Coupling selection

The ROTEX® coupling is selected in accordance with DIN 740 part 2. The coupling has to be dimensioned in a way that the permissible coupling load is not exceeded in any operating condition. For this purpose the actual loads have to be compared to the permissible parameters of the coupling. The torques T_{KN}/T_{Kmax} mentioned refer to the spider. The shaft-hub-connection has to be investigated by the customer.

1. Drives without periodical torsional vibrations

e. g. centrifugal pumps, fans, screw compressors, etc.The coupling is selected taking into account the rated torques T_{KN} and maximum torque $T_{K\ max}$.

1.1 Load produced by rated torque

Taking into consideration the ambient temperature, the permissible rated torque T_{KN} of the coupling has to correspond at least to the rated torque T_N.of the machine.

T_N [Nm] = 9550 • P [kW] / n [rpm]

$T_{KN} \geq T_N \cdot S_t$

1.2 Load produced by torque shocks

The permissible maximum torque of the coupling has to correspond at least to the total of peak torque T_S and the rated torque T_N of the machine, taking into account the shock frequency Z and the ambient temperature. This applies in case if the rated torque T_N of the machine is at the same time subject to shocks. Knowing the mass distribution, shock direction and shock mode, the peak torque T_S can be calculated. For drives with A. C.-motors with high masses on the load side we would recommend to calculate the peak driving torque with the help of our simulation programme.

$T_{K\ max} \geq T_S \cdot S_z \cdot S_t + T_N \cdot S_t$

Drive-sided shock
$T_S = T_{AS} \cdot M_A \cdot S_A$

Load-sided shock
$T_S = T_{LS} \cdot M_L \cdot S_L$

$M_A = J_L / (J_A+J_L)$ $M_A = J_L / (J_A+J_L)$

2. Drives with periodical torsional vibrations

For drives subject to high torsional vibrations, e.g. diesel engines, piston compressors, piston pumps, generators, etc., it is necessary to perform a torsional vibration calculation to ensure a safe operation. If requested, we perform the torsional vibration calculation and the coupling selection in our company. For necessary details please see KTR standard 20004.

2.1 Load produced by rated torque

Taking into account the ambient temperature, the permissible rated torque T_{KN} of the coupling has to correspond at least to the rated torque TN of the machine.

$T_{KN} \geq T_N \cdot S_t$

2.2 Passing through the resonance range

Taking into account the temperature, the peak torque T_S arising when the resonance range is run through must not exceed the maximum torque T_{Kmax} of the coupling.

$T_{K\ max.} \geq T_S \cdot S_t$

2.3 Load produced by vibratory torque shocks

Taking into account the ambient temperature, the permissible vibratory torque T_{KW} of the coupling must not be exceeded by the highest periodical vibratory torque T_W with operating speed. For higher operating frequencies f > 10, the heat produced by damping in the elastomer part is considered as damping power P_W. For higher operating frequencies f > 10, the heat produced by damping in the elastomer part is considered as damping power P_W.

$T_{KW} \geq T_W \cdot S_t$

$P_{KW} \geq P_W$

Description	Symbol	Definition or explanation
Rated torque of coupling	T_{KN}	Torque that can continuously be transmitted over the entire permissible speed range
Maximum torque of coupling	$T_{K\ max}$	Torque that can be transmitted as dynamic load ≥ 105 times or 5 x 104 as vibratory load, respectively, during the entire operating life of the coupling
Vibratory torque of coupling	T_{KW}	Torque amplitude of the permissible periodical torque fluctuation with a frequency of 10 Hz and a basic load of T_{KN} or dynamic load up to T_{KN}, respectively
Damping power of coupling	P_{KW}	Permissible damping power with an Pambient temperature of + 30 °C.
Rated torque of machine	T_N	Stationary rated torque on the coupling
Rated torque of driving side	T_{AN}	Rated torque of machine, calculated from rated power and rated speed
Rated torque of load side	T_{LN}	Maximum figure of the load torque calculated from power and speed
Peak torque of machine	T_S	Peak torque on the coupling
Peak torque on the driving side	T_{AS}	Peak torque with torque shock on the driving side, e. g. breakdown torque of the electric motor

Description	Symbol	Definition or explanation
Peak torque of load side	T_{LS}	Peak torque with torque shock on load side, e. g. braking
Vibratory torque of machine	T_W	Amplitude of the vibratory torque effective on the coupling
Damping power of the machine	P_W	Damping power which is effective on the coupling due to the load produced by the vibratory torque
Moment of inertia of driving side	J_A	Total of moments of inertia existing on the driving or load side referring to the coupling speed
Moment of inertia of load side	J_L	
Rotational inertia coefficient of driving side	M_A	Factor taking into account the mass distribution with shocks and vibrations produced on the driving or load side $M_A = J_L / (J_A + J_L)$ $M_L = J_A / (J_A + J_L)$
Rotational inertia coefficient of load side	M_L	
Screw tightening torque	T_A	Tightening torque of screw

Permissible load on feather key of the coupling hub

The shaft-hub-connection has to be verified by the customer. Permissible surface pressure according to DIN 6892 (method C).

Cast iron GJL 225 N/mm²
Nodular iron GJS 225 N/mm²
Steel 250 N/mm²

Coupling selection

Service factor temperature S_t											
	-50 °C	-30 °C +30 °C	+40 °C	+50 °C	+60 °C	+70 °C	+80 °C	+90 °C	+100 °C	+110 °C	+120 °C
T-PUR®	1,0	1,0	1,1	1,2	1,3	1,45	1,6	1,8	2,1	2,5	3,0
PUR	–	1,0	1,2	1,3	1,4	1,55	1,8	2,2	–	–	–

For the selection with PEEK spider a temperature factor is not necessary.
For temperature factors for PA spiders see page 26.

Service S_Z factor for starting frequency				
starting frequency/h	100	200	400	800
S_Z	1,0	1,2	1,4	1,6

Service factor S_A/S_L for shocks	
	S_A/S_L
gentle shocks	1,5
average shocks	1,8
heavy shocks	2,5

Example of calculation of standard IEC motors shown on page 23:

Given: Details of driving side

A. C. motor type: 315 L • SA =1,8

Motor output: P = 160 kW

Speed: n = 1485 rpm

Moment of inertia of driving side: J_A = 2,9 kgm2

Start-up frequency: z = 6 1/h • S_Z =1,0

Ambient temperature: = + 70 °C → St =1,45 using T-PUR®

Given: Details of load side

Screw compressor

Rated torque of load side: T_{LN} = 930 Nm

Moment of inertia of load side: J_L = 6,8 kgm²

Calculation

- I Rated driving torque

T_{AN} [Nm] = 9550 • P_{AN} [kW] / n_{AN} [rpm]

T_{AN} [Nm] = 9550 • 160 [kW] / 1485 [rpm] = 1029 Nm

Coupling selection:

- I Load produced by rated torque

$T_{KN} \geq T_{LN} \cdot S_t$

$T_{KN} \geq$ 930 Nm • 1,45 = 1348,5 Nm

Selected:

ROTEX® Size 90 - spider 92 Shore A with:

T_{KN} = 2400 Nm

$T_{K\,max.}$ = 4800 Nm

- Load produced by torque shocks

$T_{K\,max.} \geq T_S \cdot S_z \cdot S_t$

→ Drive-sided shock
$T_S = T_{AS} \cdot M_A \cdot S_A$

→ $M_A = J_L / (J_A + J_L)$ = (6,8 kgm² + 0,0673 kgm²) / (2,9 kgm² + 0,0673 kgm² + 6,8 kgm² + 0,0673 kgm²)

→ Driving torque

T_{AS} = 2,0 • T_{AN} = 2,0 • 1029 Nm = 2058 Nm

T_S = 2058 Nm • 0,7 • 1,8 = 2593,1 Nm

$T_{K\,max.} \geq$ 2593,1 Nm • 1 • 1,45 = 3670 Nm

$T_{K\,max.}$ with 4800 Nm ≥ 3760 Nm ✓