



The **POLY** is a torsionally elastic claw coupling. It is able to compensate offset of shafts, e. g. caused by manufacturing inaccuracies, thermal expansion etc.

The **POLY** type PKD enables a change of the elastomer package without having to disassemble the drive or driven machine in case of low shaft distance dimension.

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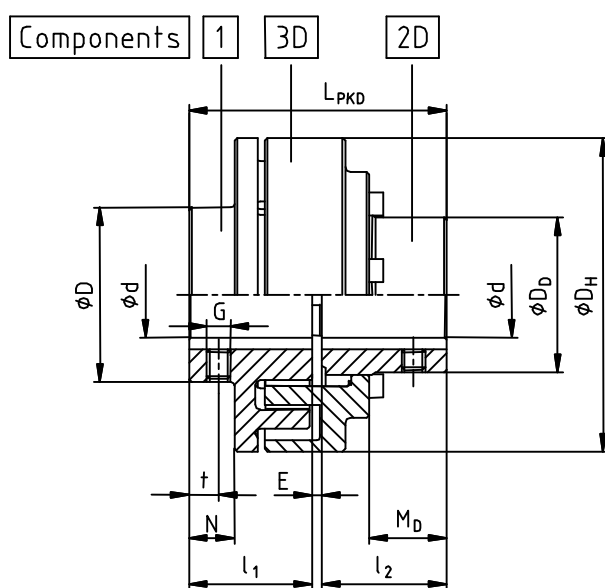
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1 Technical Data



picture 1: POLY design PKD

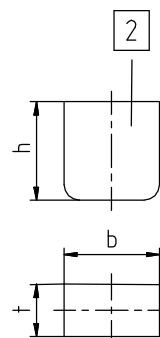


Bild 2: Poly - Elastomerpaket
NBR (Perbunan) 92 ShA

Components:

- 1 cam part (preferably to be used at the driving end)
- 2D flange hub
- 3D cam ring

Table 1: dimensions design PKD

POLY size	pilot bore	finish bore $d_{max.}$ [mm]		dimensions [mm]										thread of setscrew	
		component 1	component 2D	general								G	t	tightening torque T_A [Nm]	
				D_H	D	D_D	l_1, l_2	M_D	N	E	L_{PKD}				
15	-	50	45	157	90	75	65	35	21	4	134	M8	15	10	
17	-	60	50	176	100	90	70	40	26	4	144	M8	15	10	
19	-	75	65	195	125	107	75	45	27	4	154	M8	15	10	
20	-	65	60	205	115	105	80	45	22	4	164	M8	15	10	
22	-	85	75	224	140	129	90	59	38	4	184	M10	20	17	
25	-	90	85	257	150	140	100	60	43	5	205	M12	20	40	
28	-	100	95	288	165	160	110	65	44	5	225	M12	20	40	
30	-	110	100	308	180	170	130	75	58	5	265	M16	20	80	
35	60	130	130	373	210	210	160	95	70	5	325	M16	25	80	
40	70	145	145	423	240	240	180	115	85	5	365	M16	25	80	
45	80	160	160	473	270	270	180	110	74	6	366	M16	30	80	
50	90	170	170	543	290	290	200	130	80	6	406	M16	30	80	
55	100	180	180	580	310	310	200	120	74	8	408	M16	30	80	
60	110	200	190	630	350	330	230	135	85	8	468	M16	30	80	
65	120	210	200	685	360	340	250	150	90	10	510	M16	30	80	

Table 2: dimensions elastomer packages

coupling size	15	17	19	20	22	25	28	30	35	40	45	50	55	60	65
quantity of packages ¹⁾	12	12	12	12	16	16	16	16	20	20	20	20	20	20	20
package size	3	3a	4	3b	4	5	6	7	8	9	10	11	12	13	
dimensions [mm]	h	24,6	26,8	34,6	29,6	34,6	40,6	42,4	45,1	52,6	58,1	70,1	75,5	91,4	103
	b	27,2	27,7	34,9	29,6	34,9	40,0	43,7	60	59,9	69	79	81	98,2	108,1
	t	16,1	18,4	19,6	18,4	19,6	22,2	23,7	22,3	29,6	29,3	36,3	42,5	44,3	48,5

1) Quantity for the complete coupling.



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1 Technical Data

Table 3: torque and speed

POLY size		15	17	19	20	22	25	28	30
torque [Nm]	T_{KN}	320	400	660	820	1100	1600	2500	3950
	$T_{Kmax.}$	640	800	1320	1640	2200	3200	5000	7900
max. speed n [1/min.] ¹⁾		4300	3800	3500	3300	3000	2700	2350	2200

POLY size		35	40	45	50	55	60	65	
torque [Nm]	T_{KN}	6100	9000	14300	21500	27000	34000	46000	
	$T_{Kmax.}$	12200	18000	28600	43000	54000	68000	92000	
max. speed n [1/min.] ¹⁾		1850	1600	1400	1300	1150	1050	980	

1) For peripheral speeds of more than $v=30$ m/sec a dynamical balancing is necessary.

Table 4: cap screws DIN 912

coupling size	15	17	19	20	22	25	28	30	35	40	45	50	55	60	65
quantity of cap screws DIN 912 ²⁾	6	6	6	6	8	8	8	8	10	10	10	10	10	10	10
screw size	M8	M8	M8	M10	M8	M10	M10	M12	M12	M14	M16	M16	M16	M16	M20
screw length	30	25	25	30	30	30	40	40	55	55	60	65	70	75	75
tightening torque T_A [Nm]	25	25	25	49	25	49	49	86	86	135	210	210	210	210	410

2) Quantity for the complete coupling.



CAUTION !

For a continuous and troublefree operation of the coupling it must be designed according to the selection instructions (according to DIN 740 part 2) for the particular application (see POLY® catalogue).

If the operating conditions (performance, speed, changes at engine and machine) change, the coupling selection must be checked again.

2 Hints

2.1 General Hints

Please read through these mounting instructions carefully before you set the coupling into operation.



The **POLY** coupling is approved for the use in hazardous areas.

When using the coupling in hazardous areas please observe the special hints and instructions regarding safety in enclosure A.

Please pay special attention to the safety instructions!

The mounting instructions are part of your product. Please keep them carefully and close to the coupling.

The copyright of these mounting instructions remains with **KTR Kupplungstechnik GmbH**.

2.2 Safety and Advice Hints



DANGER !

Danger of injury to persons.



CAUTION !

Damages on the machine possible.



ATTENTION !

Pointing to important items.



PRECAUTION !

Hints concerning explosion protection.

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2 Hints

2.3 General Hints of Danger



DANGER !

With assembly, operation and maintenance of the coupling it has to be made sure that the entire drive train is protected against unintentional engagement. You can be seriously hurt by rotating parts. Please make absolutely sure to read through and observe the following safety instructions.

- All operations on and with the coupling have to be performed taking into account "safety first".
- Please make sure to disengage the power pack before you perform your work.
- Protect the power pack against unintentional engagement, e. g. by providing hints at the place of engagement or removing the fuse for current supply.
- Do not touch the operation area of the coupling as long as it is in operation.
- Please protect the coupling against unintentional touch. Please provide for the necessary protection devices and caps.

2.4 Proper Use

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

- carefully read through the mounting instructions and understood them
- had technical training
- are authorized to do so by your company

The coupling may only be used in accordance with the technical data (see table 1 to 4 in chapter 1).

Unauthorized modifications on the coupling design are not admissible. We do not take any warranty for resulting damages. To further develop the product we reserve the right for technical modifications.

The **POLY-coupling** described in here corresponds to the technical status at the time of printing of these mounting instructions.

3 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 elastomer packages remain unchanged for up to 5 years in case of favourable stock conditions.



CAUTION !

The storage rooms may 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 there is no condensation. The best relative air humidity is under 65%.

4 Assembly

Basically the coupling is supplied in individual parts. Before assembly the coupling has to be controlled for completeness.

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4 Assembly

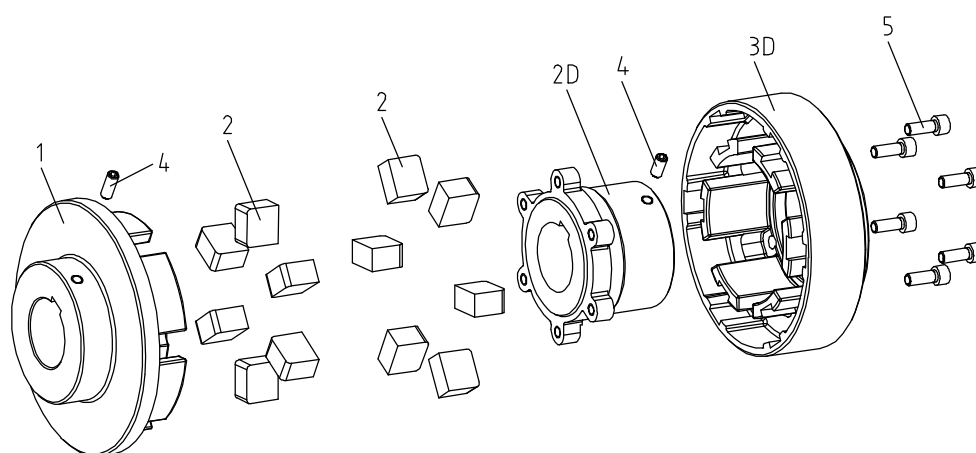
4.1 Components of the Couplings

Components of POLY design PKD

Component	Quantity	Designation	Material	Balancing Condition ¹⁾
1	1	cam part	EN-GJL-250	2)
2	see table 5	elastomer packages	NBR (buna N) 92 ShA	
2D	1	flange hub	EN-GJL-250 / EN-GJS-400-15	2)
3D	1	cam ring	EN-GJL-250	2)
4	2	set screw DIN 916	steel	
5	see table 5	cap screw DIN 912	steel	

1) Component 2D, 3D and 5 is balanced in assembled condition.

2) acc. to customer's request



picture 3: POLY design PKD

Table 5:

coupling size	15	17	19	20	22	25	28	30	35	40	45	50	55	60	65
quantity of packages ¹⁾	12	12	12	12	16	16	16	16	20	20	20	20	20	20	20
package size	3		3a	4	3b	4	5	6	7	8	9	10	11	12	13
quantity of cap screws DIN 912 ¹⁾	6	6	6	6	8	8	8	8	10	10	10	10	10	10	10

1) Quantity for the complete coupling (dimension elastomer packages - see table 2).

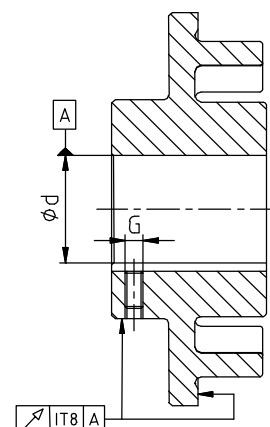
4.2 Hint regarding the finish bore



DANGER !

The maximum permissible bore diameters d (see table 1 in chapter 1 - Technical Data) must not be exceeded. If these figures are disregarded, the coupling may tear. Rotating particles may cause serious danger.

- Hub bores machined by the customer have to observe concentric running or axial running, respectively (see picture 4).
- Please make absolutely sure to observe the figures for d_{max} .
- Carefully align the hubs when the finish bores are brought in.
- Please provide for a setscrew or an end plate for the axial fastening of the hubs.



picture 4: concentric running and axial running



4 Assembly

4.3 Assembly of the Coupling



ATTENTION !

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

Heating the cam part and flange hub slightly (approx. 80 °C) allows for an easier installation onto the shaft.



PRECAUTION !

Please pay attention to the danger of ignition in hazardous areas.



DANGER !

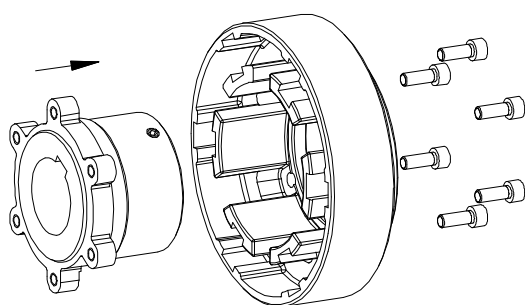
Touching the heated parts causes burns.
We would recommend to wear safety gloves.



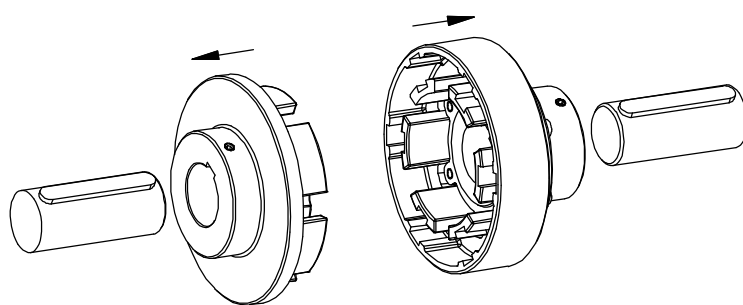
CAUTION !

During the assembly please make sure that the L dimension (see table 1) is observed, so that the spacer and the driving flange do not contact each other during the operation. Disregarding this hint may cause damage on the coupling.

- Plug cam ring and flange hub together (see picture 5).
- Hand-screw the parts first of all.
- Mount cam part and flange hub with cam ring to the shaft of the drive and driven side (see picture 6).
- Tighten the screws with a suitable torque wrench to the tightening torques T_A mentioned in table 4.
- Insert the packages in the cam and the pocket section (see picture 7).
- Move the power packs in axial direction until the dimension E is achieved (see picture 8).
- If the power packs are already firmly assembled, axial movement of the hubs on the shafts allows for adjusting the dimension E (see picture 8).
- Fasten the hubs by tightening the setscrews DIN 916 with cup point (see table 1).



picture 5: assembly of flange hub with cam ring

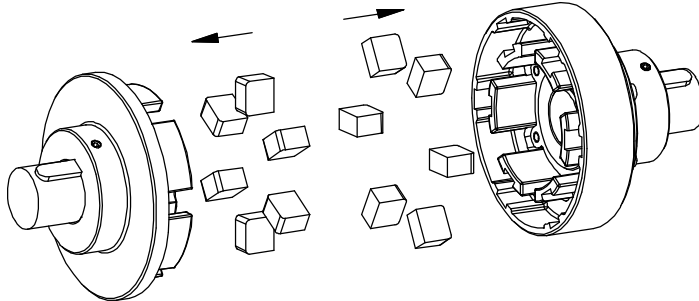


picture 6: assembly of cam part and flange hub with cam ring

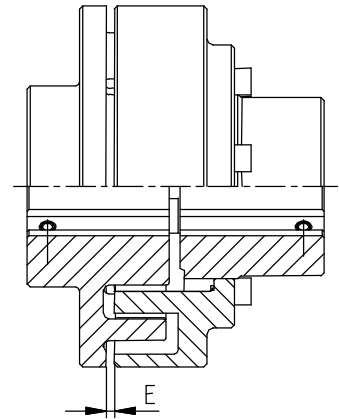


4 Assembly

4.3 Assembly of the Coupling



picture 7: assembly of packages



picture 8: coupling assembly



CAUTION !

Having set the coupling into operation, the tightening torque of the screws and wear of elastomer packages have to be inspected in usual maintenance intervals.

4.4 Displacements - Alignment of the Couplings

The displacement figures shown in table 6 offer sufficient safety to compensate for environmental influences like, for example, heat expansion or lowering of foundation.



CAUTION !

In order to ensure a long lifetime of the coupling and to avoid dangers regarding the use in hazardous areas, the shaft ends must be accurately aligned.



Please absolutely observe the displacement figures indicated (see table 6). If the figures are exceeded, the coupling is damaged.

In case of a use in hazardous areas for the explosion group IIC (marking II 2G c IIC T4) only the half displacement figures (see table 6) are permissible.

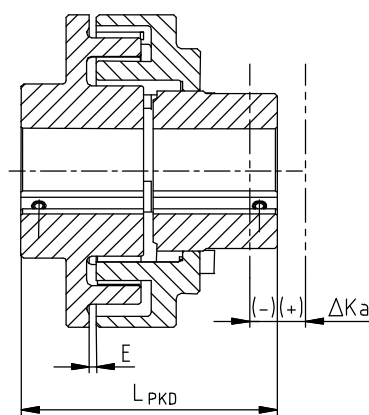
Please note:

- Please check with a dial gauge, ruler or feeler whether the permissible displacement figures of table 6 can be observed.



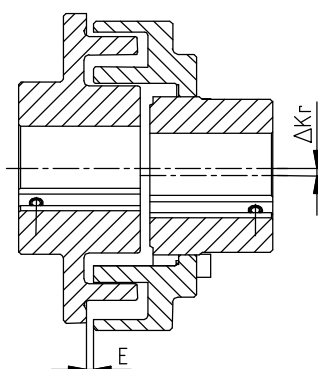
4 Assembly

4.4 Displacements - Alignment of the Couplings

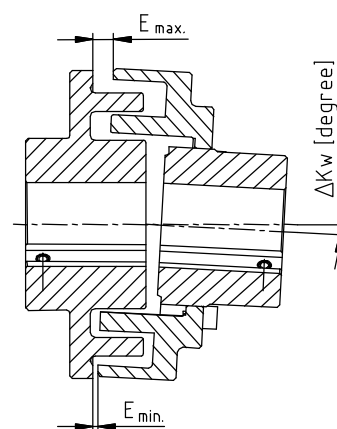


axial displacements

$$L_{PKD \text{ perm.}} = L_{PKD} + \Delta K_A \text{ [mm]}$$



radial displacements



angular displacements

$$\Delta K_W = E_{\max.} - E_{\min.} \text{ [mm]}$$

picture 9: displacements

The radial and angular displacements can occur simultaneously. The sum $V = \Delta K_R + (E_{\max.} - E_{\min.})$ shall not exceed the values in table 6.

Example for the misalignment combinations given in picture 10:

Example 1:

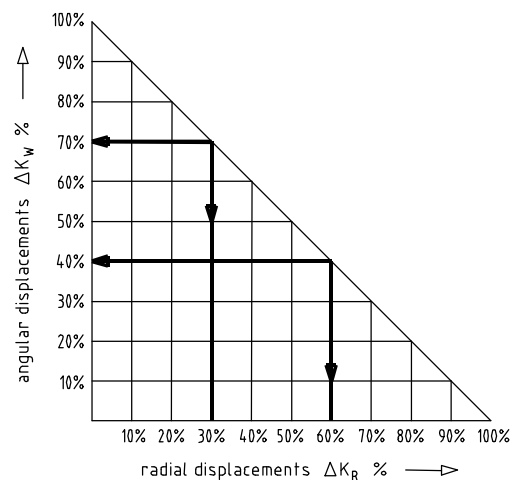
$$\Delta K_R = 30\%$$

$$\Delta K_W = 70\%$$

Example 2:

$$\Delta K_R = 60\%$$

$$\Delta K_W = 40\%$$



picture 10: combinations of displacement

$$\Delta K_{\text{total}} = \Delta K_R + \Delta K_W \leq 100 \%$$

Table 6: displacement figures

coupling size		15	17	19	20	22	25	28	30	35	40	45	50	55	60	65
max. axial displacement ΔK_A [mm]		±2	±2	±2	±2	±2	±2	±2	±2	±3	±3	±3	±3	±4	±4	±4
max. radial displacement ΔK_R [mm]	n= bis 750 1/min	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,2	1,2	1,2	1,2	1,2	1,2	1,2
or																
max. angular displacement ΔK_W [mm]	n=1000 1/min	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	1,1	1,1	1,1	1,1	1,1	1,1	1,1
or																
sum V	n=1500 1/min	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,9	0,9	0,9	0,9	0,9	0,9	0,9
	n=3000 1/min	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	-	-	-	-	-	-	-



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5 Enclosure A

Hints and instructions regarding the use in  hazardous areas

design PKD: flange hub and cam ring / elastomer packages / cam part

5.1 Selection of the Coupling Size

If the coupling is used in explosion proof areas, the size must be selected in a way that there is a minimum safety of $s = 2,0$ from the unit torque to the nominal torque of the coupling.

5.2 Control intervals for couplings in hazardous areas

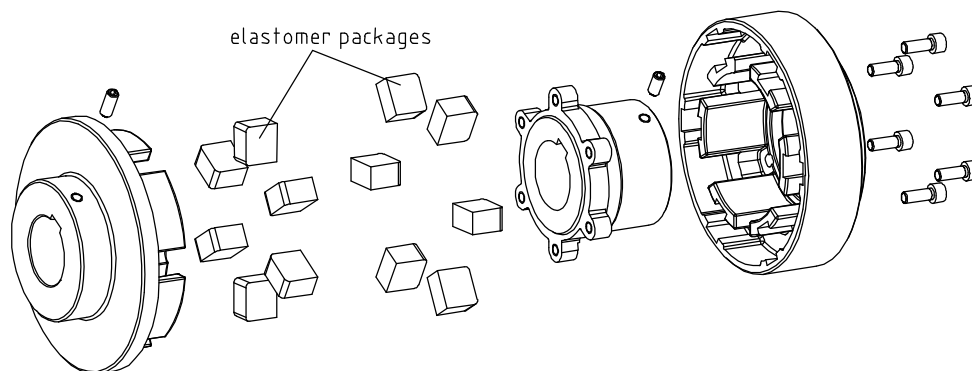
explosion group	control intervals
II 2G c IIB T4	<p>The torsional backlash of the coupling (see chapter 5.3) according to Guideline 94/9/EG (ATEX 95) must only be controlled if a friction of the elastomer packages (part 2) and consequently a machine down-time of the drive leads to explosion hazard.</p> <p>A preventive checking of torsional backlash is recommended.</p> <p>A checking of the circumferential backlash and a visual check of the elastomer packages must be effected after 3000 operating hours for the first time, after 6 months at the latest. If you note an unconsiderable or no wear at the elastomer packages after this first inspection, the further inspections can be effected, in case of the same operating parameters, respectively after 6000 operating hours or after 18 months at the latest. If you note a considerable wear during the first inspection, so that a change of the elastomer packages would be recommended, please find out the cause according to the table „Breakdowns“, as far as possible.</p> <p>The maintenance intervals must be adjusted according to the changed operating parameters.</p>
II 2G c IIC T4	<p>The torsional backlash of the coupling (see chapter 5.3) according to Guideline 94/9/EG (ATEX 95) must only be controlled if a friction of the elastomer packages (part 2) and consequently a machine down-time of the drive leads to explosion hazard.</p> <p>A preventive checking of torsional backlash is recommended.</p> <p>A checking of the circumferential backlash and a visual check of the elastomer packages must be effected after 2000 operating hours for the first time, after 3 months at the latest. If you note an unconsiderable or no wear at the elastomer packages after this first inspection, the further inspections can be effected, in case of the same operating parameters, respectively after 4000 operating hours or after 12 months at the latest. If you note a considerable wear during the first inspection, so that a change of the elastomer packages would be recommended, please find out the cause according to the table „Breakdowns“, as far as possible.</p> <p>The maintenance intervals must be adjusted according to the changed operating parameters.</p>



5 Enclosure A

Hints and instructions regarding the use in  hazardous areas

5.2 Control intervals for couplings in hazardous areas



picture 11: POLY design PKD

Checking of torsional backlash

Here the backlash between coupling cams and the elastomer packages must be checked by reverse backlash. The friction / wear may be 20% of the original thickness of the elastomer package before exchanging the elastomer packages. After having reached the limit of wear Δs_{\max} , the elastomer packages must be exchanged immediately, irrespective of the inspection intervals.

5.3 Approximate values of wear

The reaching of the exchange values depends on the operating conditions and the existing operating parameters.

If the torsional backlash is $\geq \Delta s_{\max}$ in mm, the elastomer packages must be exchanged.

Friction of $\geq 20\%$ of the original thickness of the elastomer package - exchange necessary!



CAUTION !

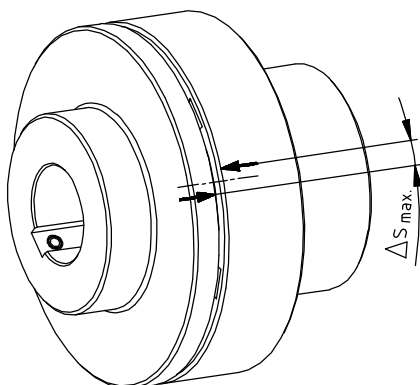
When changing the elastomer packages please do only use packages with the same Shore hardness.



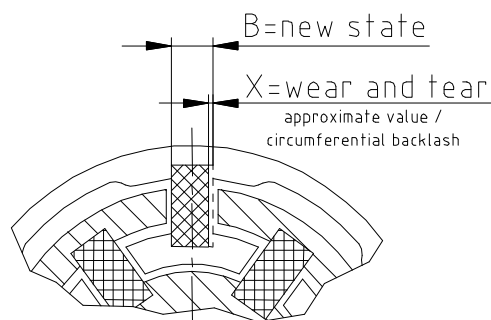
CAUTION !

In order to ensure a long lifetime of the coupling and to avoid dangers regarding the use in hazardous areas, the shaft ends must be accurately aligned.

Please absolutely observe the displacement figures indicated (see table 6). If the figures are exceeded, the coupling is damaged.



picture 12: checking of the limit of wear



picture 13: wear of elastomer packages

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5.3 Approximate values of wear

Table 7: limits of wear

POLY size	standard design			design with low backlash (enlarged elastomer packages)		
	thickness of elastomer packages [mm]	friction $X_{max.}$ [mm]	torsional backlash $\Delta s_{max.}$ [mm]	thickness of elastomer packages [mm]	friction $X_{max.}$ [mm]	torsional backlash $\Delta s_{max.}$ [mm]
15	16,1	3,0	8,2	18,7	3,8	5,5
17	16,1	3,0	8,7	18,7	3,8	5,5
19	18,4	3,5	9,7	-	-	-
20	19,6	4,0	10,3	22,9	4,6	6,7
22	18,4	3,5	10,3	-	-	-
25	19,6	4,0	9,4	22,9	4,6	6,8
28	22,2	4,0	10,6	23,9	4,8	7,3
30	23,7	4,5	11,3	28,6	5,7	8,4
35	22,3	4,0	11,7	31,3	6,3	9,4
40	29,6	6,0	14,5	-	-	-
45	29,3	6,0	15,4	-	-	-
50	36,3	7,0	18,3	-	-	-
55	42,5	8,5	20,4	-	-	-
60	44,3	9,0	21,9	-	-	-
65	48,5	10,0	24,0	-	-	-

5.4 Permissible coupling materials in the hazardous area

In the explosion groups **IIB** and **IIC** only the following material combinations may be used:

EN-GJL-250 - EN-GJL-250 (old designation GG 25)
EN-GJS-400-15 - EN-GJS-400-15 (old designation GGG 40)
steel - steel
stainless steel - stainless steel

Aluminium as coupling material is generally excluded for the explosion area.

5.5 Marking of coupling for the hazardous area

Couplings for the use in hazardous areas are marked for the respectively permissible conditions of use.

Explosion group IIC: e. g. II 2G c IIC T4

In the marking II 2G c IIC T4 the explosion group IIB is included.

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Hints and instructions regarding the use in  hazardous areas

5.6 Starting

Before putting the coupling into operation, check the tightness of the setscrews in the cam part or pocket section, the alignment and the distance dimension E and correct, if necessary, and also check all screw connections regarding the stipulated tightening torques dependent on the type of coupling.



If used in hazardous areas, the setscrews must be additionally secured against self-loosening to fix the cam part and flange hub, e. g. with Loctite (medium strength).

Last but not least, the coupling protection against unintended contact must be fixed.



Coupling protection in the hazardous area.

Covering of the coupling

The couplings must be provided with firm coverings (*if possible, made from stainless steel*) protecting the couplings against falling objects. There can be regular openings in the coverings which may not exceed the following dimensions:

	circular openings diameter in mm	rectangular openings side length in mm
top surface of the covering	4	4
side parts of the covering	8	8

The distance between the cover and the rotating parts must be at least 5 mm.

The cover must be electrically conductive and be included in the equipotential bonding. Bellhousings made from aluminium and damping rings (NBR) can be used as connecting element between pump and electro motor if the magnesium part is below 7,5 %. The cover may only be taken off after having stopped the unit.

During operation, please pay attention to

- strange running noises
- occurring vibrations.



CAUTION !

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

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	Geprüft: 14.01.03 Sha	Ersetzt durch:	W	K	V	VA			M	KC



5 Enclosure A

Hints and instructions regarding the use in  hazardous areas

5.7 Breakdowns, Causes and Elimination

breakdowns	causes	danger hints for hazardous areas	elimination
change of the running noises and / or occurring vibrations	misalignment	danger of ignition due to sparking	1) put the unit out of operation 2) eliminate the reason for the misalignment (e. g. loose foundation bolts, break of the engine fixing, heat expansion of unit components, change of the assembly dimension E of the coupling) 3) check coupling parts and exchange damaged coupling parts 4) checking of wear see under point Control
	wear of elastomer package, low / no torque transmission since coupling cams slip through	danger of ignition due to hot surfaces	1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) check alignment, correct if necessary
	loose screws for axial securement of hubs	danger of ignition due to sparking	1) put the unit out of operation 2) check alignment of coupling 3) tighten the screws to secure the hubs and secure against self-loosening 4) check coupling parts and exchange damaged coupling parts 5) checking of wear see under point Control
failure of the elastomer packages	break of the elastomer packages due to high shock energy / overload, coupling cams slip through	danger of ignition due to hot surfaces	1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) find out the reason of overload
	operating parameters do not correspond to the coupling performance / coupling cams slip through	danger of ignition due to hot surfaces	1) put the unit out of operation 2) check the operating parameters and select a larger coupling (consider installation space) 3) assemble new coupling size 4) check alignment



5 Enclosure A

Hints and instructions regarding the use in  hazardous areas

5.7 Breakdowns, Causes and Elimination

breakdowns	causes	danger hints for hazardous areas	elimination
failure of the elastomer packages	mistake in service of the unit / coupling cams slip through	danger of ignition due to hot surfaces	1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) instruct and train the service staff
premature wear of elastomer packages	misalignment		1) put the unit out of operation 2) eliminate the reason for the misalignment (e. g. loose foundation bolts, break of the engine fixing, heat expansion of unit components, change of the assembly dimension E of the coupling) 3) check coupling parts and exchange damaged coupling parts 4) checking of wear see under point Control
	e. g. contact with aggressive liquids / oils, ozone-influence, too high ambient temperatures etc. effecting a physical change of the elastomer packages		1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) check alignment, correct if necessary 6) make sure that further physical changes of the spider are excluded
	ambient / contact temperatures which are too high for the elastomer packages, max. permissible -20 °C / +80 °C	danger of ignition due to hot surfaces	1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) check alignment, correct if necessary 6) check and regulate ambient / contact temperature




KTR Kupplungstechnik
GmbH
D-48407 Rheine

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Design PKD

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5 Enclosure A

Hints and instructions regarding the use in  hazardous areas

5.7 Breakdowns, Causes and Elimination

breakdowns	causes	danger hints for hazardous areas	elimination
premature wear of elastomer packages (liquefaction of material inside the elastomer packages cam)	drive vibrations	danger of ignition due to hot surfaces	<ol style="list-style-type: none"> 1) put the unit out of operation 2) disassemble the coupling and remove rests of the elastomer packages 3) check coupling parts and exchange damaged coupling parts 4) insert elastomer packages, assemble coupling parts 5) check alignment, correct if necessary 6) find out the reason for the vibrations
break of cams or hubs	blockade due to destroyed elastomer packages	danger of ignition due to sparking	<ol style="list-style-type: none"> 1) put the unit out of operation 2) change complete coupling 3) check alignment 4) determine the cause, remove the mistakes



ATTENTION !

KTR does not assume any liabilities or guarantees regarding the use of spare parts and accessories which are not provided by KTR and for the damages resulting herefrom.

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GmbH
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Hints and instructions regarding the use in  hazardous areas

5.8 Certificate of Conformity

Certificate of Conformity

corresponding to EG Standard 94/9/EG dated 23 March 1994
and to the legal regulations

The manufacturer - KTR Kupplungstechnik GmbH, D-48432 Rheine - states that the

POLY couplings

described in these mounting instructions and explosion-proof designed correspond to Article 1 (3) b) of Standard 94/9/EG and comply with the general Safety and Health Requirements according to enclosure II of Standard 94/9/EG.

The couplings are certified according to Type Examination Certificate IBExU02ATEXB007 X.

According to article 8 (1) of Standard 94/9/EG the technical documentation is deposited with the:


IBExU
Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7

09599 Freiberg

Rheine,

20.08.02
Date

ppa.


Dr. Norbert Partmann
Engineering Manager

i. V.


Bernd Tenfelde
Product Manager

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