require a Performance Level e solution.

Possible	Scarcely Possible
<ul style="list-style-type: none"> <li>» Possible to limit the hazard</li> <li>» Most mechanical test systems would be classified in this category</li> <li>» Requires minimum of PL-c if severity = S2</li> </ul>	<ul style="list-style-type: none"> <li>» Severe obstacles to limiting the hazard</li> <li>» Requires a minimum of PL-d if severity = S2</li> </ul>

## Performance Level Depends on How Often the Test Operator Accesses the Test Specimen Area if Severity = S2

In summary, a Performance Level rating of c, d or e is required to meet certain safety standards for most test equipment. Frequency of access and exposure to the test specimen area are the primary factors in determining the required safety performance level.



## MTS SOLUTIONS FOR PERFORMANCE LEVEL c, d AND e COMPLIANCE

### Performance Level c (PL-c)

*Applicable for test systems in which the test specimen area is not accessed more frequently than once every 15 minutes.*

Performance Level c (PL-c) is the standard option on most MTS Landmark® Test Systems. This solution requires a load frame with test area enclosure\* and a FlexTest® controller. It includes a low flow power supply for safe speed control (<10 mm/s).

### Performance Level d (PL-d)

*Applicable for test systems in which the test specimen area is accessed more than once every 15 minutes.*

Performance Level d (PL-d) is the standard option on MTS Landmark Test Systems that are using hydraulic pressure of 57-114 lpm (15-30 gpm). This solution requires a load frame with test area enclosure\*, a FlexTest controller and a load frame station supervisor. It includes cables and hose kit. The PL-d version adds redundancy and monitoring to the already high reliability of the PL-c safety circuits. In addition, a safety-rated Programmable Logic Controller arbitrates the safety functions.

REQUIRED FOR PERFORMANCE LEVEL D (PL-D) COMPLIANCE WHEN SEVERITY = S2  
LOAD FRAME STATION SUPERVISOR (LSS)

- » Safety Programmable Logic Controller with single location for system AC power input/output
- » Safe Power Off / Safe Isolation: floor-standing manifold with positive isolation, dump, and pressure relief functions
- » Safe Speed: adds monitoring to existing low flow valve and replaces the low flow power supply with LSS
- » Handset with E-stop
- » Load frame wiring harness with redundant chains to E-Stop and switching functions
- » Test Area Enclosure (TAE) interlock switches and tamper-resistant fasteners
- » Three-position keyed Mode Selection Switch (per EN 60204)
- » Remote E-Stop/Status box with illuminated status indicators
- » For EU deliveries, a System Level CE certification/marketing along with the applicable component certifications (Declaration of Incorporation/Declaration of Conformity) will be provided

### Performance Level e (PL-e)

*Applicable for use cases where the possibility of limiting hazards is considered scarcely possible, or the risk tolerance is low.*

Meeting Performance Level e (PL-e) requires a custom solution. MTS has the experience necessary to create a system that meets PL-e standards.

*\*Must be supplied by MTS to be classified as PL-c or PL-d compliant. If customer supplies their own test area enclosure, they will be responsible for their own hazard assessment and certification.*

## BENEFIT OF MTS SOLUTION

Another important consideration when designing a safety program is that the safety system should not interfere with test system performance. With high-performance, high-fidelity test systems that deliver accurate and reliable data and meet safety requirements, MTS offers an ideal solution to maximize productivity and minimize risk. To be confident that your test system meets the specified safety performance level, MTS can supply System Level CE declaration along with the applicable component certifications. Declaration of Incorporation (DOI) or Declaration of Conformity (DOC) as required.

Protecting test operators, equipment and specimen are all critical to testing success. MTS provides the tools to help meet the functional safety requirements, and the test systems that perform reliably test after test. Contact MTS today to learn more about test system safety requirements.



**MTS Systems Corporation**  
14000 Technology Drive  
Eden Prairie, MN 55344-2290 USA  
Telephone: 1-952-937-4000  
Toll Free: 1-800-328-2255  
Fax: 1-952-937-4515  
E-mail: [info@mts.com](mailto:info@mts.com)  
[www.mts.com](http://www.mts.com)  
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100-346-285 GlobalSafety Printed in U.S.A. 3/17