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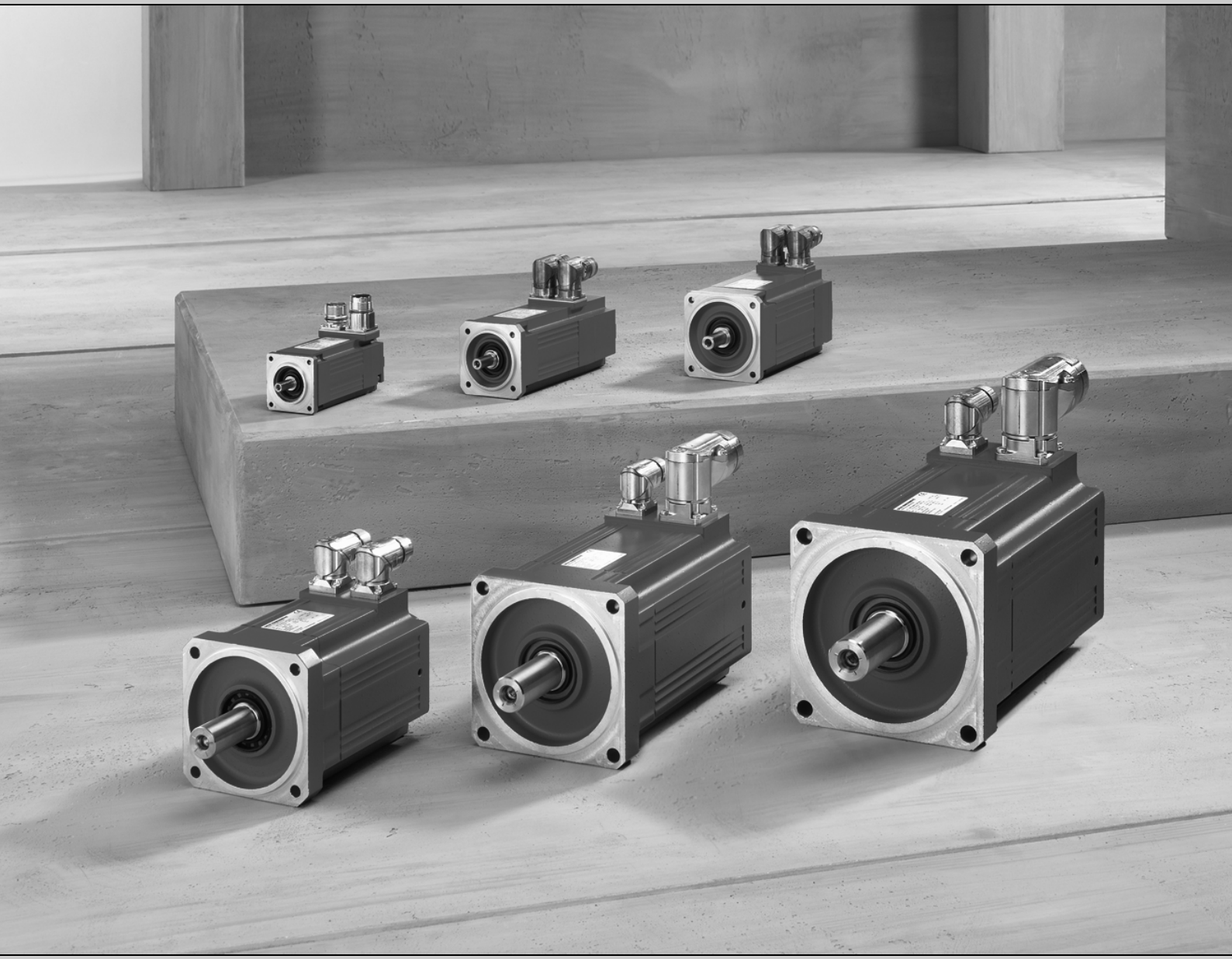
Data Sheet



Functional Safety
Safety Characteristics for BP.. Brake

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17076811 / EN

1 Data Sheet

INFORMATION

This data sheet applies in addition to the "CMP40 – CMP100, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions.

Please observe the data specified in this publication. This document does not replace the "CMP40 – CMP100, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions.

Observe the other applicable documentation[1]:

- "CMP40 – CMP100, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions
- "Synchronous Servomotors" catalog

1) We reserve the rights to make technical changes.

Make sure you always use the latest edition of the documentation and the software.

The SEW-EURODRIVE homepage (www.sew-eurodrive.com) provides provides a broad selection of documentation downloads in various languages. Consult SEW-EURODRIVE directly if you have any questions or require further information.

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 BP.. 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 for the brake in the "CMP40 – CMP100, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions, in particular the maximum permitted work done by the brake.

INFORMATION

Usage in safety-relevant applications:

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

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

1.2 Characteristic safety values

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
BP01	30.000.000
BP04	15.000.000
BP09	12.000.000
BP1	3.500.000
BP3	3.000.000
BP5	7.000.000

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
BP.. Brake without safety technology	Category B (according to EN ISO 13849-1)

1.3 Sample calculations

Below some examples for 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 BP3 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:

Input data for the BP3 brake:

- B_{10d} = 3 000 000
- Operating days per year: d_{op} = 300 d/a
- Daily operating period: h_{op} = 24 h/d
- Cycle time: t_{cycle} = 87 s
- Starting frequency: 41.4 per hour

Calculation:

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

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

Inserting the values:

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

$$MTTF_d = \frac{3\,000\,000}{0.1 \text{x} 297\,931} a = 100.7 a$$

Result:

$MTTF_d$ = 100 years

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

Designation	Section
Low	3 years ≤ $MTTF_d$ < 10 years
medium	10 years ≤ $MTTF_d$ < 30 years
High	30 years ≤ $MTTF_d$ ≤ 100 years

1.3.2 Example 2

Input data:

Input data for the BP3 brake:

- Same values as in example 1 but with reduced cycle time
- Cycle time: t_{cycle} = 25 s
- Starting frequency: 144 per hour

Calculation:

Make the calculation as shown in example 1.

Result:

$MTTF_d$ = 29 years

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