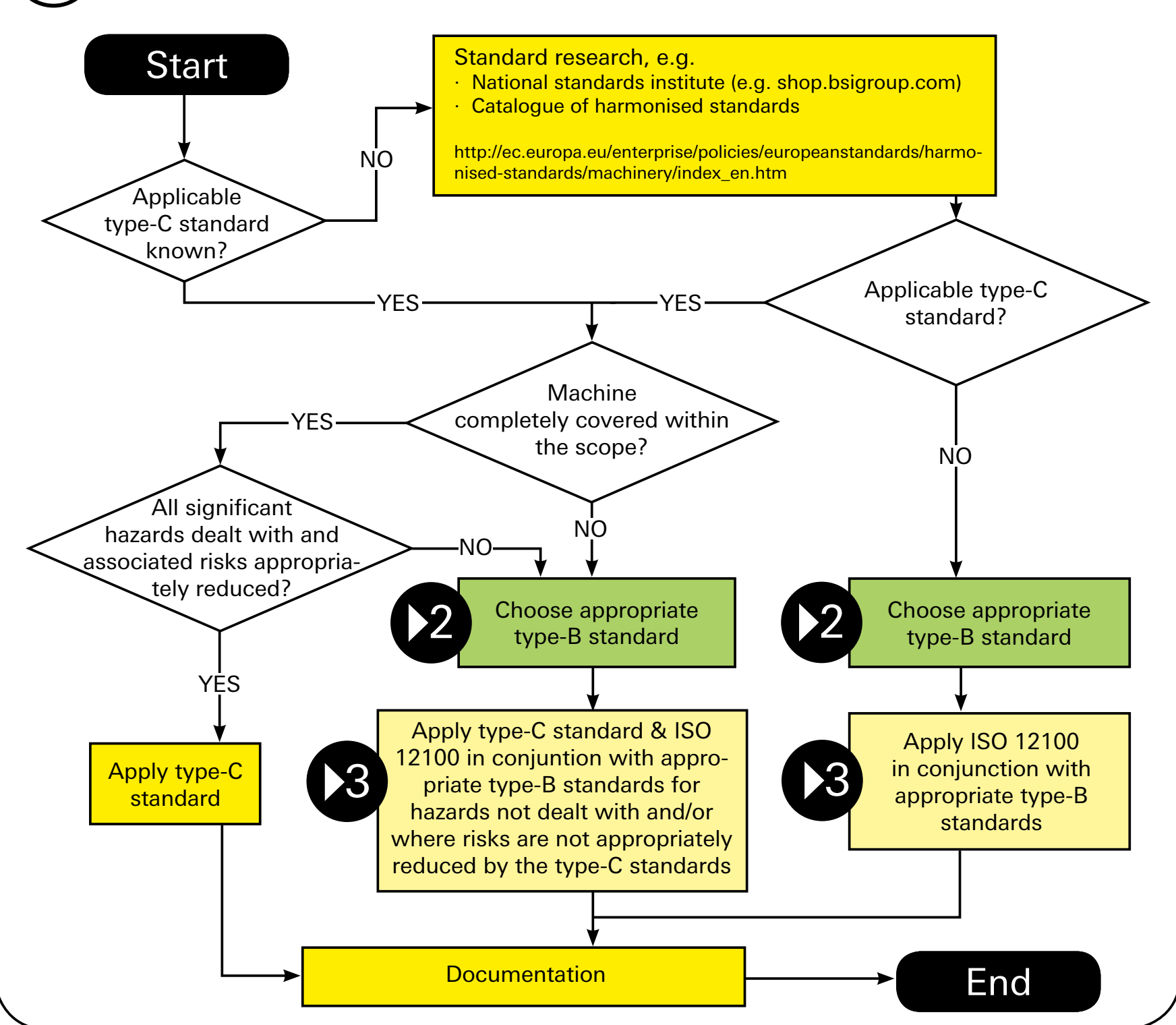


1 Selection of standards



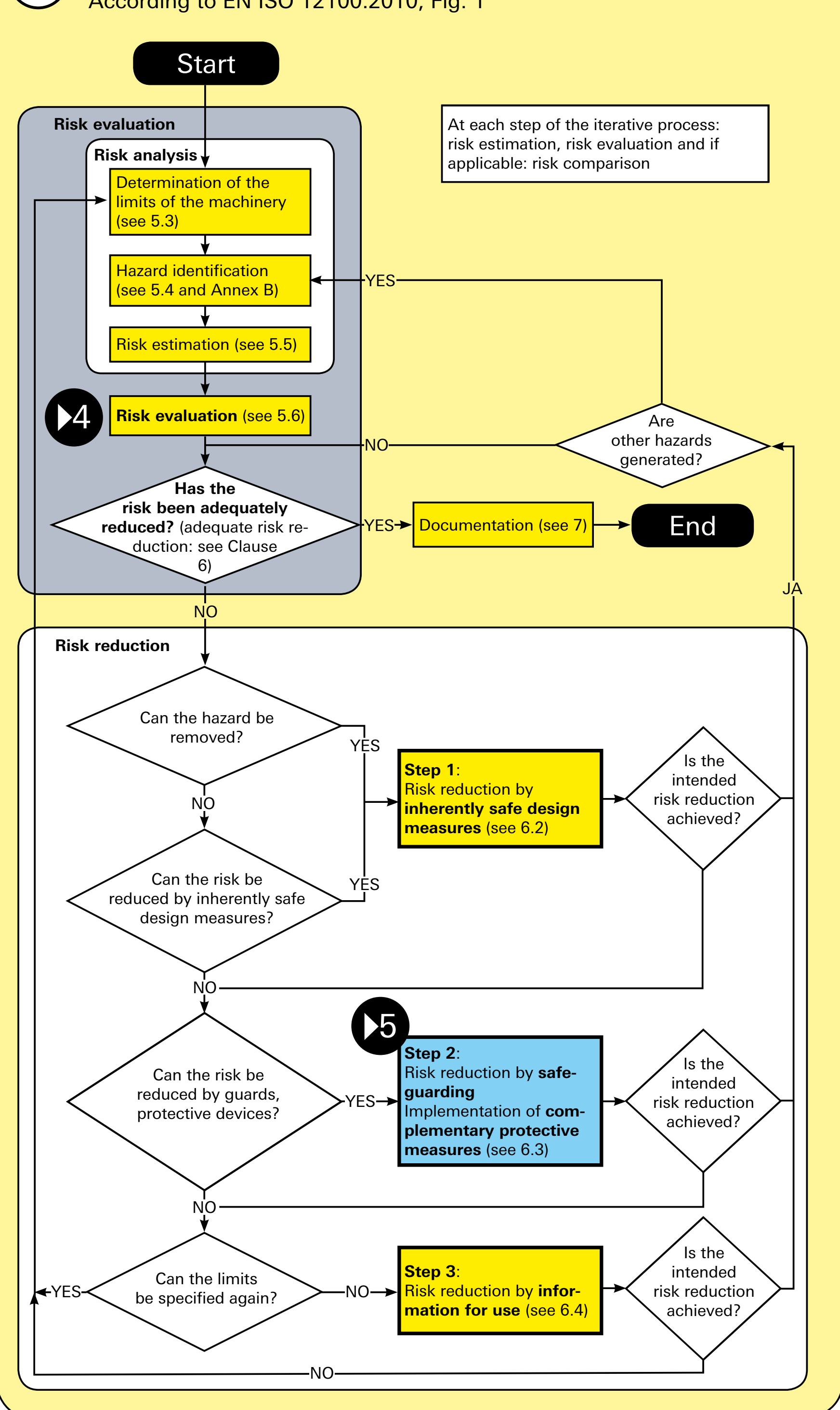
2 Scheme of standards according ISO/TR 22100-1: 2016

GENERAL PRINCIPLES FOR DESIGN – RISK ASSESSMENT & RISK REDUCTION
EN ISO 12100 (TYPE-A STANDARD)

Type-B Standards related to: hazards			Type-B Standards related to: aspects and technology		
NOISE	SUBSTANCES	VIBRATION & SHOCK	DIMENSIONS & DISTANCES	POWER SOURCE	SAFETY DEVICES
Determination of emission sound pressure levels at a workstation EN ISO 11200 to 11205	Evaluation of emission of airborne hazardous substances ISO 29042 series	Whole body vibration ISO 2631 series	Gaps to avoid crushing EN ISO 13854	Electrical equipment EN 60204-1	Guards EN ISO 14120
Determination of sound power & energy levels EN ISO 3741, 3743-1, 3744, 3745, 3746, 3747	Reduction of risks to health from hazardous substances ISO 14123-1 & -2	Hand-arm vibration EN ISO 13753	Minimum distances EN ISO 13855	Pneumatic equipment EN ISO 4414	Interlocking devices EN ISO 14119
Determination of sound power levels by sound intensity EN ISO 9614 series	Hygiene requirements EN ISO 14159	Hand-held & hand-guided machinery EN ISO 20643	Safety distances EN ISO 13857	Hydraulic equipment EN ISO 4413	Series connection of doors EN ISO/TR 24119
Insulation performances of enclosures EN ISO 11546 series	THERMAL HAZARDS	ERGONOMICS	Permanent means of access EN ISO 14122 series	CONTROL SYSTEMS	Two-hand control devices EN ISO 13851
Insulation performances of cabins EN ISO 11957	HUMAN RESPONSES TO CONTACTS WITH SURFACES EN ISO 13732-1 & -3	Access openings EN ISO 15534	ALARMS & WARNINGS	Avoidance of unexpected start-up EN ISO 14118	Electro-sensitive protective equipment EN 61496 series
Declaration & verification of noise emission EN ISO 4871	FIRE HAZARDS	Anthropometric requirements for workstations EN ISO 14738	Design principles for safety signs ISO 3864-1	Design of safety-related parts of control systems EN ISO 13849-1	Detection of persons EN 62046
	Fire prevention and protection EN ISO 19353	Computer manikins and body templates EN ISO 15536-1	Registered safety signs EN ISO 7010	Validation of safety-related parts of control systems EN ISO 13849-2	Pressure-sensitive protective devices EN ISO 13856 series
	ELECTRICAL HAZARDS	RADIATION HAZARDS	Auditory danger signals EN ISO 7731	Emergency stop function EN ISO 13850	ASSEMBLY OF MACHINERY
	Protection against electric shock EN 60204-1	Lasers and laser-related equipment - Generals EN ISO 11145	Visual, acoustic and tactile signals EN 61310-1		Integrated manufacturing systems EN ISO 11161

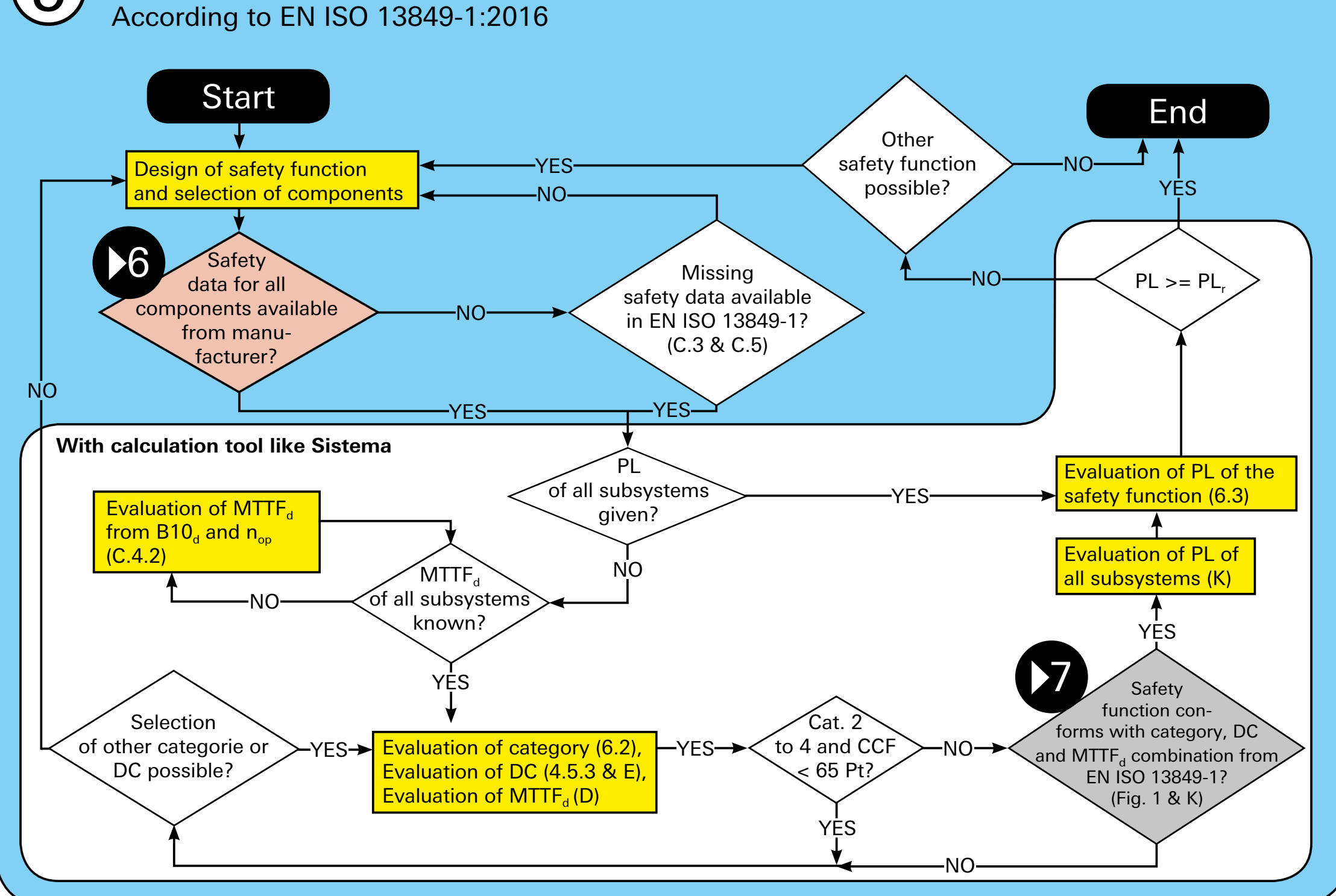
3 Risk evaluation and risk reduction

According to EN ISO 12100:2010, Fig. 1



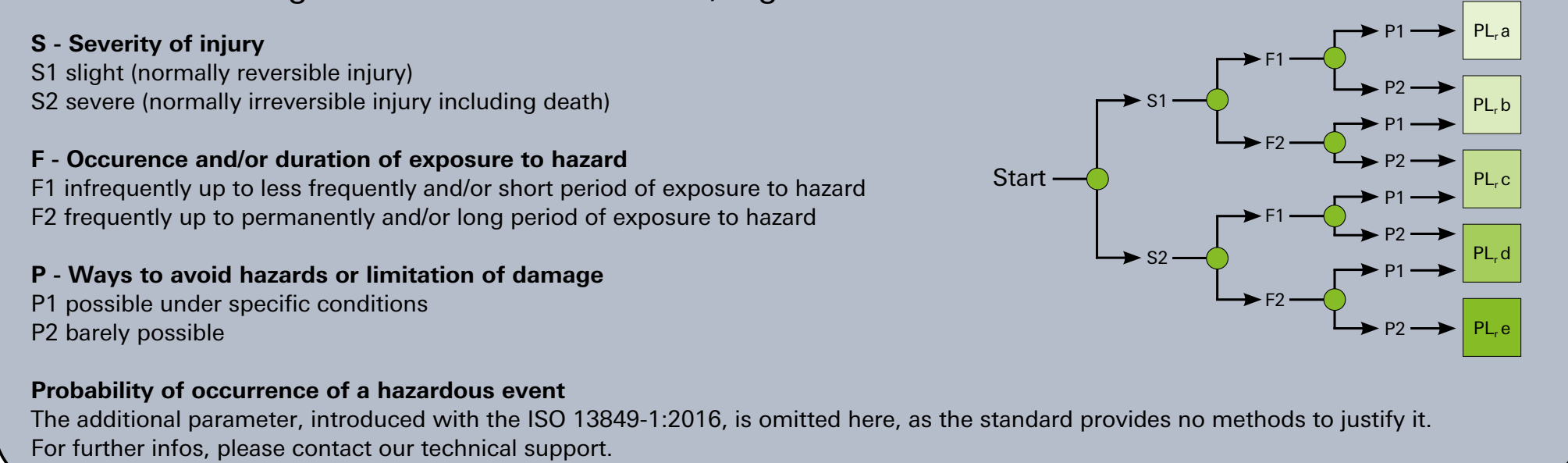
5 Evaluation of technical safeguards

According to EN ISO 13849-1:2016



4 Determination PL_r – Risk graph

According to EN ISO 13849-1:2016, Fig. A.1



7 Determination PL

According to EN ISO 13849-1:2016, Fig. 5 and Table 4, 5

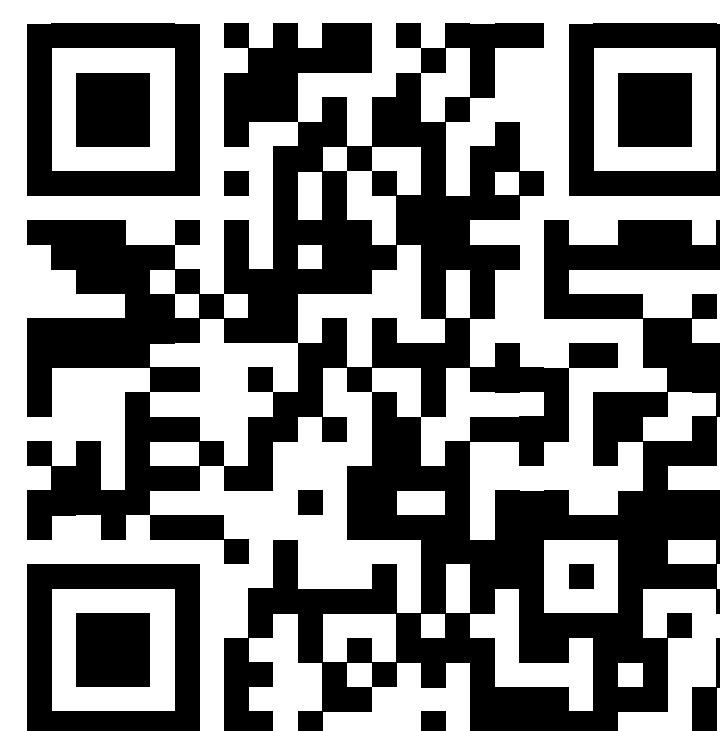
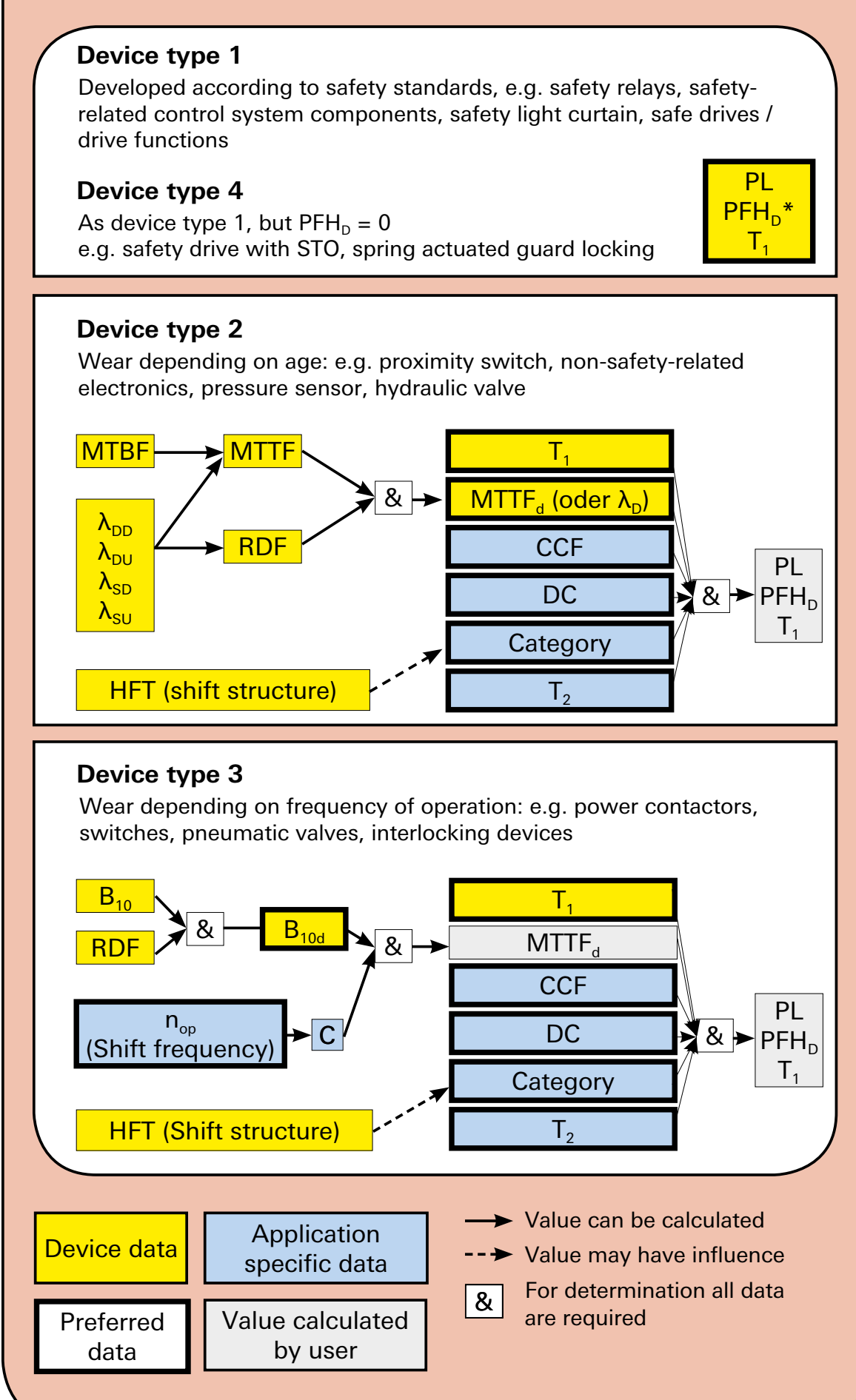
PFH ₀	PL a					PL b					PL c					PL d					PL e				
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
10 ⁻⁴	Cat. B	Cat. 1	Cat. 2	Cat. 2	Cat. 3	Cat. 3	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4	Cat. 4				
10 ⁻⁵	DC _{ov} = None	DC _{ov} = None	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low	DC _{ov} = Medium	DC _{ov} = Low				
3x10 ⁻⁶	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High				
10 ⁻⁶	3 years	10 years	30 years	100 or 2500 years	None	Low	Medium	High	None	Low	Medium	High	None	Low	Medium	High	None	Low	Medium	High	None				
10 ⁻⁷	None	Low	Medium	High	None	Low	Medium	High	None	Low	Medium	High	None	Low	Medium	High	None	Low	Medium	High	None				
10 ⁻⁸	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None				

1. Determination of category, DC_{ov} and MTTF_d
 2. Selection of applicable column from Category and DC_{ov}
 3. Determination of horizontal position based on MTTF_d
 4. Reading of PL

Note: Please use chart K.1 from EN ISO 13849-1 for more accurate results.

6 Safety specifications

Acc. to VDMA 66413:2012, Fig. 1 (modified)



safety service by Wieland