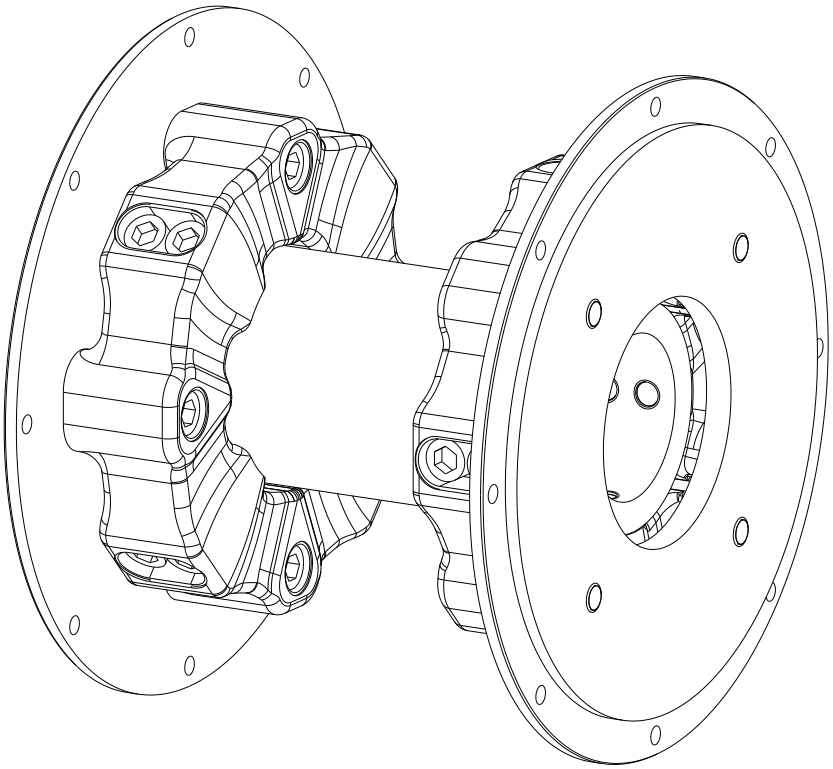
EVOLASTIC®

highly flexible coupling type
D2F and their combinations



Type D2F

EVOLASTIC® type D2F is a double-cardanic, highly torsionally flexible, non-slip and backlash-free flange coupling. It dampens torsional vibrations and load shocks, reduces structure-borne noise transmission and compensates for axial, radial and angular displacements above average.

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1 Technical data

1.1 Coupling dimensions and technical data

Type D2F

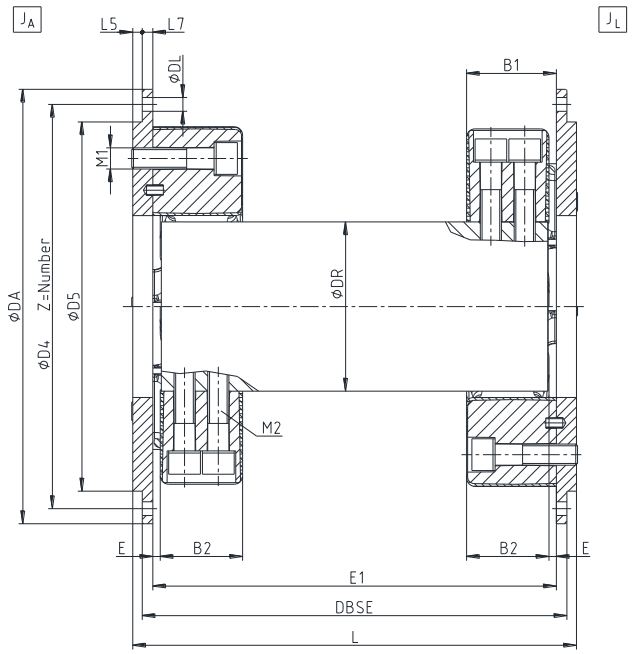


Illustration 1: EVOLASTIC® type D2F

Table 1: Dimensions - type D2F

Size	Flange connection acc. to SAE - J620 / diameter 1)	Dimensions 1) [mm]							Cap screws DIN EN ISO 4762	
		B1	B2	D5	DR	E	L5	L7	M1	M2
360	14“	85	78	405	160	8	9	10	M20	M20

1) For dimensions of flange connection see table 3. Dimensions DBSE, E1 and L as well as mass moment of inertia of intermediate shaft and total weight depend on the mounting length.

In case if a dimensional drawing was prepared for the coupling, the dimensions specified have to be primarily observed.

1.2 General dimensions and torques

Table 2: Technical data - type D2F

Size	Flange connection acc. to SAE - J620 / diameter 1)	Total weight with maximum bore of coupling [kg] 2)	Mass moment of inertia with maximum bore of coupling [kgm²]	
			J_A	J_L
360	14“		0.628	0.628

1) For dimensions of flange connection see table 9.
2) For dimensions of flange connnection see table 3. Dimensions DBSE, E1 and L depend on the mounting length.

Table 3: Flange dimensions according to SAE J 620

Nominal size	Flange dimensions [mm]
	14“
Dimension DA	466.62
Dimension D4	438.15
Z x Pitch	8 x 45°
Dimension DL	14

1 Technical data

1.2 General dimensions and torques

Table 4: Torques

Size	Type of elastomers	Torque [Nm]				Perm. operating speed [rpm]	
		T_{KN}	$T_{K\,max}$	$T_{K\,max1}$	T_{KW}	n	$n_{max.}$
360	WN	3200	6400	9600	1280	2700	3000
	SN	3400	6800	10200	1360	3060	3400
	MN	3600	7200	10800	1440	3060	3400

Maximum torque of coupling $T_{K\,max}$ = rated torque of coupling T_{KN} x 2.0.
The maximum torque $T_{K\,max.}$ indicates short-term torque peaks (e.g. when passing through the resonance). $T_{K\,max}$ may arise at the maximum 50,000 times as vibratory torque or 100,000 times as pulsating torque.

Triple torque of coupling $T_{K\,max1}$ = rated torque of coupling T_{KN} x ~3.0.
The triple rated torque $T_{K\,max1}$ is the torque that may arise only rarely, but only 1,000 times at the maximum. Exceeding the triple torque of $T_{K\,max1}$ may cause impairment resp. damage of the coupling components.

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 Advice

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. 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".
- 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. 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
- are technically qualified and specifically trained (e. g. safety, environment, logistics)
- 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 **EVOLASTIC®** described in here corresponds to the state of the art at the time of printing of these operating/assembly instructions.

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 "EVOLASTIC®").
If the operating conditions (performance, speed, modifications on engine and machine) change, the coupling selection must be reviewed.
Make sure that the technical data regarding torque refer to the elastomer part 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 Advice

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 refer to the present operating/assembly instructions considering the warnings.

3 Storage, transport and packaging

3.1 Storage

The metal components are supplied in preserved condition resp. with corrosion protection and can be stored in a dry and roofed place for 6 - 9 months.
With favourable storage conditions the properties of the elastomer part remain unchanged for up to 5 years.

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.
Make sure that condensation is not generated. The best relative air humidity is less than 65 %.

Please bear in mind that the elastomer part may be stored horizontally only.

3.2 Transport and packaging

In order to avoid any injuries and any kind of damage 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 in the following subassemblies and single parts. Before assembly the coupling has to be inspected for completeness.

4.1 Components of the couplings

Components of type D2F

Component	Quantity	Description
1	2	Elastomer part E
2	1	Intermediate shaft
3	2	Flange
4	see table 5	Cap screw DIN EN ISO 4762 - 12.9
5	see table 5	Ratchet washer
6	see table 5	Cap screw DIN EN ISO 4762 - 12.9
7	see table 5	Ratchet washer
8	see table 5	Clamping sleeve DIN 7346

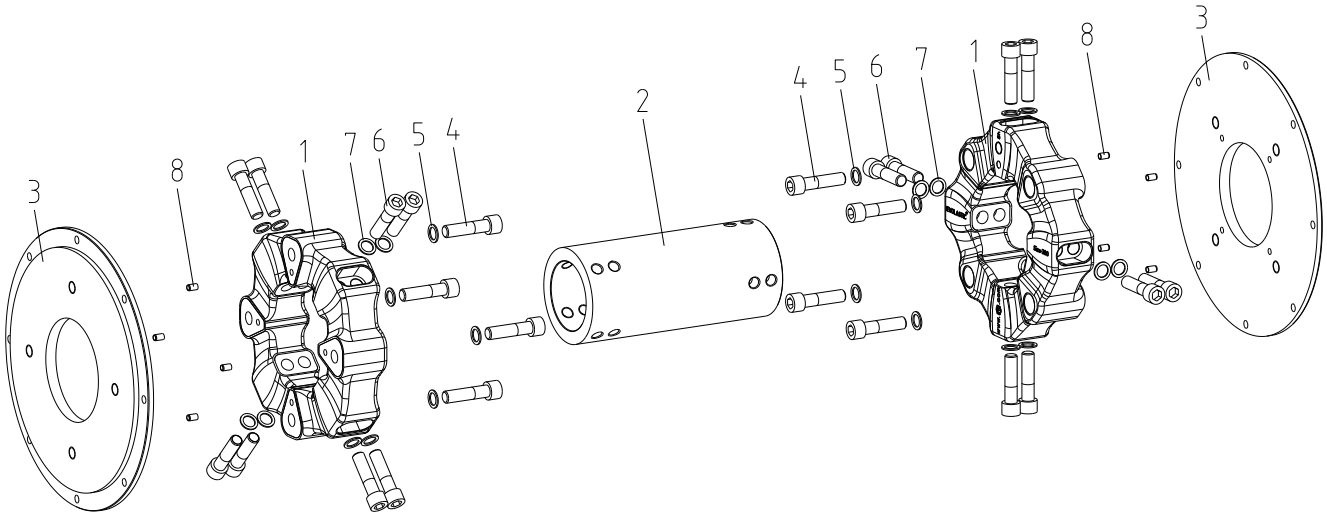


Illustration 2: EVOLASTIC® type D2F (size 360)

Table 5: Number of cap screws, ratchet washers and clamping sleeves

Size	360
Number of cap screws (component 4)	8
Number of ratchet washers (component 5)	8
Number of cap screws (component 6)	16
Number of ratchet washers (component 7)	16
Number of clamping sleeves (component 8)	8

4.2 Advice on remachining

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.

4 Assembly

4.3 General advice for assembly

The EVOLASTIC® coupling may only be assembled in the order described in here.

In case if a dimensional drawing was prepared for the coupling, the dimensions specified have to be primarily observed.

We recommend to inspect the coupling for dimensional accuracy before assembly.

We recommend to secure all screw connections against working loose additionally to securing screws by the ratchet washer, e. g. applying Loctite screw adhesive (average strength), while the elastomer parts must not come into contact with any type of adhesive.

4.4 Assembly of clamping sleeves (component 8)

- Drive the clamping sleeves (component 8) in the flanges (component 3) resp. the attachments provided by the customer (see illustration 19).

For the assembly of the clamping sleeves observe dimensions DB and LB1 according to catalogue "EVOLASTIC®".

Any kind of twisting must be eliminated with assembly of the elastomer part (component 1).

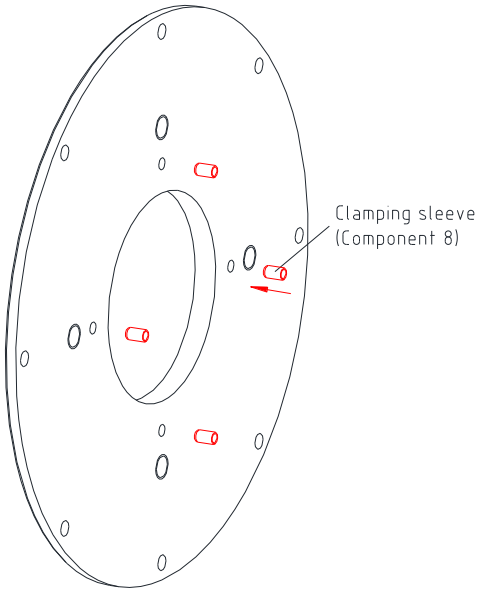


Illustration 3: Assembly of clamping sleeves (component 8)

4 Assembly

4.5 Assembly of the flanges (component 3)

- Push the flanges (component 3) in the centerings of the attachments provided by the customer.
- Align the through holes of the connection flanges to the threads of the attachments provided by the customer.
- Hand-tighten the components via suitable screws (not part of the scope of delivery) first.
- Tighten the screws at the tightening torques T_A specified in table 6 by means of a suitable torque wrench.

We recommend to secure all screw connections against working loose additionally, e. g. applying Loctite screw adhesive (average strength), while the elastomer parts must not come into contact with any type of adhesive.

Table 6: Screw tightening torques for screwing the flange (component 3)

Size of flywheel acc. to SAE - J620 [1)]	14“
Screw size	M12
Tightening torque [Nm]	120
Minimum screw strength	10.9
Inch screw	1/2 - 13
Tightening torque [Nm]	150
Minimum screw strength	8

1) For dimensions of flange connection see table 3.

4.6 Assembly of the elastomer parts (component 1)

We recommend to secure all screw connections against working loose additionally, e. g. applying Loctite screw adhesive (average strength), while the elastomer parts must not come into contact with any type of adhesive.

- Mount the elastomer parts (component 1) to the flanges (component 3) resp. the attachments provided by the customer and align the bores to the clamping sleeves (component 8) (see illustration 4).
- Hand-tighten the elastomer parts and the flanges via the cap screws (component 4) and the ratchet washers (component 5) first.

Make sure that the ratchet washer (component 5) is inserted with the convex side to the screw head of the cap screw (component 4).

- Tighten the cap screws (component 4) to the tightening torques T_{A1} specified in table 7 by a suitable torque wrench.

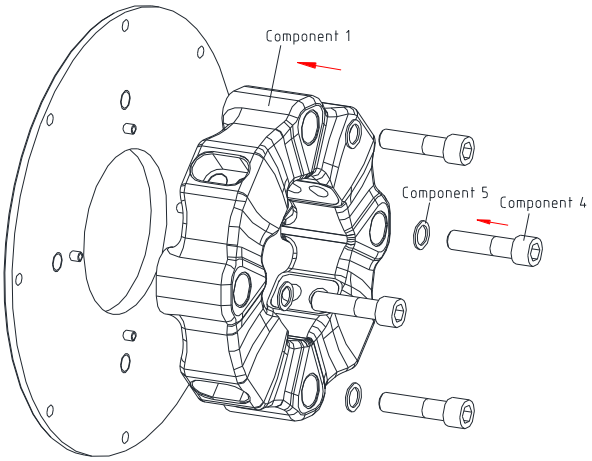


Illustration 4: Assembly of the elastomer parts to the flanges

4 Assembly

4.6 Assembly of the elastomer parts (component 1)

- Insert the intermediate shaft (component 2) in one of the two elastomer parts. Align the threads of the intermediate shaft (component 2) to the bores of the elastomer part (see illustration 5).
- Hand-tighten the elastomer parts and the flanges via the cap screws (component 6) and the ratchet washers (component 7) first.

☞ **Make sure that the ratchet washer (component 7) is inserted with the convex side to the screw head of the cap screw (component 6).**

- Shift the power pack of the driven side resp. the opposite side in axial direction until the mounting dimension E1 is achieved. Align the bores of the second elastomer part resp. the attachment provided by the customer to the threads of the intermediate shaft (component 2) (see illustration 5).

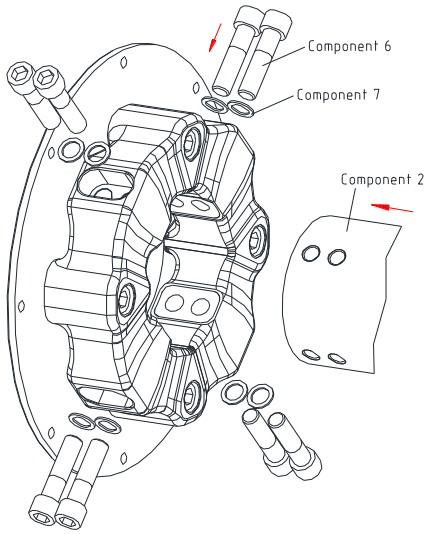


Illustration 5: Assembly of the elastomer parts to the intermediate shaft

- Hand-tighten the elastomer parts and the flanges via the cap screws (component 6) and the ratchet washers (component 7) first.

Make sure that the ratchet washer (component 7) is inserted with the convex side to the screw head of the cap screw (component 6).

- Tighten the cap screws (component 6) to the tightening torques T_{A2} specified in table 7 by a suitable torque wrench.

☞ **The clamping sleeves (component 8) respectively double radial screw connection (cap screws, component 6) prevent twisting of the elastomer parts with mounting.**

Table 7: Cap screws DIN EN ISO 4762 - 12.9 (component 5 and 7)

Size	360
Dimension M1	M20
Tightening torque T_{A1} [Nm]	592
Dimension M2	M20
Tightening torque T_{A2} [Nm]	592

4 Assembly

4.7 Displacements - alignment of the couplings

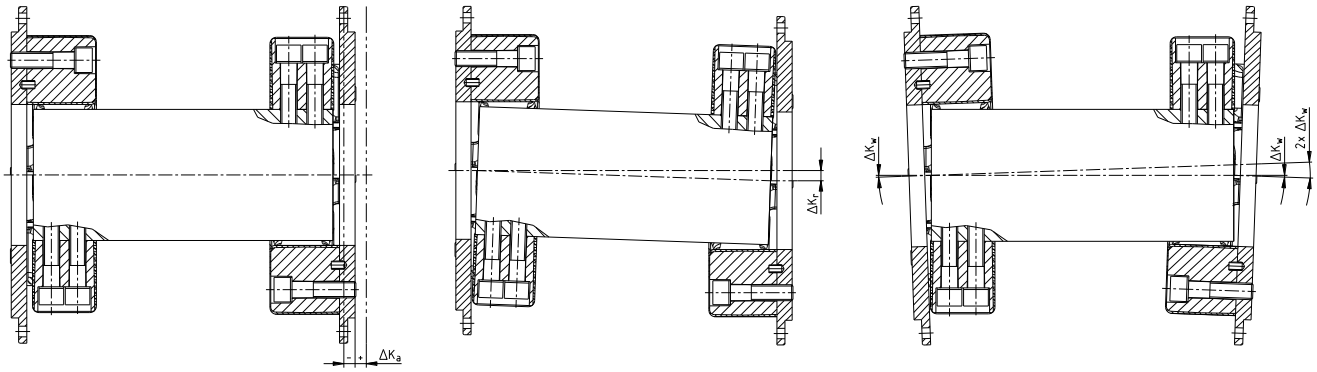
The **EVOLASTIC®** flange couplings compensate for position deviations of the machine components to be connected up to the data specified in table 8.
With alignment, the radial and angular displacement should be kept as small as possible, because the service life is increased in this way if the operating conditions are otherwise maintained.

Alignment of the **EVOLASTIC®** flange coupling is made between driving and driven side flange.

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 8). 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 8 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 7).
- The radial and angular displacement figures specified refer to a reference speed of 1500 rpm. The diagramme of displacement alignment (see illustration 8) provides for a speed-dependent increase or reduction of displacement figures by factor f_{rpm}. The displacement figures between the speeds specified have to be interpolated accordingly.
- The figures of maximum displacements refer to the mounting process, in addition they are permissible for a short time respectively rarely at standstill or with start-up operation as well as with exceptional loading conditions.
- The displacement figures are general standard figures that apply up to an ambient temperature of +80 °C, ensuring a sufficient service life of the **EVOLASTIC®** coupling.
- Inspect with a dial gauge, ruler or feeler gauge whether the permissible displacement figures specified in table 8 can be observed.



Axial displacement | Radial displacement | Angular displacement

Illustration 6: Displacements

4 Assembly

4.7 Displacements - alignment of the couplings

Examples of the displacement combinations specified in illustration 7:

Example 1:
ΔK_r = 30 %
ΔK_w = 70 %

Example 2:
ΔK_r = 60 %
ΔK_w = 40 %

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

Illustration 7: Combinations of displacement

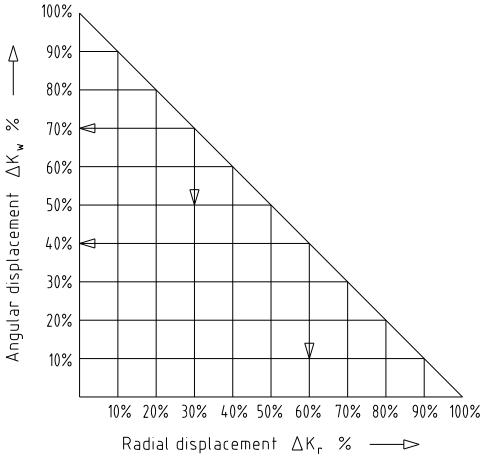


Table 8: Displacement figures per elastomer part

Size		360
Perm. axial displacement ΔK_a [mm]		±4.0
Perm. radial displacement ΔK_r [mm]	1500 rpm	3.0
	max. 1)	5.0
Perm. angular displacement ΔK_w [°]	1500 rpm	2.0
	max. 1)	4.0

1) With assembly for a short time resp. rarely with downtime or start-up operation as well as exceptional load conditions.

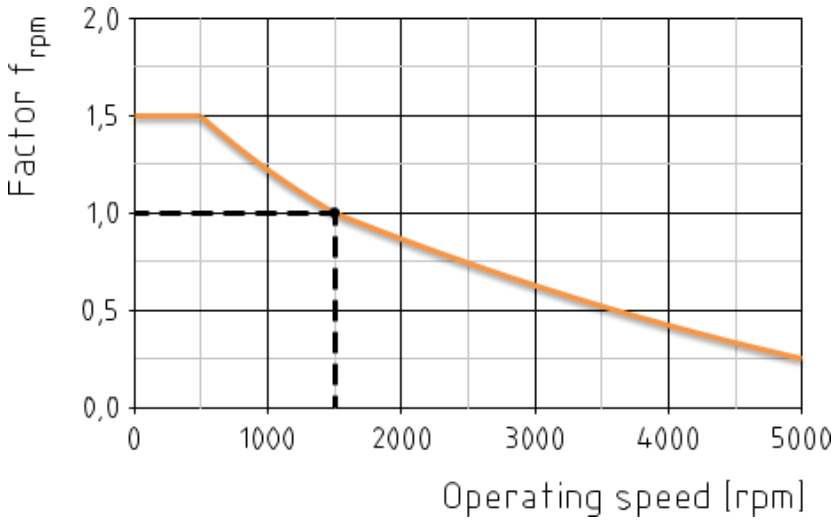


Illustration 8: Diagramme of displacement alignment

5 Start-up

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

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 2014/34/EU and must protect against

- access with a 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.

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 improper use of the **EVOLASTIC®** coupling. In addition to the specifications given in these operating/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 are not forwarded.
- The calculation of the shaft-hub-connection is not considered.
- Coupling components with damage occurred during transport are assembled.
- If the heated hub is assembled, the permissible temperature is exceeded.
- The clearance 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.
- No original **KTR** components (purchased parts) are used.
- Old/already worn out elastomer parts or those 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	Errors in alignment, too high displacement, internal contact of coupling components	1) Set the unit out of operation 2) Eliminate the reason for the misalignment (e. g. loose foundation bolts, fracture of the engine mount, heat expansion of unit components, modification of the installation dimension E of the coupling) 3) For visual inspection/inspection of wear see chapter 8 *Maintenance*
	Axial fastening of hubs working loose and screw connection unfastened	1) Set the unit out of operation 2) Inspect alignment of coupling 3) For visual inspection/inspection of wear see chapter 8 *Maintenance* 4) Secure the hubs axially and against working loose
Fracture of elastomer part	Fracture of elastomer part/ high dynamic energy/ overload	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the elastomer part 3) Inspect coupling components and replace coupling components that are damaged 4) Insert elastomer part, assemble coupling components 5) 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) Disassemble the coupling and remove remainders of the elastomer part 3) Inspect coupling components and replace coupling components that are damaged 4) Insert elastomer part, assemble coupling components 5) Instruct and train the service staff
High rotational angles during operation, formation of wrinkles up to external cracks in the elastomer part, fracture of elastomer, internal depolymerisation	Vibrations of drive, resonance in the elastomer	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the elastomer part 3) Inspect coupling components and replace coupling components that are damaged 4) Insert elastomer part, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Find out the reason for vibrations (selection of loads)
	ambient/contact temperatures which are too high for the elastomer part, max. permissible -30 °C/+80 °C	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the elastomer part 3) Inspect coupling components and replace coupling components that are damaged 4) Insert elastomer part, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Inspect and adjust ambient/contact temperature
	e. g. contact with aggressive liquids/oils, influence by ozone, too high ambient temperature etc. causing a physical change of the elastomer part	1) Set the unit out of operation 2) Disassemble the coupling and remove remainders of the elastomer part 3) Inspect coupling components and replace coupling components that are damaged 4) Insert elastomer part, assemble coupling components 5) Inspect alignment, adjust if necessary 6) Make sure that other physical modifications of the elastomer part are excluded

7 Disposal

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

- **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

We recommend to perform a visual inspection on the coupling **at least once a year**. Please pay special attention to the condition of the elastomer part of the coupling.

- Remove loose dirt from the coupling.
- Inspect the coupling for spalling or missing components, if necessary. Inspect the elastomer part in particular for cracks.
- Defective components must be replaced immediately resp. missing components must be replaced immediately.
- Inspect and correct the tightening torques of all screw connections, if necessary.
- Since the flexible machine bearings of the driving and driven side settle during the course of load, inspect the alignment of the coupling and re-align the coupling, if necessary.

Please perform visual inspection as follows:

- Inspect adhesion of the elastomer to the metal insert.
- Inspect the elastomer part for wrinkles or cracks in the areas marked with ①, ②, ③, ④ and ⑤ in illustration 9. Formation of wrinkles is trouble-free, but dependent on the application may generate cracks in the long run.
  If the cracks in the areas marked achieve or exceed the limit specified in table 9, the elastomer part must be replaced.

Elastomer parts that are damaged or worn off have to be replaced, with the maintenance interval of the engine at the latest.

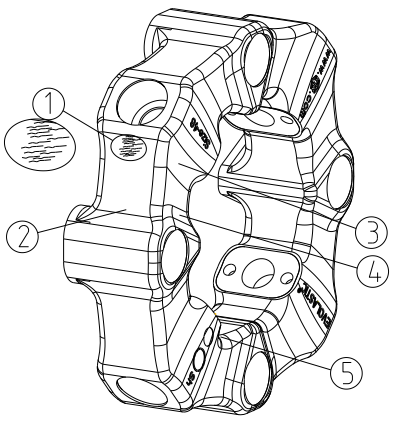


Illustration 9: Visual inspection

Table 9: Crack depth

Size	360
Max. perm. crack depth [mm]	8.0

9 Spares inventory, customer service addresses

We recommend to store major spare parts on site to ensure the readiness for use of the machine in case if a coupling fails.

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.**