**Sizing Information**

**Determination of the Duty Cycle (ED)**

\[
ED = \frac{t_a + t_c + t_d}{t_{cycle}}
\]

If \( ED < 60\% \) and \((t_a + t_c + t_d) < 20 \text{ minutes}\), perform a cycle operation selection (S5)

If \( ED > 60\% \) or \((t_a + t_c + t_d) > 20 \text{ minutes}\), perform a continuous operation selection (S1)

**Selection of Optimum Gearbox for a Continuous Operation (S1)**

**Data needed before selection can be performed:**

1. Output profile
2. Desired ratio \((i)\)

**Calculations to be performed:**

1. Mean Output Speed

\[
=> n_{2m} = \frac{n_2 t_a + n_2 t_c + n_2 t_d}{t_a + t_c + t_d} = \frac{n_2 t_a}{t_a + t_c + t_d} + \frac{n_2 t_c}{t_a + t_c + t_d} + \frac{n_2 t_d}{t_a + t_c + t_d}
\]

2. Root-Mean Output Torque

\[
=> T_{2m} = \sqrt[3]{\frac{n_2 t_a T_{2d}^2 + n_2 t_c T_{2d}^2 + n_2 t_d T_{2d}^2}{n_2 t_a + n_2 t_c + n_2 t_d}}
\]

**Selection Criteria for Gearbox:**

1. Mean Output Speed must not exceed the nominal speed rating of the gearbox.

\[n_{2m} \times i \leq n_{in}\]

2. Mean Output Torque must not exceed the nominal torque rating of the gearbox.

\[T_{2m} \leq T_{2n}\]

See technical data tables for values of \( n_{in} \) and \( T_{2n} \)

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**Symbol**

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<td>Number of Cycles</td>
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<td>η</td>
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<td>Efficiency</td>
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Selection of Optimum Gearbox for a Cycle Operation (S5)

Data needed before selection can be performed:

1. Maximum Torque of the motor \((T_{1B})\)
2. Output profile
3. Desired ratio \((i)\)
4. Inertia of the load \((J_L)\)*
5. Inertia of the motor \((J_{motor})\)*

*optional

Calculation to be performed:

1. Shock Factor \((fs)\)

\[
Zh = \frac{3600}{t_{cycle}}
\]

\[
1000 < Zh < 1500 \quad \Rightarrow \quad fs = 1.1
\]

\[
1500 < Zh < 2000 \quad \Rightarrow \quad fs = 1.3
\]

\[
2000 < Zh < 3000 \quad \Rightarrow \quad fs = 1.6
\]

\[
3000 < Zh < \quad \Rightarrow \quad fs = 2.0
\]

2. Maximum Output Torque

\[
T_{2max} = T_{1B} \cdot i \cdot fs \cdot \eta = \quad \text{__________________________}
\]

Selection Criteria for Gearbox:

1. Maximum Output Speed must not exceed the maximum speed rating of the gearbox.
\(n_{2c} \cdot i \leq n_{1max}\)

2. Maximum Output Torque must not exceed the maximum torque rating of the gearbox.
\(T_{2max} \leq T_{2B}\)

3. (optional) Match inertia of the motor to the inertia of the load.

See technical data tables for values of \(\eta, n_{1max}, T_{1B}, \text{and } J_1\)

Sizing and Selecting for Couplings and Safety Couplings

Sizing

1. Determine torque \((M_N)\)

\[
M_N = M_a \cdot \frac{J_{load}}{J_{load} + J_{drive}} \cdot 2.5
\]

2. Verify resonant frequency

\[
f_{coupling} = \sqrt{C_{coupling}}
\]

\[
f_{drive} = \frac{1}{2\pi} \sqrt{C_{drive} \cdot \frac{(J_{drive} + J_{load})}{(J_{load} \cdot J_{load})}}
\]

3. Apply operating temperature safety factor only for elastomer couplings

<table>
<thead>
<tr>
<th>Operating Temperature</th>
<th>&lt; 50°C</th>
<th>50°C - 70°C</th>
<th>70°C - 90°C</th>
<th>90°C - 110°C</th>
<th>&gt; 110°C</th>
</tr>
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<tr>
<td>Multiply (M_N) by</td>
<td>1</td>
<td>1.3</td>
<td>1.6</td>
<td>1.8</td>
<td>2</td>
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Selecting:

1) Determine series of coupling
2) Determine size of coupling based on MN
3) Verify shaft diameters are within range

Ordering Examples:

(When ordering, please include shaft sizes and tolerances)

**Standard Coupling KM-20**
- \(D_1 = 14 \text{ mm} k6\)
- \(D_2 = 1.00" +0/-0.005", x 1/8" keyway\)

**Safety Coupling SKB-30**
- \(D_1 = 19 \text{ mm} k6\)
- \(TA\) (disengagement torque) = 25 Nm

**Drive Shaft Coupling WDS-100**
- \(D_1 = .500" +/- .0005"\)
- \(D_2 = 32 \text{ mm} k6\)
- Distance Between Shafts = 915 mm