

# Certificate MTTF and MTTFD / B10d

**Order code**

KSE0302

**Date**

17.05.2024

**Product series**

KSEP 22 25 30 SERIES

► **Application Standard**

- BS EN ISO 13849-1: 2015 / Annex C

► **Standard MTTFd**

**Mean time to dangerous failure of each channel (MTTF<sub>D</sub>)**

MTTF <sub>D</sub>	
Denotation of each channel	Range of each channel
Low	3 years ≤ MTTF <sub>D</sub> < 10 years
Medium	10 years ≤ MTTF <sub>D</sub> < 30 years
High	30 years ≤ MTTF <sub>D</sub> ≤ 100 years

NOTE 1 The choice of the MTTF<sub>D</sub> ranges of each channel is based on failure rates found in the field as state-of-the-art, forming a kind of logarithmic scale fitting to the logarithmic PL scale. An MTTF<sub>D</sub> value of each channel less than three years is not expected to be found for real SRP/CS since this would mean that after one year about 30 % of all systems on the market will fail and will need to be replaced. An MTTF<sub>D</sub> value of each channel greater than 100 years is not acceptable because SRP/CS for high risks should not depend on the reliability of components alone. To reinforce the SRP/CS against systematic and random failure, additional means such as redundancy and testing should be required. To be practicable, the number of ranges was restricted to three. The limitation of MTTF<sub>D</sub> of each channel values to a maximum of 100 years refers to the single channel of the SRP/CS which carries out the safety function. Higher MTTF<sub>D</sub> values can be used for single components

NOTE 2 The indicated borders of this table are assumed within an accuracy of 5 %.

► **MTTFd calculation**

The emergency stop switch is used for 220 working days per year, 16 hours per day.

The average operating time between the start of two consecutive cycles of the emergency stop switch is calculated to be 400 seconds.

$$d_{op} = 220(\text{days/year}) \quad h_{op} = 16(\text{hours/day}) \quad B10d = 100,000 \quad T_{cycle} = 400(\text{seconds})$$

$$n_{op} = \frac{220\text{days/year} \times 16\text{hours/day} \times 3,600\text{sec/hour}}{400\text{sec/cycle}} = 31,680 \text{ cycles/year}$$

$$T10d = \frac{B10d}{n_{op}} = \frac{100,000 \text{ cycles}}{31,680 \text{ cycles/year}} = 3.156 \text{ years}$$

$$MTTFd = \frac{T10d}{0.1} = 31.56 \text{ years}$$

► **conclusion**

PL LEVEL: HIGH (31 years)

B10d: 100,000