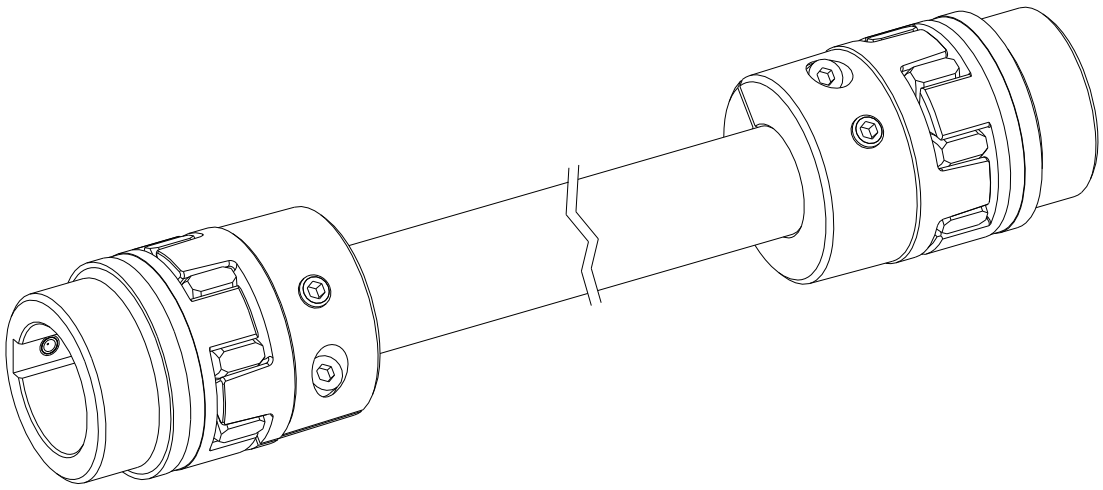
ROTEX®

Torsionally flexible jaw couplings type ZR
and their combinations



ROTEX® is a torsionally flexible jaw coupling. It is able to compensate for shaft misalignment, for example caused by manufacturing inaccuracies, thermal expansion, etc.
The double-cardanic design of the coupling allows to compensate for higher radial displacements.

- Type ZR is not permissible for crane drives and hoist drives.
- For vertical assembly of type ZR it is necessary to use a pulling washer in the cam ground of the hub at the bottom.

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1 Technical data

Type ZR

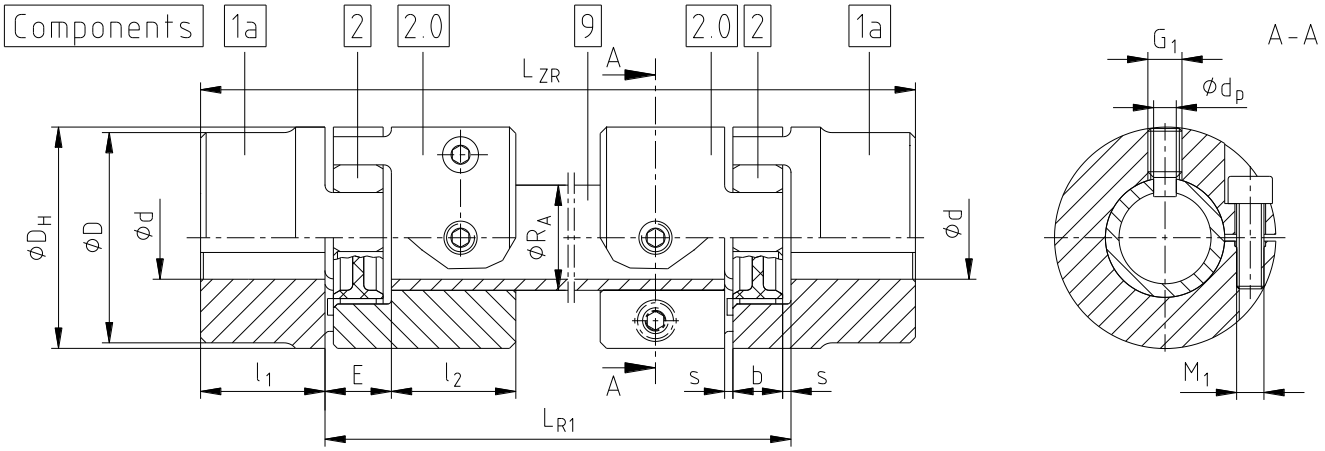


Illustration 1: Type ZR (with ROTEX® GS spider)

Table 1: Dimensions and technical data

Size	Spider [1] (component 2) Rated torque [Nm]			Dimensions [mm]							Intermediate pipe Torsional stiffness	
	92 ShA	98 ShA	64 ShD	Max. finish bore d [2]	D_H	D	l_1; l_2	E	s	b	$ØR_A$ [mm]	C [3] [Nm²/rad]
19	10	17	21	25	40	40	25	16	2.0	12	20x3	954.9
24	35	60	75	35	55	55	30	18	2.0	14	30x4	4522
28	95	160	200	40	65	65	35	20	2.5	15	35x4	7611
38	190	325	405	48	80	66	45	24	3.0	18	40x4	11870
42	265	450	560	55	95	75	50	26	3.0	20	45x4	17487
48	310	525	655	62	105	85	56	28	3.5	21	50x4	24648
55	410	685	825	74	120	98	65	30	4.0	22	55x4	33544
65	-	940	1175	80	135	115	75	35	4.5	26	65x5	68329
75	-	1920	2400	95	160	135	85	40	5.0	30	75x5	108000

Size	Clamping hub (part 2.0)							L_{ZR}	Shaft distance dimension
	M_1	T_A [Nm]	T_R [Nm]	Locking screw G_1	Pin hole Ødp	Number of screws	Hub material		min. L_{R1}
19	M6	14	58	M6	4.0	1	St	$L_{ZR} = L_{R1} + 2 \bullet l_1$	110
24	M6	14	83	M8	5.5	1	St		128
28	M8	35	185	M10	7.0	1	St		145
38	M8	25	144	M12	8.5	1	Al-D		180
		35	203				St		
42	M10	49	258	M12	8.5	1	Al-D		198
		69	377				St		
48	M12	86	431	M16	12	1	Al-D		217
		120	618				St		
55	M12	120	1418	M16	12	2	St		242
65	M12	120	1620	M16	12	2	St		281
75	M16	295	3500	M16	12	2	St		318

1) Maximum torque of the coupling $T_{K\,max}$ = rated torque of the coupling $T_{K\,rated}$ x 2
2) Bores H7 with keyway to DIN 6885 sheet 1 [JS9] and thread for setscrew
3) Torsion spring stiffness with 1 m length of the intermediate pipe

= standard

1 Technical data

Type ZR with clamping hubs DH

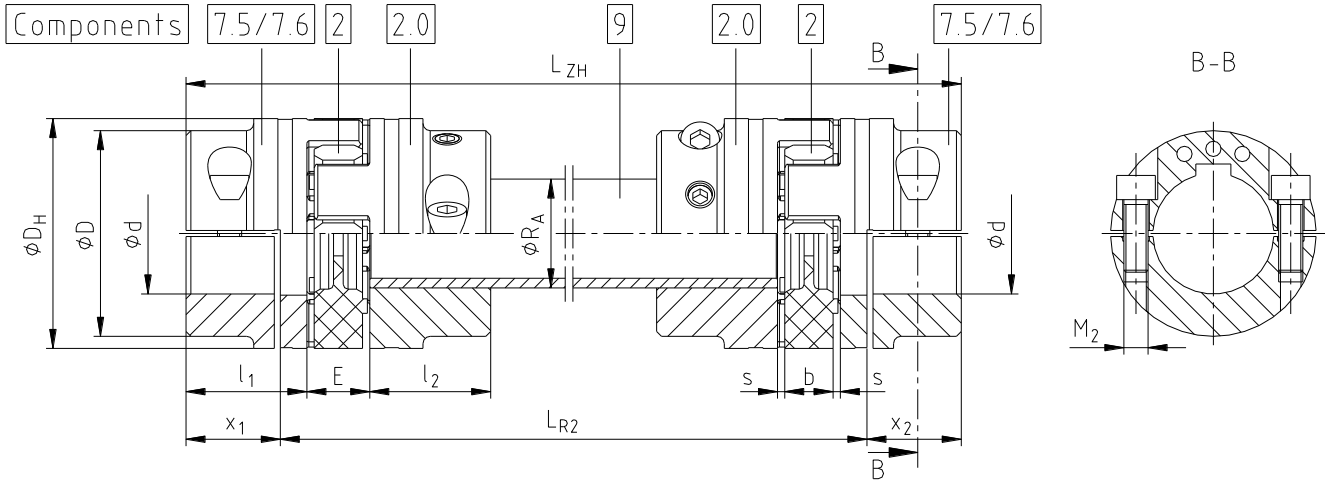


Illustration 2: Type ZR with clamping hubs DH (for double-cardanic connection 7.5 or 7.6 with ROTEX® GS spider)

Table 2: Dimensions and technical data

Size	Spider [1] (component 2) Rated torque [Nm]			Dimensions [mm]							
	92 ShA	98 ShA	64 ShD	Max. finish bore d	D_H	D	l_1; l_2	x_1; x_2	E	s	b
19	10	17	21	20	40	40	25	17.5	16	2.0	12
24	35	60	75	28	55	55	30	22.5	18	2.0	14
28	95	160	200	38	65	65	35	25.5	20	2.5	15
38	190	325	405	45	80	80	45	35.5	24	3.0	18
42	265	450	560	55	95	85	50	39.0	26	3.0	20
48	310	525	655	60	105	95	56	45.0	28	3.5	21
55	410	685	825	70	120	110	65	50.0	30	4.0	22
65	-	940	1175	80	135	115	75	60.0	35	4.5	26
75	-	1920	2400	90	160	135	85	67.5	40	5.0	30

Size	Clamping hub (part 7.5 / 7.6)				Intermediate pipe Torsional stiffness		L_{ZH}	Shaft distance dimension
	M_2	T_A [Nm]	Number of screws	Hub material	$ØR_A$ [mm]	C [2] [Nm²/rad]		min. L_{R2}
19	M6	14	2	St	20x3	954.9	$L_{ZH} = L_{R2} + 2 \bullet x_1$	97
24	M6	14	2	St	30x4	4522		111
28	M8	35	2	St	35x4	7611		129
38	M8	35	2	St	40x4	11870		157
42	M10	69	2	St	45x4	17487		174
48	M12	120	2	St	50x4	24648		190
55	M12	120	2	St	55x4	33544		220
65	M12	120	2	St	65x5	68329		250
75	M16	295	2	St	75x5	108000		285

1) Maximum torque of the coupling $T_{K\,max}$ = rated torque of the coupling $T_{K\,rated}$ x 2
2) Torsion spring stiffness with 1 m length of the intermediate pipe

2 Advice

2.1 General advice

Please read through these operating/assembly instructions carefully before you start up the coupling.
Please pay special attention to the safety instructions!
The operating/assembly instructions are part of your product. Please store them carefully and close to the coupling. The copyright for these operating/assembly instructions remains with KTR.

2.2 Safety and advice symbols

	**Warning of personal injury**	This symbol indicates notes which may contribute to preventing bodily injuries or serious bodily injuries that may result in death.
	**Warning of product damages**	This symbol indicates notes which may contribute to preventing material or machine damage.
	**General advice**	This symbol indicates notes which may contribute to preventing adverse results or conditions.
	**Warning of hot surfaces**	This symbol indicates notes which may contribute to preventing burns with hot surfaces resulting in light to serious bodily injuries.

2.3 General hazard warnings

With assembly, operation and maintenance of the coupling it has to be made sure that the entire drive train is secured against accidental switch-on. You may be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety indications.

- All operations on and with the coupling have to be performed taking into account "safety first".
- Please make sure to switch off the power pack before you perform your work on the coupling.
- Secure the power pack against accidental switch-on, e. g. by providing warning signs at the place of switch-on or removing the fuse for current supply.
- Do not reach into the operating area of the coupling as long as it is in operation.
- Please secure the coupling against accidental contact. Please provide for the necessary protection devices and covers.

2.4 Intended use

You may only assemble, operate and maintain the coupling if you

- have carefully read through the operating/assembly instructions and understood them
- had technical training
- are authorized by your company

The coupling may only be used in accordance with the technical data (see chapter 1). Unauthorized modifications on the coupling design are not admissible. We will not assume liability for any damage that may arise. In the interest of further development we reserve the right for technical modifications.
The **ROTEX®** described in here corresponds to the technical status at the time of printing of these operating/assembly instructions.

2 Advice

2.5 Coupling selection

For a permanent and failure-free operation of the coupling it must be selected according to the selection instructions (according to DIN 740 part 2) for the particular application (see catalogue drive technology "ROTEX®").
If the operating conditions (performance, speed, modifications on engine and machine) change, the coupling selection must be reviewed.
Please make sure that the technical data regarding torque refer to the spider only. The transmittable torque of the shaft-hub-connection must be reviewed by the customer and is subject to his responsibility.

For drives subject to torsional vibrations (drives with cyclic stress due to torsional vibrations) it is necessary to perform a torsional vibration calculation to ensure a reliable selection. Typical drives subject to torsional vibrations are e. g. drives with diesel engines, piston pumps, piston compressors etc. If requested, KTR will perform the coupling selection and the torsional vibration calculation.

2.6 Reference to EC Machinery Directive 2006/42/EC

The couplings supplied by KTR should be considered as components, not machines or partly completed machines according to EC Machinery Directive 2006/42/EC. Consequently KTR does not have to issue a declaration of incorporation. For details about safe assembly, start-up and safe operation please refer to the present operating/assembly instructions considering the warnings.

3 Storage, transport and packaging

3.1 Storage

The coupling hubs are supplied in preserved condition and can be stored at a dry and roofed place for 6 - 9 months.
The features of the coupling spiders (elastomers) remain unchanged for up to 5 years with favourable storage conditions.

The storage rooms must not include any ozone-generating devices like e. g. fluorescent light sources, mercury-vapour lamps or electrical high-voltage appliances.
Humid storage rooms are not suitable.
Please make sure that condensation is not generated. The best relative air humidity is less than 65 %.

3.2 Transport and packaging

In order to avoid any injuries and any kind of damage please always make use of proper transport and lifting equipment.

The couplings are packed differently each depending on size, number and kind of transport. Unless otherwise contractually agreed, packaging will follow the in-house packaging specifications of KTR.

4 Assembly

The coupling is supplied as an assembled/pre-assembled unit or in individual parts. Before assembly the coupling has to be inspected for completeness.

4.1 Components of the coupling

Components of ROTEX® type ZR

Component	Quantity	Description
1	2	Hub
2	2	Spider
3	2	ZR clamping hub
4	1	ZR intermediate pipe
5	see table 1 and 2	Cap screws DIN EN ISO 4762
6	1)	Setscrews DIN EN ISO 4029
7	2	Setscrews with pins DIN EN ISO 4028

1) depending on hub (component 1)

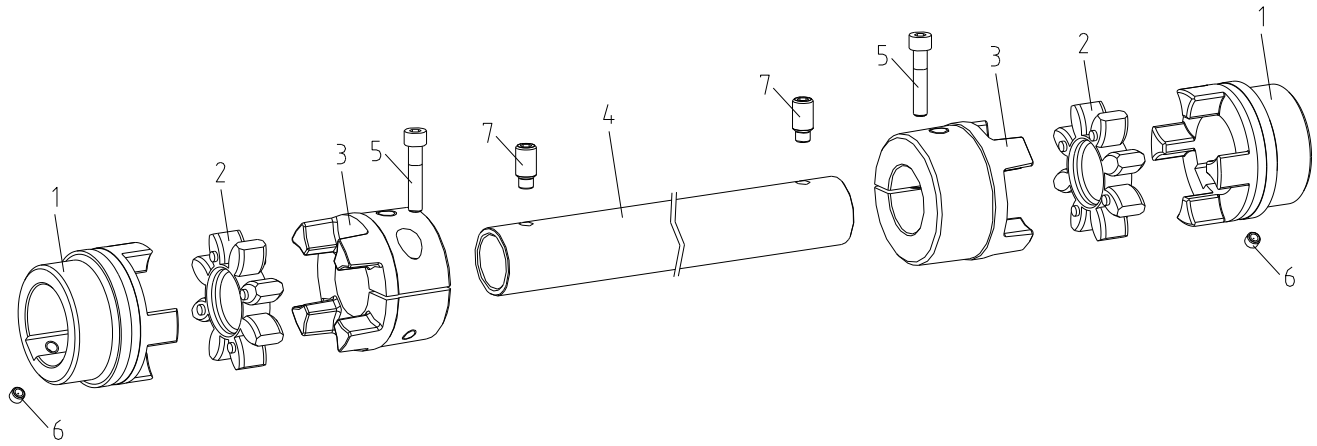


Illustration 3: ROTEX® type ZR

Features of standard spiders

Spider hardness (Shore)	92 ShA-GS	98 ShA-GS	64 ShD-H-GS	64 ShD-GS
Size	19 - 55	19 - 75	19 - 38	42 - 75
Material	Polyurethane	Polyurethane	Hytrel	Polyurethane
Marking (colour)				

4 Assembly

4.2 Advice for finish bore

STOP

The maximum permissible bore diameters d (see table 1 and 2 in chapter 1 - technical data) must not be exceeded. If these figures are disregarded, the coupling may tear. Rotating particles may cause danger to life.

- Hub bores machined by the customer have to observe concentricity or axial runout, respectively (see illustration 4).
- Please make absolutely sure to observe the figures for Ø d_{max}.
- Carefully align the hubs when the finish bores are drilled.
- Please provide for a setscrew according to DIN EN ISO 4029 with a cup point or an end plate to fasten the hubs axially.

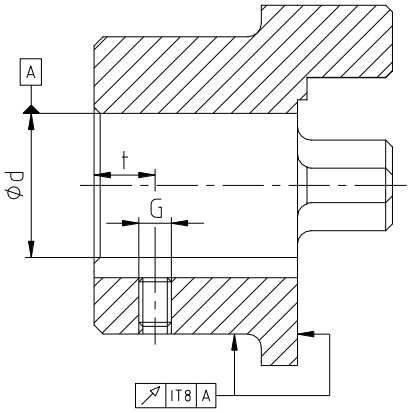


Illustration 4: Concentricity and axial runout

The customer bears the sole responsibility for all machining processes performed subsequently on unbored or pilot bored as well as finish machined coupling components and spare parts. KTR does not assume any warranty claims resulting from insufficient remachining.

Table 3: Setscrews DIN EN ISO 4029

Size	19	24	28	38	42	48	55	65	75
Dimension G	M5	M5	M8	M8	M8	M8	M10	M10	M10
Dimension t	10	10	15	15	20	20	20	20	25
Tightening torque T_A [Nm]	2	2	10	10	10	10	17	17	17

Table 4: Recommended fit pairs acc. to DIN 748/1

Bore [mm]		Shaft tolerance	Bore tolerance
above	up to		
	50	k6	H7 (KTR standard)
50		m6	

If a feather keyway is intended to be used in the hub, it should correspond to the tolerance ISO JS9 (KTR standard) with normal operating conditions or ISO P9 with difficult operating conditions (frequently alternating torsional direction, shock loads, etc.). The keyway should preferably be located between the cams. With axial fastening by setscrews the tapping should be located on the keyway except for Al-D which should be located opposite the keyway.

The transmittable torque of the shaft-hub-connection must be reviewed by the customer and is subject to his responsibility.

4 Assembly

4.3 Assembly of the coupling (general)

We recommend to inspect bores, shaft, keyway and feather key for dimensional accuracy before assembly.

Heating the hubs lightly (approx. 80 °C) allows for an easier mounting on the shaft.

Touching the heated hubs causes burns.
Please wear safety gloves.

With the assembly please make sure that the distance dimension E (see table 1 and 2) is observed to allow for axial clearance of the spider when in operation.
Disregarding this advice may cause damage to the coupling.

4.4 Assembly of the hubs

- Mount the hubs on the shaft of driving and driven side (see illustration 5).
- The internal sides of the hubs must be flush with the front sides of the shafts.
- Shift the power packs in axial direction until the dimension L_{R1} is achieved (see illustration 1).
- Fasten the hubs by tightening the setscrews DIN EN ISO 4029 with a cup point (tightening torque see table 3).

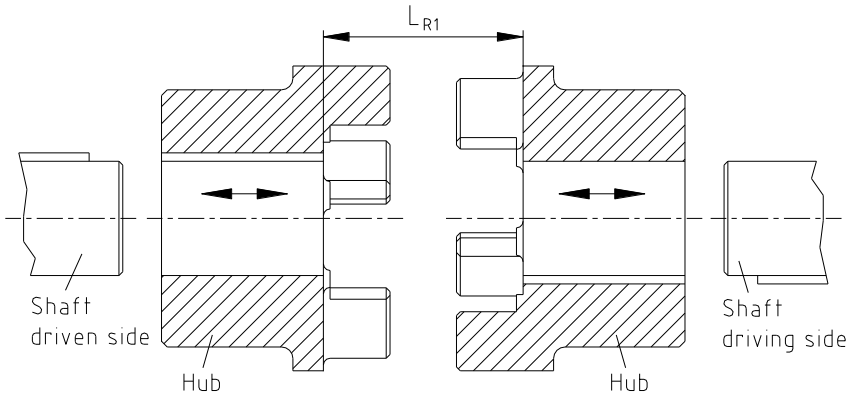


Illustration 5: Assembly of the hubs

4 Assembly

4.5 Assembly of DH clamping hubs

- Remove the half shells from the hub body (see illustration 6).
- Put the hub body with the cap screws installed on the shaft (see illustration 7).
- Position the half shells towards the hub body (see illustration 8). Screw in the cap screws for several pitches.
- The radial kerf of the DH clamping hubs must be flush with the front sides of the shafts.
- Hand-tighten the components first until the hub bodies with the half shells fit closely to the shaft.
- Secure the DH clamping hubs by tightening the clamping screws reciprocally. The screws have to be tightened at the tightening torques T_A specified in table 2 by means of a suitable torque wrench.
- Shift the power packs in axial direction until the dimension L_{R2} is achieved (see illustration 2).

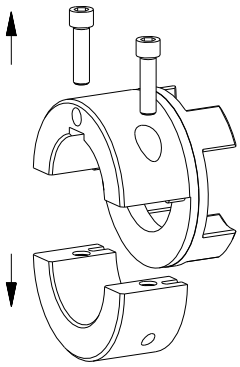


Illustration 6

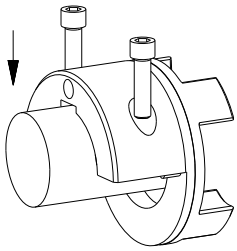


Illustration 7

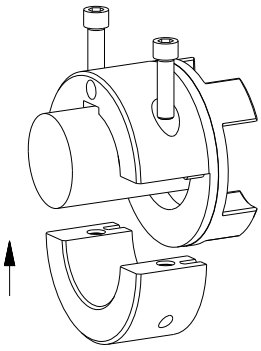


Illustration 8

4.6 Assembly of the ZR spacer

- Shift the ZR clamping hub onto the ZR intermediate pipe (see illustration 9).
- Insert the spiders in the cam section of the hubs or clamping hubs DK, respectively.
- Insert the pre-assembled unit between the hubs (see illustration 10).
- Align the ZR clamping hubs to the dimension E resp. s required (see illustration 1 and 2 as well as table 1 and 2).
- Hand-tighten the ZR clamping hubs first. Tighten the cap screws to the tightening torques T_A specified in table 1 by means of a suitable torque key.
- Drill the through holes Ødp (see illustration 1 and table 1) in the ZR intermediate pipe for the setscrews with pin DIN EN ISO 4028.
- Screw in the setscrews with pin against a stop.

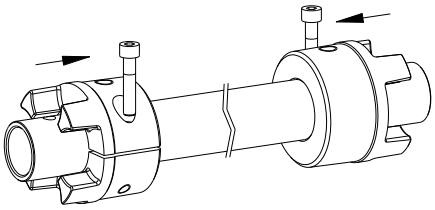


Illustration 9: Assembly of ZR clamping hubs on the ZR intermediate pipe

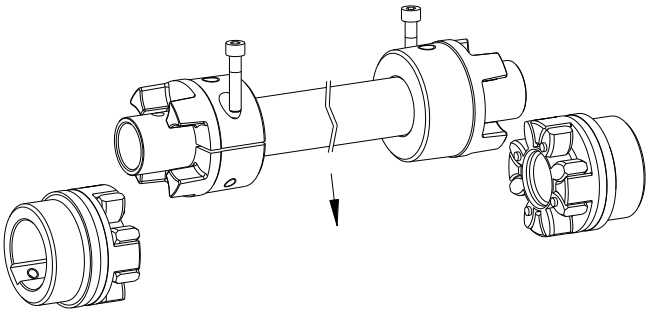


Illustration 10: Assembly of the ZR spacer

With vertical assembly of ROTEX® type ZR a special washer of KTR has to be inserted between the coupling hub at the bottom and the spider at the bottom.

4 Assembly

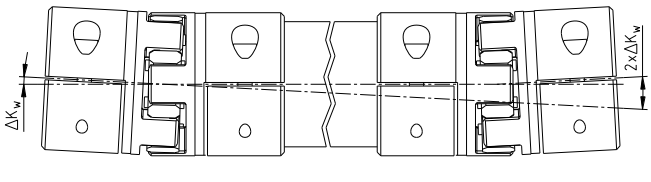
4.7 Displacements - alignment of the couplings

The displacement figures specified in table 5 provide for sufficient safety to compensate for external influences like, for example, thermal expansion or foundation settling.

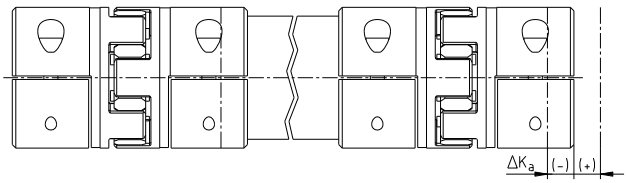
In order to ensure a long service life of the coupling, the shaft ends have to be accurately aligned. Please absolutely observe the displacement figures specified (see table 5). If the figures are exceeded, the coupling will be damaged.
The more accurate the alignment of the coupling, the longer is its service life.

Please note:

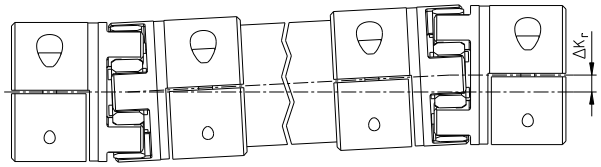
- The displacement figures specified in table 5 are maximum figures which must not arise in parallel. If radial and angular displacements arise at the same time, the permissible displacement values may only be used proportionally (see illustration 12).
- Please inspect with a dial gauge, ruler or feeler gauge whether the permissible displacement figures specified in table 5 can be observed.



Angular displacements



Axial displacements



Radial displacements

Illustration 11: Displacements

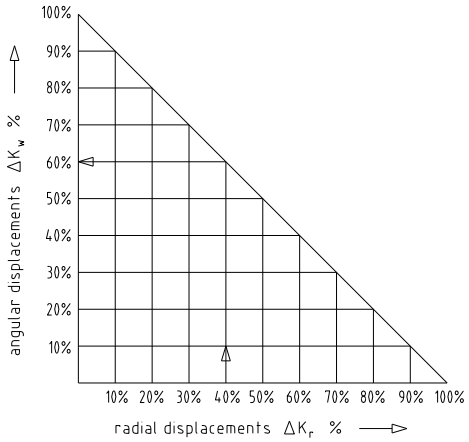


Illustration 12:
Combinations of displacement

Example:

ROTEX® 24 ZR,
Speed 1500 rpm,
Coupling length L_{ZR} = 651 mm
Max. radial displacement ΔK_r = 10 mm
Max. angular displacement ΔK_w = 1°

with radial displacement of 4 mm = 40 % of the max. radial displacement 10 mm,

results in a permissible angular displacement of 60 % of the max. angular displacement 1° = 0.6°

$\Delta K_{total} = \Delta K_w + \Delta K_r \leq 100\ \%$

4 Assembly

4.7 Displacements - alignment of the couplings

Table 5: Displacement figures

Size	Max. axial displacement ΔK_a [mm]	Max. angular displacement ΔK_w [degree] with n =		Max. radial displacement ΔK_r [mm]
		1500 rpm	3000 rpm	
19	1.2	1.0	0.75	1) Calculate the distance from the center of one spider to the center of the other spider L_{ZK} (see illustration 1 and 2) $L_{ZK} = L_{ZR} - 2 \times l_1 - E$ 2) Calculate the maximum radial displacement ΔK_r (see illustration 11) $\Delta K_r = \tan\Delta K_w \times L_{ZK}$
24	1.4			
28	1.5			
38	1.8			
42	2.0			
48	2.1			
55	2.2			
65	2.6			
75	3.0			

4.8 Critical bending speed

Please observe the critical bending speed of the coupling.

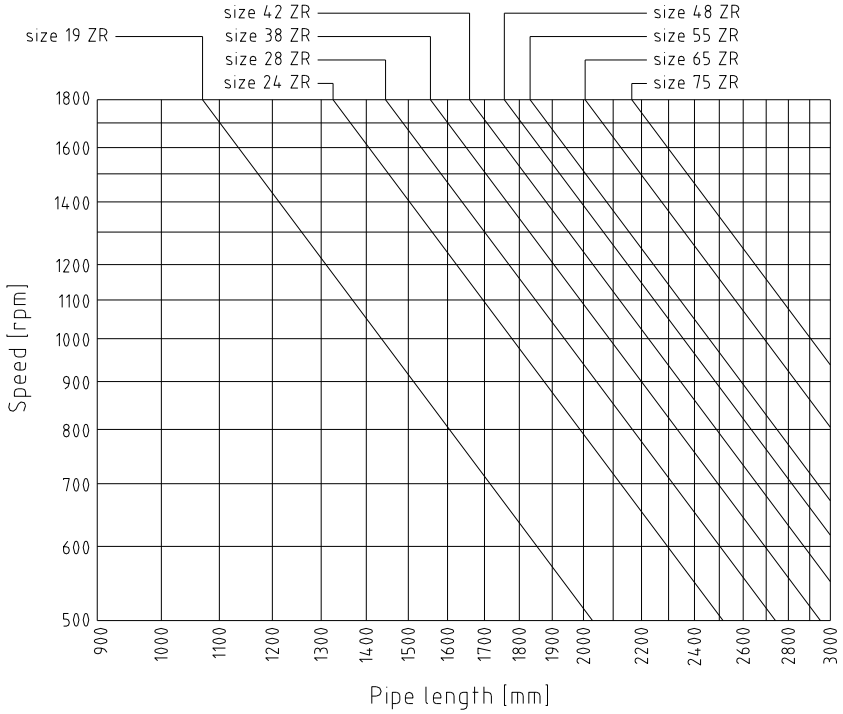


Illustration 13: Critical bending speed of type ZR

5 Start-up

Before start-up of the coupling, inspect the tightening of the setscrews in the hubs, the alignment and the distance dimension E and adjust, if necessary, and also inspect all screw connections for the tightening torques specified, dependent on the type of coupling.

Finally the coupling protection against accidental contact must be fitted. It is required in accordance with DIN EN ISO 12100 (Safety of Machinery) and directive 2014/14/EU and must protect against

- access with the little finger
- falling down of solid foreign objects.

The cover may provide for openings intended for necessary heat dissipation. These openings have to comply with DIN EN ISO 13857.
The cover must be electrically conductive and included in the equipotential bonding. Bellhousings (magnesium share below 7.5 %) made of aluminium and damping rings (NBR) can be used as connecting element between pump and electric motor. The cover may only be taken off with standstill of the unit.

During operation of the coupling, please pay attention to

- different operating noise
- vibrations occurring.

If you note any irregularities with the coupling during operation, the drive unit must be switched off immediately. The cause of the breakdown must be specified by means of the table „Breakdowns“ and, if possible, be eliminated according to the proposals. The potential breakdowns specified can be hints only. To find out the cause all operating factors and machine components must be considered.

6 Breakdowns, causes and elimination

The below-mentioned failures can lead to a use of the **ROTEX®** coupling other than intended. In addition to the specifications given in these operating and assembly instructions make sure to avoid such failures.
The errors listed can only be clues to search for the failures. When searching for the failure the adjacent components must generally be considered.

General failures with use other than intended:

- Important data for the coupling selection were not forwarded.
- The calculation of the shaft-hub-connection was disregarded.
- Coupling components with damage occurred during transport are assembled.
- If the heated hubs are assembled, the permissible temperature is exceeded.
- The fit of the components to be assembled is not coordinated with one another.
- Tightening torques have been fallen below/exceeded.
- Components are mixed up by mistake/assembled incorrectly.
- A wrong or no spider is inserted in the coupling.
- No original **KTR** components (purchased parts) are used.
- Old/already worn out spiders or spiders stored for too long are used.
- Maintenance intervals are not observed.

6 Breakdowns, causes and elimination

Breakdowns	Causes	Elimination
Different operating noise and/or vibrations occuring	Misalignment	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, breaking of the engine mount, thermal expansion of unit components, modification of the installation dimension E of the coupling) 3) For inspection of wear see item inspection
	Wear of spider, short-term torque transmission due to metal contact	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that have been damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary
	Screws for axial fastening of hubs working loose	1) Set the unit out of operation 2) Inspect alignment of coupling 3) Tighten the screws to fasten the hubs and secure against working loose 4) For inspection of wear see item inspection
Fracture of cams	Wear of spider, torque transmission due to metal contact	1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment
	Fracture of the cams due to high impact energy/overload	1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment 4) Find out the reason for overload
	Operating parameters do not meet with the performance of the coupling	1) Set the unit out of operation 2) Review the operating parameters and select a bigger coupling (consider mounting space) 3) Assemble new coupling size 4) Inspect alignment
	Operating error of the unit	1) Set the unit out of operation 2) Replace complete coupling 3) Inspect alignment 4) Instruct and train the service staff
Early wear of spider	Misalignment	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, breaking of the engine mount, thermal expansion of unit components, modification of the installation dimension E of the coupling) 3) For inspection of wear see item inspection
	e. g. contact with aggressive liquids/oils, ozone influence, too high/low ambient temperatures etc. causing physical modification of the spider	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that have been damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Make sure that further physical modifications of the spider are excluded
	Ambient/contact temperatures which are too high for the spider, max. permissible e. g. with T-PUR® T4 = - 50 °C/+ 120 °C	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that have been damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Inspect and adjust ambient/contact temperature (possibly corrective by using different spider materials)
Early wear of spider (liquefaction of material inside the spider cam)	Vibrations of drive	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the spider 3) Inspect coupling components and replace coupling components that have been damaged 4) Insert spider, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Find out the reason for the vibrations (possibly corrective by spider with lower or higher Shore hardness)

7 Disposal

In respect of environmental protection we would ask you to dispose of the packaging or products on termination of their service life in accordance with the legal regulations and standards that apply, respectively.

- **Metal**
  Any metal components have to be cleaned and disposed of by scrap metal.
- **Nylon materials**
  Nylon materials have to be collected and disposed of by a waste disposal company.

8 Maintenance and service

ROTEX® is a low-maintenance coupling. We recommend to perform a visual inspection on the coupling **at least once a year**. Please pay special attention to the condition of the coupling spiders.

- Since the flexible machine bearings of the driving and driven side settle during the course of load, please inspect the alignment of the coupling and re-align the coupling, if necessary.
- The coupling components have to be inspected for damages.
- The screw connections have to be inspected visually.

Having started up the coupling the tightening torques of the screws have to be inspected during the usual inspection intervals.

9 Spares inventory, customer service addresses

A basic requirement to ensure the readiness for use of the coupling is a stock of the most important spare parts on site.

Contact addresses of the KTR partners for spare parts and orders can be obtained from the KTR homepage at www.ktr.com.

KTR does not assume any liability or warranty for the use of spare parts and accessories which are not provided by KTR and for the damages which may incur as a result.