# Operating Manual Elastomer Couplings
# EWD, EWE, EWN, EWJ





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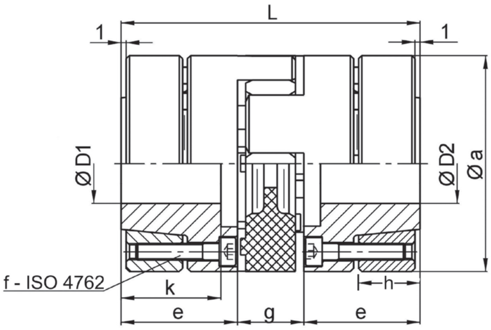
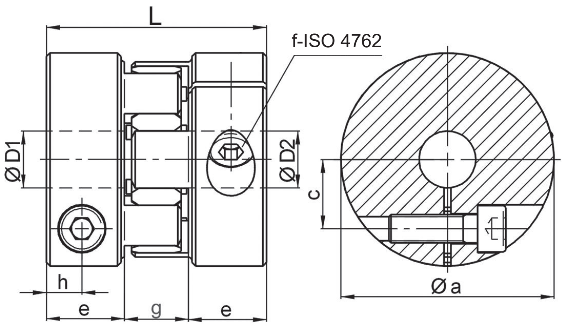
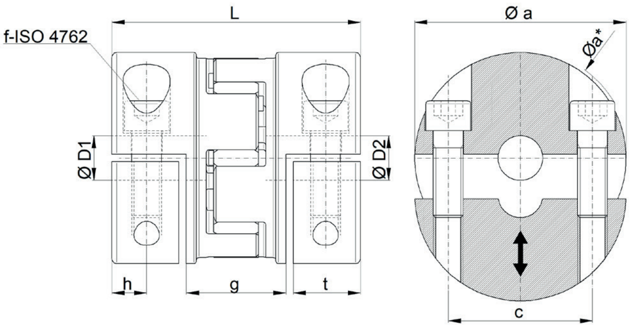
## 1. Assembly Drawings



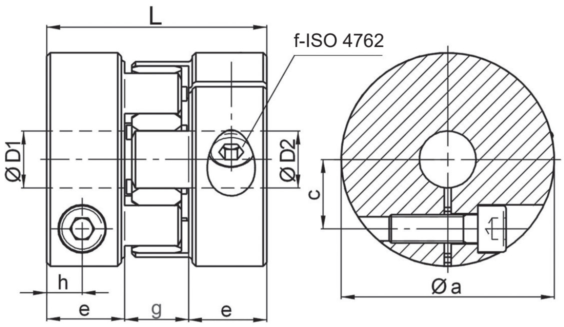

**Elastomer Coupling EWE**




**Elastomer Coupling EWD**




**Elastomer Coupling EWN**




**Elastomer Coupling EWJ**

## 2. Construction and Function

### 2.1 Construction

An elastomer coupling consists of three main components: two hub parts and an elastomer spider. Type EWD is equipped on both sides with an easy-to-install radial clamping hub made of high-strength aluminium. In the structurally identical EWJ variant, however, the hubs are made of stainless steel. In type EWE, the shaft is fastened using clamping ring hubs made of tempered steel with reduced mass moment of inertia, and the EWN series is equipped with split hubs.

### 2.2 Function

Elastomer couplings are pluggable, backlash-free, flexible shaft couplings for low to medium torques. A polyurethan spider with high Shore hardness serves as the connecting and compensating element. This is inserted with a slight preload into two high-precision hubs with claw-shaped cams. The elastic coupling star can compensate for minor shaft misalignments, is electrically insulating and has good vibration-damping properties.

## 3. Dimensioning of the Coupling

### 3.1 Definitions

### a) Nominal Torque of the Coupling: $T_{KN}$ [Nm]

The nominal torque of the coupling indicates the limit load of the continuous alternating strength. If TKN is not exceeded during normal operation, an infinite number of work cycles can be performed (see also 3.5 Service life of the coupling).

### b) Mass Moment of Inertia: $J_K$ - [$10^{-3}$ $kgm^2$]

The coupling values for the moment of inertia apply to:
middle hub bores in the indicated diameter range $D_{min}$ / $D_{max}$.

conversion: **[$kgcm^2$] = [$10^{-4}$ $kgm^2$]**

### c) Torsional Stiffness: $C_{TK}$ - [Nm / arc min]

When specifying the torsional stiffness (twist stiffness) of all coupling series, a change was made from the previous unit [$10^3$ Nm/rad] to the unit ‘Newton metres per angular minute’ [Nm/arcmin].
This enables the designer to determine the resulting torsional angle error based on the operating torque (see 3.3). 60 angular minutes (or arc minutes) correspond to one degree of angle. This results in the following conversion factor:

**1 rad = 57,3° = 3,438 arcmin**
**[$10^3$ Nm/rad = 0.291 Nm/arcmin] resp.**
**[1 Nm/arcmin = 3,438 Nm/rad]**

Example: Size EWD 150: 1.2 Nm/arcmin = 4,126 Nm/rad

### d) Maximum Misalignment [mm]

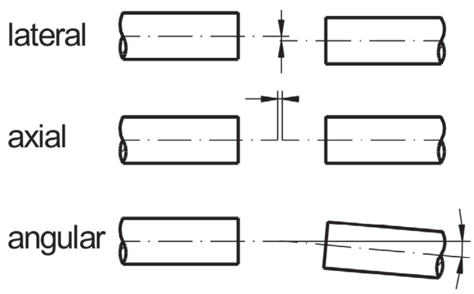
Maximum permissible misalignment between input and output shafts resulting from the fatigue strength calculation for the compensating elements. When operating below the permissible misalignment values, an infinite number of load cycles can be performed. In exceptional cases (e.g. assembly) or with reduced load cycle numbers, the misalignment values may be significantly higher in some cases (please consult us).
If the permissible misalignment value is exceeded, excessive wear of the elastomer spider may occur.

### e) Lateral- and Parallel Misalignment:

Lateral misalignment refers to the parallel displacement of the centre lines of the shafts to be connected to each other. Precise alignment is important because excessive lateral misalignment places heavy stress on couplings and bearings and reduces their service life. (see sketch)

### f) Axial Misalignment:

Axial misalignment refers to the longitudinal displacement of the shafts to be connected along their common axis of rotation. It therefore describes the distance by which the shafts are displaced axially relative to each other. (see sketch)




### g) Angular Misalignment:

Angular misalignment (also known as angular offset) refers to the angular deviation of the axes of rotation of the shafts to be connected. Maximum permissible value for ENEMAC elastomer couplings: 1 - 1.3°. (see sketch)

### h) Spring Stiffness - axial / lateral: [N/mm]

Restoring forces of the elastomer spider, resulting from misalignment.

### 3.2. Dimensioning according to the Torque

As a rule, the coupling size is selected based on the torque. To determine the exact drive torque required, appropriate calculations must be performed. Once the motor size has been determined, the required nominal coupling torque can be estimated as follows:

$$T_{KN} > 1{,}25 \times TA_{max} \times i$$

## 3.3 Dimensioning according to Torsional Stiffness:

In case of high accuracy requirements (positioning, encoder system) transmission errors due to an excessive elastic deformation of the coupling can represent a selection criterion. The torsion angle „αT“ resulting from the torque load can be calculated as follows:

$$\alpha T = \frac{TA}{C_{TK}}$$

[arc minute] with **TA** = driving torque [Nm] / $\mathbf{C_{TK}}$ = torsional stiffness of the coupling [Nm/arcmin]

## 3.4 Dimensioning according to the Bore Size:

In principle, after determining the type of coupling, a check of the given shaft diameter should take place with the permissible diameter range ($D_{min}$ / $D_{max}$) of the hub bore. If the shaft diameter is oversized in relation to the torque, which means it‘s greater than $D_{max}$ of the hub, a different type of coupling or size has to be selected.

**Note**: Hub bores smaller than $D_{min}$ are possible; a safe transmission of the rated torque is not guaranteed, which means that a reduction of $T_{KN}$ is required.

## 3.5 Lifetime of the Coupling:

The lifetime of the compensating couplings is essentially determined by the amount of torque and the existing shaft misalignments. If the permissible maximum values for the axial, lateral and angular misalignment are not exceeded and, at the same time, the operating torque is below the rated coupling torque $T_{KN}$, the coupling is in the area of the permanent fatigue strength.
Continuous operation around the clock is possible or infinitely many acceleration and deceleration phases can be carried out without expection of any operational failures of the coupling.

## 3.6 Maximum Load:

In exceptional cases, the elastomer couplings can be temporarily overloaded by a maximum of 100% (2 x $T_{KN}$). However, the respective shaft-hub connection should be calculated separately.

## 3.7 Load of the Bearings:

Due to the flexibility of the compensating couplings in all directions significant bearing loads or restoring forces are avoided despite any axial, lateral-, or angular displacements of the drive to the output shaft. This prevents premature failure or increased wear of the ball bearing, and therefore reduce costly and expensive repairs.

## 3.8 Operating Temperature:

The application limit of the elastomer couplings is 363 K (98 Sh-A) or 393 K (72 Sh-D); high operating temperatures have to be taken into account by means of an appropriate correction factor (see table on the next page)

### 3.9 Operating Speed - Balance Quality:

The standard balance grades are Q6.3 or Q16. Some coupling types with cone clamping ring hubs (EWE) can be operated at speeds of over 30,000 rpm. Low moments of inertia have a positive effect on the balance grade.

## 4. Dimensioning of the Bore Sizes (ØD1 und ØD2)

The fitting between hub and shaft should be designed as a transition-fit, whereupon the bore of the hub owns an H7 fitting.

## 5. Dimensioning of the Torque

### 5.1 Formula

The required torque $T_K$ can roughly be calculated according to the following formula:

$T_A$ = driving torque [Nm]
$f_D$ = torsional rigidity
$f_T$ = temperatur factor
$f_B$ = operating factor

$$T_K = T_A \times f_D \times f_T \times f_B < T_{KN}$$

The calculated torque $T_K$ should not exceed the nominal torque of the selected size $T_{KN}$. Short-term overloads to twice the value of the nominal torque are permissible. The driving torque results from the manufacturers' instructions of the drive motor or can be calculated by means of the drive power $P_A$.

$T_A$ = driving torque [Nm]
$P_A$ = driving power [kW]
$n_B$ = operating speed [$min^{-1}$]

$$T_A = \frac{9550 \times P_A}{n_B}$$

### 5.2 Definitions

#### 5.2.1 Temperature Factor $f_T$

| permissible temperature range for continuous operation | | |
|---|---|---|
| PUR 98 Sh-A | 243 K up to 363 K | red |
| PUR 72 Sh-D | 253 K up to 393 K | white |
| PUR 80 Sh-A | 253 K up to 343 K | blue |

| operating temperature | 303 K<br>243 K | 323 K | 343 K | 363 K | 383 K |
|---|---|---|---|---|---|
| factor $f_T$ | 1 | 1,3 | 1,6 | 1,8 | 2 |

#### 5.2.2 Torsional Stiffness Factor $f_D$

If an exact, angular transmission of the torque is required, as for example with servo drives or measuring systems, a high torsional stiffness is essential. For this purpose the required driving torque should be applied with a multiplication factor of at least 3 to 10, when selecting the size, or use a torsionally rigid metal bellows coupling.

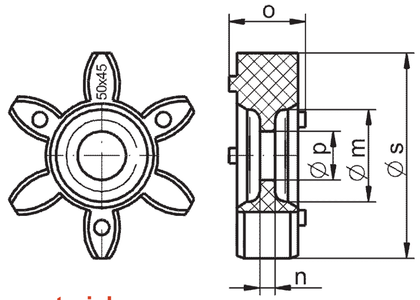
#### 5.2.3 Operating Ratio $f_B$

Due to the operating ratio $f_B$ (1.5-2.5), application-specific features, such as impact loads, must be taken into account.

# 6. The Elastomer Spider

## 6.1 Dimensions [mm]

| Size | Øs | Øm | n | o | Øp $^{+0,5}$ |
|---|---|---|---|---|---|
| 8 / 10 | 32 | 10,5 | 2 | 10 | 8,5 |
| 15 / 17 / 20 / 25 | 40 | 18 | 3 | 12 | 9,5 |
| 30 / 43 / 45 / 50 | 50 | 27 | 3 | 14 | 12,5 |
| 60 / 90 | 55 | 27 | 3 | 14 | 12,5 |
| 150 / 200 | 65 | 30 | 4 | 18 | 16,5 |
| 300 / 320 / 400 | 80 | 38 | 4 | 18 | 16,5 |
| 500 | 100 | 47 | 5 | 22 | 20,5 |
| 700 / 1000 | 120 | 58 | 6 | 25 | 22,5 |
| 2000 | 160 | 77 | 7 | 38 | 60 |




**material**

- Polyurethane
- 98 Shore-A / red
- 72 Shore-D / white
- 80 Shore-A / blue

## 6.2 Notes

The diameter „p“ of the inner bore of the spider can be customized, if required by the application (eg shaft passage), up to max. Øm - 2 mm.

# 7. Precausional Measures

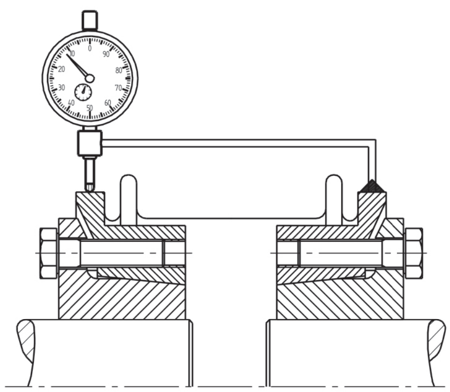
Before installation, ensure that the characteristics and specifications of the coupling are appropriate and suitable for the intended use.
There must be sufficient space available for installation and future maintenance. Ensure that the device cannot cause dangerous situations for people and/or property and that work is always carried out in accordance with current safety regulations. ENEMAC products are NO MACHINE within the meaning of the EU Machinery Directive. Operation is therefore subject to compliance with all requirements of the machine in which the device is installed. If the instructions are not followed correctly, ENEMAC GmbH is released from any liability.

If you have any questions that cannot be answered by this manual, please contact ENEMAC GmbH.

# 8. Mounting and Demounting

## 8.1 Aligning the Shafts

To determine the lateral misalignment, we recommend proceeding as follows: Place a dial gauge with a suitable holder on a shaft journal or on the second coupling half. Now turn the shafts with the dial gauge and read the deflection. The existing parallel misalignment is half of the total deflection. The permissible maximum values for shaft misalignment can be found in the technical data sheets for the corresponding series.



picture: alignment of the shafts

### 8.2 Shaft-Hub-Connection:

The couplings are usually delivered with finished bores, in exceptional cases also prebored. The shaft / hub fit is to be selected as a transition fit (example: hub bore diameter 28 G6 / shaft diameter 28 k6). When installing conical bushings, the conical surfaces should be lightly oiled to avoid fretting corrosion. In general, it must be ensured that the surface of the shaft and the hub bore are free of oil and grease, as well as of dirt particles. The function of the non-positive connection is never affected by an existing keyway in the shaft, (possibly insert half feather key).
Chamfered edges on the front sides basically allow a blind assembly for all versions. Due to the obligatory pre-load of the elastomer spider an axial assembly force must be applied when pushing together spider and claw. This assembly force can be minimized by slightly oiling the star. When demounting the EWE conical bushings, extracion holes are provided for releasing the clamping ring. The corresponding tightening torques of the fixing screws can be found in the corresponding data sheets.

#### 8.2.1 Radial Clamping Hub (Types EWD and EWJ):

Permissible fitting tolerance between shaft and hub: min. 0.01 mm / max. 0.04 mm.
The assembly is very easy to perform by tightening only one radially arranged clamping screw (ISO 4762). The values for the corresponding tightening torques can be found in the data sheets. A hole in the housing is sufficient for tightening the clamping screw.

#### 8.2.2 Conical Bushing and Clamping Ring Hub (Type EWE):

Permissible fitting tolerance between shaft and hub: max. 0,02 mm.
Press-in of the conical bushing or tightening the clamping ring is possible by means of several concentrically arranged fastening screws (usually ISO 4017). One side of the coupling is mounted on the shaft journal by tightening the fastening screws criss-cross (avoiding jamming). The input or output is now rotated a few turns, so that the shaft journal rotates in the second hub and this can move on the shaft for axial relaxation. Now the 6 screws of the second hub are also tightened evenly. To disassemble the conical hubs, loosen the fixing screws; afterwards the clamping ring can be released by means of 3 extraction threads.

#### 8.2.3 Split Hub (Type EWN):

Permissible fitting tolerance between shaft and hub: min. 0,01 mm / max. 0,04 mm.
The hubs are divided and consist of a fixed and a loose half. The solid half-shell part can be placed on the aligned shafts. Now tighten two (or four) clamping screws (ISO 4762) evenly alternately on both sides. While doing so, check the gap and observe the prescribed tightening torques. If necessary, a larger hole should be provided in the housing for installation.

### 8.3 Notes:

- Hub bores smaller than $D_{min}$ are possible, but safe transmission of the rated torque is not guaranteed. For smaller shaft diameters, the conical hubs (larger wall thickness) are additionally slotted. Further type-related details can be found in the data sheets.

- Due to the damping capacity of the elastomer spider, the power train is largely protected against dynamic overloading. A forced movement of both coupling halves (at least $3xT_N$) is always guaranteed due to the claw contour, even in the event of a total breakdown of the spider.

## 9. Maintenance

When used correctly (see data sheet), ENEMAC elastomer couplings are maintenance-free. However, it is recommended to check the alignment and tightening torque of the screws after the first few hours of operation and then at regular intervals. At operating temperatures close to the permissible limits (see data sheet), it is also recommended to replace the polyurethane star regularly.

## 10. Supplements

### 10.1 Warranty

The warranty period is 12 months from the date of delivery, provided the product is used as intended in a single-shift operation. The warranty claim shall lapse if damage is caused by improper operation. Repair work or interventions carried out by unauthorised persons and the use of accessories and spare parts that are not compatible with ENEMAC elastomer couplings will void all warranty claims.

### 10.2 Safety Regulations

Regardless of the information provided in this operating manual, the statutory safety and accident prevention regulations apply. Every person assigned by the operator to operate, maintain and repair the elastomer couplings must have read and understood the operating manual before commissioning. Repairers of the elastomer coupling are fundamentally responsible for occupational safety. Compliance with all applicable safety regulations and legal requirements is a prerequisite for avoiding damage to persons and the product during maintenance and repair work. The proper repair of ENEMAC products requires appropriately trained specialist personnel. The obligation to provide training lies with the operator or repairer. They must ensure that operators and future repairers are properly trained for the product.

### 10.3 Copy Right

This operating instructions manual is copyrighted property of ENEMAC GmbH.

### 10.4 Spare Parts

Only spare parts, which correspond to the requierements specified by ENEMAC GmbH or supplier are allowed. This is always guaranteed with original spare parts. Improper repairs, as well as incorrect spare parts lead to the exclusion of product liability or warranty. When ordering spare parts it is essential to specify type and size of the elastomer coupling to avoid incorrect deliveries.

### 10.5 Provisio

ENEMAC reserves the right to make technical changes. Changes, errors and misprints shall not justify any titles of indemnity.