Control Categories

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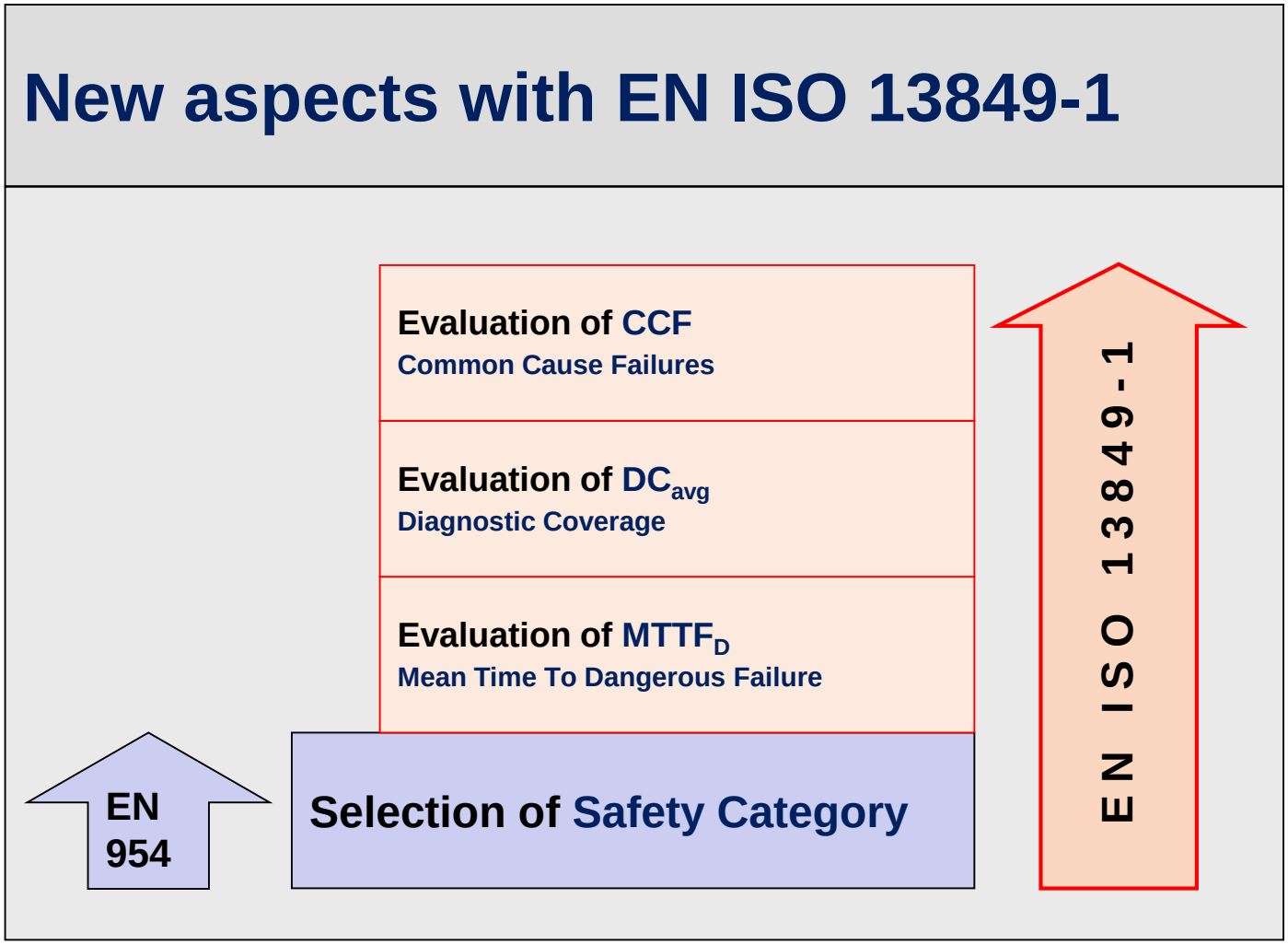
EN ISO 13849-1 - Parameters for PL Calculations



1. Control Categories - Architecture of the Control System

This is achieved by taking help from earlier EN 954-1, from **Control categories, i.e B, 1, 2, 3 and 4.**

2 (a) Mean Time to Dangerous Failure ($MTTF_D$)

$MTTF_d$ is a statistical mean value of operational time without dangerous failure in a single control channel. It describes the reliability / quality of the product or parts of the product.

LOW QUALITY	–	3-10 YEARS
MEDIUM QUALITY	–	10-30 YEARS
HIGH QUALITY	–	30-100 YEARS

2 (b) B10d VALUE FOR ELECTROMECHANICAL DEVICES WITH WEAR & TEAR

$B10_D$ is denoted by cycle of operations when 10% of components have failed

Magnetic Safety Switches -	400,000 … 20,000,000 Cycles (depending on load)
Position Switches (+ve break NC contact) -	20,000,000 Cycles (independent on load)
Safety Switches with separate actuator -	2,000,000 Cycles (independent on load)
E-Stops and Enabling devices -	100,000 Cycles (independent on load)

The $B10_d$-values are either provided by the manufacturer (preferred source) or can be found in the standard itself (appendix C, table C1)

3. DIAGONOSTIC COVERAGE

DC is a the performance of a item to detect failure in time

Data as given in 13849 or from Manufacturer

NO Diagonistic	–	LESS than 60%
Low Diagonistic	–	60 - 90%
Medium Diagonistic	–	90 – 99%
High Diagonistic	-	More than 99%

4. COMMON CAUSE FAILURE

CCF is determined by selection of the following with minimum points
Data as given in 13849 or from Manufacturer

Design / Application / Experience	–	20 POINTS
Assesment / Analysis	–	5 POINTS
Competence / Training	–	5 POINTS
Environemental	-	35 POINTS

This shall have more than 65 points as per stds

Selection of control category

Control category B

Requirements

The safety-related parts of control systems and/or their protective equipment and their components must be so arranged, built, selected, assembled and combined in accordance with the applicable standards that they are able to withstand the influences to be anticipated.

System behaviour

The occurrence of a fault can lead to the loss of the safety function.

Principles to achieve safety

Mainly characterised by the selection of components

Additional requirements

$MTTF_D$	→	low – medium
DC_{avg}	→	not relevant
CCF	→	not relevant
PL_{max}	→	**b**

Selection of control category

Control category 1

Requirements
The requirements of B must be fulfilled. Proved components and safety principles must be applied.

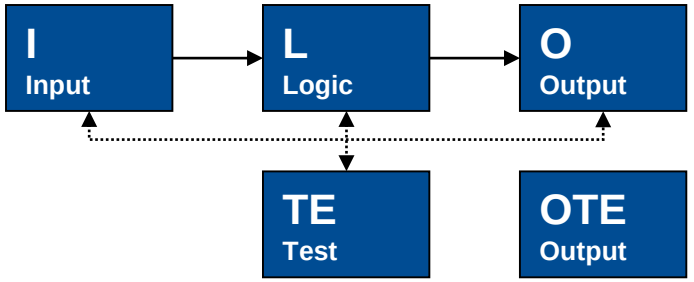
System behaviour
The occurrence of a fault can lead to the loss of the safety function. The probability of a fault occurring is lower than in Category B.

Principles to achieve safety
Mainly characterised by the selection of components

Additional requirements

$MTTF_D$	→	low – medium
DC_{avg}	→	not relevant
CCF	→	not relevant
PL_{max}	→	**c**

Selection of control category



Control category 2

Requirements
The requirements of B and the application of proved safety principles must be fulfilled.
The safety function must be tested by the machine control system at suitable intervals.

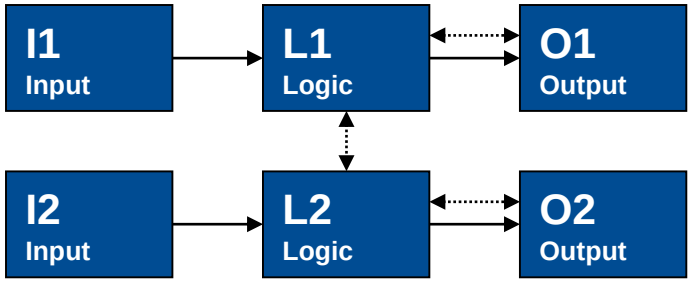
System behaviour
The occurrence of a fault can lead to loss of the safety function in the interval between tests. The loss of the safety function is detected by the test.

Principles to achieve safety
Mainly characterised by the structure

Additional requirements

$MTTF_D$	→	low – high
DC_{avg}	→	low – medium
CCF	→	≥ 65 points
Test frequency	→	> 100 x $F_{1,2}$
PL_{max}	→	**d**

Selection of control category



Control category 3

Requirements
The requirements of B and the application of proved safety principles must be fulfilled. Safety-related parts must be arranged such that: A single fault in each of these parts does not lead to loss of the safety function and: Whenever this can be carried out in an appropriate manner, the individual fault should be detected.

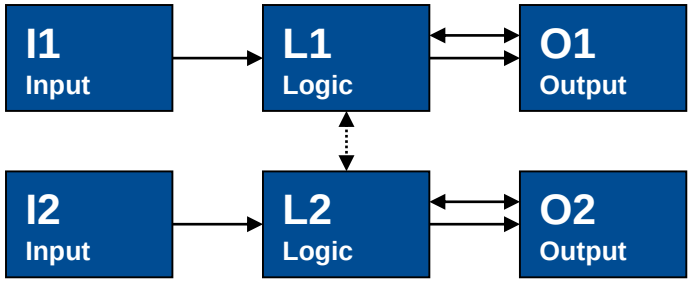
System behaviour
If an individual fault occurs, the safety function is always maintained. Some but not all faults are detected. An accumulation of undetected faults can lead to loss of the safety function.

Principles to achieve safety
Mainly characterised by the structure

Additional requirements

$MTTF_D$	→	low – high
DC_{avg}	→	low – medium
CCF	→	≥ 65 points
PL_{max}	→	**e**

Selection of control category



Control category 4

Requirements
The requirements of B and the application of proved safety principles must be fulfilled. Safety-related parts must be arranged such that: A single fault in each of these parts does not lead to loss of the safety function and: The individual fault is detected on or before the next requirement of the safety function. If this is not possible, an accumulation of faults must not lead to loss of the safety function.

System behaviour
If faults occur, the safety function is always maintained. The faults are detected in time to prevent a loss of the safety function.

Principles to achieve safety
Mainly characterised by the structure

Additional requirements

$MTTF_D$	→	high
DC_{avg}	→	high
CCF	→	≥ 65 points
PL_{max}	→	**e**

Thank you

for your attention!

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