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APPLICATION NOTE

Functional safety and reliability data for Motor starting and protection

The purpose of this document is to describe briefly and simply what represents safety and reliability for ABB motor starting products.

B_{10} and B_{10D} values

The values given are target values that components are expected to achieve based on testing and are for the oper-ation in high or continuous demand applications. A high-demand safety function is for a demand which occurs more often than once per year (e.g., once per day). In the following table, which contains data based on functional safety and reliability calculations done by ABB for product groups, failure to open the circuit is considered a dangerous failure:

ABB Electromechanical componets	Contact load, Utilization category	B_{10} values	B_{10D} values	RDF	
(only devices with positive opening contacts allowed)					
MPE, MPM, CPE EMERGENCY STOP DEVICES	(1)	45 000	225 000	20%	
Cable-operated switches for EMERGENCY STOP function	(1)	20 000	100 000	20%	
Hinge switches	(1)	20 000	100 000	20%	
Limit switches LS2 LS3, LS4	 (2) (2)	 10 000 000 > 5 000 000 (4)	 20 000 000 > 10 000 000 (4)	 50% 50%	
3-pole AF / AFS contactors					
AF...(Z)(B)/AFS 09 / 12 / 16 / 26 / 30 / 38	AC-3 / AC-3e	1 000 000	1 300 000	73%	(5) (6)
AF/AFS 40 / 52 / 65 / 80 / 96	AC-3 / AC-3e	1 000 000	1 300 000	73%	(5) (6)
AF...(B)/AFS 116 / 140 / 146 / 190 / 205	(3) AC-3 / AC-3e	5 000 000 1 000 000	10 000 000 1 300 000	50% 73%	(5) (6)
AF...(B)/AFS 265 / 305 / 370	(3) AC-3 / AC-3e	3 000 000 1 000 000	6 000 000 1 300 000	50% 73%	(5) (6)
AF/AFS 400 / 460	(3) AC-3 / AC-3e	2 000 000 500 000	4 000 000 680 000	50% 73%	(5) (6)
AF/AFS 580 / 750	(3) AC-3 / AC-3e	1 000 000 500 000	2 000 000 680 000	50% 73%	(5) (6)
AF1350...AF2050	(3) AC-3 / AC-3e	400 000 50 000	800 000 68 000	50% 73%	(5) (6)

1) Mainly limited by mechanical wear
2) Mainly limited by contact wear
3) Maximum value of B10 if the current is lower than 1% of the rated value (Ie)
4) For detailed B10 value, please refer to "mechanical durability" in the online product datasheet
5) The diagnostic coverage of the subsystem incorporating a contactor with mirror contacts can be 99% if an appropriate fault reaction function(s) is provided
6) The values given are based on 50% of Ie (based on the common practice for output devices used in safety-related systems)

Example to calculate λ_D, the rate of dangerous failures per hour:

An AFS contactor > 100A ≤ 205A is used 10 times an hour, switching a motor to start and stop.
$B10_D$ for AFS116 is 1.3×10^6, which will give

$$\lambda_D = \frac{0.1 \times C}{B_{10D}} = \frac{0.1 \times 10}{1.3 \times 10^6} \approx 7.7 \times 10^{-7}$$

This gives a λ_D of 7.7×10^{-7} of dangerous failure per hour for the single contactor

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http://www.abb.com/contacts > Low-voltage products

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