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EN ISO 13849-1 FUNCTIONAL SAFETY DESIGN

❑ Introduction

EN 13849 is a TYPE-B1 standard. If there is a type-C standard to comply, the TYPE-C is still the main standard. The component is called SRP/CS (Safety-related parts of control system) when the control unit is designed to provide safety function. In addition, SRP/CS provides operation such as two-hand control device.

SRP / CS have 5 categories to provide protection according to predictable conditions. (Performance level/PL) PL is defined by Probability of dangerous failure per hour.

Probability of a dangerous failure per hour [1/h]	PL EN ISO 13849-1 Performance Level	SIL EN IEC 62061 Safety Integrity Level
$10^{-5} < PFH < 10^{-4}$	a	no corresponding level
$3x10^{-6} < PFH < 10^{-5}$	b	1
$10^{-6} < PFH < 3 \cdot 10^{-6}$	c	1
$10^{-7} < PFH < 10^{-6}$	d	2
$10^{-8} < PFH < 10^{-7}$	e	3

Probability of dangerous failure per hour is determined by elements including of hardware and software structure, Diagnostic coverage/DC, Mean time to dangerous failure/MTTFd, Common cause failure/CCF, Design process, Operating stress, environment condition and Operating procedures.

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❑ **PL has 5 categories including of B, 1, 2, 3, and 4.**

PL can be applied in safety control system as follows

-Safety device (ex. Two-hand control device, interlock), photoelectric protective devices (ex. sensor), pressure sensor devices.

-Control unit (ex. logic unit, data processing and monitor)

-Power control unit (ex. relay and valve)

Also applicable to performing safety function of machines-from simple machine such as small kitchen machine, auto door, wrapping machine, printing machine and press.

1. Category

EN ISO 13849 is applicable to electric/hydraulic/pneumatic safety control system.

2. Explanation of terms

Definition Safety-related part of a control system (SRP/CS) Safety related parts of control systems" deals with safety signal input and output Remark1: SRP/CS combined starts from signal input including of position switch rod/roller to stop when power control component output. Remark2: Monitor diagnostic is SRC/CS.

3 Specification of Categories

Category About failure resistance (probability of occurrence) and follow-up behavior made by the structure, failure detecting, and stability of SRP/CS.

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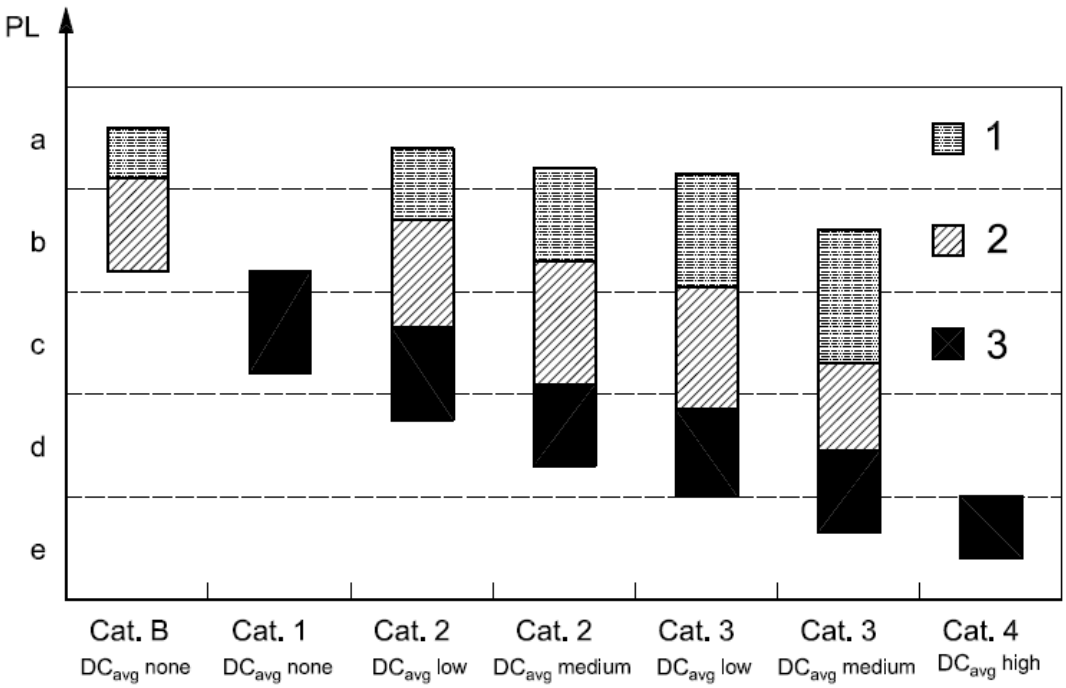
3.1 General principle



Key

PL performance level
1 $MTTF_d$ of each channel = low
2 $MTTF_d$ of each channel = medium
3 $MTTF_d$ of each channel = high

The chart shows the general structure and sample, but any extend structure is possible. Any extend structure is analyzed by the diagnostic tool to comply PL requirement.

3.2 Structure

Generally most machines have the relative PL. Every PL has a safety block. According to specification of category , PL (MTTFd and DCavg of each channel) is based on designated structure.

The structure assesses PL and SRP/CS needs to explain how to comply the level. Generally if the design complies with level requirement, the design also complies with the designated structure.

3.3 (Category 1) MTTFd of each channel (HIGH)