B General definitions

Term	Description	
AND operation	Connects two or more devices. Start-up can only occur when all the start-up conditions are met.	
Actuation types of ESPDs	Protection	Releasing the switching output passes autonomous after interrupting the protection area, when no restart interlock is activated.
	Single action	By interrupting once the protection area and releasing the switching output, the start of the machine is carried out.
	Double action	By interrupting twice successively the protection area and releasing the switching output, the start of the machine is carried out.
	Reclosing interlock	Reclosing interlock prevents the automatic start after the protection area is released. The start has to be initiated manually.
B10D	Numbers of cycles, until 10% of the components fail dangerously.	
β (Susceptibility to Common Cause Failure)	Rate of failures, which have a common cause.	
CCF (Common Cause Failure)	Failure as a result of a common cause	
Clocked output	Clock pulse is directed from the clocked outputs to the inputs by corresponding wiring. Thereby it is possible to recognize cross circuits.	
Cross-/ short circuit detection	Detection of cross-/ or short circuits, detection of reduction of the insulation resistance between 2 contacts and respectively short circuit between 2 wires or more.	
Danger zone	Zone within or around machinery in which a person is exposed to risk of injury or damage to health.	
DC (Diagnostic Coverage)	Diagnostic coverage, this can be determined from the ratio of the failure rate “detected dangerous failures” and the failure rate “all dangerous failures”. The Diagnostic Coverage is suited as a parameter for the efficiency of the diagnosis.	
DCavg (Average Diagnostic Coverage)	Average diagnostic coverage	
Enable circuit	A redundant implemented output with forcibly guided contacts. The output is used to switch off a machine.	
Equipment, accessible	The danger zone can be entered through a light barrier.	
Equipment, non-accessible	The area secured by a light barrier is protected, in addition, mechanically (e.g. by a grid)	
Error	Describes the state of a device, which is not able to carry out a requested function, excepted is the inability during maintenance, other planed activities or the failure of external supplies	
ESPD	Electro sensitive protective device (ESPD) can be based on physical principles: Optoelectronics, supersonic, inductive or capacitive sensor technology, infrared movement sensors etc. An ESPD encloses the following elements: Sensor function, control / supervising function, output elements (OSSD).	
ESPE (Electro-sensitive protective equipment)	See ESPD	
Feedback loop	Circuit for monitoring externally connected contactors or relays. The N/C contacts are used to check whether the relays or contactors have assumed their fail safe before they are re-operated.	
Forcibly guided contacts	Contacts which are connected mechanically with each other so that N/Cs and N/Os can never be closed at the same time.	
Functional safety	The part of the entire plant safety, which depends from the correct function of safety related systems, for reducing the risk. These systems have to execute their intended functions (safety functions) under a defined error condition and with a defined probability.	
Housing protection classes	Protection classes characterize the range of protection of a sensor or a machine against contact as well as penetration of foreign objects or water. The protection class indication starts with the letters IP. The first number acts as an indicator for the contact and foreign objects protection, the second number as an	

	indicator against penetration of water. The higher the number is the higher is the respective protection. Protection classes from IP65 became accepted as standard in industrial environments.
Light curtain	A light curtain consists of a multiple number of lined up light barriers, so that the danger zone can be supervised consistently. If the light curtain is mounted near the danger zone, a lower resolution, viz. less light barriers per unit of length, is required than with bigger distances. There are several types: Light curtains for finger guard (14 mm of resolution) or hand guard (30 mm of resolution) as well as for body protection (2 - 4 beams).
Light grid	Multibeam configuration of one way light barriers in one housing.
Light barrier, oneway	A light barrier with which the light of the light transmitter is leaded to an optical and special separated light receiver.
λ (Failure Rate)	Probability of a failure
λ avg (Failure Rate,average)	Average probability of a failure per hour
λ DD (Failure Rate,dangerous, detected)	Dangerous, detected failure
λ DU (Failure Rate, dangerous undetected)	Dangerous undetected failure
λ SD (Failure Rate,safe, detected)	Safe detected failure
λ SU (Failure Rate,safe, undetected)	Safe undetected failure
Machinery safety	After done risk analysis by implemented action achieved minimization of risk on an accepted remaining risk
MTBF (Mean Time Between Failures)	Mean time between two failures
MTTF (Mean Time To Failure)	Mean time to failure
MTTFd (Mean Time To Dangerous Failure)	Mean time to dangerous failure
Muting	Bypass function: A time limited automatic bypass function of the safety function with additional sensor technology, to differ persons from objects
OR operation	Connects two or more units. Start-up occurs when at least one of the start-up conditions is met.
OSSD (Output Signal Switching Device)	Output circuit of an ESPE, which is connected to the machine control and switches in den off-state, as soon as the sensor function acts during the intended operation.
Performance Level	Ability of safety related parts to run a safety function under predictable conditions to achieve the expected reduction of risk.
PFD	Probability of Failure on Demand
PFDavg	Average Probability of Failure on Demand
PFH	Probability Of Failure Per Hour
PFHd	Probability Of Dangerous Failure Per Hour
Readiness delay time	Readiness delay time is the time, between applying the supply voltage and the output of the right switching signal.
Redundancy	The application of more than one identical element, in order to ensure that if one element malfunctions, a second element is available to guarantee that the safety function is maintained.
Reaction time	After supply voltage is applied, the period that elapses before the unit is ready for operation.
Safety Integrity	Average probability, that a safety related system executes the required safety related functions among all specified conditions within an agreed period of time.
Safety Integrity Level	One out of 4 discrete steps for the specification of the requirements for the safety integrity of the safety function, which are assigned to a safety-related system. Safety integrity level 4 represents the highest and safety integrity level 1 the lowest safety level.
Safe output	see OSSD
SFF (Safe Failure Fraction)	The part of safe failures, viz. the rate of failures which direct into the fail safe

Signaling current path	A non redundant conducted output with forcibly guided contacts. These are used as auxiliary contacts for signalling certain states of the machine.	
SIL (Safety Integrity Level)	Safety Integrity Level	
Synchronicity check	The synchronous actuation of the start buttons is monitored and for the two hand control required. The outputs are only switched, if both start buttons are pressed within 0,5s simultaneously.	
Synchronizing-bright connection	For one way and reflex light barriers counts: If the beam of light is not interrupted between transmitter and receiver or reflector, the exit is switched through.	
Synchronizing-dark connection	For one way and reflex light barriers counts: If the beam of light is interrupted between transmitter and receiver or reflector, the exit is switched through.	
Types of standards	Type A- Standards	Contain fundamental terms, design guidelines and general aspects, which could be used for all machines. (basic safety standard)
	Type B- Standards	Treat a safety aspects or a safety equipment, which can be used for a wide range of machines.
	Type B1-Standards for special safety aspects	(e.g. safety clearance, surface temperature, noise) the electric safety of machines (EN60204) the calculation of safety clearance (EN 999). Type B2-standards for safety equipment (e.g. two hand controls, interlock devices, separating protective devices, contactless protective equipments)
	Type C- Standards	(Standards for machinery safety) contain all safety requirements for a special machine or a machine construction. If this standard exists, it takes priority over the B- or the A- standards. However a type C-standard can refer to a type A- or a type B- standard. If no type C-standard exists for a machine, the conformity can be established on the basis of the type A- or B-standard. In any case the requirements of the machine directive have to be achieved.