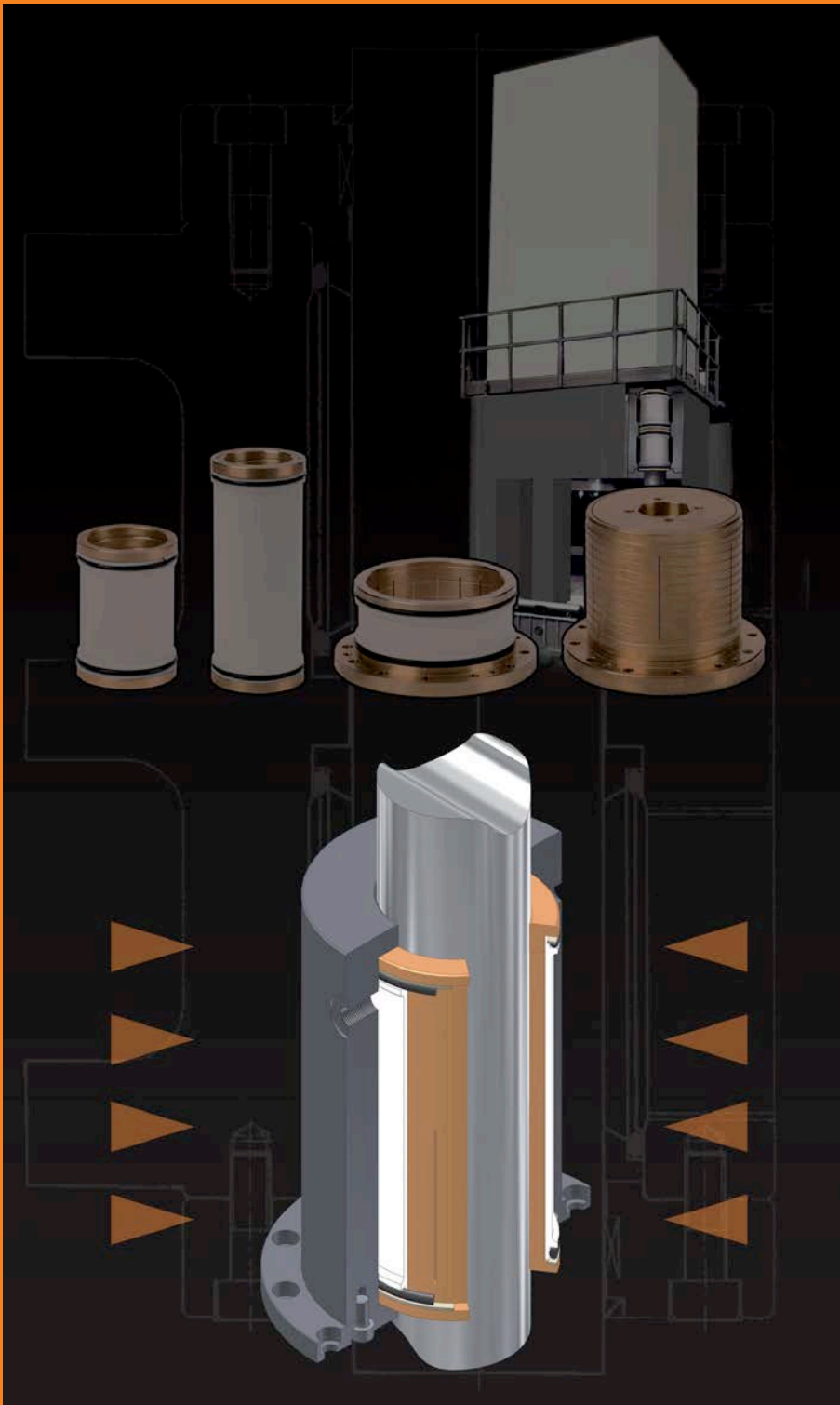


CLAMPING
ROUND MACHINE
ELEMENTS.

HYDRAULICALLY
ACTUATED
CLAMPING
SLEEVES.



THE PRINCIPLE OF THE KOSTYRKA® CLAMPING SLEEVE. MADE-TO-ORDER FOR EVERY APPLICATION.

The development of modern machine tools was decisively influenced by the use of KOSTYRKA® clamping sleeves. They allow extremely high holding forces, are fully designed for program control, close and open extremely quick and support the designer with their unique space-saving concept. No wonder that to date, KOSTYRKA has delivered several hundred thousand clamping sleeves to machine and fixture manufacturers all over the world.

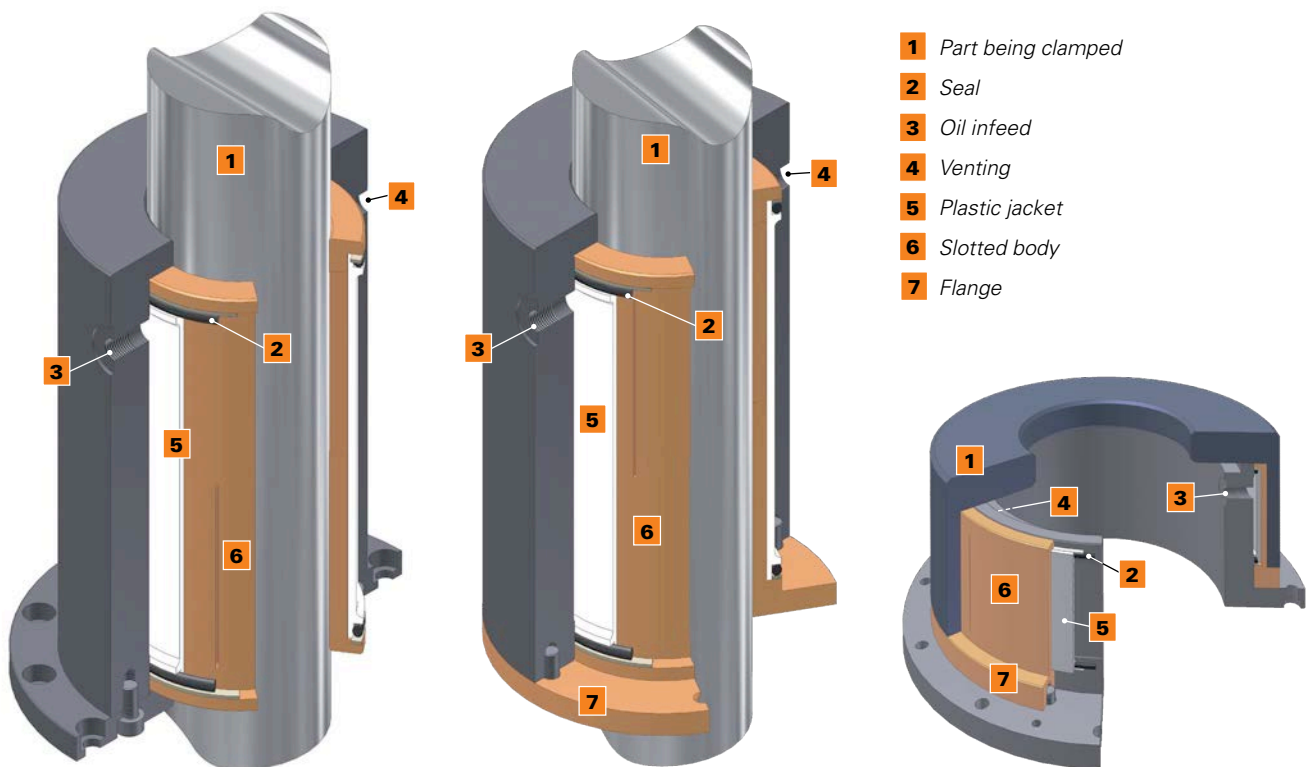
Precise and wear-free

The precision and durability of KOSTYRKA® clamping sleeves are precondition for smooth production. Disassembling and reassembling a 2,500-tonne press

for repairs isn't a simple overnight job. The high expectations that customers have in terms of product quality are met by using state-of-the-art production and control procedures. So that they can rely on safe operation day after day, year after year.

The principle: Ingeniously simple, simply ingenious

The basic item of every KOSTYRKA® clamping sleeve is a flexible body made from a metal-plastic composite that, depending on the type, surrounds the part being held or is surrounded by it. Pressure is built up on the sleeve jacket. This is converted via a flexible metal body into clamping force without



KOSTYRKA® clamping sleeves without flange ring for absorbing axial forces only (clamping inwards).

KOSTYRKA® clamping sleeves with flange ring for absorbing axial forces and torques (clamping inwards).

KOSTYRKA® expanding sleeves with or without flange ring for absorbing axial forces and possibly torques (clamping outwards).

loss and completely without reaction. After the oil pressure has been released, the sleeves spring back into their original position and the clamped part is free again. This form of force transmission does not damage the surfaces of the parts being clamped.

There will be three different types of clamping sleeves:

- Clamping sleeves without a flange ring-clamp inwards. They absorb forces only in axial direction.
- Clamping sleeves with a flange ring-clamp inwards. They absorb forces in axial direction and also torques.
- Expansion sleeves with or without a flange ring-clamp outwards. They absorb forces in axial direction – and in the case of the version with a flange ring, torques also.

It doesn't matter whether you call the products clamping sleeves, spring collets, clamping bushes, retaining bushes, clamping mandrels or expansion mandrels, they all refer to the original KOSTYRKA® clamping sleeves.

Accompanying development processes

At KOSTYRKA, partnership with the customer means finding individual solutions and accompanying development processes right from the

beginning, because KOSTYRKA clamping technology is in most cases customization. The process starts with your specifications, such as forces and torques, the duration and frequency of the clamping operations, details of travel speeds and space conditions.

Geared to customer's demands

Based on the customer's specifications, KOSTYRKA first performs a precise calculation of all parameters. This is followed by a 3D design. Besides a few standard sizes, KOSTYRKA makes almost any desired clamping sleeve – currently with inside diameters from 6 to more than 2,000 millimetres, lengths over 900 millimetres and for operating pressures of up to 600 bar. We almost always develop for any number of installation situations, calculate the necessary holding forces and work out concepts for pressure generation. If desired, we can also supply clamping sleeves complete with a housing. In this case, you receive a clamping unit that is ready to install.

Step by step towards a customer-orientated solution: KOSTYRKA accompanies the development process from the first drawing all the way to the individual clamping solution. Contact our Development Department or use our checklist at the end of the brochure.



KOSTYRKA® clamping sleeves and expansion sleeves are primarily custom items – they can therefore be adapted to almost any installation space.

THE ORIGINAL KOSTYRKA® CLAMPING SLEEVE WITHOUT FLANGE RING.



Sleeve materials

The body of the clamping sleeve is made from a specific bronze alloy. Depending on the application, the sleeves can also be made from hardened steel. The sleeve jacket is made from plastic as standard.

Operating conditions

KOSTYRKA® clamping sleeves are normally operated with hydraulic oil, but water or up to 10 bar of compressed air can also be applied to them. Contact our Development Department for details.

The working pressure for KOSTYRKA® clamping sleeves is normally 50 - 450 bar*. Working pressures outside this range are possible if required.

*Hint: 1 bar = 14.5 psi = 0.1 N/mm²

The standard version of the plastic jacket on KOSTYRKA® clamping sleeves is resistant to mineral oils, brake fluids and hardly flammable hydraulic fluids up to a temperature of 100°C. For higher operating temperatures, special versions have plastic jackets that are suitable for the purpose. The seals of the sleeves are resistant to petroleum-based hydraulic fluids and lubricants, transmission oils and both animal and vegetable fats in the range from -35°C to +135°C. They can be designed for higher operating temperatures by request.

General tolerances

All designs and sizes of the KOSTYRKA® clamping sleeves normally have the following tolerances:

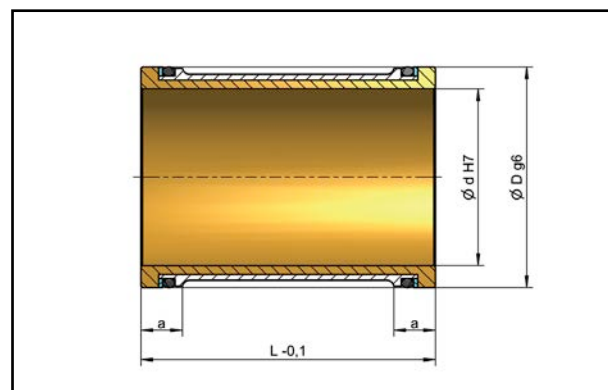
Outside diameter $D = g6$

Inside diameter $d = H7$

Length* $L = - 0.1$

Customer-specific tolerances are possible.

* Length (L) refers to the pure installation length, i.e. in the case of KOSTYRKA® clamping sleeves without a flange ring the total length, and in the case of KOSTYRKA® clamping sleeves with a flange ring the total length minus the flange thickness.



Calculating the holding forces of KOSTYRKA® clamping sleeves

The following applies to any KOSTYRKA® clamping sleeve with a clamping diameter of d (mm), a length L (mm) and a distance a (mm) to which the pressure p (N/mm²) is applied:

$$F [N] = d \cdot (L - 2a) \cdot \pi \cdot p \cdot \mu$$

F is the holding force. Use $\mu = 0.1$ as the friction coefficient for steel parts that are being clamped.

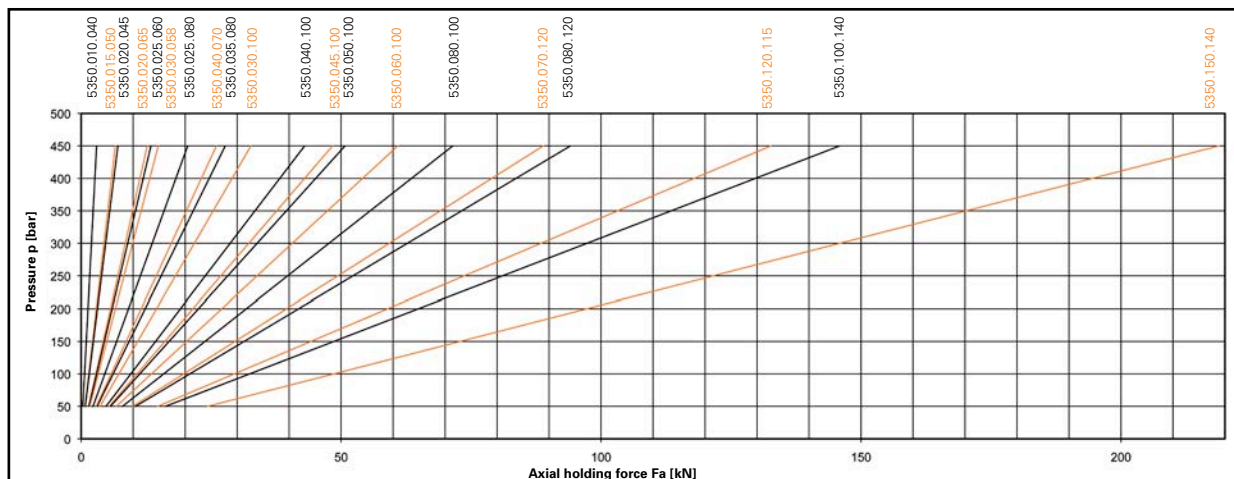
Important: KOSTYRKA® clamping sleeves without a flange ring can only absorb forces in axial direction. Clamping sleeves with a flange ring are required in order to transmit torques!

Calculating the holding forces of standard dimensions

Over the course of more than four decades, some sizes of KOSTYRKA® clamping sleeves without a flange ring have turned out to be the optimum solutions for many applications. Profit from this vast

experience, from an economic advantage and from rapid availability. The table shows the dimensions of the 20 available standard sizes.

Type no.	d	D	L	a
5350.010.040	10 mm	20 mm	40 mm	9,5 mm
5350.015.050	15 mm	25 mm	50 mm	9,5 mm
5350.020.045	20 mm	30 mm	45 mm	10,0 mm
5350.020.065	20 mm	30 mm	65 mm	10,0 mm
5350.025.060	25 mm	35 mm	60 mm	11,0 mm
5350.025.080	25 mm	35 mm	80 mm	11,0 mm
5350.030.058	30 mm	40 mm	58 mm	11,5 mm
5350.030.100	30 mm	40 mm	100 mm	11,5 mm
5350.035.080	35 mm	45 mm	80 mm	12,0 mm
5350.040.070	40 mm	50 mm	70 mm	12,0 mm
5350.040.100	40 mm	50 mm	100 mm	12,0 mm
5350.045.100	45 mm	55 mm	100 mm	12,0 mm
5350.050.100	50 mm	65 mm	100 mm	14,0 mm
5350.060.100	60 mm	75 mm	100 mm	14,0 mm
5350.070.120	70 mm	85 mm	120 mm	15,0 mm
5350.080.100	80 mm	100 mm	100 mm	18,5 mm
5350.080.120	80 mm	100 mm	120 mm	18,5 mm
5350.100.140	100 mm	125 mm	140 mm	18,5 mm
5350.120.115	120 mm	140 mm	115 mm	18,5 mm
5350.150.140	150 mm	175 mm	140 mm	18,5 mm



Holding forces of standard sleeves

Axial holding forces as a function of the operating pressure. A friction coefficient of $\mu 0.1$ was assumed.

Note: With special seals, it is possible to operate the sleeves at up to 600 bar.

THE ORIGINAL KOSTYRKA® CLAMPING SLEEVE WITH FLANGE RING.



If KOSTYRKA® clamping sleeves are to be used not just to absorb axial forces but also to transmit torques, they must have a flange. The way in which KOSTYRKA® clamping sleeves with a flange ring work, the materials, the operating conditions and the general tolerances are the same as those for the KOSTYRKA® clamping sleeves without a flange ring. If desired, we can also supply the clamping sleeves complete with a housing. In this case, you receive a clamping unit that is ready to install.

The outside diameter of the part being clamped must have a tolerance of g6. If parts with different tolerances are to be clamped, the inside diameter of the KOSTYRKA® clamping sleeve must be adapted accordingly. For this it is essential that you consult our Development Department.

Dimensions

KOSTYRKA® clamping sleeves with a flange ring are always customized and are not standard. For your enquiry, our checklist in the Appendix gives you the possibility of specifying the required dimensions and also the working and usage conditions. KOSTYRKA® clamping sleeves with a flange ring are currently

made in over 2,000 different types with clamping diameters of up to 2,000 mm and total lengths of up to 750 mm.

Operating conditions

The operating conditions are the same as described in the chapter „KOSTYRKA® clamping ring without flange ring“.

Calculation

The transmittable torque of KOSTYRKA® clamping sleeves with a flange ring is obtained by multiplying the holding force F by the sleeve inside radius d/2:

$$M [N_m] = d \cdot (L - 2a) \cdot \pi \cdot p \cdot \mu \cdot d/2 \cdot 0,001$$

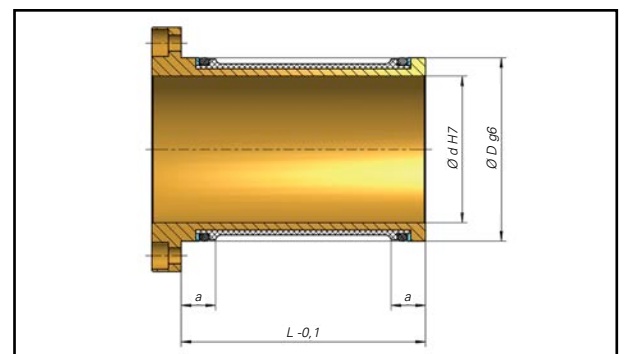
Important: The length L (mm) is the installation length of the clamping sleeve, i.e. the total length minus the flange thickness.

d = clamping diameter (mm)

p = pressure (N / mm²)

μ = friction coefficient = 0.1

a = distance (mm)



KOSTYRKA® EXPANDING SLEEVES WITH OR WITHOUT FLANGE RING.

KOSTYRKA® expanding sleeves were developed specially for clamping round tables and indexing units. Based on the reversal of the function principle of the clamping sleeves, with expanding sleeves the jacket is expanding by oil pressure. With these for example, a roating machine table is clamped from the inside.

KOSTYRKA® expanding sleeves are manufactured exclusively to the customer's specifications. If desired, we can also supply expanding sleeves complete with a housing. In this case, you receive a clamping unit that is ready to install.

Operating conditions

The operating conditions are the same as described in the chapter „KOSTYRKA® clamping ring without flange ring“.

Calculating the holding forces of expanding sleeves

KOSTYRKA® expanding sleeves clamp on their outside diameter. Use the following formula to calculate the holding forces:

$$M [N_m] = D \cdot (L - 2a) \cdot \pi \cdot p \cdot \mu \cdot D/2 \cdot 0,001$$

In this case, the outside diameter of the expanding sleeve must be used for D.

d = clamping diameter (mm)

p = pressure (N / mm²)

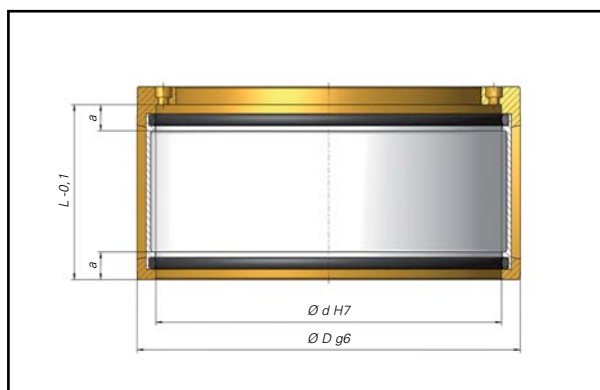
μ = friction coefficient = 0.1

a = distance (mm)

The inside diameter of the part being clamped must have a tolerance of H7.



If parts with different tolerances are to be clamped, the outside diameter of the KOSTYRKA® expanding sleeve must be adapted accordingly. For this it is essential that you consult our Development Department.



INSTALLATION SPACE AND ADJACENT COMPONENTS.

The part being clamped

All hardened or unhardened ferrous and non-ferrous metals can be clamped with KOSTYRKA® clamping sleeves. With very low-strength material, pay attention to the maximum permissible surface pressing when selecting the operating pressure.

Important note: During the clamping operation, the part being clamped must be in its absolute static condition, i.e. the KOSTYRKA® clamping sleeve must not be used as a brake.

We recommend:

- Do not clamp any cast surfaces
- If necessary, case harden or flame harden clamping surfaces – Do not nitride
- Surface area in the clamping surfaces
min. $Ra \leq 3.2$
- The roundness in the area of the sealing surfaces should be $\varnothing 0.02$ or better
- If necessary hollow shaft sufficient wall thickness

If necessary, it is essential that you consult our Development Department.

Condition of the clamping surfaces

The clamping surfaces must be kept free of preservatives, rust converters, graphite-based or molybdenum-based solid lubricants, seal abrasion and metal abrasion and all types of dirt. Additional wipers prevent dirt from infiltration.

If piston guide rings are provided, make sure that a graphite-filled or carbon-filled carrier material is not used under any circumstances. Its abrasion can get onto the clamping surfaces and reduce the required holding force. Bronze-filled guide rings can be used.

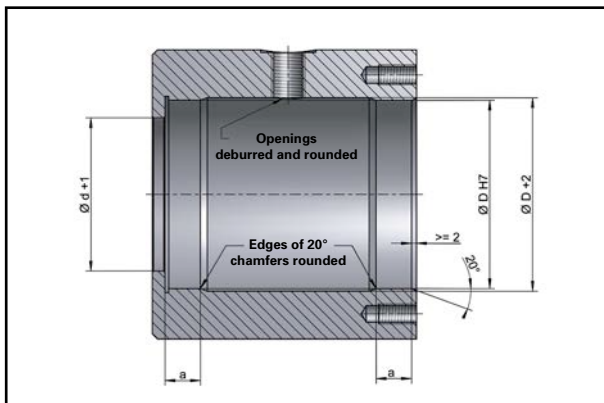
Shape of the locating hole

In principle, a cylindrical locating hole can be made without a chamber. However, we recommend the chambered shape, even if it is somewhat more complicated to make. When the KOSTYRKA® clamping sleeves are installed, it offers optimum protection for the seals if shaped and made correctly. The deburred oil feed and vent holes are near the chamber, so that the seals only have to be pushed through a short fit area of the jacket surface.

In order to prevent damage to their seals when installing KOSTYRKA® clamping sleeves, it is essential to provide sufficiently large, rounded 20° lead chamfer on the locating hole and in the area of the chamber. The openings in the oil feed and bleed holes must also be carefully deburred and rounded (figure at right).

The surface roughness of the locating hole in the area of the sleeve seals must be maximum $R_{\max} = 6 - 10 \mu\text{m}$ ($R_a \leq 1.6 \mu\text{m}$).

The roundness in the area of the sealing surfaces should be 0.02 mm or better.



Location hole of the KOSTYRKA® clamping sleeves.

Lubricating KOSTYRKA® clamping sleeves

KOSTYRKA® clamping sleeves should be sparingly lubricated with mineral oil on a regular basis. The viscosity and the amount of oil are not critical, provided that the oil is clean and can flow off unhindered*. Greases and also oils containing solid lubricant components are completely unsuitable for lubrication.

For clamping on presses and where the travel paths of the parts being clamped are long, force-feed lubrication must be provided so that abrasion can be flushed out.

*If lubrication is required, do not use any lubricants containing Teflon, MoS₂ or Graphite!

Influences on the response performance (switching speed) of KOSTYRKA® clamping sleeves

The oil flows back only due to the elastic recovery of the sleeve. A suitably dimensioned oil flow must therefore be guaranteed:

- Length of the oil lines (hose / pipe) and oil holes as short as possible
- Line cross sections for the oil feed and drainage as large as possible
- When the pressure is removed, the oil must be able to flow back unhindered so that no residual pressure remains in the system
- Diameter of the valves used as large as possible
- Open the check valves

Please note

Detailed information on the surface quality the part being clamped can be found in the brochure „Design, integration, operation and maintenance of hydraulic clamping sleeves“.



INSTALLATION REQUIREMENTS.

Installation requirements

KOSTYRKA® clamping sleeves must never have pressure applied to them when empty, i.e. without the part being clamped – that would immediately destroy them beyond repair!

Fit combinations of sleeve / housing with locating hole and part being clamped

In practice, the shaft diameter g6 and standard bore hole H7 fit combination has proved successful as a clearance fit with good sliding properties. The inside and outside diameters of all shapes and sizes of KOSTYRKA® clamping sleeves are therefore adapted to this fit combination. If the tolerances are different, please consult our Development Department because the sleeves must then be altered accordingly.

Fit combination of clamping sleeve with locating hole

Outside diameter of the sleeve: g6
Inside diameter of the locating hole: H7

Fit combination of clamping sleeve / part being clamped

Inside diameter of the sleeve: H7
Outside diameter of the part being clamped: g6

Axial preloading of KOSTYRKA® clamping sleeves without flange ring

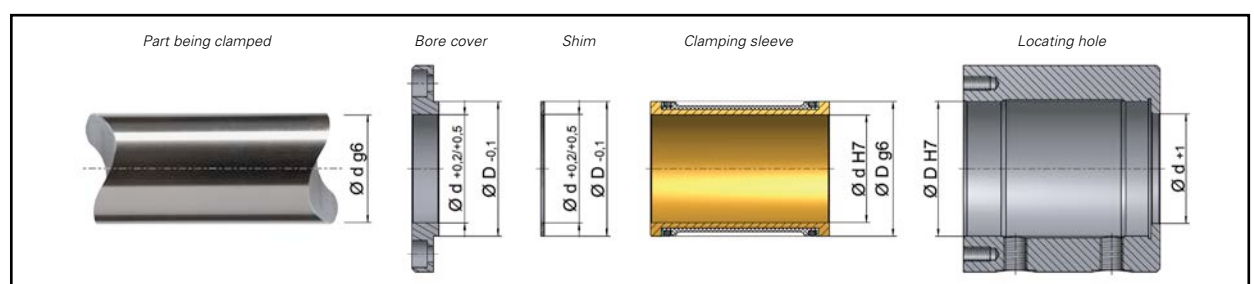
KOSTYRKA® clamping and expanding sleeves cannot transmit forces via their seals. Under axial load they, together with the part being clamped, would be displaced by the amount of any axial play present in their locating hole.

For this reason, KOSTYRKA® clamping sleeves must be axially preloaded by about 0.3 per mil of their length (example: sleeve length $L = 100 \text{ mm} \triangleq \text{max. preload of } 0.03 \text{ mm}$).

Greater preloading can result in an impermissible narrowing of the sleeve diameter. The preloading can be achieved by precision in the depth of the locating hole, a shim or by adjusting the bore cover.

Axial preloading of KOSTYRKA® clamping sleeves with flange ring

From an operating pressure of 100 bar upwards, we also recommend that a clamping sleeve with a flange ring / expanding sleeve is axially supported. For how to precisely determine the preloading, see „Preloading of KOSTYRKA® clamping sleeves without flange ring“. In the case of KOSTYRKA® clamping sleeves with flange ring, the preloading can also be slightly less than 0.3 per mil.



FITTING.

Installing and removing KOSTYRKA® clamping sleeves

Coat the lead chamfers, the fit of the locating hole and the sleeve seals with some grease, and carefully push the sleeve into the hole without tilting it.

KOSTYRKA® clamping sleeves with flange ring and larger KOSTYRKA® clamping sleeves without flange ring have at least two extraction threads for removal. These aids are not present on smaller versions. If technically feasible, extraction threads are provided only at the customer's request.

Venting KOSTYRKA® clamping sleeves

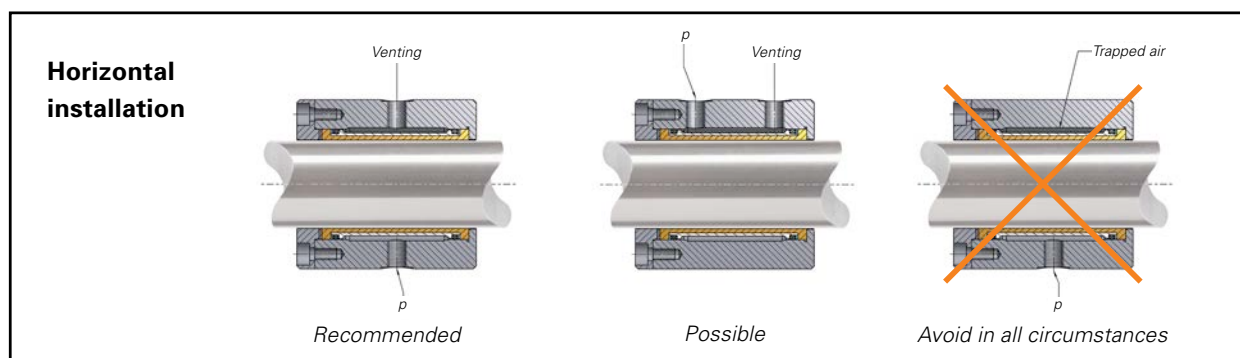
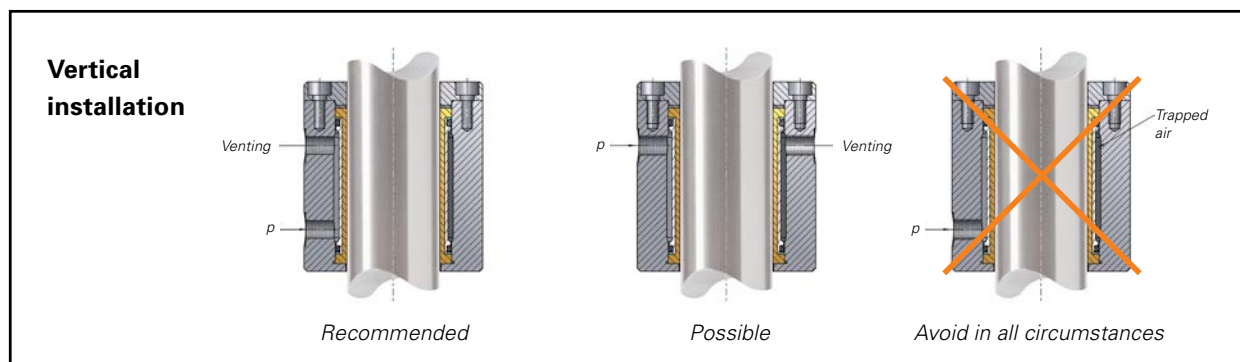
It must be ensured that air pockets cannot be formed either in the feed lines or in the installation space of the sleeves. Compression causes air to heat up to such an extent that the sleeve material and seals could possibly be damaged.

Position of the pressure oil and vent connections when KOSTYRKA® clamping sleeves are installed vertically

It is recommended to feed in the pressure oil at the lower point of the sleeve installation space and to provide a venting possibility at the highest point (above figure, left). A configuration like the one shown in the above figure on the right causes damage!

Position of the pressure oil and vent connections when KOSTYRKA® clamping sleeves are installed horizontally

The installation recommendations for vertically inserted sleeves also apply accordingly to horizontally inserted sleeves, as the figure below shows.



KOSTYRKA® ROD CLAMP



The KOSTYRKA® rod clamp is a compact clamping unit in which both a proven KOSTYRKA® clamping sleeve and a spring preloaded pressure generator is integrated. This means that a pneumatic pressure of only 6 bar is required to release the clamp – i.e. if the primary energy fails (compressed air), it is in any case guaranteed that pressure will be applied to the clamping sleeve and that the clamp will therefore remain closed.

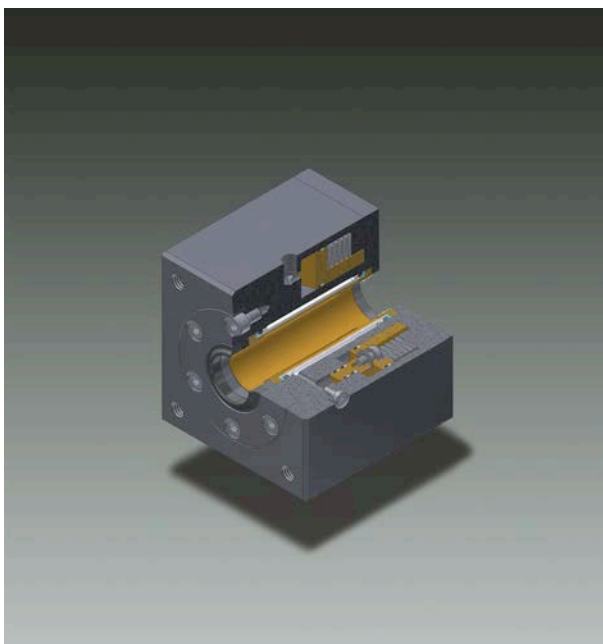
The KOSTYRKA® rod clamp can be used to absorb both axial holding force and holding torques.

Advantages of the rod clamp:

- Safety if the primary energy fails
- Energy saving
- Retrofittable
- Custom size

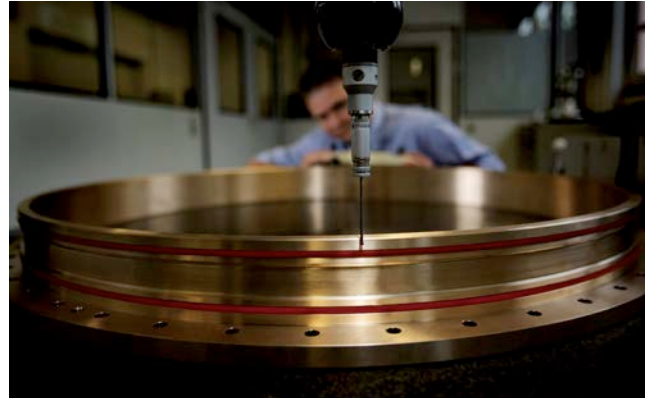
Note:

According to the fact that the clamping force is activated by a hydraulic system it is strictly forbidden to operate the device in danger areas for people.



VARIANTS AND EXAMPLES OF USE.

*KOSTYRKA®
clamping sleeve
with 6 mm inside
diameter.*



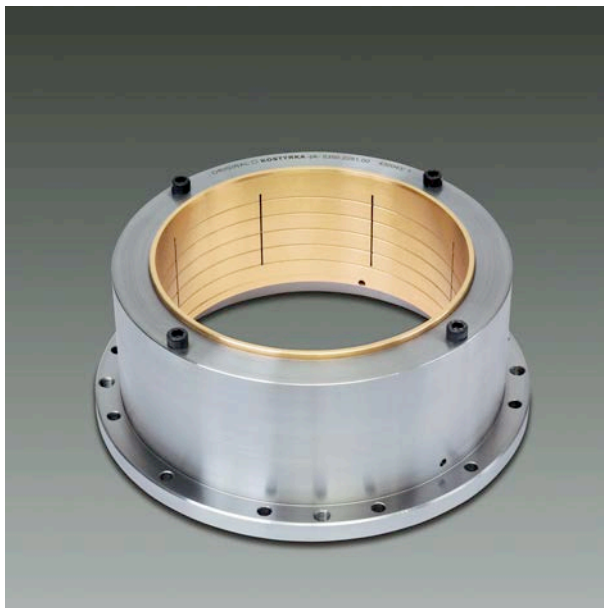
KOSTYRKA® clamping sleeves – individually made to the customer's specifications and strictly controlled for dimensional accuracy.



KOSTYRKA® clamping sleeve with flange ring with inside diameter of 1,600 mm for a peeling machine (used in steel production).



Drive unit of an indexing unit with integrated KOSTYRKA® clamping sleeve.



KOSTYRKA clamping element, i.e. housing and KOSTYRKA® clamping sleeve as a ready-to-use unit.



KOSTYRKA® clamping sleeve for a hexagonal rod.

CHECKLIST FOR YOUR ENQUIRY.

CLAMPING SLEEVE WITH OR WITHOUT FLANGE RING.

Company
Street / PO Box
Postal code / town
Phone
Fax
E-mail
Contact partner

Please contact:

KOSTYRKA GmbH
 Dieselstraße 6
 70839 Gerlingen · Germany
 Konstruktion@kostyrka.com
 Telefon: +49 (0) 7156 - 1 76 73-28
 Telefax: +49 (0) 7156 - 1 76 73-30

Which component is to be clamped?

Only axial forces arise.

- Maximum axial force

- Travel speed

- Length of the travel path

Torques are transmitted

- Expected torque

- Speed (rpm)

General information

What clamping pressure is available?

How is it generated?

Is there residual pressure in the system?

Frequency and duration of the clamping operations

Minimum and maximum operating temperature

Is there lubrication?

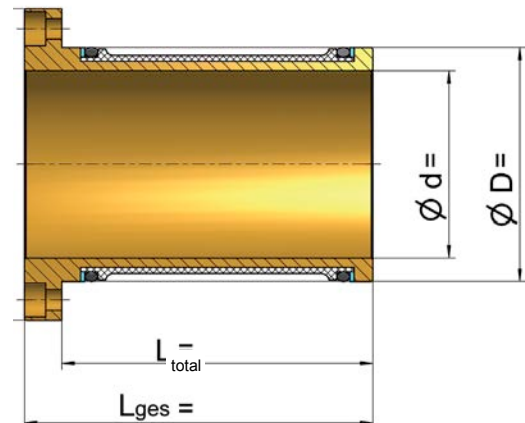
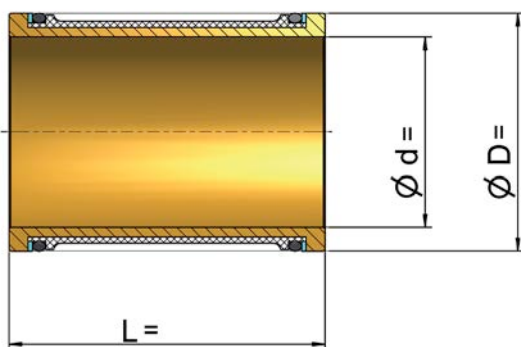
If so, what type?

What pressure medium is used?

Do you require a complete clamping unit?

Enter the desired dimensions in the diagram!

Please send the brochure „Design, integration, operation and maintenance of hydraulic clamping sleeves“



If there is already a drawing of the installation situation, please enclose a copy with the enquiry.

CHECKLIST FOR YOUR ENQUIRY.

EXPANDING SLEEVE WITH OR WITHOUT FLANGE RING.

Company
Street / PO Box
Postal code / town
Phone
Fax
E-mail
Contact partner

Please contact:

KOSTYRKA GmbH
 Dieselstraße 6
 70839 Gerlingen · Germany
 Konstruktion@kostyrka.com
 Telefon: +49 (0) 7156 - 1 76 73-28
 Telefax: +49 (0) 7156 - 1 76 73-30

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- Length of the travel path

Torques are transmitted

- Expected torque

- Speed (rpm)

General information

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Is there residual pressure in the system?

Frequency and duration of the clamping operations

Minimum and maximum operating temperature

Is there lubrication?

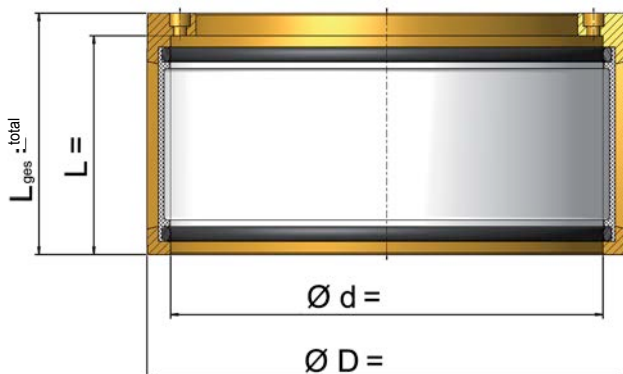
If so, what type?

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Do you require a complete clamping unit?

Enter the desired dimensions in the diagram!

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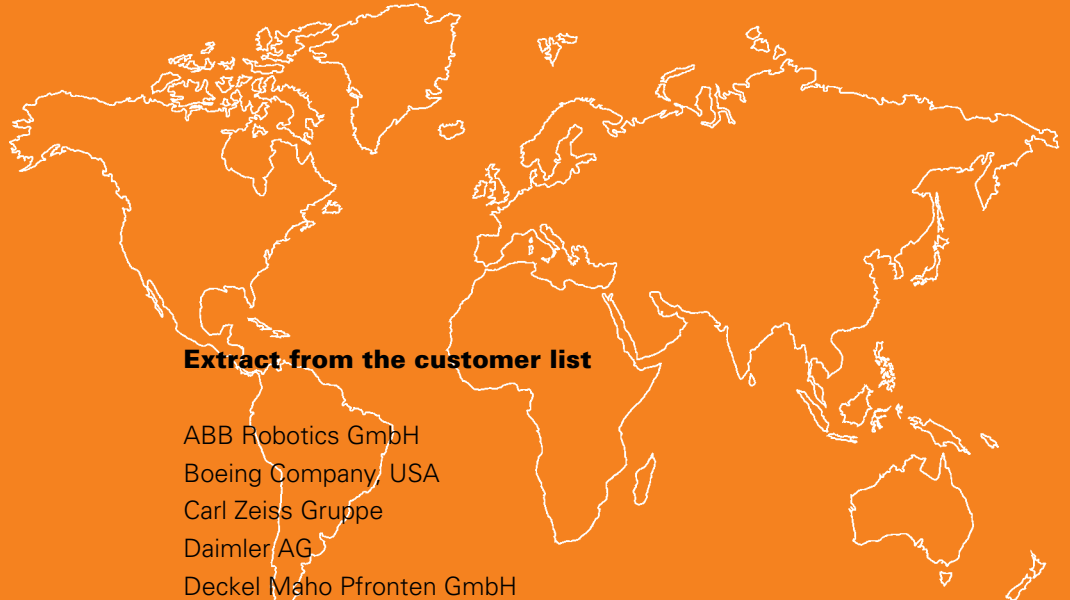
**Extract from the customer list**

ABB Robotics GmbH
Boeing Company, USA
Carl Zeiss Gruppe
Daimler AG
Deckel Maho Pfronten GmbH
Dörries Scharmann Technologie GmbH
Dr. Ing. h.c. F. Porsche AG
F. Zimmermann GmbH
FIBRO GmbH
Gebr. Heller Maschinenfabrik GmbH
General Electric Canada Inc., Kanada
GKN Aerospace GmbH
Hilti Aktiengesellschaft, Liechtenstein
Hyundai Motor Company, Süd Korea
INA Tooling Technique Pvt. Ltd., Indien
INDEX-Werke GmbH & Co. KG Hahn & Tessky
Israel Aerospace Industries Ltd., Israel
Japan Machinery Company Ltd., Japan
Lindauer DORNIER GmbH
MAN Nutzfahrzeuge Vertrieb GmbH
Maschinenfabrik Berthold Hermle AG
Robert Bosch GmbH
Romheld Automation Pty. Ltd., Australien
Schott AG
Siemens AG
StarragHeckert GmbH
Steinway & Sons Pianoforte-Fabrikanten
Swarovski AG, Österreich
ThyssenKrupp AG
Traub Drehmaschinen GmbH & Co. KG
TRUMPF GmbH + Co. KG
Waldrich Siegen Werkzeugmaschinen GmbH
ZF Friedrichshafen AG

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