


2 Follow one of the two existing directives

For new machines

> Machinery Directive 2006/42/EC

Compels machine manufacturers to meet a minimum set of requirements before a machine can be released on the market within the EEA.

For existing machines

> Use of Work Equipment Directive 89/655/EEC

Sets forth users' obligations, which can, in most cases, be met by using machinery compliant with the relevant standards.

3 Use the right standard

For new machines

> EN ISO 13849-1 or EN 62061

European machine safety standards >

- EU Machinery Directive 2006/42/EC
- **Type A** Basic safety standards EN ISO 12100
- **Type B** Generic safety standards EN ISO 13849-1 or EN 62061 or EN 60204-1 or EN ISO 13850
- **Type C** Specific machine safety
- CE marking and certification under the Machinery Directive

Calculation of the safety level of the processes and machines

EN ISO 13849-1 standard

PL

EN 62061 standard

SIL

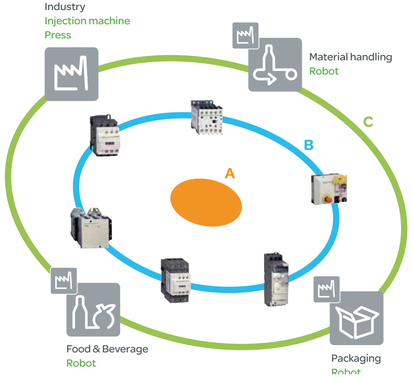
TeSys products, for safety you can trust

TeSys contactors – part of the TeSys motor drive range – are used for machine and process protection you can rely on to keep people and property safe.
Equipped with integrated mirror contacts, TeSys contactors are designed to provide the self-control features required by the major safety standards.
The TeSys product line also includes all of the isolation, protection, and emergency handling components (circuit breakers and switches with an emergency kill handle, enclosed starters, etc.) you need to comply with the EN 60204-1 and the EN ISO 13850 standards.

Type A
Basic safety standards
EN ISO 12100

Type B
Generic safety standards
EN ISO 13849-1,
EN 62061,
EN 60204-1,
EN ISO 13850

Type C
Specific machine safety standards



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Let TeSys® be your drive

For safer processes and machines

Safety M

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Why Safety?

As well as the moral obligation to avoid harming anyone, there are standards that require machines to be safe, and sound economic reasons for avoiding accidents.

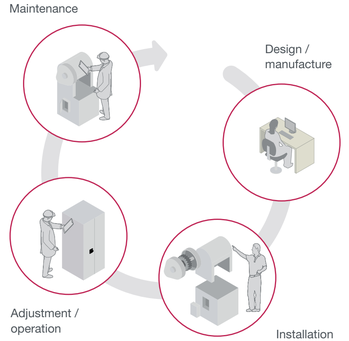
The cost of accidents

- Some of the costs of accidents are obvious – such as sick pay for injured employees. Other costs are harder to quantify.
- The full financial impact of accidents can include higher insurance premiums, lost production, lost customers, and even loss of reputation.



How to ensure safer processes and machines?

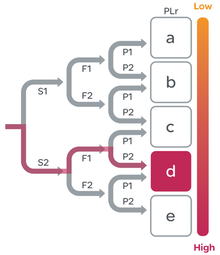
1 Make safety a part of every stage in your machine's life cycle



Performance Level

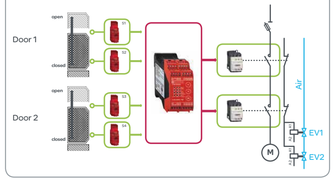
Risk evaluation

Consist for each dangerous part to analyze:
> the severity of injury
> the frequency and the exposure time of the person to hazard
> the technical possibility to avoid or limit the harm



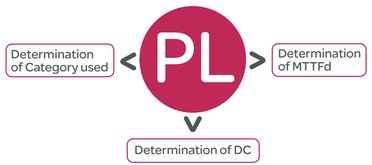
- **S**everity of injury
- **F**requency and/or exposure to hazard
- **P**ossibility of avoiding hazard or limiting harm

Example of machine design under EN ISO 13849-1



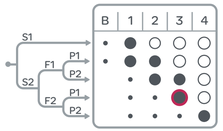
Determination of the Performance Level - PL

Performance level (PL) is calculated using architecture category, MTTFd and DC. The ISO standard defines five Performance Levels ranging from PL a (the highest failure probability) to PL e (the lowest).



1 Determination of Category used

The standard classifies the parts of the commands systems relative to the safety in 5 categories according to their behavior in case of appearance of defect.



Cat.	System behavior	Principle for ensuring safety
B	A fault can lead to loss of the safety function	Chose the appropriate component
1	Same as B, but better reliability of the safety function required	Well-tried safety principles
2	A fault can lead to loss of the safety function, which would be detected by the control system	Periodic testing
3	**If the fault is an isolated case, then the safety function is always assured. An accumulation of undected faults can lead to loss of the safety fuction**	**Redundant**
4	When faults occur, the safety function is always assured. The faults would be detected in time so as not to lose the safety function	Redundant + periodic testing

2 Determination of MTTFd

Mean Time To Dangerous Failure

The average period before the failure of a component will cause a failure of a safety function.

$$MTTF_d = \frac{B_{10d}}{0{,}1 \times n_{op}}$$

MTTFd result is:

Index	MTTFd range
Low	> 3 years to < 10 years
Medium	> 10 years to < 30 years
High	**> 30 years to < 100 years**

➔ What is B10 number ?

B10 is the number of operations at which 10% of the products will have failed and **B10d** is the number of cycles after which 10% of the products has failed to a dangerous state.

Information provided by the manufacturer.

TeSys D

B10d = 1 369 863

For specific applications contact your Schneider Electric specialist

3 Determination of DC

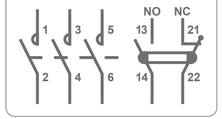
Diagnostic coverage

The ability of a component or circuit to detect/diagnose a fault concerning it (a short circuit, for example).

DC level of each product is provided by the standards

Diagnostic coverage	Range
Nil	DC < 60%
Low	60% ≤ DC < 90%
Medium	90% ≤ DC < 99%
High	**99% ≤ DC**

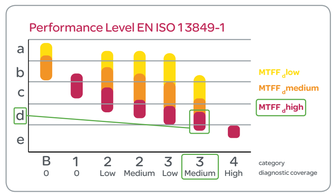
Mirror contact (1 "NC") EN 60947-4-1



Mirror contact

4 Calculating PL

You know:
- the category of architecture (B, 1, 2, 3 or 4)
- the MTTFd (low, medium or high)
- the diagnostic coverage (0, low, medium or high)



Comparing PL and SIL

Standard	Definition	Level equivalence				
EN ISO 13849-1	PL	a	b	c	d	e
EN 62061	SIL	X	1	1	2	3

Determination of CCF level

Common Cause Failures

CCF occur when an external effect (such as physical damage) renders a number of components unusable irrespective of MTTFd.

Steps taken to reduce CCF include:
- Diversity in the components used and modes in which they are driven
- Protection against pollution
- Separation
- Improved electromagnetic compatibility

Scoring for Measures Against Common Cause Failure

N°	Mesure against CCF	Score
1	Separation/Segregation	25
2	Diversity	38
3	Design/Application/Experience	2
4	Assessment/Analysis	18
5	Competence/Training	4
6	Environmental	18

Score ≥ 65	Meets the requirements
Score < 65	Additional measures required

Assess your machines' performance levels easily

Sistema is free, open-source software that makes it easy to assess your machines' PL. The user simply enters the machine architecture, and the software leverages standard databases from a variety of manufacturers to determine the PL. If you use Sistema, Schneider Electric can provide you with a database of its safety product specifications compatible with the software.
If you are not already using Sistema, you can download the software on the Schneider Electric website:
www.schneider electric.com