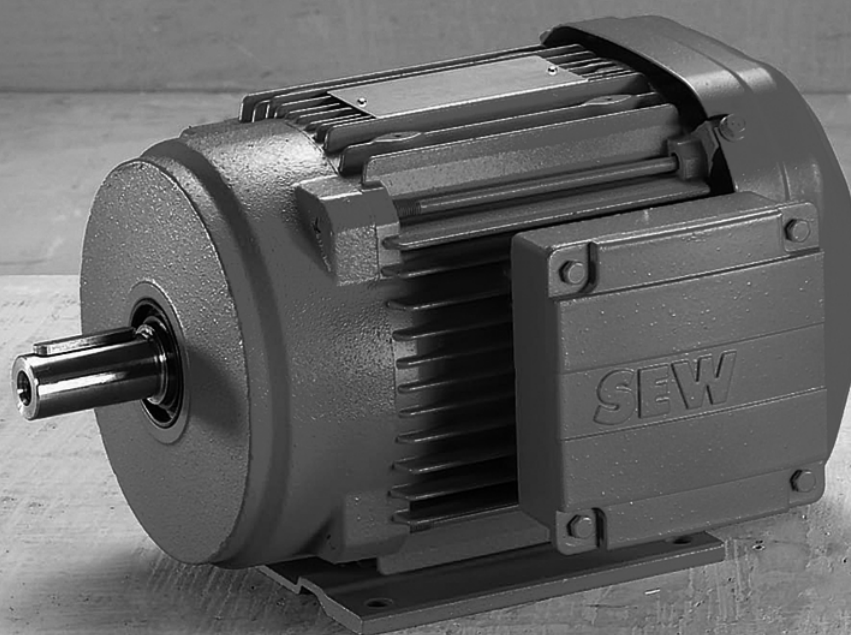




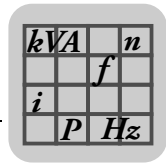
SEW
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Data Sheet



Functional Safety **Safety Characteristics for Brake BE..(FS)**





1 Data Sheet



INFORMATION

Please observe the data specified in this publication. This document does not replace the detailed operating instructions "DR.71-225, 315 AC Motors".

Observe the other applicable documentation¹⁾:

- "DR.71-225, 315 AC Motors" operating instructions
- "DR. Series AC Motors" catalog
- "Safety-Rated Brakes – Functional Safety for AC Motors DR.71 – 225" addendum to the operating instructions
- "Safety-Rated Drive System" system manual

1) We reserve the rights to make technical changes.

1.1 Safety notes



INFORMATION

Meaning of the value "MTTF_d":

MTTF_d is a statistical value. It is defined in the standard EN ISO 13849-1 as "expected value of the mean time to dangerous failure".

Statistical value means that it is a value that has been determined empirically. The value does not imply a "guaranteed operating life" or a "failure-free time".

For the BE.. (FS) brake, the value MTTF_d refers to its capability of performing the mechanical switching operation, that is to move the pressure plate. **Wear of the brake lining, which is caused by the conversion of kinetic energy during the braking process, does not affect this value.**

The values differ for every application because the value MTTF_d depends on the mean number of actuations per year.



INFORMATION

Observe the technical data of the brake in the "AC Motors DR.71-225, 315" operating instructions and the addendum to the operating instructions "Safety-Rated Brakes – Functional Safety for AC Motors DR.71 – 225". In the latter document, observe in particular the maximum permitted work done.

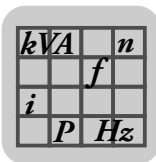


INFORMATION

Usage in safety-relevant applications:

The system/machine manufacturer is responsible for compliance of the system/machine with applicable safety regulations.

If a brake of the type BE.. (FS) is used to fulfill a safety function, then the brake is to be regarded as component (element) and not as a safety-related subsystem. Usually, the BE.. (FS) brake alone is not sufficient to execute a safety function in compliance with the standard.



1.2 Safety characteristics

Definition of the characteristic safety value B_{10d} :

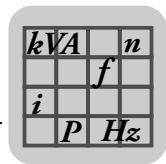
The value B_{10d} specifies the number of cycles at which 10% of components have failed dangerously (definition according to standard EN ISO 13849-1). Failed dangerously means in this context that the brake is not applied when required. This means the brake does not deliver the necessary braking torque.

Size	B_{10d} Switching cycles
BE05	20,000,000
BE1	16,000,000
BE2	12,000,000
BE5	10,000,000
BE11	8,000,000
BE20	5,000,000
BE30	3,000,000
BE32	3,000,000

Definition of the categories:

The categories classify safety-related components regarding their resistance to errors and their response in the event of an error based on the reliability and/or the structural arrangement of the parts. A higher resistance to errors means a higher potential to reduce risk.

Brake type	Category (according to EN ISO 13849)
Brake BE..(FS) without external diagnostics	Category 1



1.3 Sample calculations

Below some examples of how to use the value B_{10d} to calculate the mean time to dangerous failure ($MTTF_d$).

In the examples, the values $MTTF_d$ are calculated for size BE11 based on 2 different switching frequencies. The equations used are described in standard EN ISO 13849-1.

The following sample calculations are based on two selected applications. The calculation has to be adjusted for other applications. Also, other parameters might influence the calculation. If you have any questions on calculating the values, please contact SEW-EURODRIVE.

1.3.1 Example 1

Input data for the BE11 brake:

- $B_{10d} = 8,000,000$
- Operating days per year: $d_{op} = 300$ d/a
- Operating time per day: $h_{op} = 24$ h/d
- Cycle time: $t_{cycle} = 87$ s
- Starting frequency: 41.4 1/h

Calculation:

$$MTTF_d = \frac{B_{10d}}{0.1 \times n_{op}}$$

$$n_{op} = \frac{d_{op} \times h_{op} \times 3600 \frac{s}{h}}{t_{cycle}}$$

Inserting the values:

$$n_{op} = \frac{300 \frac{d}{a} \times 24 \frac{h}{d} \times 3600 \frac{s}{h}}{87s} = 297.931 \frac{1}{a}$$

$$MTTF_d = \frac{8.000.000}{0,1 \times 297.931} a = 268,52 a$$

Result:

$MTTF_d = 100$ years

The result is assigned to "High" according to standard EN ISO 13849-1 as shown in the following table.

Designation	Range
Low	$3 \text{ years} \leq MTTF_d < 10 \text{ years}$
Medium	$10 \text{ years} \leq MTTF_d < 30 \text{ years}$
High	$30 \text{ years} \leq MTTF_d \leq 100 \text{ years}$

kVA		n
	f	
i		
P	Hz	

Data Sheet

Sample calculations

1.3.2 Example 2:

Input data for the BE11 brake:

- Same values as in example 1 but with reduced cycle time
- Cycle time: $t_{\text{cycle}} = 9 \text{ s}$
- Starting frequency: 400 1/h

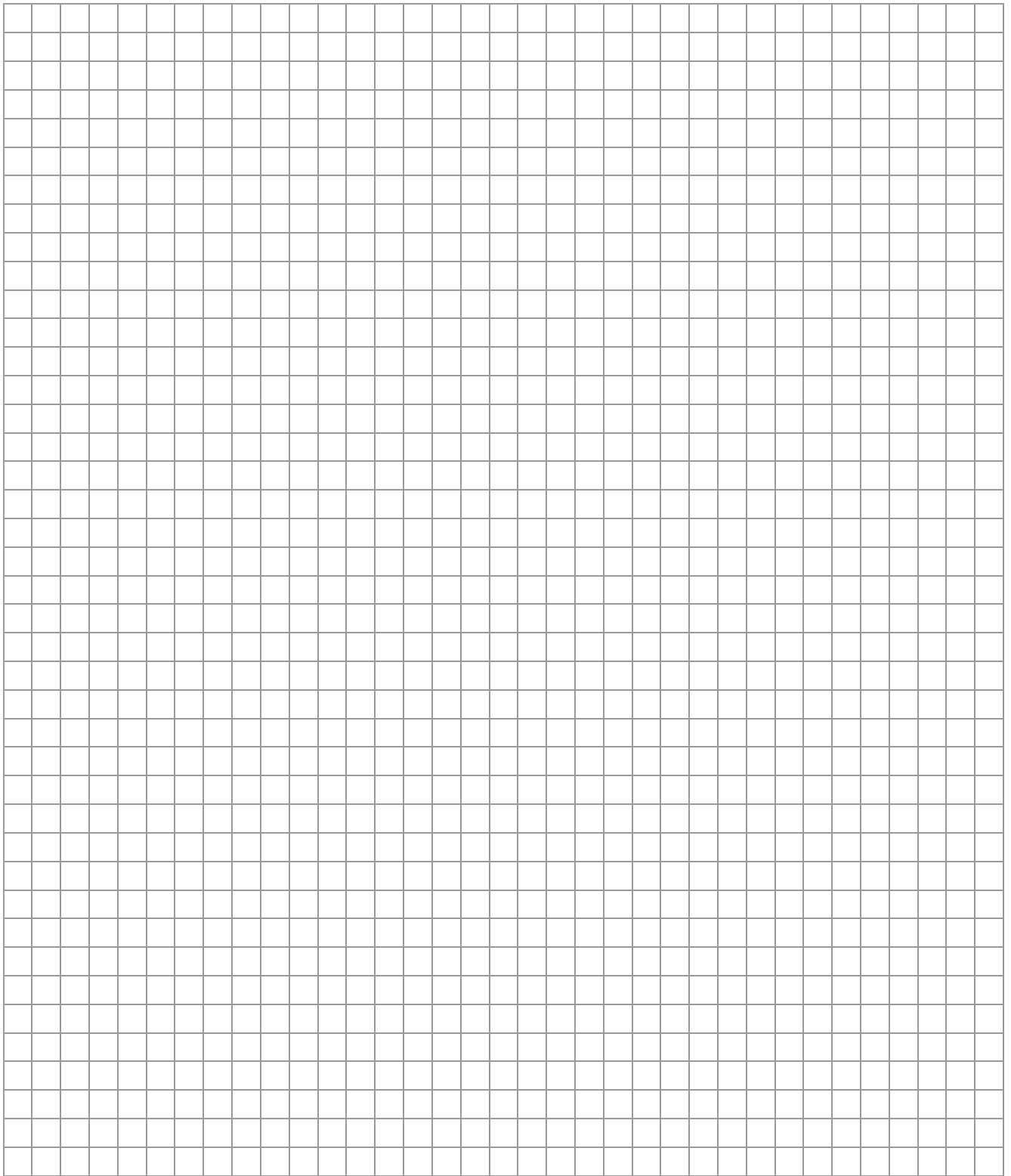
Calculation:

Make the calculation as shown in example 1.

Result:

$MTTF_d = 27.8 \text{ years}$

The result is assigned to "Medium" according to standard EN ISO 13849-1.





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