Data Sheet

Functional Safety
Safety Characteristics for BK.. Brakes
1 Data sheet

INFORMATION
This data sheet applies in addition to the "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions.

Please observe the data specified in this publication. This document does not replace the "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" document.

Observe the following other applicable documentation:
• "CMP40 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions
• "Synchronous Servomotors" catalog

INFORMATION
Make sure you always use the latest edition of the documentation and the software.
The SEW-EURODRIVE homepage (www.sew-eurodrive.com) provides a wide selection of documents for download in various languages. Consult SEW-EURODRIVE directly if you have any questions or if you 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 BK.. 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 – CMP112, CMPZ71 – CMPZ100 Synchronous Servomotors" operating instructions, in particular the maximum permitted braking work done per cycle.

INFORMATION
Usage in safety-related applications:
The system/machine manufacturer is responsible for compliance of the system/machine with applicable safety regulations.

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

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

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.

<table>
<thead>
<tr>
<th>Size BK..</th>
<th>$B_{10d}$ Switching cycles</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK01</td>
<td>15,000,000</td>
</tr>
<tr>
<td>BK02</td>
<td>15,000,000</td>
</tr>
<tr>
<td>BK03</td>
<td>15,000,000</td>
</tr>
<tr>
<td>BK04</td>
<td>15,000,000</td>
</tr>
<tr>
<td>BK07</td>
<td>15,000,000</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Brake type</th>
<th>Category (according to EN ISO 13849)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BK.. brake</td>
<td>Category B</td>
</tr>
</tbody>
</table>
1.3 Sample calculation

The following example shows how to use the value $B_{10d}$ to calculate the mean time to dangerous failure ($MTTF_d$).

The value $MTTF_d$ is calculated as an example for size BK02 with a assumed starting frequency. The equations used are described in standard EN ISO 13849-1.

The following sample calculation is based on a selected application. 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

Input data:
Input data for BK02 brake:

- $B_{10d} = 15,000,000$
- Operating days per year: $d_{op} = 300 \text{ d/a}$
- Operating period per day: $h_{op} = 24 \text{ h/d}$
- Cycle time: $t_{cycle} = 20 \text{ s}$
- Starting frequency: $180 \text{ 1/h}$

Calculation:

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

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

Inserting the values:

$$n_{op} = \frac{300 \text{ d} \times 24 \text{ h} \times 3600 \text{ s}}{20 \text{ s} \text{ d} \text{ h}} = 1.296.000 \frac{1}{a}$$

$$MTTF_d = \frac{15.000.000}{0.1 \times 1.296.000} a = 115 a$$

The result:

$MTTF_d = 115 \text{ years}$

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