

# Backlash-free safety couplings

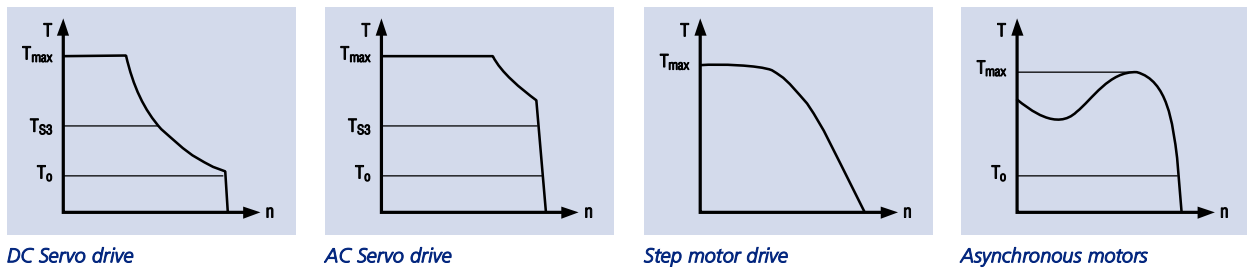
## Calculation example

When determining the cut-out torque, brief torque peaks by the drive unit and the machine must be taken into consideration because safety coup-

plings by System GERWAH® were developed for high-speed cut-out. Particular attention must be paid to the characteristic curves of the

maximum acceleration torques of the motors (figure 10).

**Figure 10: Characteristic curves of various driving motors**



In the case of dynamic drives (servo motors), e.g. in machine tools, we recommend that the relationships between the moments of inertia are

also considered. Since the acceleration torque in both positive and negative direction is usually much higher than the nominal moment,

dimensioning should always be based on the maximum acceleration torque.

**The following dimensioning values have proven to be reliable in practice for couplings on high dynamic drives:**

In general the following relationship applies:

$$T_A = K \times T_{max} \times \frac{J_{mach}}{J_{mot} + J_{mach}} = [Nm]$$

- $J_{mot}$  = Moment of inertia of motor
- $J_{mach}$  = Moment of inertia of machine
- $T_{max}$  = Max. acceleration torque
- $T_A$  = Cut-out torque (disengaging torque) of the coupling

- K = Load factor, impact factor
- K = 1.5 (regular movements)
- K = 2 (irregular movements)
- K = 2.5 – 4 (jerky movements)

A load/impact factor of K = 1.5 – 2 should be used for servo drives in machine tools. A greater load/impact factor K should be used for extreme applications.

### Checking of resonance frequency

Although the complete coupling construction of a safety coupling in combination with a metal bellows

or servo insert coupling is totally backlash-free, it should not be forgotten that the coupling links two

rotating masses. We recommend that the resonance frequency should be checked by the following formula:

$$f_{res} = \frac{1}{2\pi} \sqrt{C_{T\ dyn} \times \frac{J_{mot} + J_{mach}}{J_{mot} \times J_{mach}}} = [Hz]$$

- $C_{T\ dyn}$  = Dynamic torsional stiffness of coupling [Nm/rad]
- $J_{mot}$  = Moment of inertia of motor [kgm<sup>2</sup>]

- $J_{mach}$  = Moment of inertia of machine [kgm<sup>2</sup>]

In practice the resonance frequency calculated arithmetically should be twice as large as the excitation frequency of the drive. The excitation

frequencies of servo drives usually range between 150 and 300 Hz.

other criteria, e.g. shaft diameter, cutting force, etc.

In special cases the couplings can also be dimensioned on the basis of