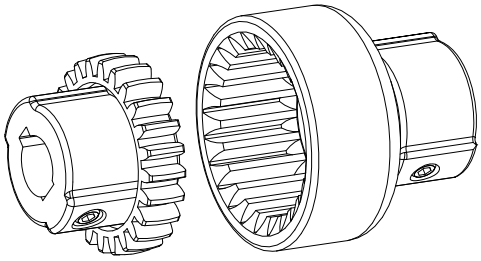
BoWex®

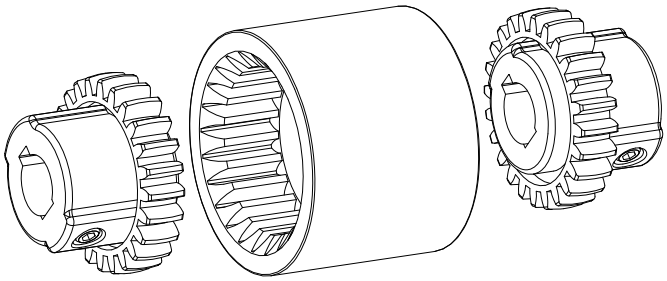
Non-failsafe
curved-tooth gear couplings
types

junior plug-in coupling,
junior M coupling,
M und M...C
I
and their combinations

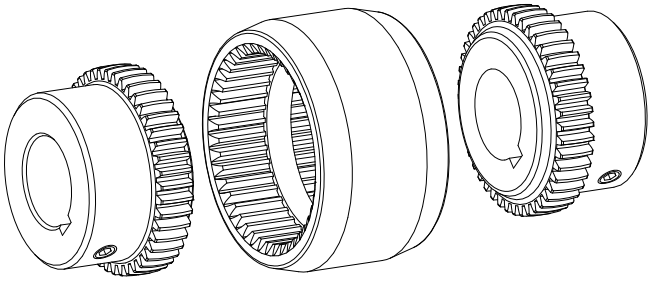
according to directive 94/9/EC
(ATEX 95) for finish bored, pilot bored
and unbored couplings



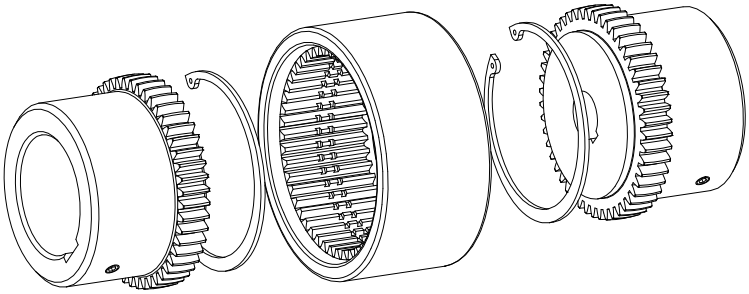
Type junior plug-in coupling (two-part)



Type junior M coupling (three-part)



Type M and M...C



Type I

The **BoWex®** curved-tooth gear coupling is a flexible shaft connection. It is able to compensate for shaft misalignment, for example caused by manufacturing inaccuracies, thermal expansion, etc.

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1 Technical data

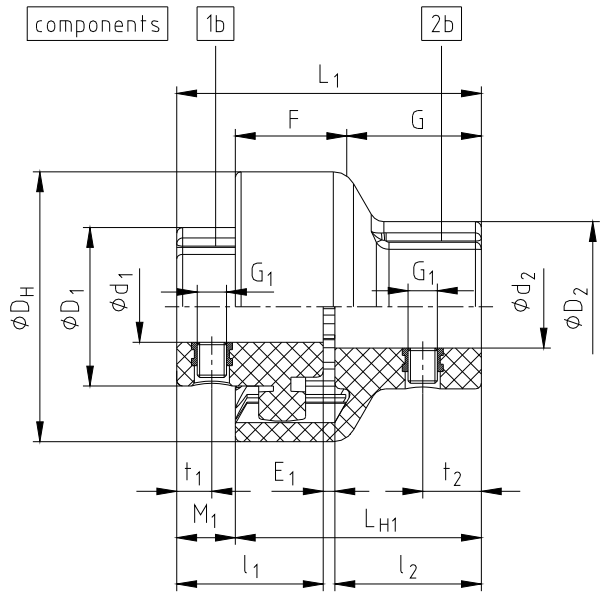


Illustration 1: BoWex® junior plug-in coupling (two-part)

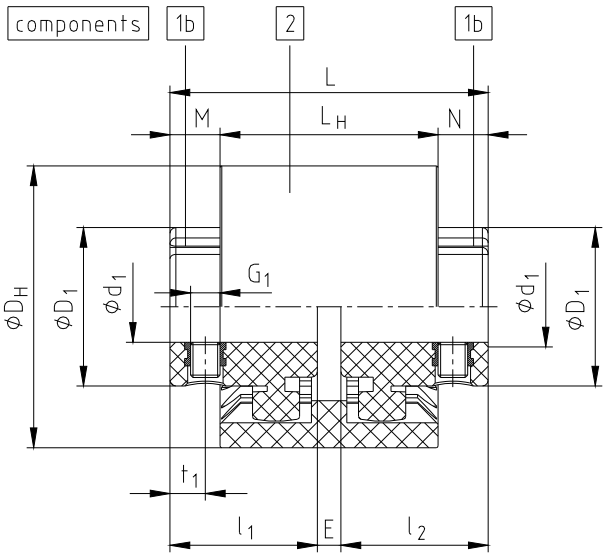


Illustration 2: BoWex® junior M coupling (three-part)

Table 1:

BoWex® junior plug-in coupling and BoWex® junior M coupling

Size	Torque [Nm]		Finish bores [mm]				Thread for setscrews				Max. speed [rpm]
	T_{KN}	$T_{K\,max.}$	Hub component 1b d_1	D_1	Plug-in sleeve component 2b d_2	D_2	G_1	t_1	t_2	T_A [Nm]	
14	5	10	Ø6, Ø7, Ø8, Ø9	22	Ø8	22	M5	6	8	1.4	6000
			Ø10, Ø11	25	Ø10, Ø11	25					
			Ø12, Ø14	26	Ø12, Ø14	26					
19	8	16	Ø12, Ø14	27	Ø14, Ø15	29	M5	6	10	1.4	6000
			Ø16	30							
			Ø19	32	Ø19	35					
24	12	24	Ø10, Ø11, Ø12	26	Ø14, Ø16	32	M5	6	10	1.4	6000
			Ø14, Ø15, Ø16	32							
			Ø18, Ø19, Ø20	36	Ø19, Ø20	36					
			Ø24	38	Ø24	40					

Table 2:

BoWex® junior plug-in coupling and BoWex® junior M coupling

Size	Dimensions [mm]											
	D_H	l_1; l_2	E_1	L_1	L_{H1}	M_1	F	G	E	L	L_H	M; N
14	40	23	2	48	40	8	18.5	21.5	4	50	37	6.5
19	47	25	2	52	42	10	19.0	23.0	4	54	37	8.5
24	53	26	2	54	45	9	21.5	23.5	4	56	41	7.5

1 Technical data

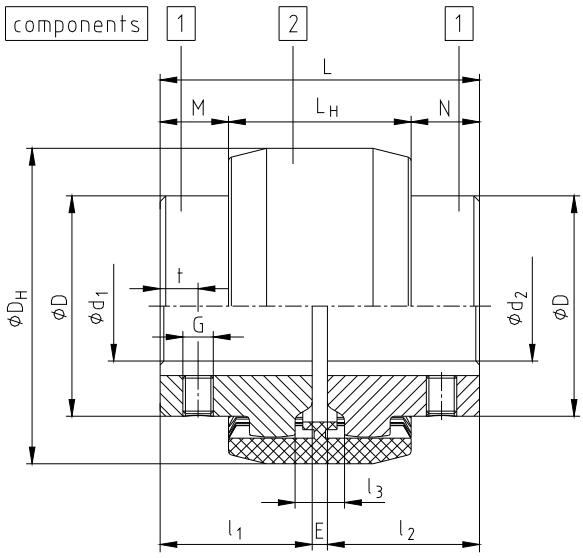


Illustration 3: BoWex® M coupling

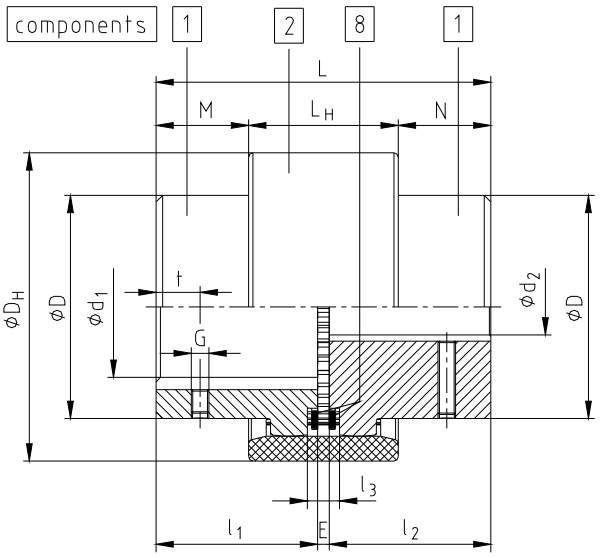


Illustration 4: BoWex® I coupling

Table 3:

BoWex® type M and type I

Size		Pilot bore		Max. finish bore d_1; d_2	Dimensions [mm]									Thread for setscrews 2) [mm]		
	Ex	Un-bored	Pilot bored		l_1; l_2	E	L	L_H	M; N	l_3	D	D_H	D_Z 1)	G	t	T_A [Nm]
M-14	M-14C	x	-	15	23	4	50	37	6.5	10	25	40	33	M5	6	2
M-19	M-19C	x	-	20	25	4	54	37	8.5	10	32	47	39	M5	6	2
M-24	M-24C	x	-	24	26	4	56	41	7.5	14	36	53	45	M5	6	2
M-28	M-28C	x	-	28	40	4	84	46	19	13	44	65	54	M8	10	10
M-32	M-32C	x	-	32	40	4	84	48	18	13	50	75	63	M8	10	10
M-38	M-38C	x	-	38	40	4	84	48	18	13	58	83	69	M8	10	10
M-42		x	-	42	42	4	88	50	19	13	65	92	78	M8	10	10
M-48	M-48C	x	-	48	50	4	104	50	27	13	68	95	78	M8	10	10
M-65	M-65C	x	27 70 lg.	65	55	4	114	68	23	16	96	132	110	M10	15 / 20 3)	17
I-80		-	31	80	90	6	186	93	46.5	20	124	175	145	M10	20	17
I-100		-	35	100	110	8	228	102	63	22	152	210	176	M12	30	40
I-125		-	45	125	140	10	290	134	78	30	192	270	225	M16	40	80

1) Tip circle of the hub
2) Position of threads for setscrews BoWex® M-14 to M-24 opposite the keyway; BoWex® M-28 to I-125 on the keyway
3) Length of hub 55 mm t = 15 mm, 70 mm t = 20 mm

BoWex® couplings with attachments that can generate heat, sparks and static charging (e. g. combinations with brake drums, brake disks, overload systems such as torque limiters, fans etc.) are <u>not</u> permitted for the use in hazardous locations.
A separate analysis must be performed.

2 Advice

2.1 Coupling selection

C A U T I O N !
For a long-lasting 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 BoWex® catalogue).
If the operating conditions (performance, speed, modifications on engine and machine) change, the coupling selection must be reviewed again.
Please make sure that the technical data regarding torque refer to the sleeve 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.

2.2 General advice

Please read through these assembly instructions carefully before you start up the coupling.
Please pay special attention to the safety instructions!

The **BoWex®** coupling is suitable and approved for the use in hazardous locations. When using the coupling in hazardous locations please observe the special advice and instructions regarding safety in enclosure A.

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

2.3 Safety and advice symbols

STOP	**D A N G E R !**	**Danger of injury to persons.**
	C A U T I O N !	**Damages on the machine possible.**
	A T T E N T I O N !	**Pointing to important items.**
	W A R N I N G !	**Hints concerning explosion protection.**

2 Advice

2.4 General hazard warnings

D A N G E R !
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 operation 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.

2.5 Intended use

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

- have carefully read through the 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 table 1 to 3 in 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 **BoWex®** described in here corresponds to the technical status at the time of printing of these assembly instructions.

3 Storage

The coupling hubs are supplied in preserved condition and can be stored at a dry and covered place for 6 - 9 months.
The features of the coupling sleeves remain unchanged for up to 5 years with favourable stock conditions.

C A U T I O N !
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 condensation is not generated. The best relative air humidity is less than 65 %.

4 Assembly

Generally the coupling is supplied in individual parts. Before assembly the coupling has to be inspected for completeness.

4.1 Components of the couplings

Type made of nylon

Components of BoWex® junior plug-in coupling

Component	Quantity	Description
1	1	Hub
2	1	Plug-in sleeve
3	2	Setscrews DIN EN ISO 4029

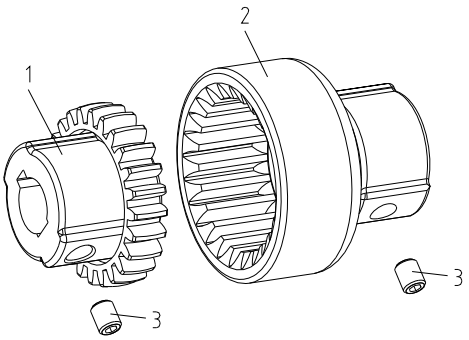


Illustration 5: BoWex® junior plug-in coupling

Components of BoWex® junior M coupling

Component	Quantity	Description
1	2	Hub
2	1	Sleeve
3	2	Setscrews DIN EN ISO 4029

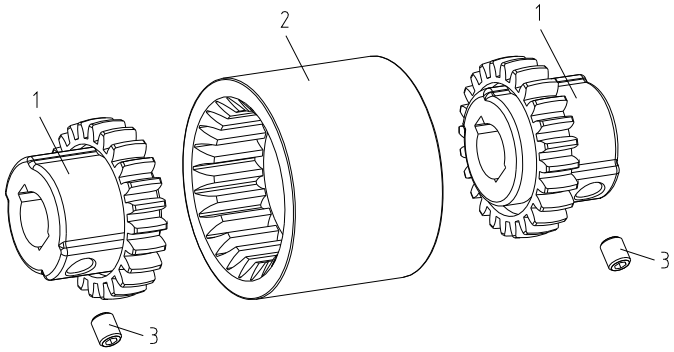


Illustration 6: BoWex® junior M coupling

Type made of steel/nylon

Components of BoWex® M coupling (size 14 - 65)

Component	Quantity	Description
1	2	Hub
2	11	M-sleeve
3	2	Setscrews DIN EN ISO 4029

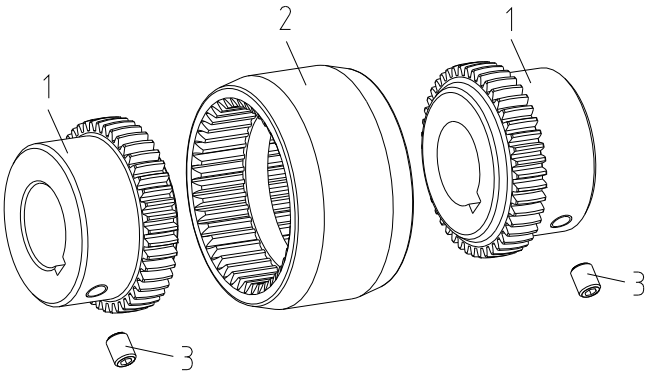


Illustration 7: BoWex® type M

4 Assembly

4.1 Components of the couplings

Components of BoWex® I coupling (size 80 - 125)

Component	Quantity	Description
1	2	Hub
2	1	I-sleeve [1]
3	2	Circlips [1]
4	2	Setscrews DIN EN ISO 4029

1) Circlips and sleeve are delivered pre-assembled.

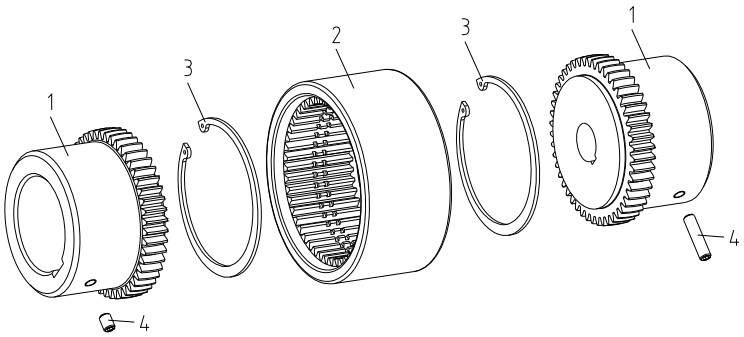


Illustration 8: BoWex® type I

4.2 Advice for finish bore

D A N G E R !
The maximum permissible bore diameters d (see table 1 to 3 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 (steel hubs) machined by the customer have to observe concentricity or axial runout, respectively (see illustration 9).
- 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.

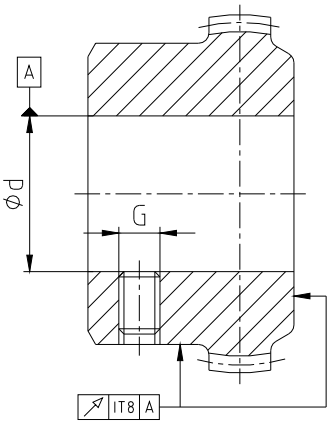


Illustration 9: Concentricity and axial runout

C A U T I O N !
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 4: Setscrews

BoWex® size	14 [1]	19 [1]	24 [1]	28	32	38	42	48	65	80	100	125
Dimension G	M5	M5	M5	M8	M8	M8	M8	M8	M10	M10	M12	M16
Tightening torque T_A [Nm]	2	2	2	10	10	10	10	10	17	17	40	80

1) Tightening torques of the BoWex® junior plug-in coupling and BoWex® junior M coupling T_A = 1,4 Nm

4 Assembly

4.2 Advice for finish bore

Table 5: 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 key 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 transmittable torque of the shaft-hub-connection must be reviewed by the customer and is subject to his responsibility.

4.3 Assembly of the hubs

A T T E N T I O N !
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.

W A R N I N G !
Please pay attention to the ignition risk in hazardous locations!

D A N G E R !
Touching the heated hubs causes burns.
Please wear safety gloves.

C A U T I O N !
With the assembly please make sure that the distance dimension E (see table 2 and 3) is observed to allow for axial clearance of the sleeve while being in operation.
Disregarding this advice may cause damage to the coupling.

- Assemble the hubs on the shaft of driving and driven side.
- **Does not apply with type BoWex® junior plug-in coupling:**
  Put the sleeve on the spline of the hub on the driving or driven side.
- Shift the power packs in axial direction until the distance dimension E is achieved.
- If the power packs are already firmly assembled, shifting the hubs axially on the shafts allows for adjusting the distance dimension E.
- Fasten the hubs by tightening the setscrews DIN EN ISO 4029 with a cup point (tightening torque see table 4).

4 Assembly

4.4 Displacements - alignment of the couplings

The displacement figures shown in tables 6 and 7 provide for sufficient safety to compensate for external influences like, for example, thermal expansion or foundation settling.

C A U T I O N !
In order to ensure a long service life of the coupling and avoid dangers with the use in hazardous locations, the shaft ends must be accurately aligned.
Please absolutely observe the displacement figures indicated (see tables 6 and 7). If the figures are exceeded, the coupling will be damaged.
The more accurate the alignment of the coupling, the longer is its service life.
If used in hazardous areas for the explosion group IIC (marking II 2GD c IIC T X), only half of the displacement figures (see tables 6 and 7) are permissible.

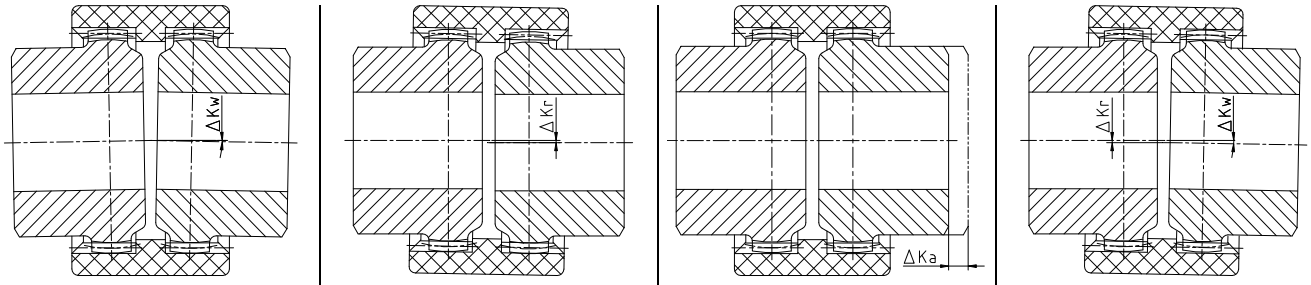
Please note:

- The displacement figures mentioned in tables 6 and 7 are maximum figures which must not arise in parallel. If radial and angular displacement arises at the same time, the permissible radial displacements of the coupling halves have to be reduced as follows:

$$\Delta Kr_{zul} = \Delta Kr - \frac{\Delta Kr}{2\Delta Kw} \bullet \Delta Ww$$

  ΔWw = angular shaft displacement

- The displacement figures mentioned are general standard figures that apply up to an ambient temperature of 80 °C, ensuring a sufficient service life of the **BoWex®** coupling.
  Displacement figures between the speeds indicated have to be interpolated accordingly. If necessary, please ask about the displacement for the corresponding coupling type.
- Please inspect with a dial gauge, ruler or feeler whether the permissible displacement figures of tables 6 and 7 can be observed.



Angular displacements | Radial displacements | Axial displacements | Radial and angular displacements

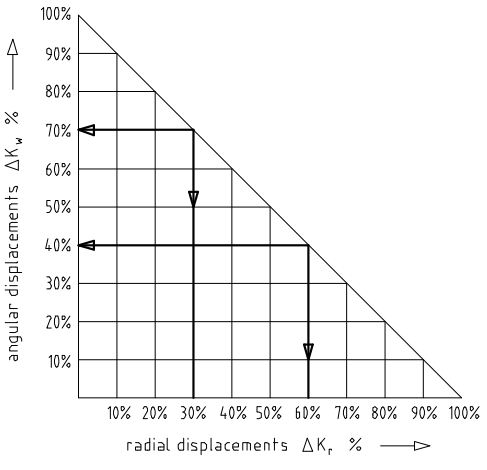
Illustration 10: Displacements

Examples for the displacement combinations specified in illustration 11:

Example 1:
ΔK_r = 30 %
ΔK_w = 70 %

Example 2:
ΔK_r = 60 %
ΔK_w = 40 %

Illustration 11: Combinations of displacement



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

4 Assembly

4.4 Displacements - alignment of the couplings

Table 6: Displacement figures

BoWex® junior plug-in coupling and BoWex® junior M coupling

BoWex® size	Type junior plug-in coupling			Type junior M		
	14	19	24	14	19	24
Max. axial displacement ΔKa [mm]	±1	±1	±1	±1	±1	±1
Max. radial displacement with n=1500 rpm ΔKr [mm]	±0.1	±0.1	±0.1	±0.3	±0.3	±0.4
Max. radial displacement with n=3000 rpm ΔKr [mm]	±0.1	±0.1	±0.1	±0.3	±0.3	±0.4
ΔKw [degree] max. angular displacement with n=1500 rpm	±1.0	±1.0	±0.9	±1.0	±1.0	±0.9
ΔKw [degree] max. angular displacement with n=3000 rpm	±0.7	±0.7	±0.6	±0.7	±0.7	±0.6

Table 7: Displacement figures

BoWex® type M and type I

BoWex® size	14	19	24	28	32	38	42	48	65	80	100	125
Max. axial displacement ΔKa [mm]	±1	±1	±1	±1	±1	±1	±1	±1	±1	±1	±1	±1
Max. radial displacement with n=1500 rpm ΔKr [mm]	±0.30	±0.30	±0.35	±0.35	±0.35	±0.40	±0.40	±0.40	±0.45	±0.45	±0.45	±0.45
Max. radial displacement with n=3000 rpm ΔKr [mm]	±0.20	±0.20	±0.23	±0.23	±0.23	±0.25	±0.25	±0.25	±0.28	±0.28	±0.28	±0.28
ΔKw [degree] max. angular displacement with n=1500 rpm	±1.0	±1.0	±0.9	±0.9	±0.9	±0.9	±0.9	±0.9	±0.7	±0.6	±0.6	±0.4
ΔKw [degree] max. angular displacement with n=3000 rpm	±0.7	±0.7	±0.6	±0.6	±0.6	±0.6	±0.6	±0.6	±0.5	±0.4	±0.4	±0.3

4.5 Spares inventory, customer service addresses

A basic requirement to ensure the operational readiness 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.

☞ **A T T E N T I O N !**
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.

5 Enclosure A

Advice and instructions regarding the use in Ex hazardous locations

Enclosure A only valid for BoWex® M coupling.

5.1 Intended use in Ex hazardous locations

Conditions of operation in Ex hazardous locations

BoWex® couplings are suitable for the use according to EC directive 94/9/EC.

1. Industry (with the exception of mining)

- Equipment group II of category 2 and 3 (*coupling is not approved for equipment group 1*)
- Media class G (*gases, fogs, steams*), zone 1 and 2 (*coupling is not approved for zone 0*)
- Media class D (*dusts*), zone 21 and 22 (*coupling is not approved for zone 20*)
- Explosion group IIC (*explosion class IIA and IIB are included in IIC*)

Temperature class:

Temperature class	Standard sleeve „light“		Conductive sleeve „black“	
	Ambient or operating temperature T_a	Max. surface temperature	Ambient or operating temperature T_a	Max. surface temperature
T4, T3, T2, T1	- 30 °C to + 90 °C 1)	+ 120 °C 2)	- 30 °C to + 100 °C 1)	+ 120 °C 2)
T5	- 30 °C to + 70 °C	+ 100 °C	- 30 °C to + 80 °C	+ 100 °C
T6	- 30 °C to + 55 °C	+ 85 °C	- 30 °C to + 65 °C	+ 85 °C

Explanation:
The maximum surface temperatures result from each the maximum permissible ambient or operating temperature T_a plus the maximum temperature increase ΔT of 30 K (standard sleeve “light”) and ΔT of 20 K (conductive sleeve “black”) which has to be taken into account.

1) The ambient or operating temperature T_a is limited to + 90 °C (standard sleeve “light”) and + 100 °C (conductive sleeve “black”) due to the permissible permanent operating temperature of the BoWex® sleeves used.
2) The maximum surface temperature of + 120 °C applies for the use in locations which are potentially subject to dust explosion, too.

2. Mining

Equipment group I of category M2 (coupling is not approved for equipment group M1).
Permissible ambient temperature - 30 °C to + 90 °C (standard sleeve “light”) and - 30 °C to + 100 °C (conductive sleeve “black”) respectively.

5 Enclosure A

Advice and instructions regarding the use in Ex hazardous locations

5.2 Inspection intervals for couplings in Ex hazardous locations

Explosion group	Inspection intervals
3G 3D	For couplings which are classified in category 3G or 3D the operating and assembly instructions that are usual for standard operation apply. During the standard operation which has to be subject to the ignition risk analysis the couplings are free from any ignition source. Merely the temperature increase produced by self-heating and depending on the coupling type has to be considered: for BoWex®: ΔT = 30 K (standard sleeve „light“) for BoWex®: ΔT = 20 K (conductive sleeve „black“)
II 2GD c IIB T4, T5, T6	An inspection of the torsional backlash and a visual inspection of the flexible sleeve must be performed after 3,000 operating hours for the first time, at the latest after 6 months after start-up of the coupling. If you note insignificant or no wear on the sleeve upon this initial inspection, further inspections can each be performed after 6,000 operating hours or at the latest after 18 months, provided that the operating parameters remain the same. If you note significant wear during the initial inspection so that it would be recommendable to replace the sleeve, please find out the cause according to the table „Breakdowns“, if possible. The maintenance intervals must be adjusted to the modified operating parameters without fail.
II 2GD c IIC T4, T5, T6	An inspection of the torsional backlash and a visual inspection of the sleeve must be performed after 2,000 operating hours for the first time, at the latest after 3 months after start-up of the coupling. If you note insignificant or no wear on the sleeve upon this initial inspection, further inspections can each be performed after 4,000 operating hours or at the latest after 12 months, provided that the operating parameters remain the same. If you note significant wear during the initial inspection so that it would be recommendable to replace the sleeve, please find out the cause according to the table „Breakdowns“, if possible. The maintenance intervals must be adjusted to the modified operating parameters without fail.

BoWex® coupling

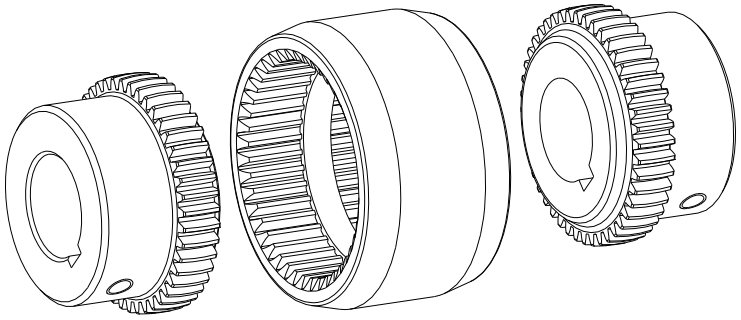


Illustration 12: BoWex® coupling

Here the backlash between the hub and the nylon spline must be inspected via torsional backlash, each separately from the driving and the driven side.
The friction/wear may only be $\mathbf{X_{max.}}$ of the original spline thickness before the nylon sleeves must be replaced.
When reaching the torsional backlash $\Delta\mathbf{S_{max.}}$, the nylon sleeve must be replaced immediately, irrespective of the inspection intervals.

5 Enclosure A

Advice and instructions regarding the use in hazardous locations

5.3 Checking of torsional backlash

C A U T I O N !
To check the torsional backlash the power pack which is switched off needs to be secured against accidental switch-on.

Driving side

- Turn the hub opposite the direction of drive.

C A U T I O N !
Here the sleeve must not be axially displaced from its position of wear.

- Mark sleeve and hub (see Illustration 13).
- Turn the hub in the direction of drive and measure the torsional backlash $\Delta S_{max.}$
- When reaching the torsional backlash $\Delta S_{max.}$ the nylon sleeve must be replaced.

Driven side

- Turn the hub in the direction of drive.

C A U T I O N !
Here the sleeve must not be axially displaced from its position of wear.

- Mark sleeve and hub (see Illustration 13).
- Turn the hub in opposite direction to the direction of drive and measure the torsional backlash $\Delta S_{max.}$
- When reaching the torsional backlash $\Delta S_{max.}$ the nylon sleeve must be replaced.

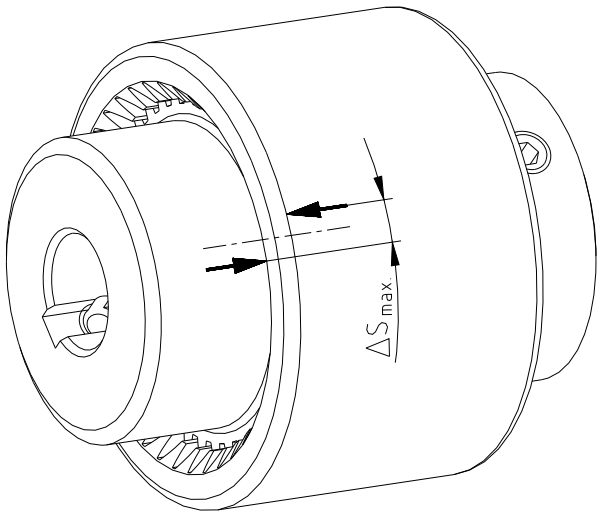


Illustration 13: Marking of the sleeve and the hub

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Advice and instructions regarding the use in hazardous locations

5.4 Standard values of wear

If the torsional backlash is ≥ $\Delta S_{max.}$ [mm] / friction ≥ $X_{max.}$ [mm], the nylon sleeves must be replaced.

Reaching the limits for replacing depends on the operating conditions and the existing operating parameters.

C A U T I O N !
In order to ensure a long service life of the coupling and avoid dangers with the use in hazardous locations, the shaft ends must be accurately aligned.
Please absolutely observe the displacement figures indicated (see tables 6 and 7). If the figures are exceeded, the coupling will be damaged.

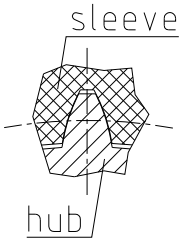

Illustration 14: Sleeve in new condition

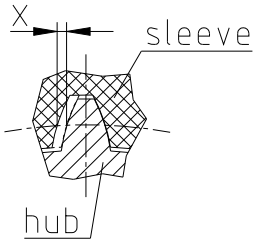

Illustration 15: Wear of sleeve

Table 8:

BoWex® size	Limits of wear each hub		BoWex® size	Limits of wear each hub	
	Friction $X_{max.}$ [mm]	Torsional backlash $\Delta S_{max.}$ [mm]		Friction $X_{max.}$ [mm]	Torsional backlash $\Delta S_{max.}$ [mm]
14	0.8	1.3	45	1.0	1.8
19	0.8	1.4	48	1.0	1.8
24	1.0	1.5	65	1.4	2.5
28	1.0	1.6	80	1.6	2.7
32	1.0	1.7	100	1.8	3.1
38	1.0	1.7	125	2.0	3.5
42	1.0	1.7			

5.5 Permissible coupling materials in hazardous locations

Explosion group	Permissible coupling materials / size
IIB	BoWex® M14 to M65 with sleeve material PA (light)
IIC	BoWex® M14 to M19 with sleeve material PA (light) BoWex® M14 to M65 with sleeve material PA12CF15 (black)

In the explosion groups **IIB** and **IIC** the following materials may be combined:
Steel
Stainless steel

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Advice and instructions regarding the use in hazardous locations

5.6 marking of coupling for hazardous locations

The ATEX marking of the BoWex® curved-tooth gear coupling is applied on the nylon sleeve.

- up to BoWex® M32-C on the outer sheath with logo only
- from BoWex® M38-C on the front

Short labelling:
(standard)

II 2GD c IIC T X/I M2 c X

Complete labelling:

II 2G c IIC T6, T5 resp. T4
- 30 °C ≤ T_a ≤ + 65 °C, + 80 °C resp. + 100 °C
II 2D c T 120 °C - 30 °C ≤ T_a ≤ + 100 °C
I M2 c - 30 °C ≤ T_a ≤ + 100 °C

The labelling with explosion group llC includes the explosion group llB.

5.7 Start-up

Before start-up of the coupling, please 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.

If used in hazardous locations the setscrews to fasten the hubs as well as all screw connections must be secured against working loose additionally, e. g. conglutinating with Loctite (average strength).

Finally, the coupling protection against accidental contact must be fitted.

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 after having stopped the unit.

During operation of the coupling, please pay attention to

- different operating noise
- vibrations occurring.

If the couplings are used in locations subject to dust explosion and in mining the user must make sure that there is no accumulation of dust in a dangerous volume between the cover and the coupling. The coupling must not operate in an accumulation of dust.

For covers with unlocked openings on the top face no light metals may be used if the couplings are used as equipment of equipment group ll (*if possible, from stainless steel*).
If the couplings are used in mining (equipment group l M2), the cover must not be made of light metal. In addition, it must be resistant to higher mechanical loads than if it is used as equipment of equipment group ll.

The minimum distance „Sr“ between the protection device and the rotating parts must at least correspond to the figures mentioned below.

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Advice and instructions regarding the use in hazardous locations

5.7 Start-up

If the protection device is used as cover, regular openings complying with the explosion protection demands can be made that must not exceed the following dimensions:

Openings	Cover [mm]		
	Top side	Lateral components	Distance „Sr“
Circular - max. diameter	4	8	≥ 10
Rectangular - max. lateral length	4	8	≥ 10
Straight or curved slot - max. lateral length/height	not permissible	8	≥ 20

C A U T I O N !
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 found out by means of the table „Breakdowns“ and if possible, be eliminated according to the proposals. The potential breakdowns mentioned can be hints only. To find out the cause all operating factors and machine components must be considered.

Coupling coating:

If coated (priming, painting etc.) couplings are used in hazardous locations, the requirements on conductibility and coating thickness must be considered. In case of paintings up to 200 µm electrostatic load does not have to be anticipated. Multiple coatings that are thicker than 200 µm are prohibited for explosion group IIC.

5.8 Breakdowns, causes and elimination

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

If used other than intended the coupling can become a source of ignition.
EC directive 94/9/EC requires special care from the manufacturer and the user.

General failures with use other than intended:

- Important data for the coupling selection were not forwarded.
- The calculation of the shaft-hub-connection was not considered.
- Coupling components with damage occurred during transport are assembled.
- If the heated hubs are assembled, the permissible temperature is exceeded.
- The clearance of the components to be assembled is not coordinated with each other.
- Tightening torques have been fallen below/exceeded.
- Components are exchanged by mistake/assembled incorrectly.
- No original **KTR** parts (purchased parts) are used.
- Old/already worn out sleeves or sleeves stored for too long are used.
- The coupling used/the coupling protection used is not suitable for the operation in hazardous areas and does not correspond to EC directive 94/9/EC, respectively.
- Maintenance intervals are not observed.

5 Enclosure A

Advice and instructions regarding the use in hazardous locations

5.8 Breakdowns, causes and elimination

Breakdowns	Causes	Hazard notes for hazardous locations	Elimination
Different operating noise and/or vibrations occurring	Micro friction by faulty alignment on the spline of the nylon sleeve	Danger of ignition due to hot surfaces	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, breaking of the engine mount, heat expansion of unit components, modification of the mounting dimension E of the coupling) 3) Inspection of wear see item inspection
	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 secure the hubs and secure against working loose 4) Inspection of wear see item inspection
Breaking of the nylon sleeve/spline	Breaking of the nylon sleeve/spline due to high shock energy/overload	none	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the nylon sleeve 3) Inspect coupling components and replace coupling components that are damaged 4) Insert nylon sleeve, assemble coupling components 5) Find out the reason for overload
	Operating parameters do not correspond to 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) Disassemble the coupling and remove remainders of the nylon sleeve 3) Inspect coupling components and replace coupling components that are damaged 4) Insert nylon sleeve, assemble coupling components 5) Instruct and train the service staff

5 Enclosure A

Advice and instructions regarding the use in ⟨Ex⟩ hazardous locations

5.8 Breakdowns, causes and elimination

Breakdowns	Causes	Hazard notes for hazardous locations	Elimination
Excessive wear on the spline of sleeve	Vibrations of drive	Danger of ignition due to hot surfaces	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the nylon sleeve 3) Inspect coupling components and replace coupling components that are damaged 4) Insert nylon sleeve, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Find out the reason for the vibrations
	ambient/contact temperatures which are too high for the sleeve, max. permissible e. g. T4 = - 30 °C/+ 100 °C		1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the nylon sleeve 3) Inspect coupling components and replace coupling components that are damaged 4) Insert nylon sleeve, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Inspect and adjust ambient/contact temperature
	e. g. contact with aggressive liquids/oils, ozone influence, too high/low ambient temperatures etc. causing a physical modification of the nylon sleeve	none	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the nylon sleeve 3) Inspect coupling components and replace coupling components that are damaged 4) Insert nylon sleeve, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Make sure that further physical modifications of the sleeve are excluded

⟨Ex⟩ If you operate with a worn sleeve (see chapter 5.2) a proper operation meeting the explosion protection requirements and the directive 94/9/EC is not ensured.

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Advice and instructions regarding the use in hazardous locations

5.9 EC Certificate of conformity

EC Certificate of conformity

corresponding to EC directive 94/9/EC dated 23 March 1994
and to the legal regulations

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

BoWex® curved-tooth gear couplings

in an explosion-proof design described in these assembly instructions correspond to article 1 (3) b) of directive 94/9/EC and comply with the general safety and health requirements according to enclosure II of directive 94/9/EC.

According to article 8 (1) of directive 94/9/EC the technical documentation is deposited with the institution:

IBExU
Institut für Sicherheitstechnik GmbH
Fuchsmühlenweg 7

09599 Freiberg

Rheine,	2014-01-27	i. V.	i. V.
Place	Date	Reinhard Wibbeling Head of Engineering	Josef Schürhörster Product Manager