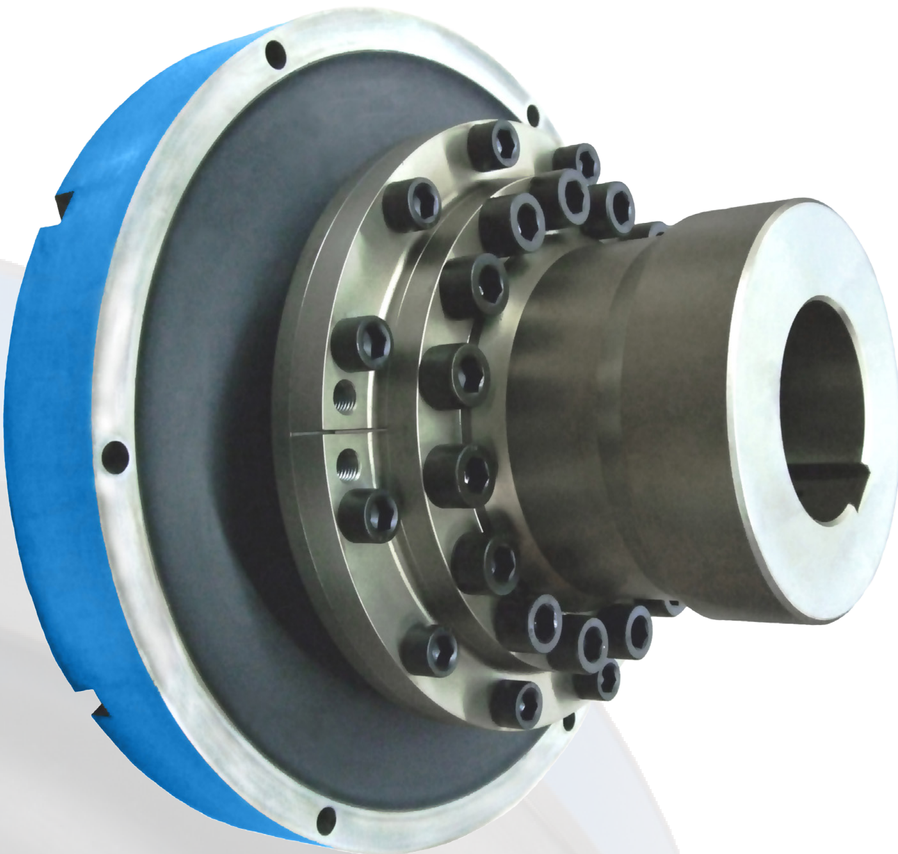
Dipl.-Ing. Herwarth Reich GmbH

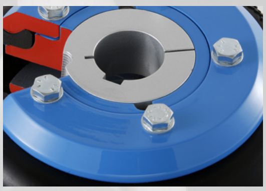
D2C
Designed to Customer

TOK

Highly flexible couplings for flexibly mounted engines



Your drive is our strength. Your strength is our drive.



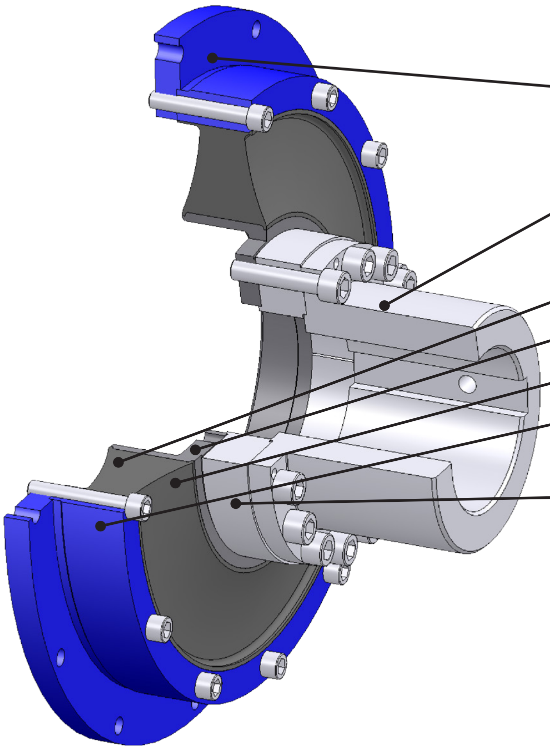
TOK – highly flexible couplings for flexibly mounted engines

The highly flexible TOK coupling is specifically designed for applications requiring extremely low torsional stiffnesses. It is furthermore particularly well suited for the compensation of radial and axial misalignments of flexibly mounted engines. The broad range of flexible coupling elements and adaptive designs provides standard solutions for a wide variety of different tasks, and these can be complemented by specific customised designs on request.

Types and sizes

The flexible element is designed to combine high torque transmission capacity and high misalignment capacity with high speed capability. Its stiffness is easily adaptable to the requirements by selecting just the right rubber quality. The adaptive designs are based on the standard flywheel adapter dimensions according to SAE J620. The TOK coupling series comprises coupling sizes for a torque range from approx. 1000 Nm up to 86000 Nm.

The extremely low torsional stiffness allows for a safe and overcritical layout of the coupling. During the start and stop operations, the resonance range is quickly passed through, and an excellent de-coupling between the combustion engine and the driven machine is achieved over the entire operating speed range. The TOK coupling enables direct connection between the engine and the driven machine and is capable of compensating for the misalignments resulting from the flexible mounting without requiring any additional components. Most versions even allow for radial dismantling. Restoring forces remain within the permissible limits and do not affect the high misalignment capacity. A distinct reduction in the mounting effort is also achieved.



Design and function

The highly flexible, torsionally optimised TOK couplings are specifically laid out for use in flexibly mounted engine applications. Accordingly, both the coupling flange 1 and the coupling hub 2 of the standard types are matched to the standard engine and shaft connection dimensions.

Radial, axial and angular misalignments are compensated for by a flexible element. The highly flexible coupling element 3 is designed as a rubber-metal bond between the inner sleeve 3a, the rubber disc body 3b and the outer ring 3c. For many applications, flange 1 and outer ring 3c are integrated in one single component. An alternatively available, divided spacer ring 4 enables radial dismantling of the coupling without having to dislodge the two connected components.

When a torque acts on the engine side of the coupling, the twisting flexibility of the rubber ring disc body enables relative twisting against the driven machine. Torsional vibrations of the engine are thus efficiently de-coupled.

Besides the standard types, a lot of custom-specific solutions can be realised with the TOK coupling system.

Advantages of the TOK coupling

- Direct connection to SAE J620 flywheels; adaptation to other flywheels on request
- Compensation of axial, radial and angular misalignments
- Variable mounting lengths
- Backlash-free and maintenance-free
- Increased torque transmission capacity by the use of 2 elements
- Suited for highest speeds
- Optionally light weights by the use of high-strength aluminium

Technical details (selection)

Coupling[1] size	Torque			Dynamic[2] torsional stiffness	Weight	Moment of inertia		Maximum speed	Maximum permissible misalignment [4] continuously/short-time		
	Nominal	Maximum	Fatigue[3]						Radial	Axial	Angular
	T_{KN}	T_{Kmax}	T_{KW}	$C_{T\,dyn}$	m	J_1	J_2	n_{max}	Δ Kr	Δ Ka	Δ Kw
	[Nm]	[Nm]	[Nm]	[Nm/rad]	[kg]	[kgm²]	[kgm²]	[rpm]	[mm]	[mm]	[°]
TOK 270 F2.10	1500	4500	480	5500	13.1	0.20	0.02	5000	0.6/1.8	2.9/8.8	0.3/0.9
TOK 305 F2.11,5	2800	8400	870	12000	17.4	0.32	0.06	4400	0.7/2.1	2.8/8.5	0.3/0.9
TOK 410 F2.14	5000	15000	1530	15000	36.6	1.34	0.11	3300	1.5/4.6	5.5/16	0.5/1.6
TOK 510 F2.18	7500	22500	2300	27000	50.2	2.47	0.40	2600	1.8/5.5	5.7/17	0.6/1.7
TOK 605 F2.21	18000	54000	5400	75000	88.5	6.28	0.94	2200	2.2/6.6	5.8/17	0.6/1.7
TOK 605 F2D	36000	108000	10800	150000				2200	2.2/6.6	5.8/17	0.1/0.3
TOK 700 F2.21	30000	90000	9000	120000	202.5	11.2	4.8	1900	3.8/11.3	7/21	0.7/2.0
TOK 835 F2.920	43000	129000	12900	180000	213.0	25.9	5.85	1600	6.9/20.6	8/24	0.8/2.3
TOK 835 F2D	86000	258000	25800	360000				1600	6.9/20.6	8/24	0.2/0.5

Tab. 1 Technical details

[1] Standard rubber element version, relative damping ψ = 0.5; alternative versions on request.

[2] Continuous vibratory torque: ± T_{KW} at f = 10 Hz. Apply $T_{KW} \cdot \sqrt{\frac{10}{f_x}}$ for other frequencies f_x.

[3] Details referred to 1500 rpm. Values for other speeds on request.
Recommendation: For mounting, align to max. 20% ΔK for each direction of misalignment
The sum of all ΔK portions should not exceed 100% in service

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Coupling size selection

Layout and selection of the coupling size for use on combustion engines are subject to torsional vibration aspects. A general safety factor of S = 1.3 - 1.5 should be applied for TOK couplings for a preliminary selection according to the engine torque T_{AN}.

The following requirements should be satisfied for proper selection of the coupling size:

1. The **nominal torque capacity T_{KN}** of the coupling should be at least equal to the max. engine torque T_{AN} at any operating temperature whilst taking into account the temperature factor S_t.
2. Calculation of the nominal engine torque T_{AN}:
3. The temperature factor S_t allows for a decreasing load carrying capability of the coupling due to elevated ambient temperatures
4. The **maximum torque capacity T_{Kmax}** of the coupling should be at least equal to the maximum torque T_{max} occurring in service and at any operating temperature whilst taking into account the temperature factor S_t.
5. The permissible **continuous vibratory torque T_{KW}** of the coupling should be at least equal to the maximum vibratory torque T_W occurring in the operating speed range whilst taking into account the temperature and frequency. The frequency factor Sf allows for the frequency dependence of the permissible continuous vibratory torque $T_{KW\,(10\,Hz)}$ for other frequencies f_x.

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

$$T_{AN}[Nm] = 9550 \cdot \frac{P[kW]}{n[\ rpm\ ]}$$

	60°C	70°C	80°C	>80°C
S_t	1,25	1,4	1,6	auf Anfrage

$$T_{Kmax} \geq T_{max} \cdot S_t$$

$$T_{KW(10Hz)} \geq T_W \cdot S_t \cdot S_f$$

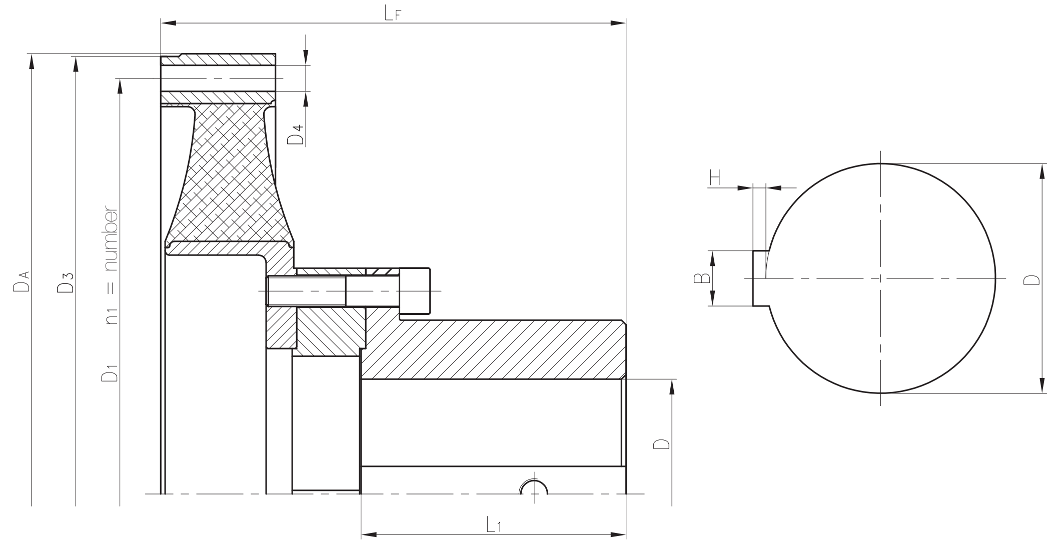
$$S_f = \sqrt{\frac{f_x}{10}}$$

The coupling selection should be verified for the permissible coupling load by a torsional vibration analysis, which we will conduct on request. When using TOK couplings in engines with large torque absorption fluctuations of the driven machine, an additional safety factor should be applied.

Take care not to continuously operate the system at resonance frequency to avoid damage to the coupling and the aggregates.

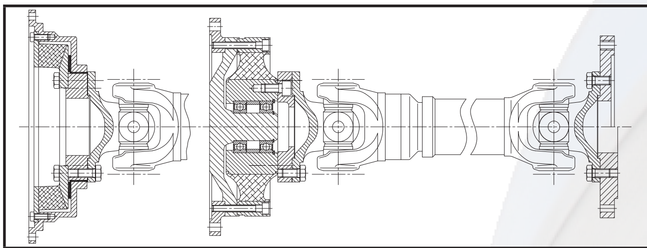
Further information on the torsional vibration analysis and the operation of the highly flexible TOK coupling is available on request.

Details for coupling selection and torsional vibration analysis



Engine type				Connection dimensions (acc. to above sketch)			
Description	Symbol	Unit	Value	Description	Symbol	Unit	Value
Power	P	[kW]		Outer dia.	D_A	[mm]	
max. speed	n_{max}	[rpm]		Hole circle dia.	D_1	[mm]	
Idle speed	n_{idle}	[rpm]		Number	n_1	[mm]	
Torque nominal	T	[Nm]		Centering dia.	D_3	[mm]	
Maximum from engine	T_{AN}	[Nm]		Hole dia.	D_4 / thread	[mm]	
Maximum in operation	T_{max}	[Nm]		Mounting length	L_F	[mm]	
Inline / V (Angle xx°)	R/Vxx°	-		Hub hole dia.	D	[mm]	
Number of cylinders	z	-		Hub length	L_1	[mm]	
Engine harmonic main order	i	-		Key Height	H	[mm]	
Firing order $z_1, z_2, \dots z_n$				Width	B	[mm]	
Total displacement volume	V_H	[ccm]		Anticipated shaft displacement			
Moments of inertia (engine + flywheel)	J_{engine}	[kgm²]		axial	K_a	[mm]	
Type of output end				radial	K_r	[mm]	
Moment of inertia *)	J_{output}	[kgm²]		angular	K_w	[°]	

Tab. 2 Details for coupling selection and torsional vibration analysis   *) to be reduced for gearbox transmissions



TOK couplings for flexible mounting are preferably intended for use as a direct connection between the aggregates. When it comes to bridging large distances between the combustion engine and the driven machine, the TOK coupling can also be equipped with a bearing of its own and a cardan shaft. Alternatively, AC-VSK cardan shaft couplings are available for such applications; ask for our separate catalogue for technical specifications. Depending on the requirements, additional adaptive designs are available to match the geometry and dimensions of custom-specific connections of the combustion engine and the driven machine; options and technical details on request.

Safety precautions

It is the customer‘s and user‘s responsibility to observe the national and international regulations and safety rules. Check all bolted connections for proper fit preferably after the test run.

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April 2009 Edition: This TOK edition supersedes all previous catalogues of this coupling type for flexibly mounted engines. All dimensions in millimetres. We reserve the right to change dimensions and / or design details without prior notice.