ROLLCO

TECHNICAL INFORMATION
SERVO COUPLINGS

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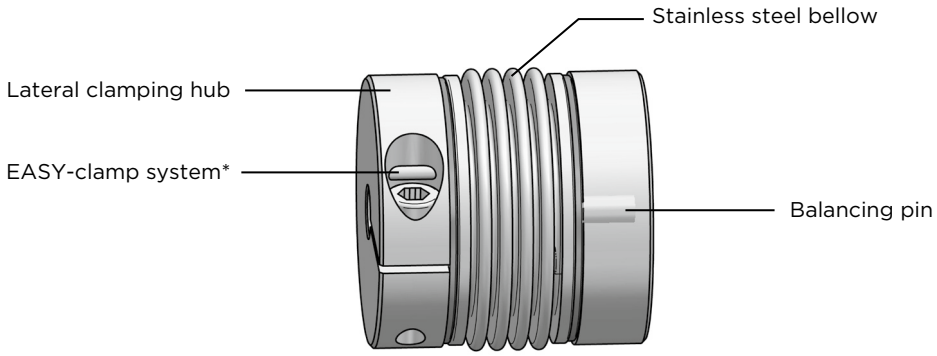
Product overview

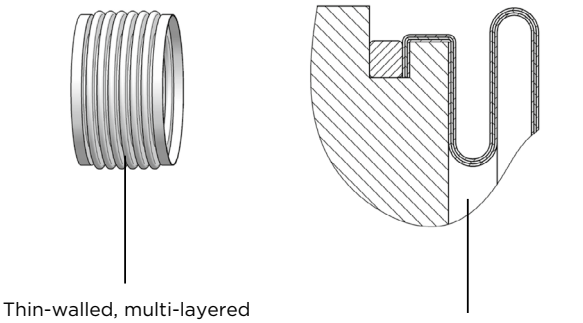
Servo couplings are compensating couplings with a backlash free and conformal torque transfer providing high torsional stiffness and a low moment of inertia. According to these requirements, metal bellows couplings can be regarded as the ideal solution. They have proven themselves in numerous servo drives as an excellent choice. Elastomer couplings with a flexible polyurethane spider can also represent a perfect alternative for different applications because of their product-specific advantages.

Metal bellows couplings



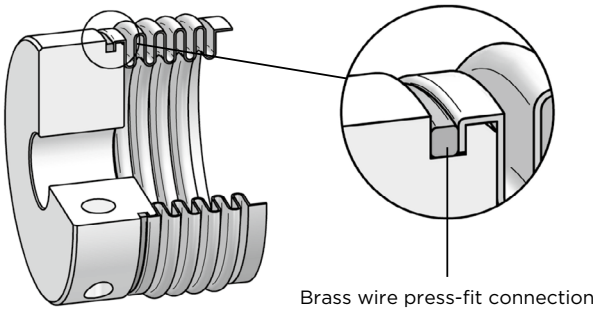
Stainless steel bellows

- Absolutely backlash-free, precise torque transmission
- Extremely high torsional stiffness
- High flexibility for compensation of shaft misalignments
- Minimized moment of inertia
- Maintenance and wear-free up to 200°C
- High-quality precision manufacture



Connection method

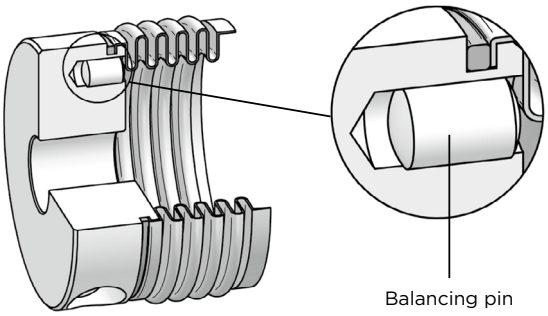
- Patented brass-wire press-fit, which is the optimal, backlash-free connection of aluminum hubs with multi-layered stainless steel bellows.
- The method provides long service life and the torque is safely induced into the hubs.



*EASY-clamp is only available for KM and KP, not for Miniature Metal Bellows Couplings.

Balancing of the hub

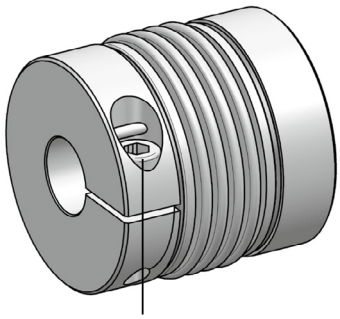
- The balancing pin ensures a standard balancing quality of Q16
- High speeds of up to 20.000 rpm
- Smooth running to prevent oscillations



Balancing pin

Lateral clamping hub

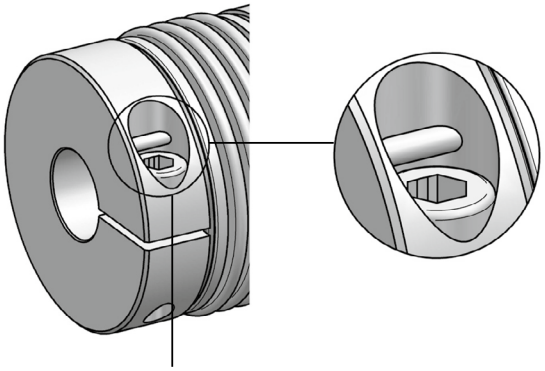
- Clamping hub made from high-tensile aluminum
- Simple lateral fitting of shaft-hub-connection
- Ensures the backlash-free, force-fitted transfer of the declared nominal torque value (no keyway necessary)
- Minimized moment of inertia, low mass, stainless design
- Hub bores (D1/D2 standard tolerance G6)



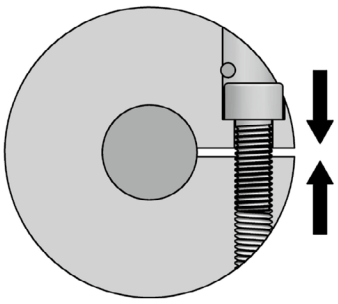
Cylinder hex socket screw ISO 4762 / 12.9
zinc flake coating

EASY-clamp system*

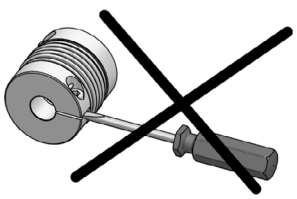
- Revolution of coupling fitting
- No shortening or extension of bellows
- Grave time saving, no reworking
- Blind assembly possible, hole in bell housing is enough
- Compensation of tolerance deviation of shaft-hub-fit
- No additional tools necessary
- No damage of hub bores and bellows at demounting of motor

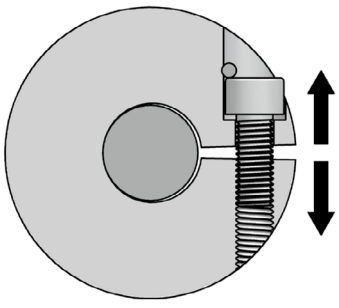


EASY-clamp system*



The clamping hub is backlash-free
and force-fitted with the shaft.





For assembly and disassembly, the hub
has to be expanded elastically.

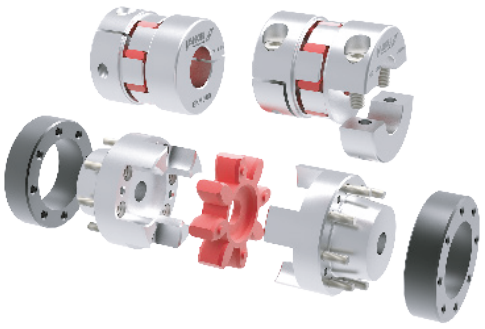
*EASY-clamp is only available for KM and KP, not for Miniature Metal Bellows Couplings.

Elastomer coulings

Elastomer couplings can be plugged in, are backlash-free, flexible shaft couplings for small to medium torques. An elastomer spider serves as connection and compensating element with involute teeth and a high shore hardness. This is inserted in form-fit, with slight preload between two high-precision machined hubs with involutely shaped jaws. The elastomer spider can compensate slight shaft misalignments, is electrically insulating and has good oscillation dampening characteristics. Two variations with backlash-free, frictional shaft-hub connection are available as standard which ensure safe torque transfer even without keyways.

Characteristics

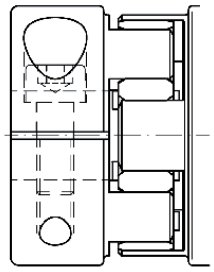
- Plug-in
- Backlash-free
- Flexible
- Compact
- Oscillation dampening
- Different shore hardnesses
- Low moment of inertia
- High speeds
- Electrically insulating
- Temperatures up to 120°C



Hub types

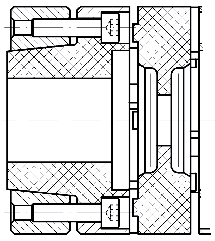
EKM - lateral clamping hub

Admissible seat clearance shaft hub: min. 0,01mm / max. 0,04mm.
Very simple fitting by tightening only one laterally arranged clamping screw (DIN 912). The value for the relevant tightening torques can be found in the data sheets. One hole in the housing is sufficient to tighten the clamping screw (see EASY-clamp sytem).



ESM-A - conical hub / conical ring hub

Allowable clearance shaft hub: max.0,02mm.
For the ESM-A coupling type, an axial plug-in installation is generally required. For this purpose, both hub parts are previously fastened on the drive and output shaft, the star is inserted into a claw hub, and finally the other claw hub is pushed onto the star by means of an axial mounting force. The conical clamping ring is fastened from “inside” by tightening the fastening screws with hexagon socket crosswise. The hub clearance dimension “g” must be observed and checked. Several release threads are provided for releasing the cone hub.



Definitions

Nominal torque of the coupling T_N - [Nm]
The nominal torque of the coupling defines the max. load of the prolonged alternating-stress strength. If in normal operation, T_N is not exceeded, an infinite number of operation cycles can be carried out (see section Durability).

Moment of inertia J_K - [10^{-3}kgm^2]
The values for the moment of inertia are defined for medium hub-bores in the given diameter range Dmin/Dmax. Conversion: [kgcm^2] = [10^{-4}kgm^2]

Torsional stiffness C_{TK} - [Nm/arc min]
The values for the specific torsional stiffness of all couplings are converted from the existing values [103 Nm/rad] to "Newton meter per angular minute". This enables the constructor to determine the torsion angle failure quite easily under consideration of the operating torque. 60 angular minutes (resp. arc minutes) correspond to one angular degree. This defines the conversion factor 1 rad = 57,3° = 3438 arcmin.

Conversion: [103Nm/rad = 0,291 Nm/arcmin] resp. [1Nm/arcmin = 3438 Nm/rad=3,44 kNm/rad] Example: Size KM 170: 17,5 Nm/arcmin= 60 kNm/rad

Max. misalignment of shafts [mm]
The maximum misalignment of shafts is the largest allowed misalignment between drive and output shaft, which results from the calculation of the prolonged alternating-stress strength for compensating elements. If the allowed misalignment values are not exceeded, an infinite number of load alternations can be carried out. In exceptional cases (e.g. during fixing) particularly at reduced numbers of load alternations, the misalignment values may be considerably higher (please contact us for further consultation).

Axial misalignment	Usually without problems (expansion due to temperature)
Angular misalignment	usually without problems - allowed max. value: 1 to 2 degrees
Lateral or parallel misalignment	f the admissible values are considerably exceeded, permanent distortion at the bellows and higher wear of the elastomer spider can occur. Special care must be taken during fitting!

Spring stiffness - axial / lateral [N/mm]
Restoring forces of metal bellows or elastomer spiders, caused by shaft misalignments.

Dimensioning of the coupling

According to torque

Usually, the size of the coupling is chosen according to the required torque. For exact determination of the necessary drive torque, difficult calculations are neccessary. If the size of the motor is fixed, the necessary nominal torque of the coupling T_{KN} can be calculated as follows:

$T_N > 1{,}25 \cdot T_A \text{ max} \cdot i$	T_A max = peak torque of the motor i = transmission / reduction of the toothed belt drive or the spur-toothed wheel

According to torsional stiffness

For applications with very precise requirements (position control, transmitter), transfer errors due to high elastic deformation can be an important criterion for selection of the coupling. The torsional angle “αT” is calculated as follows:

$\alpha T = \frac{T_A}{C_{TK}}$	[arc minutes] with T_A= drive torque [Nm] C_{TK}= torsional stiffness of the coupling [Nm/arcmin]

Very seldomly, metal bellows couplings may have resonance sounds (e.g. a whistling or a humming), when coupling types with a higher torsional stiffness or vibration reducing elastomer couplings are recommended.

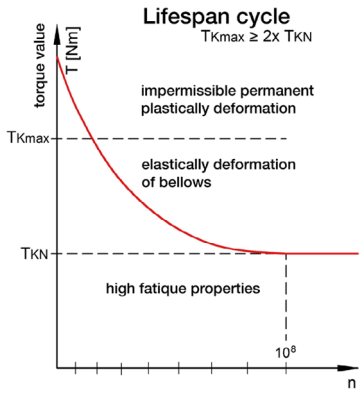
According to shaft diameter

After selecting the coupling type, it must be checked whether the requested shaft diameter corresponds with the allowed diameter (Dmin / Dmax) of the hub bores. Another coupling type or size must be chosen, if the shaft diameter is overdimensioned in relation to the torque, which means it is larger than Dmax of the hub.

Note: Hub bores which are smaller than “Dmin” are possible, but an optimal transfer of the nominal torque cannot be guaranteed in this case, so a reduction of the drive torque is necessary.

Durability

The durability of compensating couplings is basically determined by the peak torque and the existing shaft misalignment. If the admissible maximum values for the axial, lateral and angular misalignment are not exceeded and the operating torque is below the nominal torque T_{KN}, then the coupling is within the range of fatigue limit. An infinite number of start-stop-cycles or accelerations and decelerations can be carried out without having to expect a breakdown of the coupling during operation.



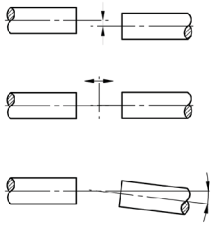
Max. load

In special cases, couplings can be overloaded for a short time with twice the nominal torque (2 x T_{KN}). This applies unless otherwise stated on the data sheet for the respective series. The shaft-hub-connection, however, must then be calculated seperately.

Bearing load

Due to the flexibility of the compensating couplings in all directions, considerable bearing loads are prevented, in spite of possible axial, lateral or angular misalignment from drive to output shaft. Therefore, an early breakdown or higher wear of the rolling bearing can be prevented. This means less difficult and expensive repairs.

Misalignment



Lateral

Axial

Angular

Operating temperatures

Metal bellows couplings are, as whole metal couplings, extremely insensitive to temperature. Series with aluminum clamping hubs can be used without restriction from -40 °C to + 150 °C, short-term up to + 200 °C. For models with welded steel or stainless steel hubs, the application temperature is a maximum of 350 °C. The temperature limits of the elastomer spider are at 90°C (98 Sh-A) and 120°C (72 Sh-D).

Speeds

Due to precision machining, the rotation symmetry, and the additional balance pin, the compensating couplings are generally suitable for high speeds even without additional balancing. The standard balancing quality is approx. Q6.3 to Q16. Couplings with conical hubs or hubs with tapered ring can be operated with speeds of over 25,000 min-1 (please contact us for further information). The low moment of inertia also has a positive effect. The type-specific maximum speeds are specified in the data sheets. For very high operating speeds and sensitive drives, we recommend an additional balancing process (optional)

Maintenance and wear

Compensating couplings are maintenance and wear free under normal conditions. The polyurethane spiders of the elastomer couplings should be changed in suitable periods, if critical operation parameters are given.

Additional dimensioning for elastomer couplings

The main layout criteria are the required drive torque, the necessary torsional stiffness, the running speeds, the dampening characteristics of the coupling, and the moment of inertia. Additionally, the minimum or maximum possible shaft diameter, the admissible temperature range, operating factors, and the existing shaft misalignment (particularly the lateral misalignment) must be taken into consideration.

Approximation of required torque

Roughly, the required coupling torque T_K can be calculated as for the following formula:

$T_K = T_A \cdot f_D \cdot f_T \cdot f_B < T_{KN}$	T_A = Drive torque [Nm] f_D = Torsional stiffness factor f_T = Temperature factor f_B = Operating factor

The calculated coupling torque T_K should not exceed the nominal torque of the selected coupling size. Short term overload up to twice the value of the nominal torque is admissible. The drive torque results from product information of drive motor or can be calculated via motor output P_A.

$T_A = \frac{9550 \cdot P_A}{n_B}$	T_A = Drive torque [Nm] P_A = Motor output [KW] n_B = Motor speed [min-1]

Temperature factor f_T

Admissible temperature range for continuous operation

- PUR 98 Sh - A: -30°C up to +90°C
- PUR 72 Sh - D: -20°C up to +120°C

operating temperature	+30°C -30°C	+50°C	+70°C	+90°C	+110°C
factor fT	1	1.3	1.6	1.8	2

Torsional stiffness factor f_D

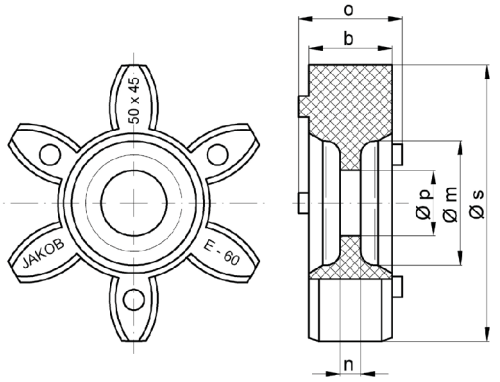
If an exact, accurate transfer of the torque is required, as for instance with servo drives or measuring systems, a high torsional stiffness is absolutely necessary. Here the required drive torque should be multiplied with a operating factor of at least 3 when selecting the size, or a torsionally stiff metal bellows coupling.

Operating factor f_B

Due to operating factor fB application specific peculiarities, such as shock loading, are taken into consideration.

Dimensions - elastomer spider [mm]:

Size	øs	øm	n	b	o	øp$^{+0,5}$
8/10	32	10.5	2	10	13	8.5
15/17/20/25	40	18	3	12	15	9.5
30/43/45/50	50	27	3	14	17	12.5
60/90	55	27	3	14	17	12.5
150/200	65	30	4	18	18	16.5
300/320/400	80	38	4	18	22	16.5
500	100	47	5	22	26	20.5
700/1000	120	58	6	25	30	22.5
2000	160	77	7	32	38	60



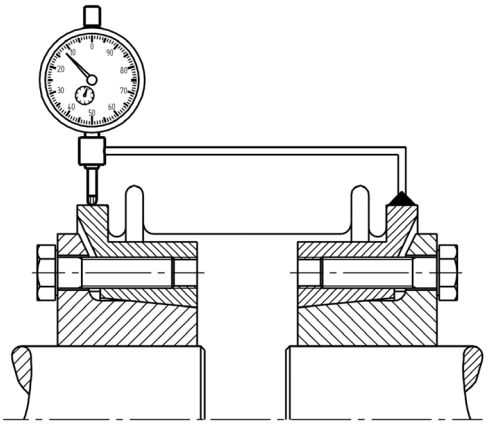
Installation and mounting instructions

As the metal bellows consist of thin stainless steel sheeting, special care during fitting and disassembly is necessary. Damages to the bellow can render the coupling useless.

Alignment of shafts

Axial and angle misalignment are usually without problems and also simple to measure. To obtain the lateral misalignment, it is recommended to proceed as follows:

Fit a dial gauge with an appropriate holding device on one shaft end or on one hub of the coupling and bring the feeler onto the second shaft end or onto the second coupling half (see sketch). Now the shafts are turned with the dial gauge and the deflection is read. One half of the total deflection is the lateral misalignment. The admissible value for the shaft misalignments must be taken from the technical data of the appropriate series.



Shaft-hub connection

The couplings are generally supplied with finished bores, in exceptional cases they are also supplied prebored. The seat shaft / hub is to be selected as a transitional seat (example: hub bore diameter 28 G6 - shaft diameter 28 k6). Prior to mounting, the finished bore shaft end conical sleeve should be oiled to prevent fretting corrosion. The coupling is then ready for assembly between the two shafts. An existing keyway in the shaft will not affect the frictional connection.

Lateral clamping hub
Admissible seat clearance shaft hub: min. 0,01mm / max. 0,04mm. Very simple fitting by tightening only one laterally arranged clamping screw (DIN 912). The value for the relevant tightening torques can be found in the data sheets. One hole in the housing is sufficient to tighten the clamping screw.

Conical hub / conical ring hub
Admissible seat clearance shaft-hub: max. 0,02 mm. Assembly of the conical bush or of the conical clamping ring with several, concentrically arranged mounting screws (as a rule 6x DIN 933). One side of the coupling is fit onto the shaft end by evenly tightening the screws crosswise (to prevent uneven draw-on). The drive or output is now turned by a few revolutions, so that the shaft pinion turns in the second hub and the hub can move on the shaft for axial release. Now the six screws of the second hub are also evenly tightened.

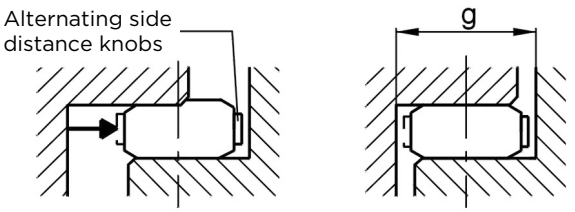
Disassembly
After releasing the six retaining screws, the hubs are released with three push-off threads each. In axially tight space conditions, it is advisable to screw in and secure the push-off-screws before fitting. For disassembly an opening in the housing should be provided.

Notes
- As the metal bellows consist of thin stainless steel sheeting, special care during fitting and disassembly is necessary. Damages to the bellows can render the coupling useless.
- At smaller shaft diameters, the conical hub (larger section thickness) is slotted additionally.

Additional installation instructions for elastomer couplings

The design of the ESM-A couplings requires mounting of the two hub halves on the shaft ends before the actual plug-in assembly. It is important that the mounting screws are tightened crosswise to prevent surface distortion of the conical clamping ring. Couplings of the EKM series on the other hand, can be assembled completely before hub mounting. For mounting the EKM hub, only a laterally arranged clamping screw must be tightened. Chamfered edges at the face enable the blind assembly. Due to the obligatory preclamping of the elastomer, an axial assembly force must be applied while sliding together the coupling spider and the jaws. This assembly force can be minimized by slight oiling the spider. For disassembly of the ESM conical hub, draw-off threads are provided for releasing the clamping ring. The relevant tightening torques of the retaining screws can be found in the technical data sheets.

Installation



elastic deformation through axial assembly force

backlash-free due to elastic distortion

Tolerable seat clearance shaft/hub

- Series ESM-A: max 0,02 mm
- Series EKM: min 0,01 mm / max 0,04 mm

Notes:

- The dampening capability of the elastomer spider protects the drive to a high extent from dynamic overload. Both coupling halves are always forced to move (min. 3xTN) because of the jaw construction, even if the spider should break down entirely.
- Because of the deformation of the elastomer spider under operation conditions, the housing (bell) should be approximately 5 % bigger than the outer diameter of the coupling itself.
- To ensure satisfactory function, dimension ‘g’ should be complied with as exactly as possible. The distance of the two shaft ends can be smaller than ‘g’ under consideration of measurements ‘m’ and ‘n’ of the spider.
- If required by the application or requested by the customer, diameter ‘p’ of the spider can be expanded up to øm - 2 mm

Coupling

KM 170 - D1=30K - D2= 35K

Type
KM, KP, EKM, ESM-A, MKM, MKP

Size
See website for sizes for respective coupling type.

D1 dore diameter (mm)*
See website for max./min. bore diameters for respective coupling type.

Keyway
With = K
Without = leave empty

D2 bore diameter (mm)*
See website for max./min. bore diameters for respective coupling type.

Keyway
With = K
Without = leave empty

*G6 standard bore tolerance. For other tolerances, please contact us.

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