Safety Instrumented Systems
&
Functional safety of safety-related systems

A substantial new opportunity for Pfannenberg Signaling products

SIL PL conform

GPM / VM

Safe Signaling

Signaling Technology

SIL
PL

Alarm

Warning

Indication



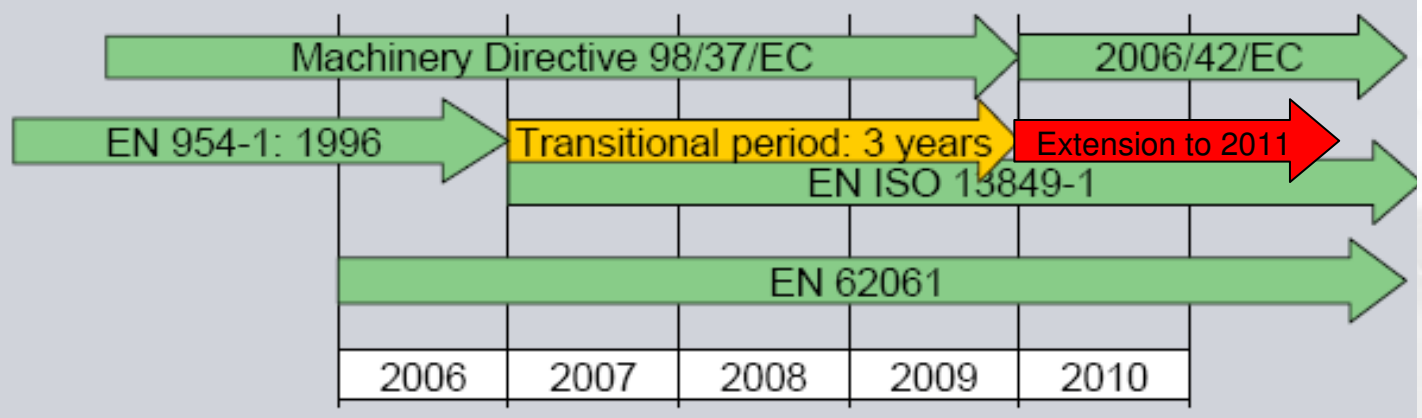




Functional Safety

Why ?

New edition of the European Directive for Machinery (2006/42/EG) which became mandatory end of 2009. This includes also the related safety standards.



Motivation for Safety of Machinery / Plants

Needless to say:

Safety for people and environment

But also:

Safety for property

Availability and economic efficiency of machines and plants

And of course:

Driven by authorities and inspection bodies

Manufacturer and Market Importer
(EU Market Regulation)

Operator (Plant Owner)
(Health and Safety Regulations)

International Safety Standards

Standards regarding to SIL & PL

Machinery Industry

Process Industry

Electric
Hydraulic
Pneumatic
Mechanic

IEC 62061

IEC 61511

EN ISO 13849

IEC 61508

Electric
Electronic
Program. Elec.
(E/E/PE)

Relevant standards / regulations:

USA

Process Safety is regulated by OSHA FCR 1910.119. It directs the End User to follow current standards, codes and best industry practice.

Safety Instrumented Systems are governed by ANSI/ISA S84.01, i.e. IEC 61511

Machine Safety: ISO 13849-1 is not mandatory in the US it becomes more and more significance

Correlation of Safety Standard

SIL / PL and Correlation to Standards	Machinery Industry			Process Industry
	Mostly EU		Mostly USA	EU and USA
Umbrella Standard	IEC 61508		IEC 61508	IEC 61508
Industry Specific Standard	ISO 13849	IEC 61062	ANSI/ISA-S84 / IEC 61511	ANSI/ISA-S84 / IEC 61511
Functional Safety Measure	PL	SIL	SIL	SIL

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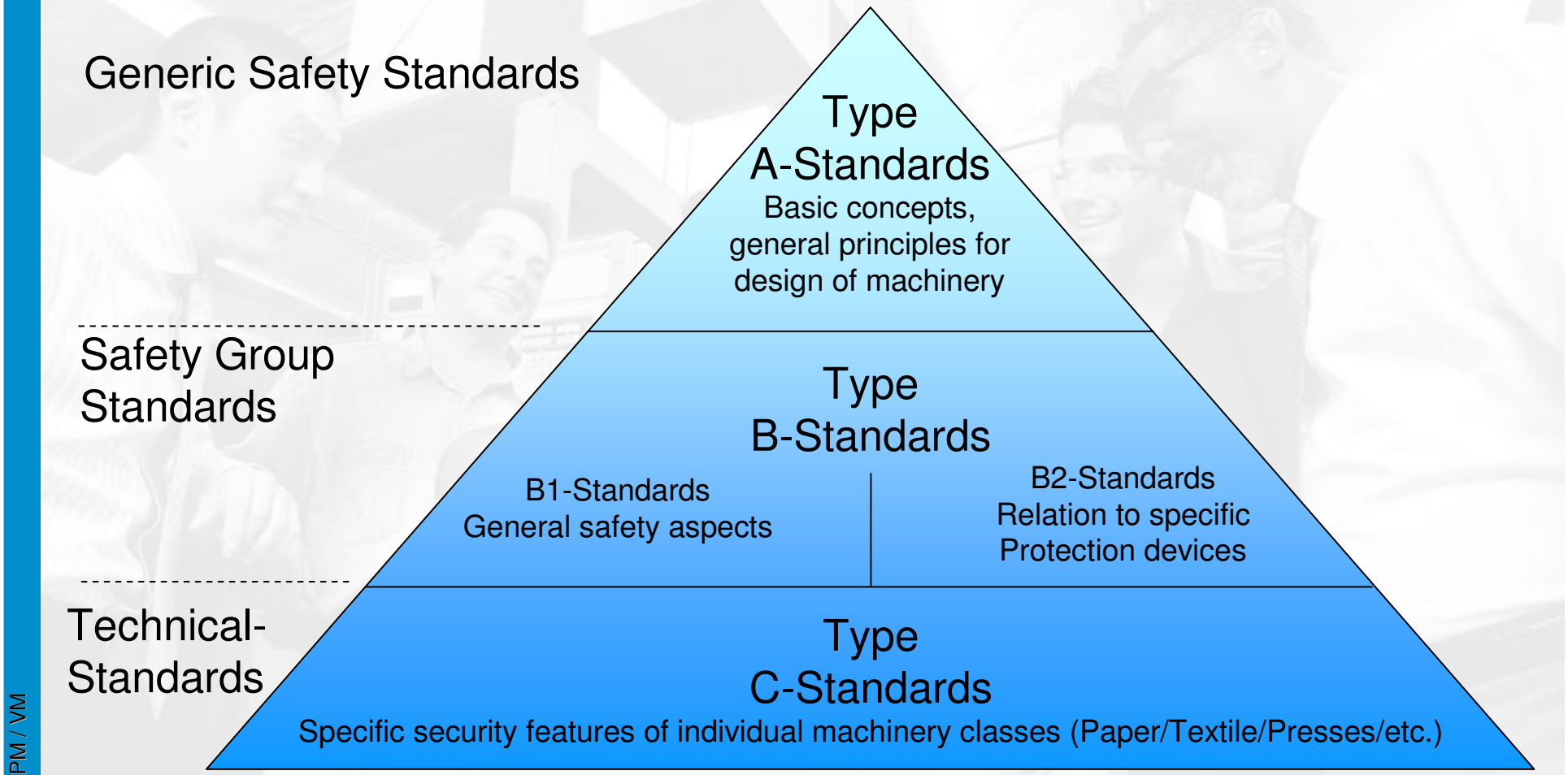
Hierarchical Structure of EN-Standards



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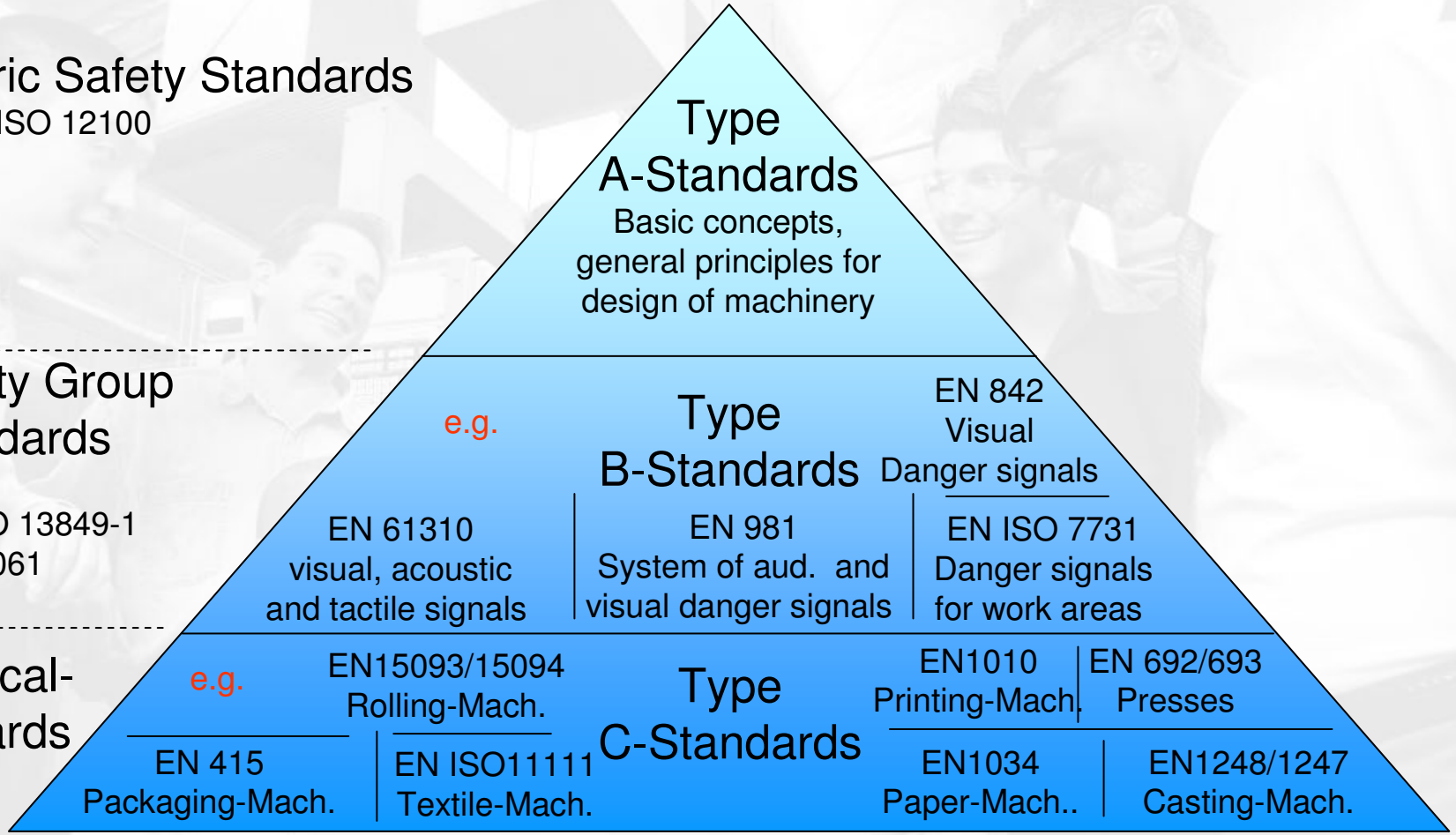
Hierarchical Structure of EN-Standards

Generic Safety Standards
e.g. EN ISO 12100



Safety Group Standards
e.g.
EN ISO 13849-1
EN 62061

Technical-Standards

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Functional Safety

SIL / PL

All Standards result in the same unit of measurement!

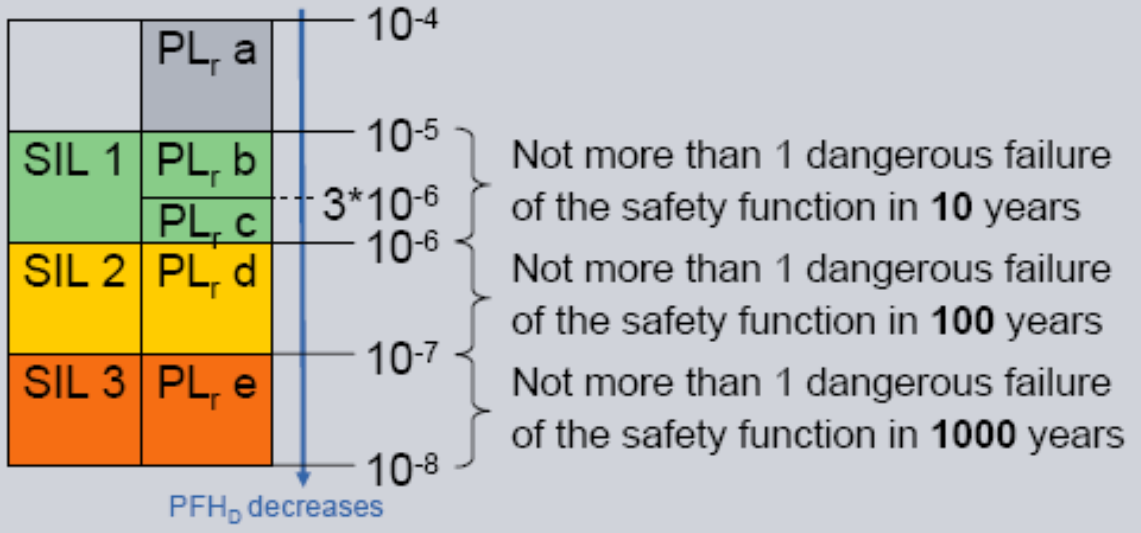
SIL => Safety Integrity Level)

PL => Performance Level

Functional Safety

SIL and PL describe requirements for the maximum permissible probability of dangerous failure for a safety function:

- Probability of dangerous failure per hour PFH_D
- The higher the safety level, the lower the required PFH_D



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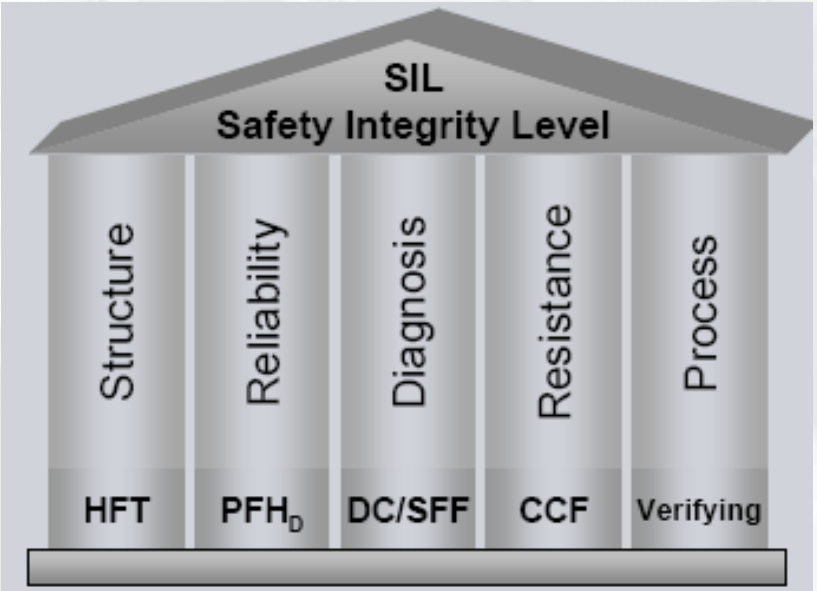
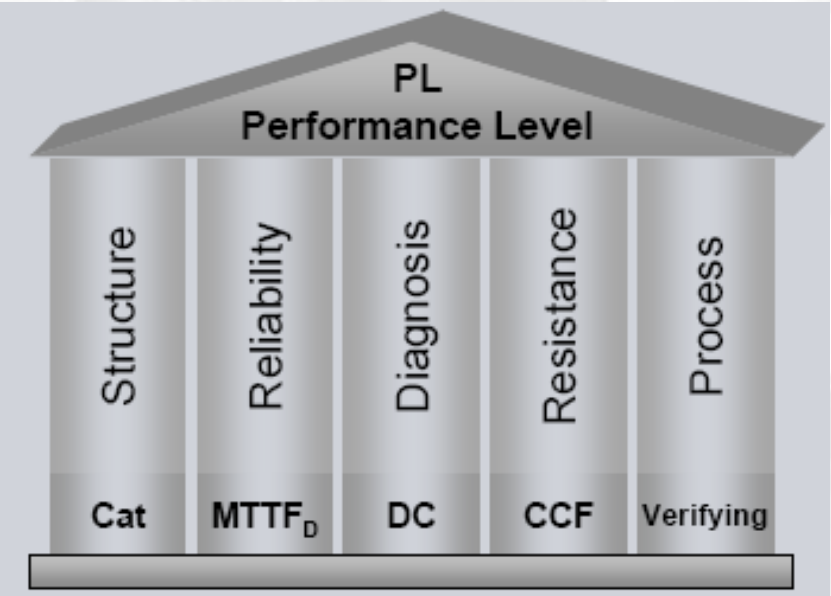
Functional Safety

The evaluation of the safety levels is based on several columns





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Functional Safety

3 Steps of Risk Reduction:

Prio. 1: Safe design (Integration of safety into the design of machines / plants / processes)

=> No application for our products !

Prio. 2: Technical protective measures (A safety function must be defined for each hazard that cannot be eliminated by design)

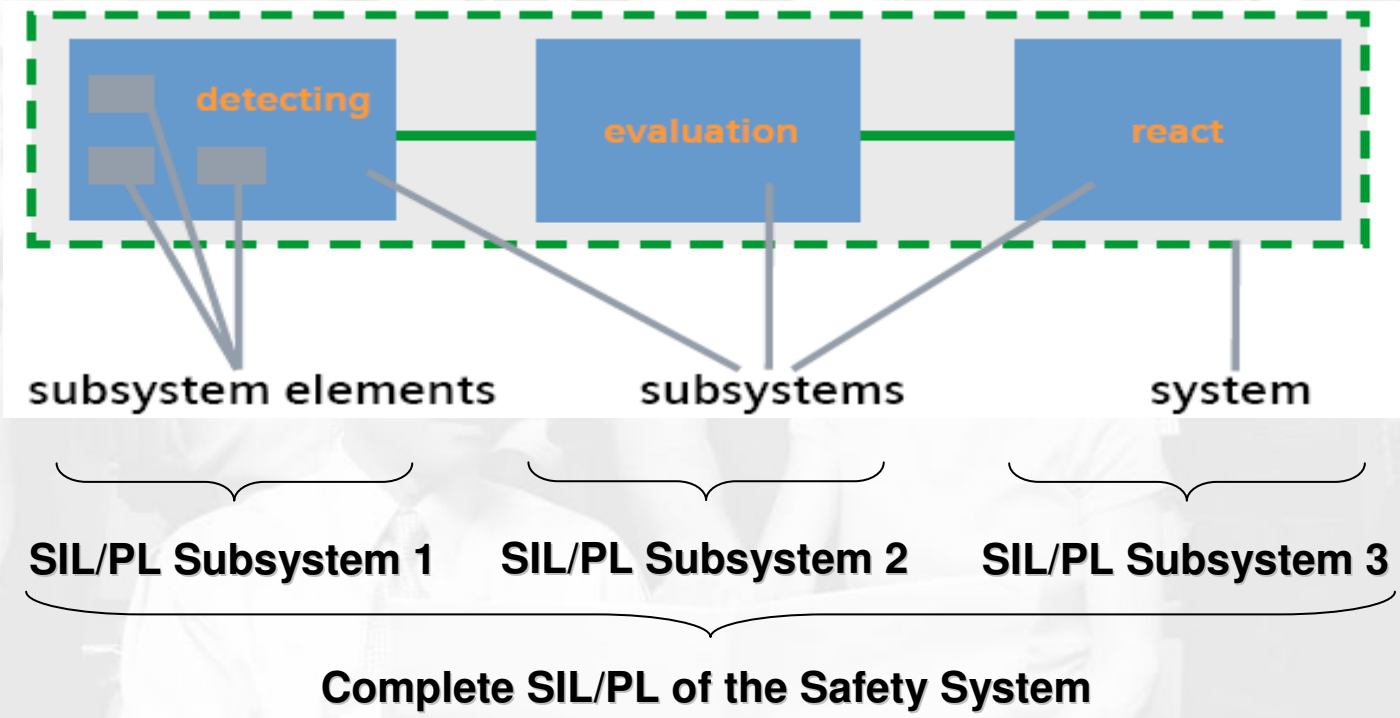
=> Partly application for our products !

Prio. 3: User information warns of residual risks

=> Definitely application for our products !

Functional Safety

A "safety function" is executed by a "system".
A "system" is combined of "subsystems".
A "subsystem" consists of "subsystem elements"



Selecting of Alarming devices

Generally alarming devices perform safety-relevant protective functions within process engineering plants.

This means, if a warning device has to warn in case of failure, at the same time the consequence of a failure of the warning device itself, is always a potential risk.

Machinery Engineering

EN 61310-1, Chapter. 4.1:

„The selection of the used equipment (safety related signaling) has to take into account the consequences of any defect that can result from one of these devices.“
... The measures have to be determined by a risk analysis"

Application of SIL – calculated Components and inserting into the safety loop!

DIN EN 61310-1: Safety of Machines -Indication, Marking and Operation - Part 1: Requirements for visible, audible and tactual signals

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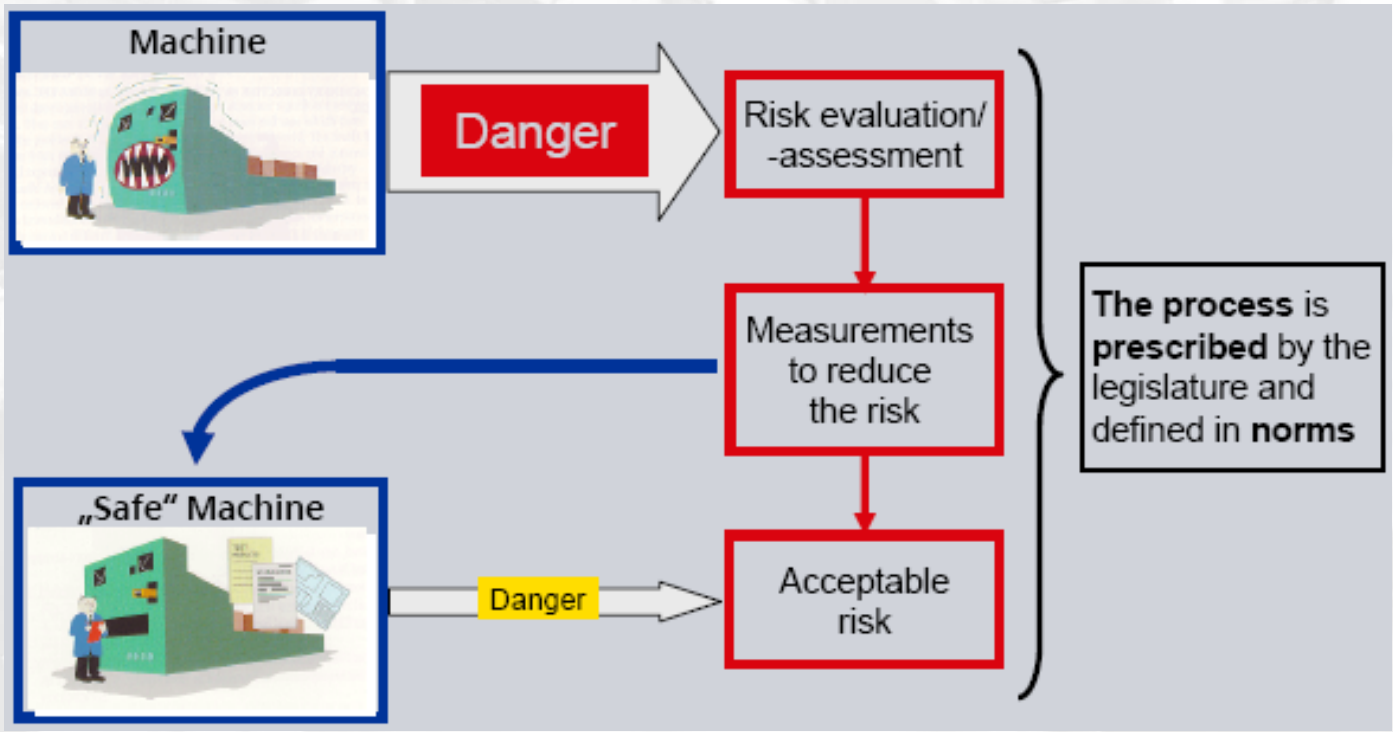
Functional Safety

Manufacturer of machinery and plants have to perform a risk evaluation to identify the needed safety level for each system / subsystem.



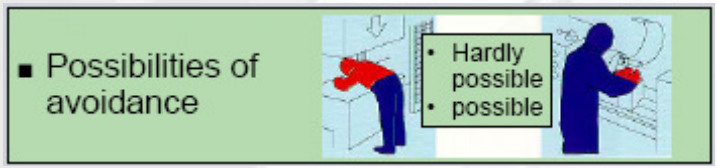
Functional Safety

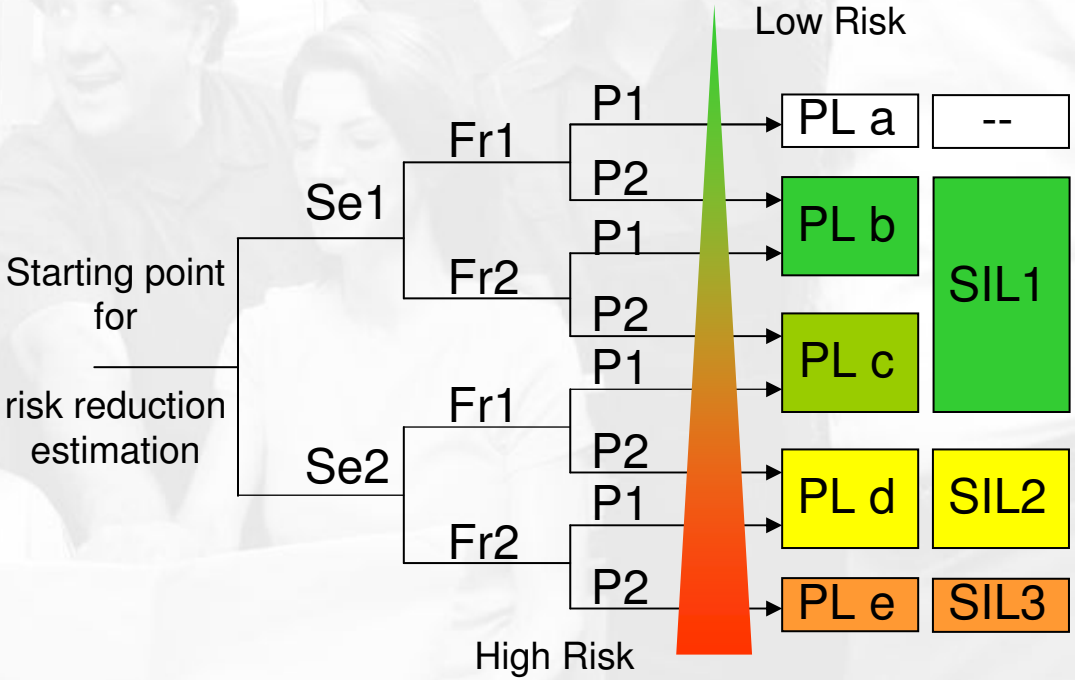
Risk = Function of:

Extent of damages (S)

Frequency and duration (F)

Possibility of avoidance (P)





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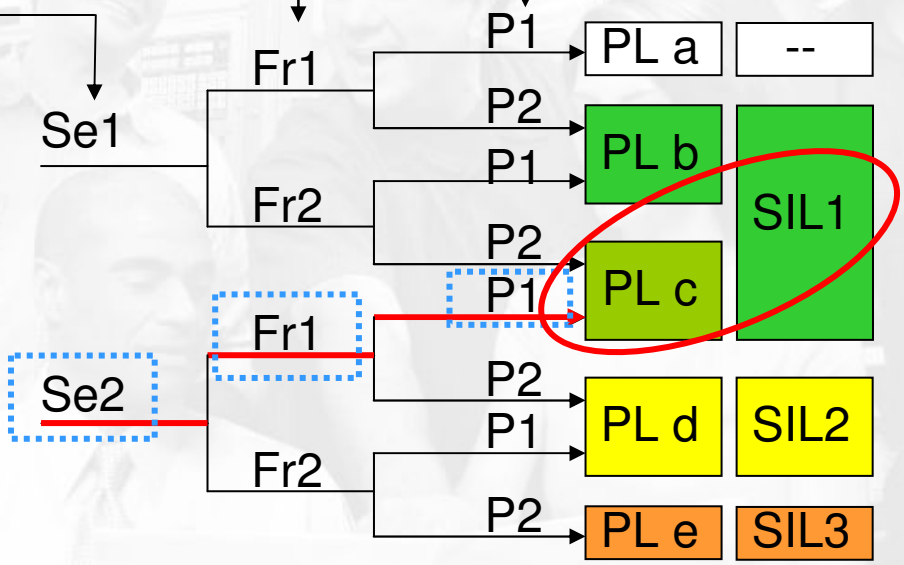
Functional Safety

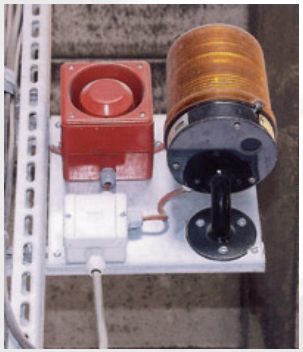
Extent of injury	Se
Irreversible injury	Se2
Reversible injury	Se1

Frequency / duration	Fr
Frequent / long	Fr2
Seldom /shortly	Fr1

Possibility of avoidance	P
Rarely	P2
Possible	P1



Risk:
Starting of Machinery



All Safety Functions have to be SIL1 or PLc!

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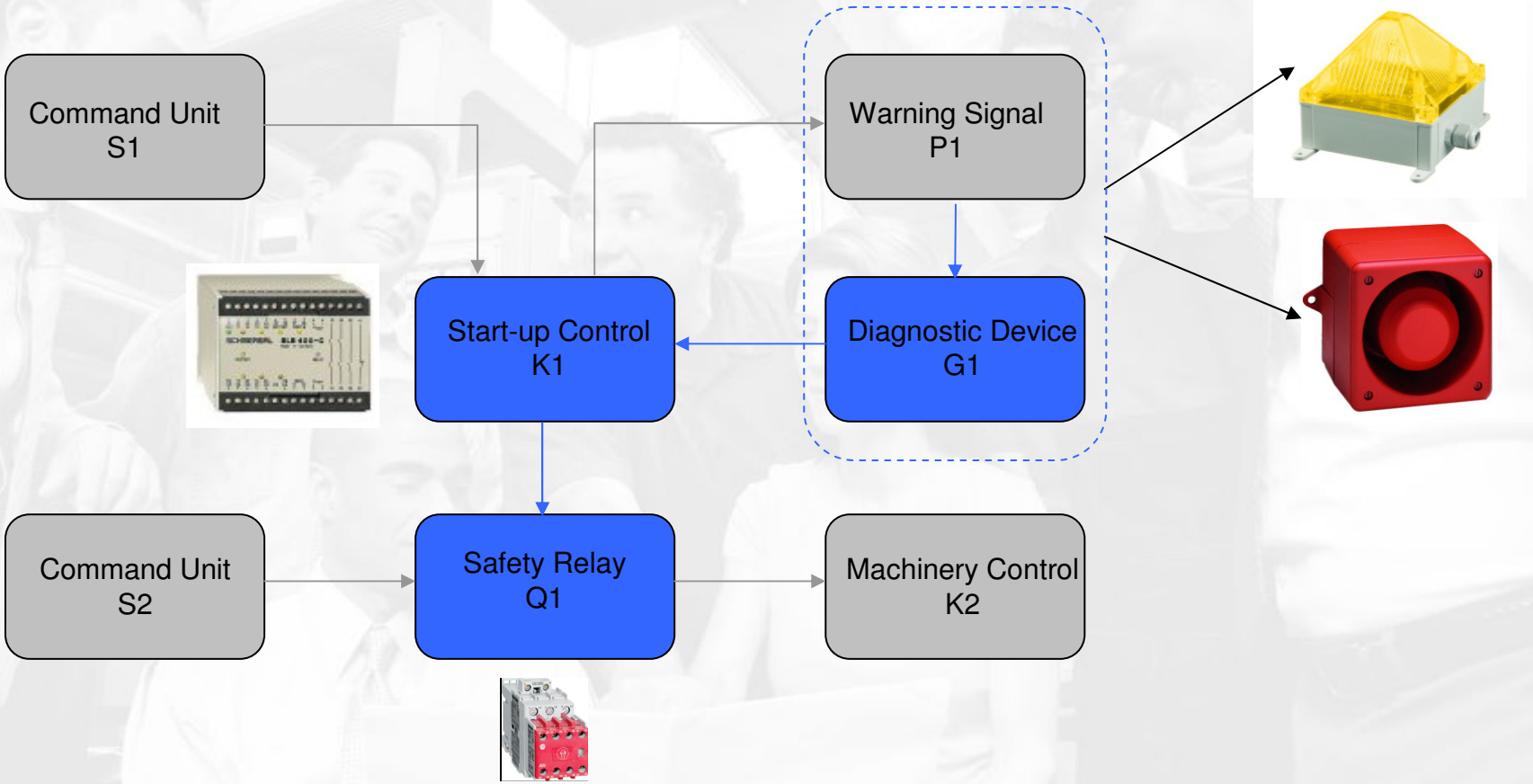
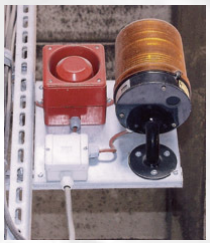
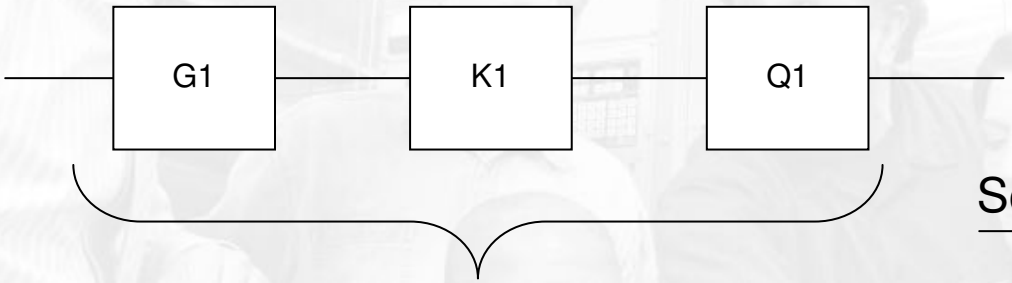
Safety Function: Machine-Start-up - Equipment



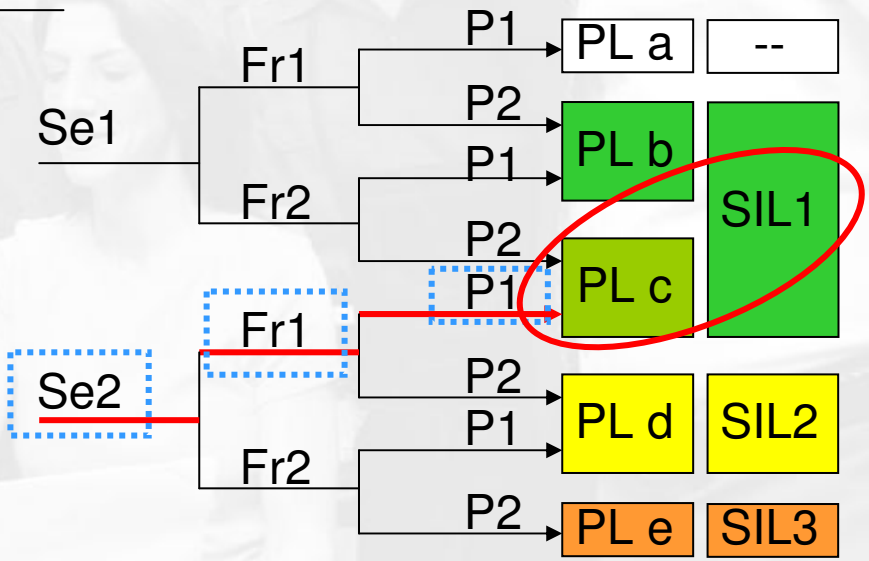
Safe Signaling

Safety-Related Block Diagram:





Required SIL/PL Value
of the Safety-System
„Machine-Start-up Alarming“
PLr c / SIL 1



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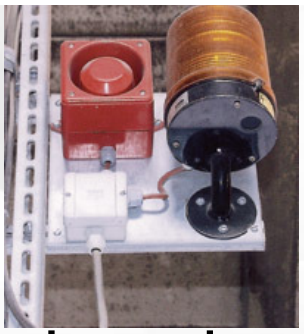
Safe Signaling

At least the following control systems shall satisfy table 2 which shows the relevant applications. Others are specified in the other parts of EN1010.

	PL_r "c" or SIL 1	PL_r "d" or SIL 2
Emergency stop for main drive movement		X
Electrically inter-locked protective devices (limit switches)		X
Operating modes (e.g. hold-to-run, crawl speed)		X
Acoustic start-up warning signal / flashing warning lights	X	
Sheet pile fans in the delivery	X	
Pull lay adjustment on the feeder	X	

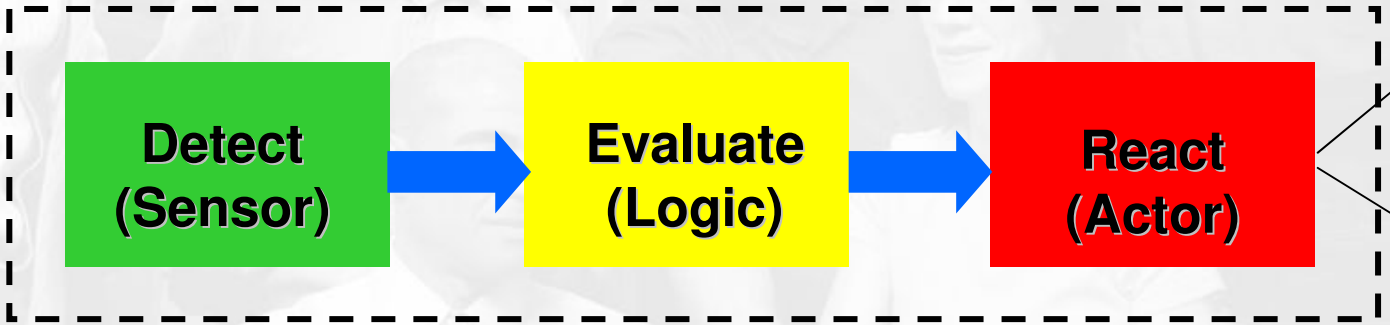


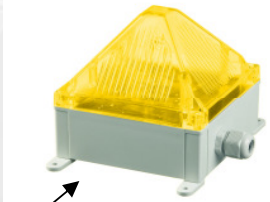
All Safety Functions have to be SIL1 or PLc!

Functional Safety

Where to find our products:

Logical illustration of the safety function





Safe Signaling

SIL / PL – conform Products:

SIL PL conform

- **Sounder DS 5 / DS 10-SIL**
  105 / 110 dB, 24Vdc/115Vac/230Vac
  Integrated diagnose function
  suitable for Safety Systems till SIL 2 / PL d

- **Flashlight Quadro F12-SIL**
  10J / 118cd, 24Vdc/115Vac/230Vac
  Integrated diagnose function
  suitable for Safety Systems till SIL 2 / PL d

- **Flashlight PMF 2015-SIL**
  10J / 200cd, 24Vdc/115Vac/230Vac
  Integrated diagnose function
  suitable for Safety Systems till SIL 2 / PL d

Certified according newest Standards

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Where to find our products:

Some application examples

Machinery:

- warning for machine start up
-muting mode, in which cases the other safety functions are bypassed

Cranes:

- Warning in case of movement

Process:

- alert in case of gas or chemical leaks
- Acoustic alarm on casting platforms

Functional Safety

SIL / PL relevant target markets / countries:

In general Europe & all associated countries

<u>Countries:</u>
- USA
- Canada
- Japan
- Australia
- *China* (because of the huge export rate)

<u>Industries</u>
- machinery (manuf. & end user)
- plants (manuf. & end user)
- ind. Processes (end user)

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Pfannenberg blazes a trail, that‘s for sure!

SIL PL conform

Safety? Yes
But not too safe!

Any questions?
Please don’t hesitate to ask!