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Operating instructions jaw couplings

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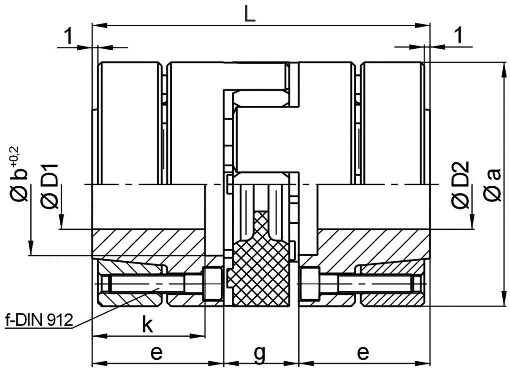
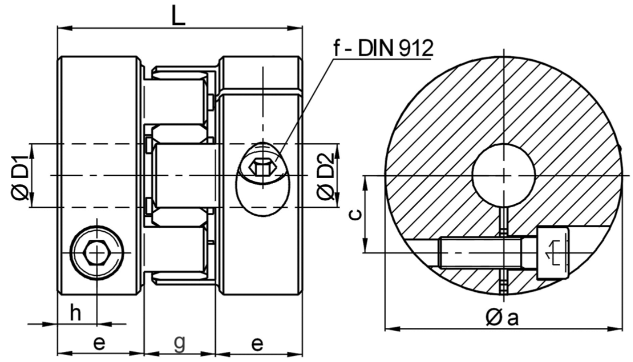
Contents

1. Assembly drawings
2. Construction and function
2.1 Construction
2.2 Function
3. Dimensioning of the coupling
3.1 Definitions
3.2 Dimensioning according to the torque
3.3 Dimensioning according to torsional stiffness
3.4 Dimensioning according to the bore size
3.5 Lifetime of the coupling
3.6 Maximum load
3.7 Load of the bearings
3.8 Operating temperature
3.9 Operating speed - balance quality
3.10 Maintenance and wear
4. Dimensioning of the bore sizes
5. Dimensioning of the torque
5.1 Formula
5.2 Definitions
5.2.1.Temperature factor f_T
5.2.2 Torsional stiffness factor f_D
5.2.3 Operating ratio f_B
6. The elastomer spider
6.1 Dimensions
6.2 Notes
7. Precausional Measures
8. Mounting and demounting
8.1 Aligning the shafts
8.2 Shaft-hub-connection
8.2.1 Radial clamping hub
8.2.2 Conical clamping hub
8.2.3 Half-shell-hub
8.3 Demounting
8.4 Notes
9. Maintenance
10. Supplements
10.1 Warranty
10.2 Safety regulations
10.3 Copy right
10.4 Spare parts
10.5 Provisio

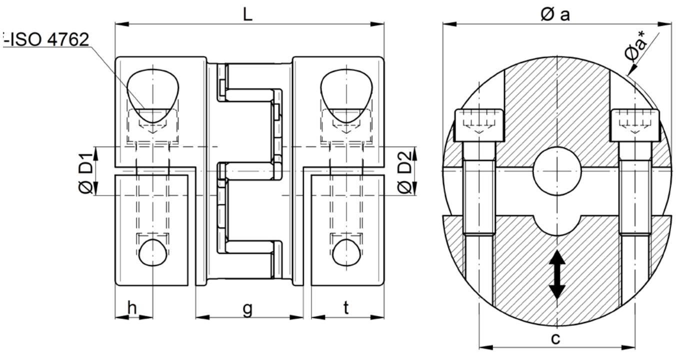
1. Assembly drawings



jaw coupling EWE



jaw coupling EWD



jaw coupling EWN

2. Construction and function

2.1 Construction

The jaw coupling consists of three main components, two hubs and an elastomer spider. The type EWD is equipped with a mounting-friendly radial clamping hub made of high tensile aluminum on both sides, while the clamping rings of type EWE are made of tempered steel with a reduced moment of inertia. For the EWN type, divided half-shells have been used for easier mounting.

2.2 Function

Jaw couplings are pluggable, free of clearance, flexible shaft couplings for small to medium torques. An elastomer spider with high Shore hardness is used as connecting and compensating element. It is used form-fitting, with slight prestressing, in two high-precision hubs with claw-shaped cams. The elastic spider can compensate minor shaft misalignments, is electrically insulating and has good vibration damping behavior.

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 endurance limit. If T_{KN} is not exceeded in normal operation, an infinite number of operating cycles can be carried out (see also 3.5 lifetimer of the coupling).

b) Mass moment of inertia: J_K - [10^{-3} kgm²]

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

conversion: **[kgcm²] = [10^{-4} kgm²]**

c) Torsional stiffness: C_{TK} - [Nm / arc min]

When specifying the specific torsional stiffness of all coupling assemblies, a conversion from the previous unit specification [103 Nm / rad] to the unit „Newtonmeter per angle minute“ was made.

This allows the engineer to easily determine the resulting twist angle errors (see 3.3) using the operating torque. 60 angular minutes (or arc minutes) correspond to an angle. This results in the following conversion factor:

1 rad = 57,3° = 3438 arcmin
[10^3 Nm/rad = 0,291 Nm/arcmin] bzw.
[1 Nm/arcmin = 3438 Nm/rad]

Example: size EWA 170: 17,5 Nm/arcmin = 60 kNm/rad

d) Maximum Misalignment [mm]

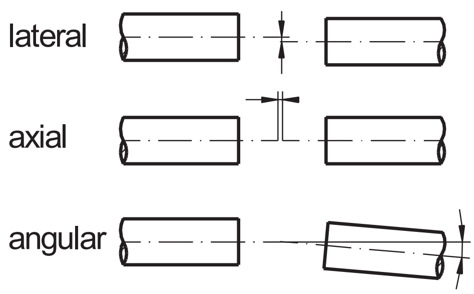
Maximum dimension of the permissible misalignment between the input and output shafts resulting from the fatigue strength calculation for the compensating elements. When operating below the permissible offset values, infinite load changes can be performed. In exceptional cases (eg assembly) or with reduced load change numbers, the offset values may be significantly higher in some cases (please consult us).

e) Lateral- and parallel misalignment:

Distinctly exceeding of the allowable offset value can lead to excessive wear of the elastomer spider. Pay special attention to the misalignment when istalling!

f) Axial misalignment:

Unproblematic in most cases! (Thermal extension)



g) Angular misalignment:

Unproblematic in most cases - admissible maximum value between 1 and 2 degrees.

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

Restoring forces of the elastomer spider, resulting from misalignment.

3.2. Dimensioning according to the torque

Usually the coupling size will be selected due to the torque. For the exact determination of the required drive torque usually complex calculations are to be carried out (see formula collection). When the size of the motor has been determined, the required nominal torque can roughly be established as follows:

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

TA_{max} = Peak torque of the motor
i = Overtransmission or reduction of the toothed belt drive or helical gear

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:

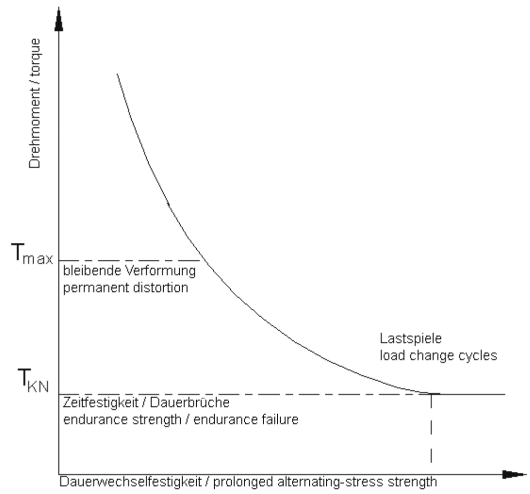
In principle, after determining the type of coupling, a check of the given shaft diameter should take place with the permissible diameter range (D_{min} / D_{max}) of the hub bore. If the shaft diameter is oversized in relation to the torque, which means its greater than D_{max} of the hub, a different 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 Liefetime 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 clutch.



3.6 Maximum load:

In exceptional cases, the jaw couplings can be temporarily over-loaded 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:

Due to the precise production and the rotationally symmetrical design, or the additional balancing pin, the compensation couplings are generally also suitable without balancing for high speeds up to 20,000 rpm. The standard balance quality is around Q6.3 or Q16. Types with conical clamping ring hubs (EWE) can partly be operated at speeds of more than 30,000 rpm. The low moments of inertia also have a positive effect.

3.10 Maintenance and wear:

Compensating couplings are maintenance and wear-free under normal conditions. The polyurethane spider of the elastomer coupling should be renewed at critical temperatures at appropriate intervals.

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 Temperatur 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 temperatur	303 K 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.

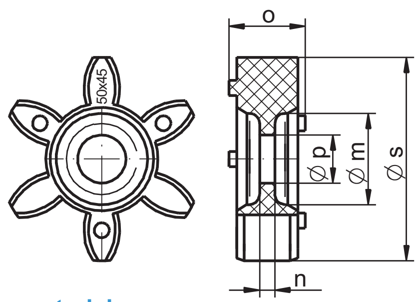
5.2.3 Operating ratio f_B

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 assembly, make sure that the characteristics and specifications of the coupling are adequate and suitable for the intended use. There has to be enough space for installation and future maintenance. Make sure that the device can not cause dangerous situations for people and / or property and always work under the current safety regulations.

With reference to the current Machinery Directive, our products are NO Machines. Operation is therefore subject to compliance with all requirements of the machine in which the device is installed. Inacurate performance will relieve ENEMAC of all liabilities.

For questions which can not be answered by this manual, or details on special applications always contact ENEMAC GmbH.

ATTENTION!

It is dangerous:

- to use the product other than intended
- to use the product for higher requirements as intended
- to change or manipulate the product on your own
- to equip the product wiht non-original parts

8. Mounting and Demounting

8.1 Aligning the shafts

Axial and angular misalignment are usually unproblematic and easy to measure. To determine the lateral offset, it is advisable to proceed as follows: Place a dial gauge with a corresponding holder on a shaft journal or on the second coupling half (see picture 8.4). Now the shafts are turned with the dial gauge and the peak is beeing read. The existing parallel offset is half of the total amount. The permissible maximum values for shaft misalignments have to be taken from the technical data sheets of the corresponding series.

8.2 Shaft-hub-connection:

The couplings are usually delivered with finished bores, in exceptional cases also pre-drilled. 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 hubs, 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 preload 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 hubs, 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 (Type EWD):

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 hub and clamping ring (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 wobble). 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 of the metal bellows. Now the 6 screws of the second hub are also tightened evenly.

8.2.3 Half-shell 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.

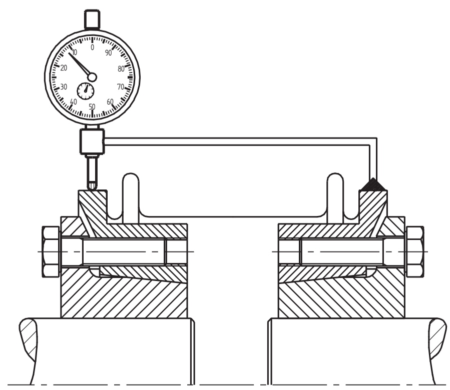
8.3 Demounting:

To disassemble the conical hubs, loosen the 6 fixing screws; afterwards the clamping ring can be released by means of 3 extraction threads. Release process of radial clamping hubs see on point „Easy clamping system“!

8.4 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



picture: alignment of the shafts

9. Maintenance

The couplings are maintenance-free. However, it is recommended to check the alignment and tightening torque of the bolts and nuts after the first hours of operation and at regular intervals thereafter.

10. Suplements

10.1 Warranty

The warranty period is 12 months starting with date of delivery when used in the intended one-shift operation, or max. 250 shutdowns. The warranty does not cover damage caused by improper operation. Any warranty claims are determined by repair or intervention, carried out by unauthorized persons and the use of utilities and spare parts, which aren‘t matching our jaw couplings.

10.2 Safety regulations

Regardless of the instructions listed in this manual, the (German) statutory safety and accident prevention regulations are valid. Any person who is responsible for the operation, maintenance and repair of the jaw couplings must have read and understood the operating instructions before commissioning. Repairer of the jaw couplings are basically responsible for workplace safety. Following all valid safety and regulatory instructions is an requirement to prevent damages to persons and the product during maintenance and repair work. Proper repair of ENEMAC products assumes accordingly trained staff. The duty of training is up to the operator or repairer. It is to ensure that the operator and future repairer are properly trained for the product

10.3 Copy right

This operating instructions manual is copyrighted property of ENEMAC. It is only delivered to our customers and users of our products and is supplied with the jaw coupling. Without our explicit approval these documents mustn‘t be reproduced nor made available to third persons in particular competitive companies.

10.4 Spare parts

Only spare parts, which correspond to the requierements specified by ENEMAC 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, size and the identification number of jaw coupling to avoid incorrect deliveries

10.5 Provisio

We reserve the right for technical changes. Changes, errors and misprints shall not justify any titles of indemnity.

enclosure: data-sheet