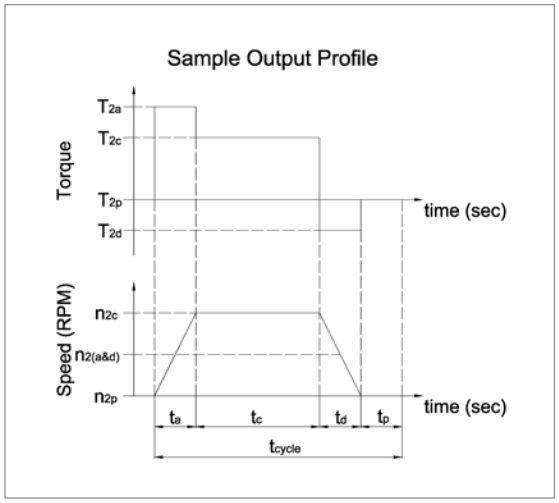
Determination of the Duty Cycle (ED)



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

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

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

Index	
1	Input
2	Output
a	Acceleration
B	Maximum Acceleration
c	Constant
d	Deceleration
m	Mean
max	Maximum
n	Nominal
p	Pause

Symbol	Unit	Description
ED	%	Duty Cycle
fs	-	Shock Factor
i	-	Ratio
J	kg-cm2	Moment of Inertia
n	RPM	Speed
t	s	Time
T	Nm	Torque
Zh	-	Number of Cycles
η	%	Efficiency

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

$$\Rightarrow n_{2m} = \frac{n_{2a}t_a + n_{2c}t_c + n_{2d}t_d}{t_a + t_c + t_d} = \_\_\_\_\_$$

2. Root – Mean Output Torque

$$\Rightarrow T_{2m} = \sqrt[3]{\frac{n_{2a}t_a T_{2a}^3 + n_{2c}t_c T_{2c}^3 + n_{2d}t_d T_{2d}^3}{n_{2a}t_a + n_{2c}t_c + n_{2d}t_d}} = \_\_\_\_\_$$

Selection Criteria for Gearbox:

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

$$n_{2m} \bullet i \leq n_{1n}$$

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_{1n} and T_{2n}

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)

$$Zh = \frac{3600}{t_{cycle}}$$

		Zh	<	1000	=>	fs = 1.0
1000	<	Zh	<	1500	=>	fs = 1.1
1500	<	Zh	<	2000	=>	fs = 1.3
2000	<	Zh	<	3000	=>	fs = 1.6
3000	<	Zh	<		=>	fs = 2.0

2. Maximum Output Torque

$T_{2max} = T_{1B} \bullet i \bullet fs \bullet \eta =$ _____

Selection Criteria for Gearbox:

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

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. $J_{motor} \approx J_1 + \frac{J_L}{i^2}$

See technical data tables for values of η, n_{1max}, T_{2B}, and J_1

Sizing and Selecting for Couplings and Safety Couplings

Sizing

1. Determine torque (M_N)

$$M_N = M_a \bullet \frac{J_{load}}{J_{load} + J_{drive}} \bullet 2.5$$

M_N	Nominal Torque of Coupling
M_a	Acceleration Torque of Motor
C	
f	Resonant frequency [Hz]
J_{mot}	Motor inertia + 1/2 coupling inertia [kgm^2]
J_{moch}	Load inertia + 1/2 coupling inertia [kgm^2]
	In general $f_{coupling} \geq 2 \bullet f_{drive}$

2. Verify resonant frequency

$$f_{coupling} = \sqrt{C_{coupling}}$$

$$f_{drive} = \frac{1}{2\pi} \sqrt{C_{drive} \bullet \frac{(J_{drive} + J_{load})}{(J_{load} \bullet J_{load})}}$$

3. Apply operating temperature safety factor only for elastomer couplings

Operating Temperature	< 50°C	50°C - 70°C	70°C - 90°C	90°C - 110°C	> 110°C
Multiply M_N by	1	1.3	1.6	1.8	2

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
D1 = 14 mm k6
D2 = 1.00″ +0/-.0005″, x 1/8″ keyway

Safety Coupling SKB-30
D1 = 19 mm k6
TA (disengagement torque) = 25 Nm

Drive Shaft Coupling WDS-100
D1 = .500″ +/- .0005″
D2 = 32 mm k6
Distance Between Shafts = 915 mm