



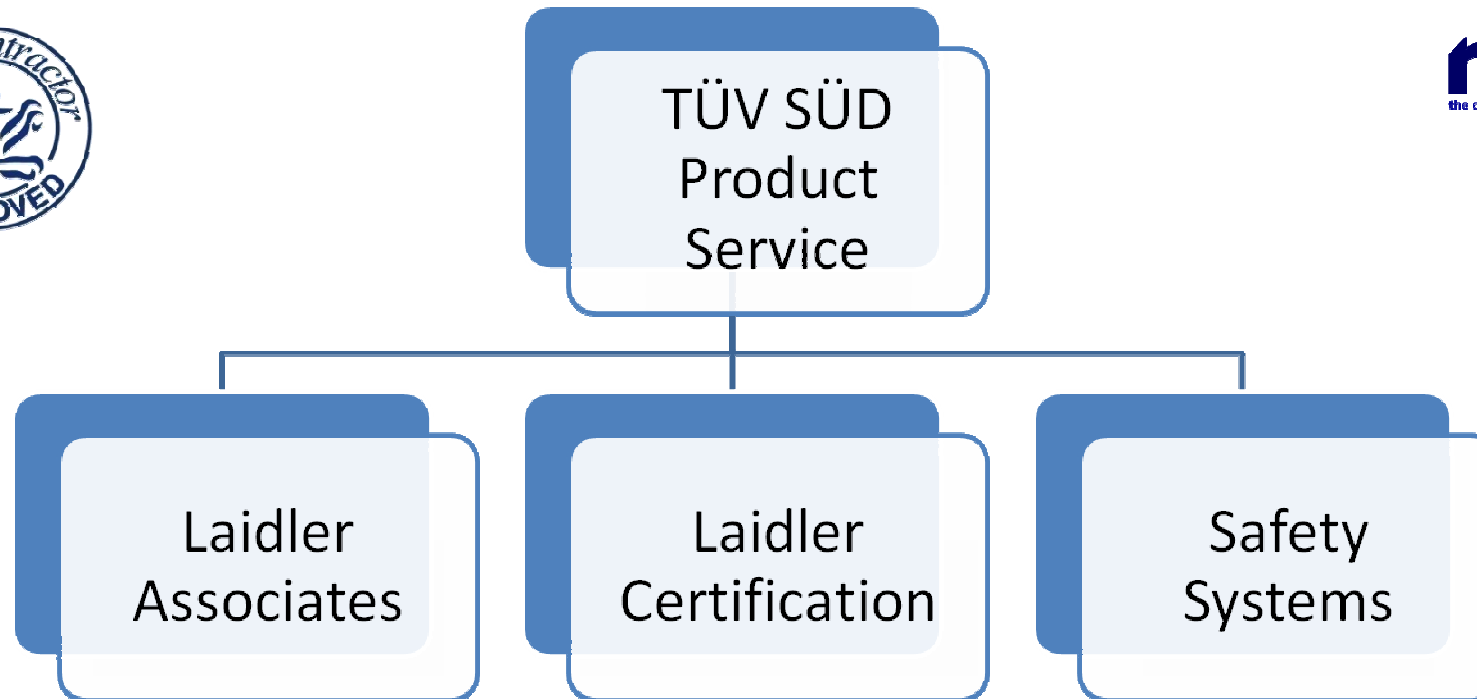
**Laidler**  
ASSOCIATES

# New Technologies for Machinery Safety

Presented by Paul Laidler



Product Service



Machinery Safety specialists carrying out consultancy, training and assessment.

Notified Body for the Machinery Directive  
Competent Body for the EMC Directive  
NB No: 0870

Providers and Installers of Electrical and Electronic Safety Devices and Guarding



- TÜV SÜD's history goes back over 140 years to the 1860s, when a number of independent TÜVs were founded by the German steam boiler industry to regulate and supervise the safety of steam installations in the interest of public safety.
- With the advancement of technology, the original TÜV association in Bavaria expanded its presence and capabilities to meet the challenges of progressive deregulation, liberalisation, and harmonisation of trade practices throughout the world.
- It has now become the TÜV SÜD Group, the largest of the three remaining, competing "TÜVs" with over 15,000 employees throughout the world.
- TÜV SÜD acquired the Laidler group, which now operates as a division of TÜV SÜD Product Service, specialised in providing CE marking services for industrial machinery as well as associated services.





- Machinery Directive.
- Low Voltage Directive.
- EMC Directive Evaluation and on site Field Testing.
- Pressure Equipment Directive.
- ATEX Directive.
- PUWER Inspections.
- Country Wide Seminars.
- In house tailor made Seminars.

**LAILDLER ASSOCIATES  
WILL ACT AS THE  
AUTHORISED  
REPRESENTATIVE, SIGN  
THE DECLARATION OF  
CONFORMITY AND  
ASSUME RESPONSIBILITY  
ON THE CLIENTS BEHALF.**



Processing & Packaging Machinery Association

*Laidler Associates are the PPMA preferred  
supplier for technical consultancy related  
to regulatory matters in the UK &  
European Union*



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## TÜV Services include

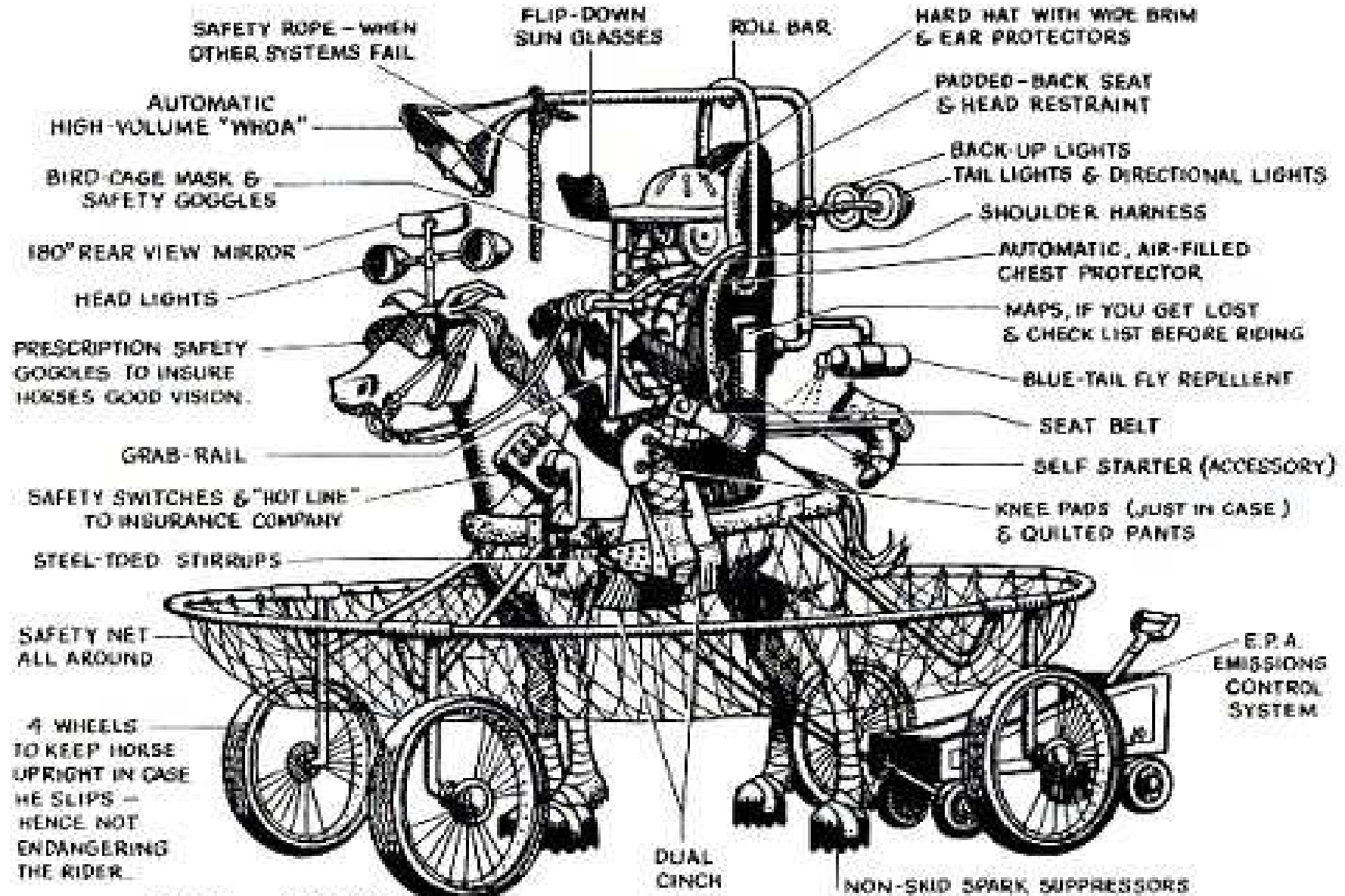
- Environmental Testing
- In Chamber EMC Testing
- Electrical Product Testing
- Worldwide certification of medical devices
- SAR Testing



# 'Elf n Safety



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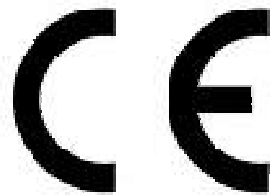


Derived from website HBEUK

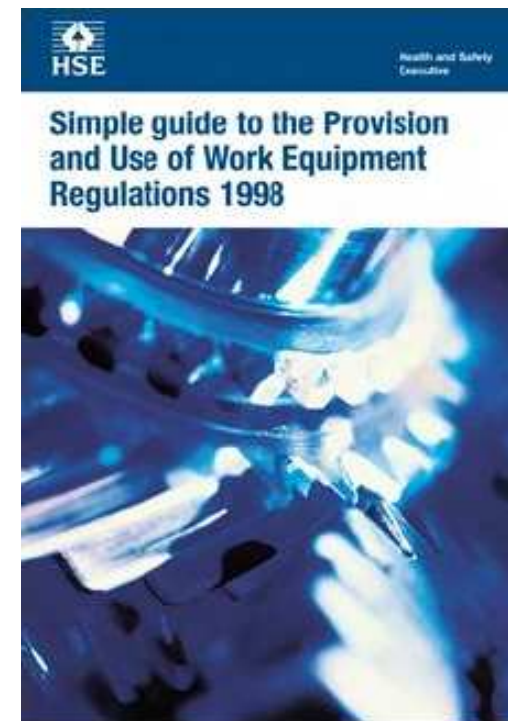


## Responsibilities?

The Manufacturer



The User



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# New Machinery Directive



- Machinery Directive 2006/42/EC
- Member States had to adopt and Publish 29<sup>th</sup> June 2008
- Directive applied in full 29<sup>th</sup> December 2009
- Numerous changes from 98/37/EC



## ARTICLE 1 Scope

- This Directive applies to the following products:
- (a) machinery;
- (b) interchangeable equipment;
- (c) safety components;
- (d) **lifting accessories;**
- (e) **chains, ropes and webbing; (as part of lifting machinery or lifting accessories)**
- (f) removable mechanical transmission devices;
- (g) **partly completed machinery.**



## Exemptions Extended to include

- Means of transport now includes trailers
- Household appliances
- Audio and video equipment
- IT equipment
- Office machinery and equipment
- Circuit breakers and switches
- High voltage switch gear & transformers
- Motors of all types



## New EHSR's

- 1.1.6 Ergonomics
- 1.1.7. Operating Positions
- The operating position must be designed and constructed in such a way as to avoid any risk due to exhaust gases/ lack of oxygen Etc.
- 1.1.8. Seating
- Work stations constituting an integral part of the machine must be designed for the installation of seating
- 1.6.3 Lightning
- Machinery which is designed for outdoor use and which may be subject to the direct effects of lightning must be fitted with a system for conducting the resultant electrical charge to earth.



## Changes to EHSR's

- 1.4.1 Guards and protection devices
- Must be securely held in place
- Guards must protect against the ejection or falling of materials and objects
- 1.4.2.1 Fixed guards
- Must be fixed with systems that can be opened only with tools.
- Their fixing systems must remain attached to the guards when removed
- Where possible guards must be incapable of remaining in position without their fixings

## Changes to the Declaration of Conformity

- Name and address of the person who is authorised to compile the **Technical File**, who must be established in the European Community.
- Where appropriate a statement confirming declaration of conformity with other applicable directives
- The place and date of the declaration.
- There is no longer a separate declaration for safety components.
- Must be typewritten or handwritten in capital letters

## A Lifecycle Directive

### 1.1.2. *Principles of safety integration*

(a) Machinery must be designed and constructed so that it is fitted for its function, and can be operated, adjusted and maintained without putting persons at risk when these operations are carried out under the conditions foreseen but also taking into account any reasonably foreseeable misuse thereof.

The aim of measures taken must be to eliminate any risk throughout the foreseeable lifetime of the machinery including the phases of transport, assembly, dismantling, disabling and scrapping.



## Key Phases of a machine lifecycle

- Transport
- Assembly
- Operation
- Maintenance
- Dismantling
- Disabling
- Scrapping
- Foreseeable use and misuse



## Implications

- Safety Components (new definition)
- Control Systems



## Definition of a Safety Components.

- which serves to fulfil a safety function,
- which is independently placed on the market,
- the failure and/or malfunction of which endangers the safety of persons.



## Safety devices that fall under the scope of the Directive Annex V Indicative list:

- Extraction systems.
- Guards and protection devices.
- Control devices for calling lifting appliances and anti fall devices for hoists.
- Protective devices designed to detect the presence of a person
- Safety belts and seat harnesses.
- Hydraulic non return valves where they are used to prevent falls

## **1.2.1. *Safety and reliability of control systems***

Control systems must be designed and constructed in such a way as to prevent hazardous situations from arising. Above all, they must be designed and constructed in such a way that:

- they can withstand the intended operating stresses and external influences,
- a fault in the hardware or the software of the control system does not lead to hazardous situations,
- errors in the control system logic do not lead to hazardous situations,
- reasonably foreseeable human error during operation does not lead to hazardous situations.





## Regulation 18 Control Systems.

Q. Is the control system fail safe?

Electrical.

Pneumatic.

Hydraulic.

Q. Will a fault lead to a dangerous situation.

Stored Energy removed?





## Safety Related Control systems

A control system in a machine should be regarded as being safety-related if it contributes to reducing any risk to an acceptable level or if it is required to function correctly to maintain or achieve safety.



NEW  
Technology



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TÜV®  A division of TÜV SÜD Product Service



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## Control Integrity

EN 954-1

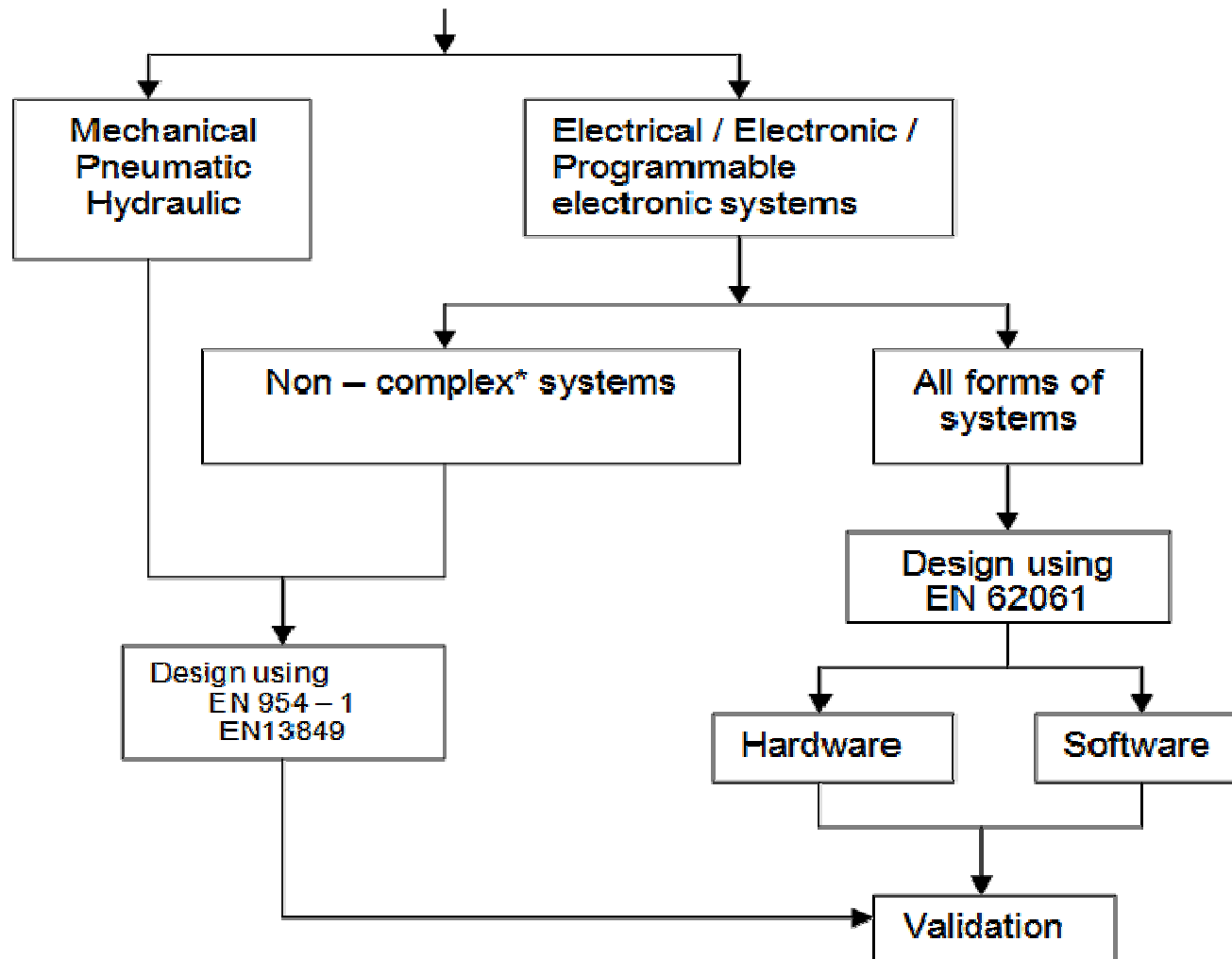
ISO 13849

IEC 62061

Which one to use?



## Choosing control Integrity Standards



- EN 954-1: traditional standard
  - Was due to be removed December 2009
  - CEN & EU agreed for it to stay until December 2011
  - Simplistic to use and understand
- EN ISO 13849-1 new standard
  - More complex to use
  - Requires validation

# EN 954-1 Category 1



All conditions of 'B' apply, but the safety related system must use 'well tried' principles and components, see 7.2.2 EN 954 -1.

Software or electronic logic is not considered adequate at this level.



- EN ISO 13849-1 is a replacement for EN 954-1 and can be used for any energy source.
- But if a specifically designed PLC is controlling the safety system please refer to IEC 62061.



## IEC 62061

An electrical standard to be used when the safety of the machinery is being controlled by a specifically designed safety PLC.

Can only be used on electrical installations.



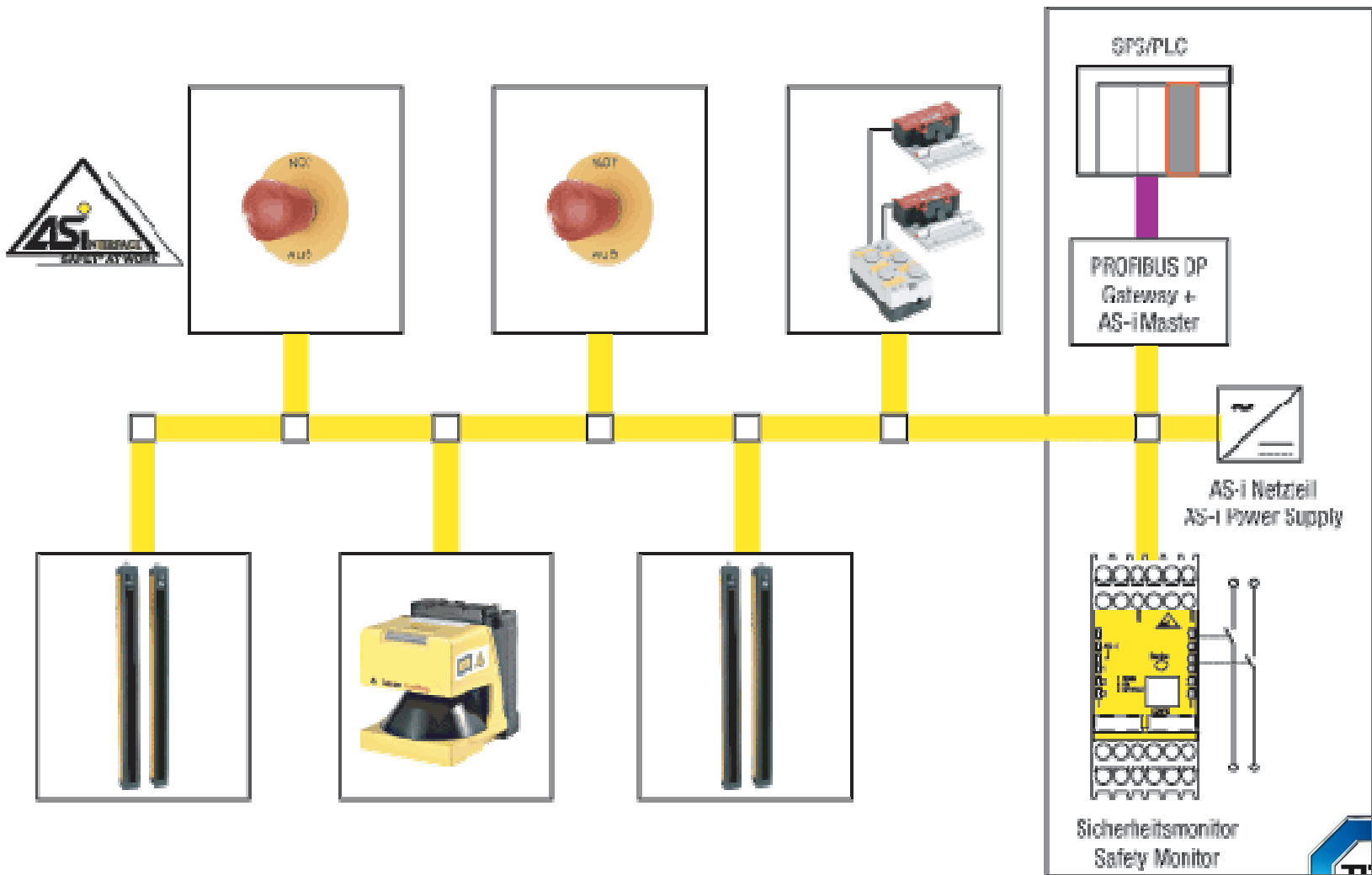


## IEC 62061

- Programmable Controllers {PCs}.
- Programmable Logic Controllers {PLCs}.
- Microprocessor based systems.
- Application specific integrated circuits (ASICs).
- Intelligent sensors/transmitters/actuators etc...
- Digital communication systems (e.g. bus systems).
- Internet based technologies.



# Functional Safety



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## ISO 13849-1

Introduces Performance levels (probability of a dangerous failure per hour) a,b,c,d,e.

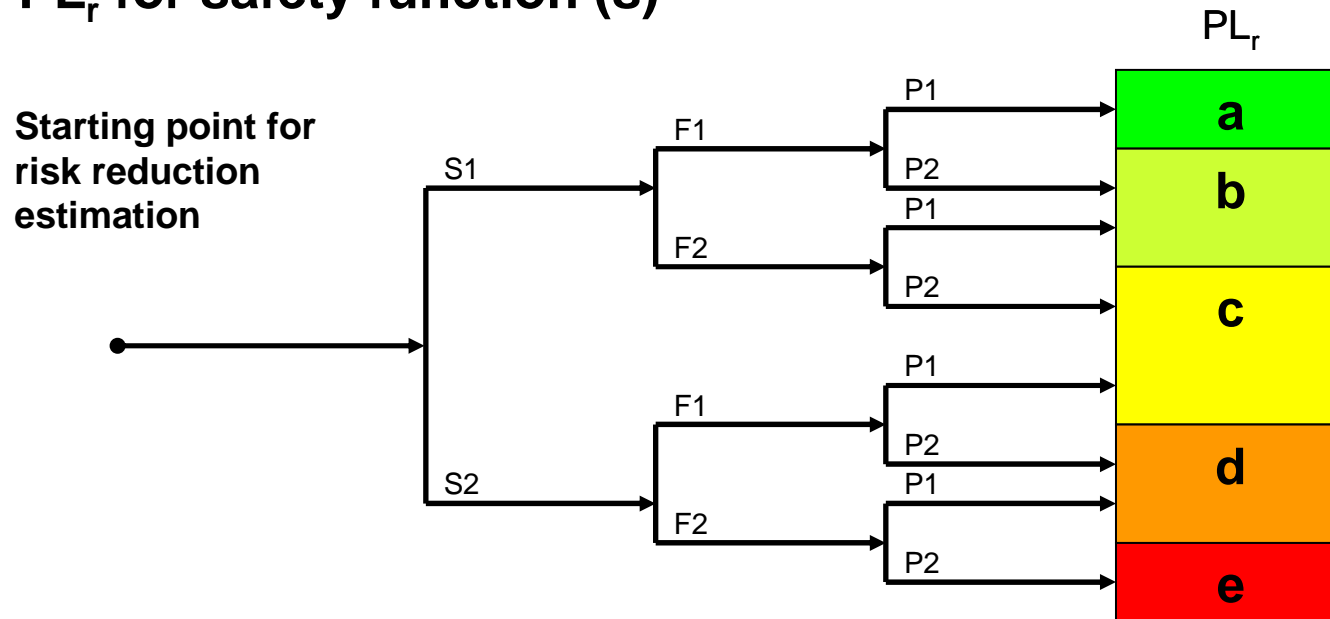
Based on the Safety Related Parts of the control system (SRP/CS).

Data to be obtained from manufacturer Mean Time To (dangerous) Failure MTTFd.

## Four stage approach.

- Perform a risk assessment
- For the identified risks, allocate the safety measure (Performance Level (PL))
- Devise a system architecture that is suitable for the Performance Level
- Validate the design to check that it meets the requirements of the initial risk assessment

## Risk graph for determining the required $PL_r$ for safety function (s)



### 1. S severity of injury

- S1 slight (normally reversible injury)
- S2 serious (normally irreversible injury or death)

### 2. F frequency and/or exposure to hazard

- F1 seldom-to-less-often and/or exposure time is short
- F2 frequent-to-continuous and/or exposure time is long

### 3. P possibility of avoiding hazard or limiting harm

- P1 possible under specific conditions
- P2 scarcely possible

## Definitions

- 3.1.25 mean time to dangerous failure
  - MTTFd
  - expectation of the mean time to dangerous failure
  - i.e. How long before an element fails

## Motoring Analogy

- EN 954-1 = an MOT
  - A snap shot of what it's like at that given point in time
- EN ISO 13849-1 = manufacturer's advice
  - i.e. Change a cam belt after 60 000 miles.
  - It takes into account the lifecycle of the machine

# Problems for Industry



- Lack of available MTTFd data
- Current lack of understanding of the standard's requirements
- Confusion around PL and categories that are achievable by assessment and through validation
- People who don't know



# Case Study



- Manufacturing company carried out 13849-1 assessment
- Chose Category to use and installed it without validation
- Laidler carried out validation which showed method used didn't achieve required Performance Level
- Company had to remove newly installed circuitry and start again at additional cost





## New Laidler Functional Safety Services

- Consultancy services carrying out 13849-1 assessment and validation
- 1 and 2 day awareness training on electrical EN standards
- 2 new University modules
  - UCPD Electrical machinery safety
  - UCPD Functional Safety





- 43 CEN Technical Committees
  - over 250 Working Groups
  - approximately 4000 technical experts
- 588 Harmonised European Standards (including amendments) cited in the Official Journal of the European Union (2007-05-08)





## **Changes to Standards** (re-harmonised for the New Directive)

BS EN 418 Emergency stop now BS EN ISO 13850

BS EN 1050 Risk Assessment now BS EN ISO 12100  
(14121-1 and 1200-1 and -2 amalgamated into 1 standard)

BS EN 811 & 294 Guarding now BS EN ISO 13857

EN 775 Robots now BS EN ISO 10218-1



**END**