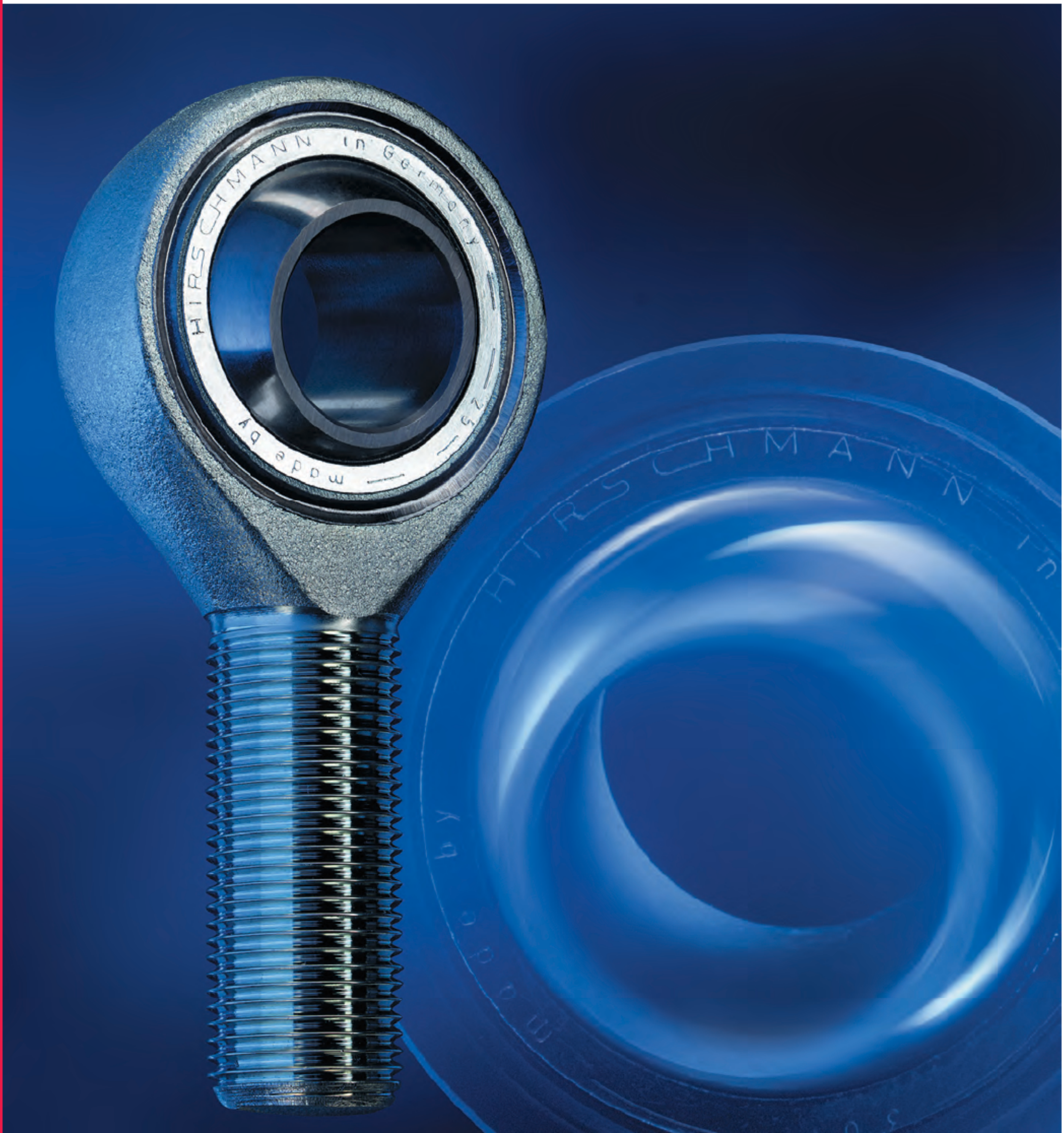
Catalogue GE 4309

HEAVY-DUTY ROD ENDS AND SPHERICAL BEARINGS



Rod ends and Spherical bearings

- A million times proved
- In sizes 2 up to 50 mm
- Acc. to DIN ISO 122404 (DIN 648K) and Cetop
- Maintenance free or Relubricatable
- Hard cromed or stainless steel, sealed
- Specials to customer requirements

Standard products

Introduction

HIRSCHMANN's rod ends and spherical bearings are bearing elements which can be used for many applications, and are of the plain bearing type. They have proved their worth in millions of instances as a design element for transmitting power between members lying at various angles, both statically and dynamically. The mounting dimensions of these bearing elements have been fixed in DIN ISO 12240-4 (648 K). This catalogue reflects the current state of development and manufacture, and the information contained in it supersedes earlier publications. We reserve the right to make modifications in the course of product development. Reprints and excerpts require our express permission.

Standard products:

For all the standard products shown in this catalogue, many variations are possible. Details are given in the text below the tables of dimensions, e.g. hard-chromed or rustproof inner ring or outer part, reduced bearing slackness etc.

Specials:

In addition to our standard products, we make specials to customer requirements or to drawing. Examples of our specials are shown on the rear cover of the catalogue.

Warranty:

All the information contained in this catalogue is the result of years of experience in the manufacture and use of rod ends and spherical bearings. Nevertheless, unknown parameters and practical conditions of use can considerably reduce the validity of these general statements, so that the user must conduct practical tests. The multitude of applications for rod ends and spherical bearings mean that we cannot accept any liability for the correctness of our recommendations in individual instances.

Quality according to EN 9100

All HIRSCHMANN GMBH rod ends and spherical bearings are produced using the latest and most reliable production methods, and are subject to quality assurance measures as per EN 9100 (air and space industry) both during production and in the product stage.

Advisory service and sales:

Our staff and the sales engineers at our agencies and dealers in Germany and abroad, all of whom have their own stocks, would be pleased to assist you at any time.

C O N T E N T S :

HIRSCHMANN GmbH

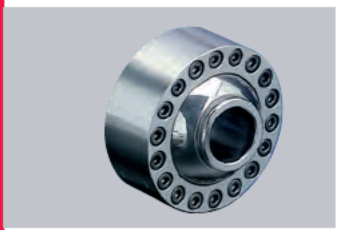
Special solutions

This is only a part of various special products which we are manufacturing according to customer requirements or customer drawings.

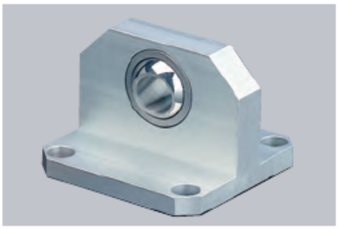
Coupling rod

Suspension for damper

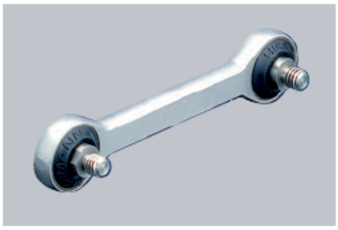
Rod End made of Titan



Special bearing for ralley sport



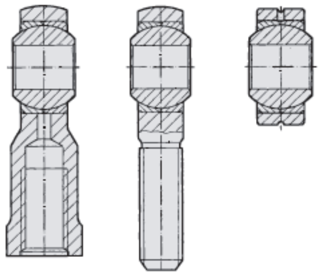
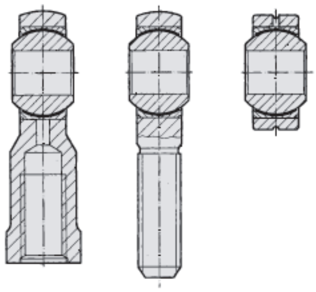
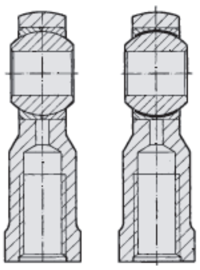
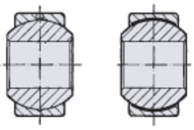
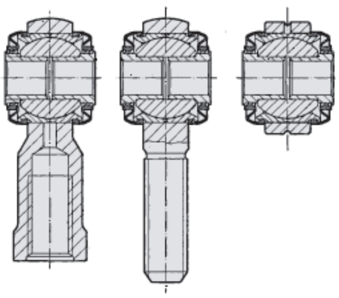
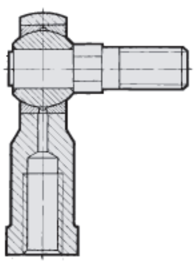
Vertical bearing for pneumatic cylinder



Sealed double Rod End

Rod End for sun sail stainless steel

Selection guidelines

Construction	Series	Design features	Application features	Page
	SFC.. SMC.. SSC..	**Relubricatable heavy-duty design, rod ends and spherical bearings** Friction pairing: Steel/heavy-duty bronze, with precision-turned bushing having extremely high lining adjustment capability.	Universal application at high alternating and shock loads in radial and axial directions. Suitable for large swings. Vmax = 60 m/min.	12–13 18
	SFCP.. SMCP.. SSCP..	**Maintenance free heavy-duty, rod ends and spherical bearings** Friction pairing: Steel/PTFE bronze fabric. The sliding film is affixed inside the bushing. This ensures long service life.	Universal application at high constant loads and low alternating and shock loads in axial and radial directions. For difficult lubrication conditions, high running speeds and large swings. V_{max} = 60 m/min.	14–15 19
	SFC..CETOP SFCP..CETOP	**CETOP-standard relubricatable or maintenance-free heavy-duty rod ends** Friction pairing: Steel/heavy-duty bronze Steel/PTFE bronze fabric	As for relubricatable or maintenance-free heavy-duty rod ends and spherical bearings.	16–17
	SC.. SCP..	**Relubricatable or maintenance-free heavy-duty spherical bearings without steel outer ring** Friction pairing: Steel/heavy-duty bronze Steel/PTFE bronze fabric	As for relubricatable or maintenance-free heavy-duty rod ends and spherical bearings.	20
	..2 RS	**Sealed rod ends, spherical bearings** Heavy-duty and maintenance-free rod ends and spherical bearings of sizes 8-30 can be supplied with replaceable sealing sleeves.	For use in severe environmental conditions (dirt, dust, splashing water, etc.)	21
	..W	**Threaded bolts for rod ends and spherical bearings** Heavy-duty and maintenance-free rod ends and spherical bearings of sizes 5–16 and 20 can be supplied ex stock with a down riveted threaded bolt.	Used as angle joints	22

Technical Notes

Bearing slackness:

Bearing slackness or bearing clearance is the dimension by which the inner ring can be moved within the bushings in a radial or axial direction when not installed and unlubricated. Rod ends and spherical bearings are manufactured with differing bearing slackness, as shown in the following charts, depending on the friction pairing and the size of the bearing. **When mounting bearings, please note that the slackness can be reduced to null if necessary, due to possible differences in tolerance (bearing diameter to housing bore hole).**

The test load is 100 N.

Bearing slackness in lubricated design
(at room temperature)

Radial slackness in µm

Size	C2		Normal		C3	
	min	max	min	max	min	max
2– 4	–	–	10	30	–	–
5– 8	5	10	10	30	30	60
10–14	10	20	20	40	40	80
16–20	15	25	30	50	50	100
22–30	20	30	40	60	60	120
35–50	40	60	60	90	90	150

Fig. 1

Bearing slackness in maintenance-free design
(at room temperature)

Radial slackness in µm

Size	C2		Normal		C3	
	min	max	min	max	min	max
2– 4	–	–	2	4	–	–
5–30	–	–	5	10	10	20
35–50	–	–	10	20	20	40

Fig. 2

The axial slackness is 2 to 3 times the radial slackness under the same test load (measured at room temperature).

Selection of bearing slackness:

Lubricated design

If there are no special reasons for a reduced bearing slackness according to C2, the “Normal” radial slacckness must be selected as it offers the best lubricating grease distribution with a high bearing contact area.

All rod ends and spherical bearings are supplied with “Normal” radial slackness unless otherwise ordered.

Maintenance-free design

These bearings are remarkable for their low bearing slackness and a high contact area ratio. Unless otherwise ordered, the maintenance-free rod ends are supplied with “Normal” radial slackness.

If the overall friction movement should be kept low when several rod ends or spherical bearings are used, bearings with a radial slackness in accordance with C3 should be used also.

Consideration of the environment:

It is recommendable to apply a stainless or sealed type when using it in a humid environment.

Accordingly to the individual customer’s requirements, the bearings are delivered in the following special designs:

stainless and acid-proof
high temperature-proof
low temperature-proof
etc.

Lubrication:

All relubricatable rod ends and bearings are supplied ungreased. We recommend lubrication with an anticorrosive Lithium-based pressure-resistant grease or a Lithium-complex metal soap (multipurpose antifriction bearing grease) for the temperature range of –20° C to +125° C. For temperatures above 125° C a high temperature grease must be used and for temperatures below –20° C a low temperature grease must be used.

Initial lubrication and relubrication, lubrication intervals

Under severe conditions and at high load, a temperature check is recommended shortly after commissioning. If a temperature rise of 25° C occurs after a running-in time of approx. 1 hour of operation, immediate lubrication is necessary. A periodical relubrication is necessary in any event.

Rod ends and spherical bearings under alternate load from both sides require shorter intervals between lubrication than rod ends and spherical bearings under load from one side only. The lubrication intervals depend on the individual circumstances and on the surrounding conditions.

The following guideline values apply for the minimum lubricating periods:

With load from one direction

$$t = \frac{G_h}{30}$$

With load from alternating directions

$$t = \frac{G_h}{130}$$

t = lubricating period in hours of operation.

G_h = duration of use in hours of operation
(see page 9).

Lubricating more often does not have any advantages, furthermore it can damage the hydrodynamic balance on the sliding surface.

If the lubricating periods are not observed, the service life can decrease.

The rod ends with female thread are equipped from size 5 upwards with funnel-type lubricating nipples to DIN 3405, those with thread from size 6 upwards. We can supply other lubricating nipples on request.

During the running-in time of the maintenance-free types only a small part of the PTFE is transferred from the sliding foil to the inner ring. Hereby a smoothing effect arises. This reduces the friction and leads to the longer durability. A greasy or oily film prevents this smoothing effect. Thus, we recommend using these elements without lubrication.

Operating temperature:

All designs can be used without restriction in a temperature range from –30° C to +120° C. Increasing the operating temperature reduces the bearing power and, thus, the service life.

Operation at high temperature of relubricatable rod ends and spherical bearings depends to a very great extent on whether the high-temperature lubricating grease used offers sufficient lubricity at high operating temperatures. These designs could be used in the short term under low load and with suitable lubrication at temperatures up to +250° C.

The maintenance-free bearings can be used in a temperature range from –50° C to +150° C (mind the decrease or the increase of bearing slackness).

Sealed rod ends and spherical bearings can be used at temperatures from –20° C to +120° C (sealing sleeves of Perbunan). For higher temperatures up to +250° C sealing sleeves can be specially made from fluorelastomer rubber (Viton®).

Moment of friction M:

The moment of friction for rod ends and spherical bearings can be calculated using the following equation:

$$M = 5 \cdot 10^{-4} \cdot \mu \cdot P \cdot K$$

M	= moment of friction	[Nm]
μ	= friction coefficient of sliding surface	
P	= dynamically equivalent bearing load	[N]
K	= inner ring diameter	[mm]

Guideline values for the friction coefficient μ

Bearing type	Friction coefficient μ min	max
lubricated	0,08	0,15
maintenance-free	0,03	0,10

Fig. 3

The low friction coefficients apply for high loads (p = 80–100 N/mm²) at low running speeds (v = 5–10 m/min). The high friction coefficients are for low loads (p = 5–10 N/mm²) at high running speeds (v = 30–60 m/min).

p = specific surface pressure	[N/mm²]
v = running speed in the lining	[m/min]

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Bearing capacities:

The dynamic bearing capacity C:

The dynamic bearing capacity C is a characteristic value for the calculation of the service life of rod ends and spherical bearings under dynamic load, i.e. having to perform tilting, swinging or pivoting movements under load.

The dynamic bearing capacity C is based on the values given in the table for the specific surface pressure k_c:

Type of bearing	Specific surface pressure k_c [N/mm²]
lubricated	50
maintenance-free	150

Fig. 4

The static bearing capacity C_0:

The static bearing capacity C_0 represents the maximum permissible load at which no permanent deformation of the lining or the outer part occurs. In the case of the spherical bearing, the surrounding components must be so designed that they prevent any deformation of the bearing.

In the case of rod ends, C_0 corresponds to the permissible load based on the weakest cross-section which results form the yield point of the outer material, **with a safety factor of 1,2.**

The ultimate load is at least 1.5 the permissible C_0 load.

The axial load-bearing capacity:

The axial load-bearing capacity of the rod ends and the spherical bearings is limited by the axial fixing of the bushing (flanged) in the outer part.

In the case of spherical bearings without steel outer ring (types SC.. and SCP..), it must be ensured that the axial bushing support can absorb the forces given in the table (Fig. 5) both statically and dynamically.

The maximum permissible axial load is calculated on the basis of the values given in the table.

Heavy-duty and maintenance-free series	Permissible axial load dynamic $F_{a\ perm.}$ [N]	static $F_{a\ perm.}$ [N]
SFC/SMC/SSC.. SFRC/SMRC/SSRC..	$0{,}06 \cdot C_0$	$0{,}3 \cdot C_0$
SFXC/SMXC/SC..	$0{,}04 \cdot C_0$	$0{,}2 \cdot C_0$

Fig. 5

Checking bearing size:

To check a bearing size with regard to its static and dynamic load-bearing capacity, the bearing must be investigated to the following criteria:

Constant dynamic load
Variable dynamic load
Static load

The equivalent bearing loads are calculated from F_r and F_a.

Dynamic load:

The inner ring carries out a swinging or pivoting movement in relation to the bushing.

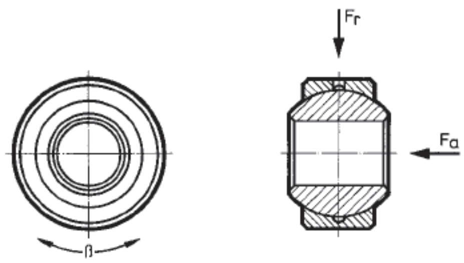


Fig. 6

Constant dynamic load:

The dynamically equivalent bearing load P for rod ends and spherical bearings with constant dynamic loads is calculated as follows:

$$P = F_r + Y \cdot F_a$$

It is necessary that: $F_a \leqq F_{a,\,perm.}$
$F_{a,\,perm.}$ as per table (Fig. 5)

The axial factor Y is taken from the following table (Fig. 7). Intermediate values can be interpolated linearly.

Load-relation	$\frac{F_a}{F_r}$	0,1	0,2	0,3	0,4	0,5	> 0,5
Axial-factor	Y	0,8	1	1,5	2,5	3	not suitable

Fig. 7

Using the calculated value for P, the load ratio $f_c = \frac{C}{P}$ is formed and compared with the values in the table (Fig. 8). The bearing is overloaded if a value below the limit value is obtained.

P is also required for calculation of the service life.

Type of bearing	$f_c = \frac{C}{P}$ (lower limit)
lubricated	0,5
maintenance-free	1,0

Fig. 8

Variable dynamic load:

For rod ends and spherical bearings with variable radial dynamic load, the mean dymanic bearing load F_m from the individual load steps $F_1, F_2 \ldots F_n$ and the corresponding time components $q_1, q_2 \ldots q_n$, for instance for three load steps, are calculated as follows: (Fig. 9)

$$F_m = \sqrt{\frac{F_1^2 \cdot q_1 + F_2^2 \cdot q_2 + F_3^2 \cdot q_3}{Q}}$$

The dynamic bearing load is:

$$P = F_m$$

If there is also a constant axial load acting, P is calculated as follows:

$$P = F_m + Y \cdot F_a$$

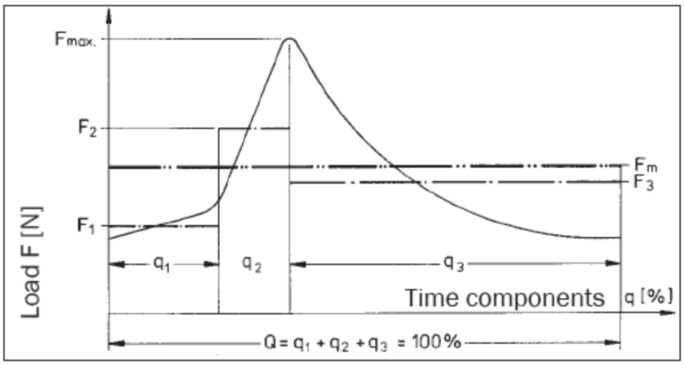


Fig. 9

In addition F_{max} must be checked for static safety.

$$F_{max} \leqq P_{perm.}$$

For $P_{perm.}$ see “Permission load”.

Static load:

The inner ring is stationary in relation to the bushing.

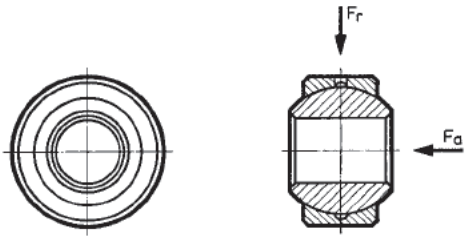


Fig. 10

For rod ends and spherical bearings with static load, the statically equivalent bearing load P_0 is calculated as follows:

$$P_0 = F_r + Y \cdot F_a$$

It is necessary that:

$$F_a \leqq F_{a\,perm.}$$

$F_{a,\,perm.}$ as per table (Fig. 5)
The axial factor Y is taken from the table (Fig. 7).
P_0 must be $\leqq P_{perm.}$. See “Permissible load” for $P_{perm.}$

Permissible load $P_{perm.}$:

Rod ends: $P_{perm.} = C_0 \cdot b_2 \cdot b_4$

Spherical bearings: $P_{perm.} = C_0 \cdot b_2$

$P_{perm.}$ = permissible load [N]
C_0 = static bearing capacity [N]
b_2 = temperature factor from table (Fig. 12)
b_4 = load factor from table (Fig. 11)

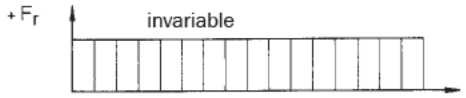
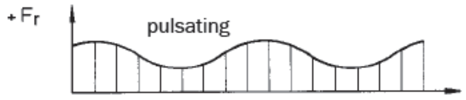
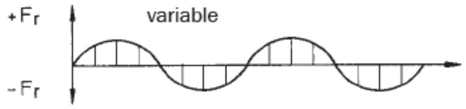
Type of load	b_4
invariable 	1
pulsating 	0,5 (0,35)
variable 	0,5 (0,35)

Fig. 11

The values written in brackets are valid for rod ends with male threads and lubricating nipples or lubrication holes.

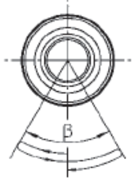
It is necessary that: $P \leqq P_{perm.}$ $\qquad P_o \leqq P_{perm.}$

Service life:

The service life of a rod end or spherical bearing is a function of several factors, some of which are difficult to determine. A precise calculation is therefore not possible. The calculation method following, which has been proved correct in many test stand trials, gives a relatively accurate result for the service life. Influences as shocks, vibrations, soiling etc. are not taken into consideration. This calculation is based on a total abrasion of the linings of 0.3% of the diameter of the inner ring. The coefficient of the sliding friction of the linings increases of about 0.25.

$$G_h = \frac{b_1 \cdot b_2 \cdot b_3}{K \cdot \beta \cdot f} 10^7 \cdot \frac{C}{P}$$

G_h = service life [h]
C = dynamic bearing capacity [N]
P = dynamic equivalent bearing load [N]
K = inner ring diameter [mm]
β = swing angle $\geqq 1$ [degrees]
(by pivoting movements $\beta = 180°$)



f = swing frequency [rpm]
b_1 = load direction factor (Fig. 12)
b_2 = temperature factor (Fig. 12)
b_3 = material factor (Fig. 13)

Operating-factors	Load direction factor b_1		Temperature factor b_2				
	Load direction		Temperature [°C]				
Bearing type	single direction	alternat. direction	80	100	150	200	250
lubricated	1	2,5	1	1	1	0,8	0,5
maintenance-free	1	0,3	1	1	0,8	0,5	0,3

Fig. 12

Very low loads or running speeds result in a relatively high arithmetic service life. In practice, with a longer service life, environmental influences can acquire importance and lead to an error in the results.

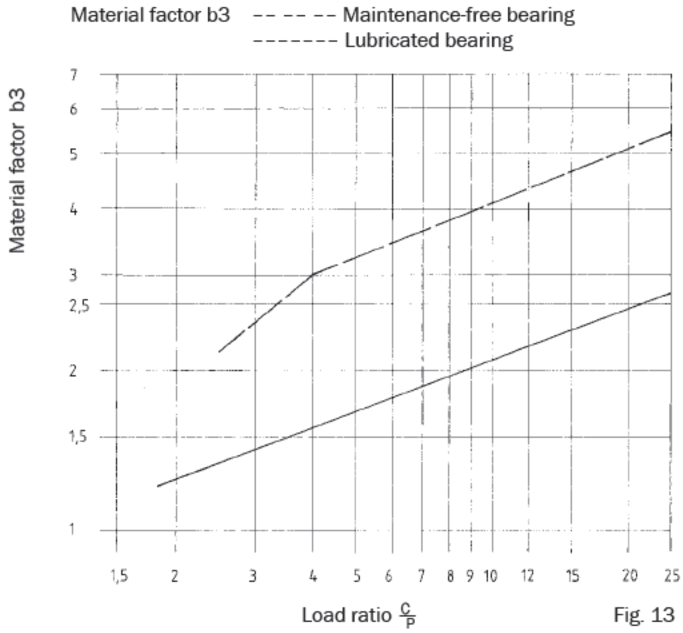


Fig. 13

If the required service life is not obtained, repeat this calculation with next bearing size up.

Checking of linings for overheating:
Permissible running speed:

The permissible running speed is largely a function of the surface exerted, the friction pairing, the lubrication and cooling if applicable. The heat building up in the bearing is proportional to the product of surface pressure and running speed. When checking the bearing size, therefore the p · v value must be determined and compared with the permissible value (Fig. 14). The bearing running speed must also be checked.

To avoid overheating, the following is necessary:

$$p \cdot v \leqq (p \cdot v)_{perm.} \qquad \left[\frac{N}{mm^2} \cdot \frac{m}{min}\right]$$

$$v \leqq v_{perm.} \qquad [m/min]$$

p = surface pressure = $k_c \cdot \frac{P}{C}$ [N/mm²]
k_c = specific surface pressure (Fig. 4) [N/mm²]
v = mean running speed = $1{,}745 \cdot 10^{-5} \cdot K \cdot \beta \cdot f$ [m/min]

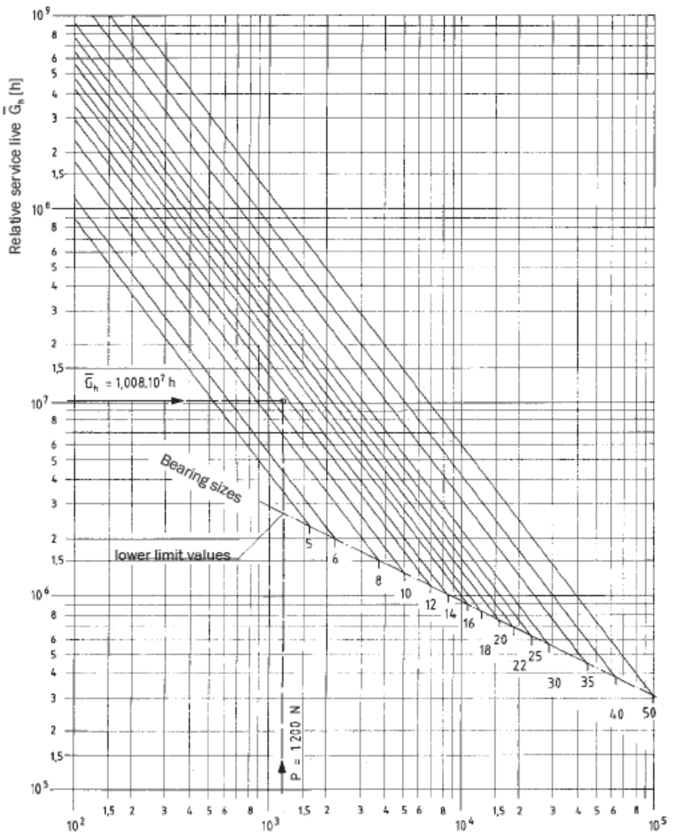
Guideline values for the permissible p · v -value

Bearing type	$(p \cdot v)_{perm.}$ $\frac{N}{mm^2} \cdot \frac{m}{min}$	perm. running speed $v_{perm.}$ [m/min]	
		swing	pivot
lubricated	30	15	60
maintenance-free	80	60	

Fig. 14

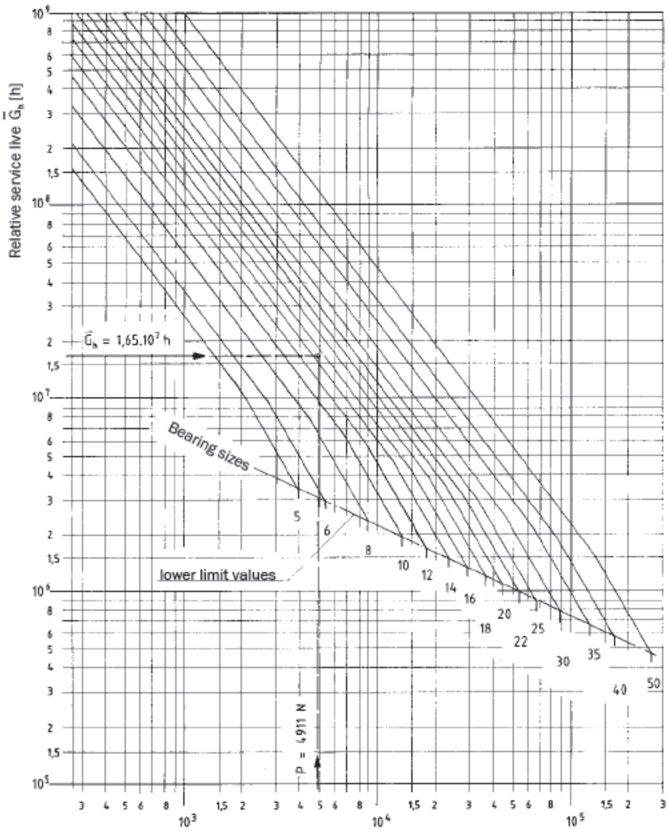
Determining of the bearing size

Lubricated design



Dynamically equivalent bearing load P [N]
Fig. 15

Maintenance-free design



Dynamically equivalent bearing load P [N]
Fig. 16

The insertion of the relative service life G_h as auxiliary quantity enables a correlation between the relative service life and the dynamically equivalent bearing load to be represented graphically.

$$\bar{G}_h = G_h \cdot \frac{\beta \cdot f}{b_1 \cdot b_2}$$ applies for the relative service life:

$\bar{G}_h$	= relative service life	[h]
G_h	= required service life	[h]
β	= swing angle	[degrees]
f	= swing frequency	[min^{-1}]
b_1	= load direction factor (Fig. 12)	
b_2	= temperature factor (Fig. 12)	

Example:

A rod end with male thread is required for the following operating conditions:

Alternating dynamic load F_r	1200 N
Swing angle β	30°
Swing frequency f	120 rpm
Operating temperature	50° C
Required service life G_h	7000 h

Since the load is alternating, a lubricated design is recommended, as set forth in the “Selection” section (page 5). Thus, Fig. 12 gives b_1 = 2.5 and b_2 = 1.

Dynamically equivalent bearing load:

P = F_r = 1200 N

Relative service life:

$$\bar{G}_h = G_h \cdot \frac{b \cdot f}{b_1 \cdot b_2} = 7000 \cdot \frac{30 \cdot 120}{2,5 \cdot 1} = 10,08 \cdot 10^6 \text{ h}$$

The intersection in Fig. 15 with P = 1200 N and $\bar{G}_h$ = 10,08 · 10⁶ h results in the bearing size 12. Thus, SMC 12 is chosen.

Checking the rod end SMC 12 with regard to the permissible load Pperm. and the service life $\bar{G}_h$, and checking the lining for overheating and determination of the lubricating intervals is conducted as shown in Example 1, page 11.

The example given in Fig. 16 is the result of the 2nd calculation example on page 11.

Calculation examples

Example 1:

The conveying lever on a packaging machine is to be moved via a rod end. The designs calls for a size 12 rod end.

Values dictated by design:

Alternating constant dynamic radial load F_r	1200 N
Swing angle β	30°
Swing frequency f	120 rpm
Operating temperature	50° C

Since the load is alternating and constant, a lubricated design is recommended according to the section “Selection” (page 5), e.g. SMC 12.

Catalogue values:

Dynamic bearing capacity C	13400 N
Static bearing capacity C_0	17000 N
Inner ring Ø K	22.225 mm

Requirements on rod end SMC 12:

1. Radial load F_r must be smaller than the permissible load $P_{perm.}$ to avoid permanent deformation.
2. The service life $G_{h,\,req.}$ should be at least 6000 operating hours.

Calculation:

Dynamically equivalent bearing load P:

$$P = F_r + Y \cdot F_a \quad \left|\ \frac{F_a}{F_r} = \frac{0}{1200} = 0 \ \right| Y = 0$$

$$P = F_r = 1200\ \text{N}$$

Permissible rod end load $P_{perm.}$:

$$P_{perm.} = C_o \cdot b_2 \cdot b_4 \quad \left|\ \begin{array}{l} b_2 = 1 \text{ (acc. to Fig. 12)} \\ b_4 = 0{,}35 \text{ (acc. to Fig. 11)} \end{array}\right.$$

$$P_{perm.} = 17\,000 \cdot 1 \cdot 0{,}35 = 5950\ \text{N}$$

$P = 1200\ \text{N} < P_{perm.} = 5950\ \text{N}$ **(1st requirement met)**

Determination of service life G_h:

$$G_h = \frac{b_1 \cdot b_2 \cdot b_3}{K \cdot \beta \cdot f} 10^7 \cdot \frac{C}{P} \quad [h]$$

$b_1 = 2{,}5$ (Fig. 12)
$b_2 = 1$ (Fig. 12)
$b_3 = 2{,}1$ (Fig. 13) $\quad \left|\ \frac{C}{P} = \frac{13400}{1200} = 11{,}1\right.$

$G_h = 7200\ \text{h} > G_{h,\,req.} = 7000\ \text{h}$ **(2nd requirement met)**

Checking of lining for overheating:

$$p = k_c \cdot \frac{P}{C} \quad [\text{N/mm}^2]$$

$k_c = 50\ \text{N/mm}^2$ (acc. to Fig. 4)

$$\frac{P}{C} = \frac{1200}{13400} = \frac{1}{11{,}1} = 0{,}089$$

$p = 50 \cdot 0{,}089\ \text{N/mm}^2 = 4{,}45\ \text{N/mm}^2$
$v = 1{,}745 \cdot 10^{-5} \cdot K \cdot \beta \cdot f = 1{,}745 \cdot 10^{-5} \cdot 22{,}225 \cdot 30 \cdot 120\ \text{m/min}$
$v = 1{,}4\ \text{m/min} < v_{perm.} = 15\ \text{m/min}$ (acc. to Fig. 14)
$p \cdot v = 4{,}45 \cdot 1{,}4 = 6{,}23 < (p \cdot v)_{perm.} = 30$ (Fig. 14)

No overheat

Lubrication interval:

$$t = \frac{G_h}{130} = \frac{7200}{130} = 55\ \text{h}$$

Example 2:

A lever of a filling machine is moved via a double-action pneumatic cylinder. A maintenance-free rod end with mounting dimensions to CETOP is required.

Values dictated by design:

Variable, pulsating, radial, dynamic load

$F_1 = 2000$ N, $F_2 = 6000$ N, $F_3 = 3000$ N. $F_{max} = 8000$ N

$q_1 = 20\%$, $q_2 = 15\%$, $q_3 = 65\%$

Constant axial load F_a	1000 N
Swing angle β	25°
Swing frequency f	60 rpm
Operating temperature	max. 80° C

Requirements on rod end:

1. The dynamically equivalent bearing load P and the statically equivalent bearing load P_0 must be lower than the permissible load $P_{perm.}$
2. The service life $G_{h,\,req.}$ must be at least 11000 operating hours.

Calculation:

Mean dynamic bearing load F_m:

$$F_m = \sqrt{\frac{F_1^2 \cdot q_1 + F_2^2 \cdot q_2 + F_3^2 \cdot q_3}{Q}}$$

$$F_m = \sqrt{\frac{2000^2 \cdot 20 + 6000^2 \cdot 15 + 3000^2 \cdot 65}{100}} = 3471\ \text{N}$$

Dynamically equivalent bearing load P:

$$P = F_m + Y \cdot F_a \quad \left|\ \begin{array}{l} \frac{F_a}{F_m} = \frac{1000}{3471} = 0{,}28 \\ Y = 1{,}44 \text{ (interpolated acc. to Fig. 7)} \end{array}\right.$$

$$P = 3471 + 1{,}44 \cdot 1000 = 4911\ \text{N}$$

Determination of relative service life $\bar{G}_h$:

$$\bar{G}_h = G_h = \frac{\beta \cdot f}{b_1 \cdot b_2} \quad \left|\ \begin{array}{l} \beta = 25 \\ f = 60 \end{array}\right. \quad \left|\ \begin{array}{l} b_1 = 1 \text{ (Fig. 12)} \\ b_2 = 1 \text{ (Fig. 12)} \end{array}\right.$$

$$\bar{G}_h = 11000 \cdot \frac{25 \cdot 60}{1 \cdot 1} = 16{,}5 \cdot 10^6\ \text{h}$$

On the basis of the chart (Fig. 16) the rod end size calculated is 16
SFCP 16 CETOP is selected (page 17).

Dynamic bearing capacity C	60000 N
Static bearing capacity C_0	28500 N
Inner ring Ø K	28,575 mm
Limit value $f_c = \frac{C}{P} = \frac{60\,000}{4911} = 12{,}2$	(correct acc. to Fig. 8)

Permissible road end load $P_{perm.}$:

$$P_{perm.} = C_0 \cdot b_2 \cdot b_4 \quad |\ b_2 = 1 \text{ (Fig. 12)} \quad |\ b_4 = 0{,}5 \text{ (Fig. 11)}$$

$$P_{perm.} = 28\,500 \cdot 1 \cdot 0{,}5 = 14\,250\ \text{N}$$

$$\left.\begin{array}{l} P_o = F_{max} = 8000\ \text{N} < P_{perm.} \\ P = 4911\ \text{N} < P_{perm.} \end{array}\right\}$$ **1st requirement met**

Determination of service line G_h:

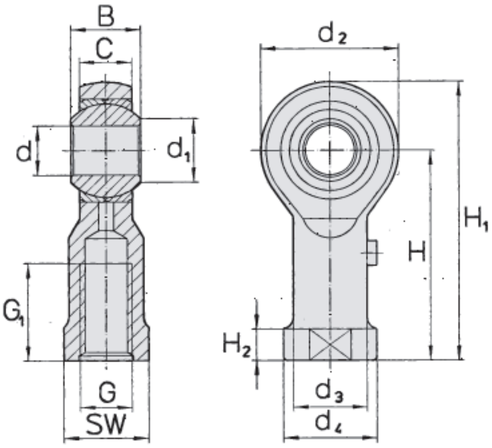
$$G_h = \frac{b_1 \cdot b_2 \cdot b_3}{K \cdot \beta \cdot f} 10^7 \cdot \frac{C}{P} \quad \left|\ b_3 = 4{,}2, \text{ für } \frac{C}{P} = 12{,}2 \text{ (Fig. 13)}\right.$$

$$G_h = \frac{1 \cdot 1 \cdot 4}{28{,}575 \cdot 25 \cdot 60} 10^7 \cdot 12{,}2 = 11900\ \text{h}$$

$G_{h,\,req.} = 11000\ \text{h} < G_h = 11900\ \text{h}$ **(2nd requirement met)**

Relubricatable heavy-duty rod ends with female thread

Friction pairing steel on heavy-duty bronze

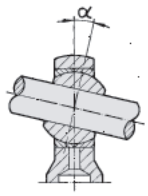


Series **SFC..**

SFXC..

SFRC.. (rustproof)

Angle of misalignment



Series	d	B	C	d_1	d_2	d_3	d_4	H	H_1	H_2	G_1	K Ball dia Ø	G Thread	SW	Bearing capacities dynamic C	static C_0* SFC/SFRC	SFXC	Angle of misalign.	Weight each
SFC..															N	N	N	α °	≈ g
2	2	4,8	3,6	3,6	9	3,8	4,5	16	20,5	2,5	7	6,000	M2	4	900	1900	--	16	3
3	3	6	4,5	5,1	12	5	6,5	21	27	3	10	7,937	M3	5,5	1 500	3600/2200	--	15	7
4	4	7	5,25	6,5	14	6	8,5	24	31	3,5	12	9,520	M4	7	2 260	4500/2700	--	14	11
5	5	8	6	7,7	18	9	11	27	36	4	10	11,112	M5	9	3 250	6 000	15 000	13	18
6	6	9	6,75	8,9	20	10	13	30	40	5	12	12,700	M6	11	4 300	7 000	16 500	13	27
8	8	12	9	10,4	24	12,5	16	36	48	5	16	15,875	M8	14	7 200	12 000	26 000	13	46
10	10	14	10,5	12,9	28	15	19	43	57	6,5	20	19,050	M10	17	10 000	14 500	35 500	13	78
12	12	16	12	15,4	32	17,5	22	50	66	6,5	22	22,225	M12	19	13 400	17 000	43 000	13	115
14	14	19	13,5	16,8	36	20	25	57	75	8	25	25,400	M14	22	17 000	24 000	51 500	15	170
16	16	21	15	19,3	42	22	27	64	85	8	28	28,575	M16	22	21 600	28 500	76 500	15	230
18	18	23	16,5	21,8	46	25	31	71	94	10	32	31,750	M18x1,5	27	26 000	40 000	92 500	15	320
20	20	25	18	24,3	50	27,5	34	77	102	10	33	34,925	M20x1,5	32	31 500	45 000	104 500	15	420
22	22	28	20	25,8	54	30	37	84	111	12	37	38,100	M22x1,5	32	38 000	52 000	125 500	15	540
25	25	31	22	29,6	60	33,5	42	94	124	12	42	42,850	M24x2	36	47 500	60 000	148 000	15	750
30	30	37	25	34,8	70	40	50	110	145	15	51	50,800	M30x2	41	64 000	81 000	193 000	15	1130
35	35	43	30	40,3	80	49	60	125	165	20	56	59,000	M36x2	50	90 000	95 000	210 000	16	1600
40	40	49	35	44,2	90	57	69	142	187	25	60	66,000	M42x2	60	120 000	130 000	293 000	15	2400
50	50	60	45	55,8	116	65	78	160	218	25	65	82,000	M48x2	65	190 000	235 000	554 000	14	5000
Tolerance	H7	0	0,2	--	--	--	--	--	--	--	1,0	--	DIN 13	0	--	--	--	--	--
±		0,12	0,2								0		6 H	0,3					

The sizes 2, 3 and 4 are not included in DIN ISO 12240-4.

***Safety factor C_0 see page 7**

Material

Series SFC..

Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501, galvanized and chromalized to DIN 50961.

Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59, 2.0550.31.

Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SFXC.. (available from size 5)

Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.

Bushings: As for SFC..

Inner ring: As for SFC..

Series SFRC.. (available from size 3)

Outer part: Stainless steel 1.4305, from size 16, forged.

Bushings: As for SFC..

Inner ring: As for SFC.. but hard-chromed; if required stainless steel.

Design

Bearing slackness: Depending on size, between 0.01 and 0.09 mm radially. With reduced or increased slackness see page 6. Designation example SFC 10 **C 2.**

Thread: DIN 13 – 6 H, r.h. or l.h. L.h. thread designation example SF**L** C 10. Special threads on request, see pages 16 and 17 for CETOP standard.

Lubricating nipple: Size 5–50 funnel-type DIN 3405, form D.

Stainless inner ring: From size 5 with stainless inner ring of material 1.4034 possible.

Designation example SFRC 10 **IR**.

Hard-chromed inner ring: From size 5 with hard-chromed inner ring (on bearing surface only).

Designation example SFC 10 **IH**.

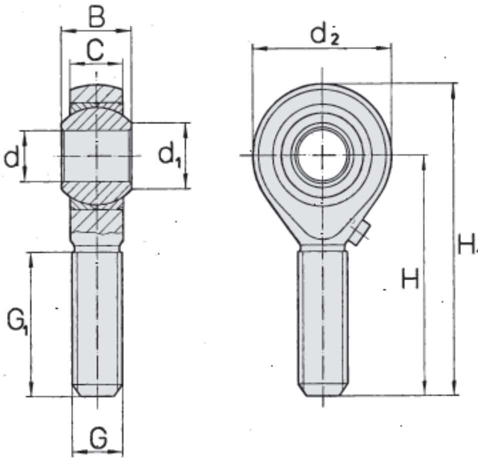
Hard-chromed outer part and inner ring:

Designation example SFC 10 **H**.

Sealed design: Sizes 8–30 can be supplied with replace-able sealing sleeves (see page 21).

Relubricatable heavy-duty rod ends with male thread

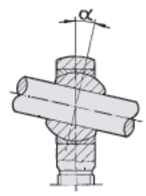
Friction pairing steel on heavy-duty bronze



Series **SMC..**

SMXC..
SMRC.. (rustproof)

Angle of misalignment



Series SMC..	d	B	C	d_1	d_2	H	H_1	G_1	K Ball dia Ø	G Thread	Bearing capacities dynamic C N	static C_0* SMC/SMRC N	static C_0* SMXC N	Angle of misalign. α°	Weight each ≈ g
2	2	4,8	3,6	3,6	9	18	22,5	9	6,000	M2	900	400	--	16	2
3	3	6	4,5	5,1	12	27	33	15	7,937	M3	1 500	1200/700	--	15	5
4	4	7	5,25	6,5	14	30	37	18	9,520	M4	2 260	2000/1200	--	14	9
5	5	8	6	7,7	18	33	42	20	11,112	M5	3 250	3 000	7 500	13	14
6	6	9	6,75	8,9	20	36	46	22	12,700	M6	4 300	4 000	10 500	13	21
8	8	12	9	10,4	24	42	54	25	15,875	M8	7 200	8 000	19 500	13	34
10	10	14	10,5	12,9	28	48	62	29	19,050	M10	10 000	13 000	30 500	13	58
12	12	16	12	15,4	32	54	70	33	22,225	M12	13 400	17 000	43 000	13	92
14	14	19	13,5	16,8	36	60	78	36	25,400	M14	17 000	24 000	51 500	15	135
16	16	21	15	19,3	42	66	87	40	28,575	M16	21 600	28 500	76 500	15	205
18	18	23	16,5	21,8	46	72	95	44	31,750	M18x1,5	26 000	38 000	92 500	15	285
20	20	25	18	24,3	50	78	103	47	34,925	M20x1,5	31 500	42 000	104 500	15	370
22	22	28	20	25,8	54	84	111	51	38,100	M22x1,5	38 000	52 000	125 500	15	475
25	25	31	22	29,6	60	94	124	57	42,850	M24x2	47 500	60 000	148 000	15	650
30	30	37	25	34,8	70	110	145	66	50,800	M30x2	64 000	81 000	193 000	15	1070
35	35	43	30	40,3	80	140	180	85	59,000	M36x2	90 000	95 000	210 000	16	1600
40	40	49	35	44,2	90	150	195	90	66,000	M42x2	120 000	130 000	293 000	15	2300
50	50	60	45	55,8	116	185	243	105	82,000	M48x2	190 000	235 000	554 000	14	4800
Tolerance ±	H7	0 0,12	0,2 0,2	--	--	--	--	1,0 0	--	DIN 13 6 g	--	-- --	--	--	

The sizes 3 und 4 are not included in DIN ISO 12240-4.

***Safety factor C_0 see page 7**

Material

Series SMC..
Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501 galvanized and chromalized to DIN 50961.
Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59, 2.0550.31.
Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SMXC.. (available from size 5)
Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.
Bushings: As for SMC..
Inner ring: As for SMC..

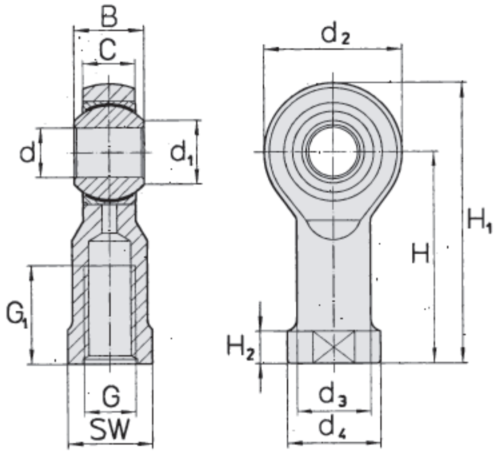
Series SMRC.. (available form size 3)
Outer part: Stainless steel 1.4305, from size 16 forged.
Bushings: as for SMC..
Inner ring: as for SMC.. but hard-chromed, if required stainless steel.

Design

Bearing slackness: Depending on size between 0.01 and 0.09 mm radially. With reduced or increased slackness see page 6. Designation example SMC 10 **C 2**.
Thread: DIN 13 – 6 g, r.h. or l.h. L.h. thread designation example SML C 10. Special threads on request.
Lubricating nipple: Size 6–50 funnel-type DIN 3405, form D.
Stainless inner ring: From size 5 stainless steel inner ring of material 1.4034 possible.
Designation example SMRC 10 **IR**.
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring (on bearing surface only).
Designation example SMC 10 **IH**.
Hard-chromed outer part and inner ring:
Designation example SMC 10 **H**.
Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

Maintenance-free heavy-duty rod ends with female thread

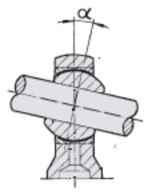
Friction pairing steel on PTFE bronze fabric



Series **SFCP..**

SFXCP..
SFRCP.. (rustproof)

Angle of misalignment



Series	d	B	C	d_1	d_2	d_3	d_4	H	H_1	H_2	G_1	K	G	SW	Bearing capacities			Angle of	Weight
															dynamic C	static C_0*		misalign.	each
												Ball	Thread			SFCP/SFRCP	SFXCP		
SFCP..												dia Ø			N	N	N	α °	≈ g
3	3	6	4,5	5,1	12	5	6,5	21	27	3	10	7,937	M3	5,5	4 700	2700/1600	--	15	7
4	4	7	5,25	6,5	14	6,5	8,5	24	31	3,5	10	9,520	M4	7	6 700	3500/2000	--	14	11
5	5	8	6	7,7	18	9	11	27	36	4	10	11,112	M5	9	7 800	6 000	15 000	13	17
6	6	9	6,75	8,9	20	10	13	30	40	5	12	12,700	M6	11	10 900	7 000	16 500	13	25
8	8	12	9	10,4	24	12,5	16	36	48	5	16	15,875	M8	14	18 000	12 000	26 000	13	43
10	10	14	10,5	12,9	28	15	19	43	57	6,5	20	19,050	M10	17	27 000	14 500	35 500	13	75
12	12	16	12	15,4	32	17,5	22	50	66	6,5	22	22,225	M12	19	36 000	17 000	43 000	13	110
14	14	19	13,5	16,8	36	20	25	57	75	8	25	25,400	M14	22	48 000	24 000	51 500	15	160
16	16	21	15	19,3	42	22	27	64	85	8	28	28,575	M16	22	60 000	28 500	76 500	15	210
18	18	23	16,5	21,8	46	25	31	71	94	10	32	31,750	M18x1,5	27	74 000	40 000	92 500	15	305
20	20	25	18	24,3	50	27,5	34	77	102	10	33	34,925	M20x1,5	32	90 000	45 000	104 500	15	400
22	22	28	20	25,8	54	30	37	84	111	12	37	38,100	M22x1,5	32	110 000	52 000	125 500	15	515
25	25	31	22	29,6	60	33,5	42	94	124	12	42	42,850	M24x2	36	136 000	60 000	148 000	15	710
30	30	37	25	34,8	70	40	50	110	145	15	51	50,800	M30x2	41	186 000	81 000	193 000	15	1130
35	35	43	30	40,3	80	49	60	125	165	20	56	59,000	M36x2	50	264 000	95 000	210 000	16	1600
40	40	49	35	44,2	90	57	69	142	187	25	60	66,000	M42x2	60	348 000	130 000	293 000	15	2400
50	50	60	45	55,8	116	65	78	160	218	25	65	82,000	M48x2	65	550 000	235 000	554 000	14	5000
Tolerance ±	H7	0 0,12	0,2 0,2	--	--	--	--	--	--	--	1,0 0	--	DIN 13 6 H	0 0,3	--	--	--	--	--

The sizes 3 and 4 are not included in DIN ISO 12240-4.

***Safety factor C_0 see page 7**

Material

Series SFCP..
Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501, galvanized and chromalized to DIN 50961.
Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59, galvanized, lined with permanently affixed sliding foil, consisting of PTFE with a bronze supporting fabric.
Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SFXCP.. (available from size 5)
Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.
Bushings: As for SFCP..
Inner ring: As for SFCP..

Series SFRCP.. (available from size 3)
Outer part: Stainless steel 1.4305, from size 16 forged.
Bushings: As for SFCP.., if required stainless steel.
Inner ring: As for SFCP.. but hard-chromed; if required stainless steel

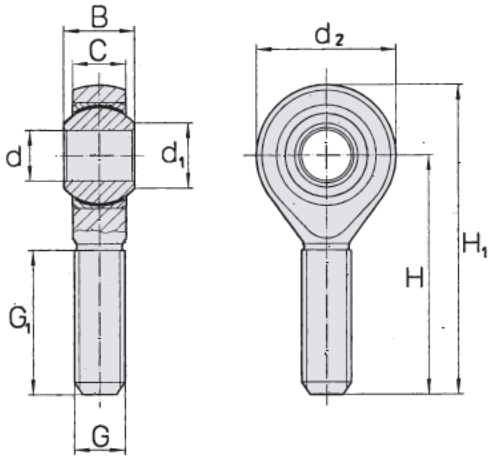
Design

Bearing slackness: Depending on size, between 0.002 and 0.020 mm radially. See page 6 for precise details.
Designation example SFCP 10 **C 2**.

Thread: DIN 13 – 6 H, r.h. or l.h. L.h. thread designation example SF**L** CP 10. Special thread on request, see pages 16 and 17 for CETOP standard.
Stainless inner ring: From size 5 with stainless inner ring of material 1.4034 possible.
Designation example SFRCP 10 **IR**.
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring (on bearing surface only). Designation example SFCP 10 **IH**.
Hard-chromed outer part and inner ring:
Designation example SFCP 10 **H**.
Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

Maintenance-free heavy-duty rod ends with male thread

Friction pairing steel on PTFE bronze fabric

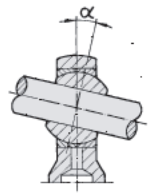


Series **SMCP..**

SMXCP..

SMRCP.. (rustproof)

Angle of misalignment



Series SMCP..	d	B	C	d_1	d_2	H	H_1	G_1	K Ball dia Ø	G Thread	Bearing capacities dynamic C N	static C_0* SMCP/SMRCP N	SMXCP N	Angle of misalign. α°	Weight each ≈ g
3	3	6	4,5	5,1	12	27	33	15	7,937	M3	4 700	900/500	--	15	5
4	4	7	5,25	6,5	14	30	37	18	9,520	M4	6 700	1500/900	--	14	9
5	5	8	6	7,7	18	33	42	20	11,112	M5	7 800	3 000	7 500	13	13
6	6	9	6,75	8,9	20	36	46	22	12,700	M6	10 900	4 000	10 500	13	18
8	8	12	9	10,4	24	42	54	25	15,875	M8	18 000	8 000	19 500	13	30
10	10	14	10,5	12,9	28	48	62	29	19,050	M10	27 000	13 000	30 500	13	55
12	12	16	12	15,4	32	54	70	33	22,225	M12	36 000	17 000	43 000	13	85
14	14	19	13,5	16,8	36	60	78	36	25,400	M14	48 000	24 000	51 500	15	125
16	16	21	15	19,3	42	66	87	40	28,575	M16	60 000	28 500	76 500	15	190
18	18	23	16,5	21,8	46	72	95	44	31,750	M18x1,5	74 000	40 000	92 500	15	265
20	20	25	18	24,3	50	78	103	47	34,925	M20x1,5	90 000	45 000	104 500	15	350
22	22	28	20	25,8	54	84	111	51	38,100	M22x1,5	110 000	52 000	125 500	15	450
25	25	31	22	29,6	60	94	124	57	42,850	M24x2	136 000	60 000	148 000	15	610
30	30	37	25	34,8	70	110	145	66	50,800	M30x2	186 000	81 000	193 000	15	1090
35	35	43	30	40,3	80	140	180	85	59,000	M36x2	264 000	95 000	210 000	16	1600
40	40	49	35	44,2	90	150	195	90	66,000	M42x2	348 000	130 000	293 000	15	2300
50	50	60	45	55,8	116	185	243	105	82,000	M48x2	550 000	235 000	554 000	14	4800
Tolerance ±	H7	0 0,12	0,2 0,2	--	--	--	--	1,0 0	--	DIN 13 6g	--	--	--	--	--

The sizes 3 and 4 are not included in DIN ISO 12240-4.

***Safety factor C_0 see page 7**

Material

Series SMCP..
Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501, galvanized and chromalized to DIN 50961.
Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59 galvanized, lined with permanently affixed sliding foil, consisting of PTFE with a bronze supporting fabric.
Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SMXCP.. (available from size 5)
Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.
Bushings: As for SMCP..
Inner ring: As for SMCP..

Series SMRCP.. (available from size 3)
Outer part: Stainless steel 1.4305, from size 16 forged.
Bushings: As for SMCP.., if required stainless steel.
Inner ring: As for SMCP.. but hard-chromed; if required stainless steel.

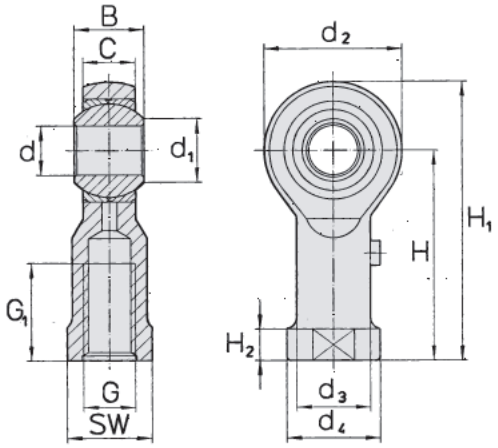
Design

Bearing slackness: Depending on size, between 0.002 and 0.020 mm radially. See page 6 for precise details.
Designation example SMCP 10 **C 2**.

Thread: DIN 13 – 6 g, r.h. or l.h. L.h. designation example SM**L**CP 10. Special thread on request.
Stainless inner ring: From size 5 with stainless steel inner ring of material 1.4034 possible.
Designation example SMRCP 10 **IR**.
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring (on bearing surface only).
Designation example SMCP 10 **IH**.
Hard-chromed outer part and inner ring:
Designation example SMCP 10 **H**.
Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

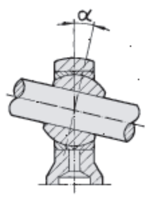
Relubricatable heavy-duty rod ends for pneumatic cylinders

Friction pairing steel on heavy duty bronze - Mounting dimensions: CETOP



Series **SFC...CETOP**

Angle of misalignment



Series SFC..	d	B	C	d_1	d_2	d_3	d_4	H	H_1	H_2	G_1	K Ball dia. Ø	G Thread	SW	Bearing capacities dynamic C N	static C_0** SFC/SFRC N	SFXC N	Angle of misalign. each α°	Weight ≈ g
5	5	8	6	7,7	18	9	11	27	36	4	10	11,112	M4	9	3 250	6 000	15 000	13	17
6*																			
8*																			
10	10	14	10,5	12,9	28	15	19	43	57	6,5	20	19,050	M10x1,25	17	10 000	14 500	35 500	13	75
12	12	16	12	15,4	32	17,5	22	50	66	6,5	22	22,225	M12x1,25	19	13 400	17 000	43 000	13	110
16	16	21	15	19,3	42	22	27	64	85	8	28	28,575	M16x1,5	22	21 600	28 500	76 500	15	210
20*																			
25*																			
30	30	37	25	34,8	70	40	50	110	145	15	51	50,800	M27x2	41	64 000	81 000	193 000	15	1130
35*																			
40*																			
50*																			
Tolerance ±	H7	0 0,12	0,2 0,2	--	--	--	--	--	--	--	1,0 0	--	DIN 13 6 H	0 0,3	--	--	--	--	--

***Sizes 6, 8, 20, 25 and 35 to 50 correspond to the rod ends on page 12.**

****Safety factor Co see page 7**

Material

Series SFC...CETOP

Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501, galvanized and chromalized to DIN 50961.

Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59, 2.0550.31.

Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SFXC...CETOP

Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.

Bushings: As for SFC..

Inner ring: As for SFC..

Series SFRC...CETOP

Outer part: Stainless steel 1.4305, from size 16 forged.

Bushings: As for SFC..

Inner ring: As for SFC.. but hard-chromed; if required stainless steel.

Design

Bearing slackness: Depending on size, between 0.002 and 0.090 mm radially. With reduced or increased slackness see page 6. Designation example SFC 10 **C 2** CETOP.

Thread: DIN 13 – 6 H, r.h. or l.h. L.h. thread designation example SF**L** C 10 CETOP.

Lubricating nipple: Sizes 5–50 funnel-type DIN 3405, form D.

Stainless inner ring: From size 5 stainless steel inner ring of material 1.4034 possible.
Designation example SFRC 10 **IR** CETOP.

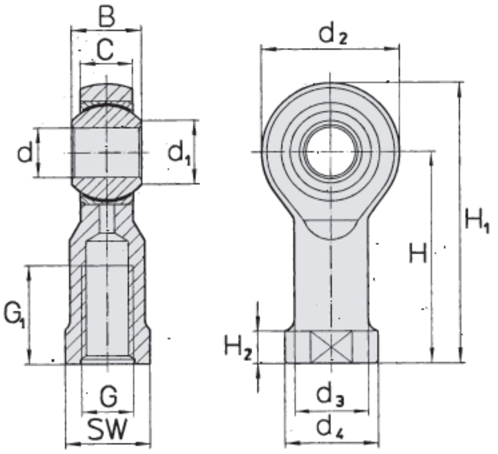
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring (on bearing surface only).
Designation example SFC 10 **IH** CETOP.

Hard-chromed outer part and inner ring:
Designation example SFC 10 **H** CETOP.

Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

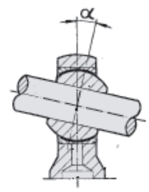
Maintenance-free heavy-duty rod ends for pneumatic cylinders

Friction pairing steel on PTFE bronze fabric Mounting dimensions: CETOP



Series **SFCP...CETOP**

Angle of misalignment



Series	d	B	C	d_1	d_2	d_3	d_4	H	H_1	H_2	G_1	K	G	SW	Bearing capacities dynamic C	static C_o**		Angle of misalign. each	Weight
												Ball	Thread			SFCP/SFRCP	SFXCP		
SFCP..												dia Ø			N	N	N	α°	≈ g
5	5	8	6	7,7	18	9	11	27	36	4	10	11,112	M4	9	7 800	6 000	15 000	13	17
6*																			
8*																			
10	10	14	10,5	12,9	28	15	19	43	57	6,5	20	19,050	M10x1,25	17	27 000	14 500	35 500	13	75
12	12	16	12	15,4	32	17,5	22	50	66	6,5	22	22,225	M12x1,25	19	36 000	17 000	43 000	13	110
16	16	21	15	19,3	42	22	27	64	85	8	28	28,575	M16x1,5	22	60 000	28 500	76 500	15	210
20*																			
25*																			
30	30	37	25	34,8	70	40	50	110	145	15	51	50,800	M27x2	41	186 000	81 000	193 000	15	1130
35*																			
40*																			
50*																			
Tolerance	H7	0	0,2	--	--	--	--	--	--	--	1,0	--	DIN 13	0	--	--	--	--	--
±		0,12	0,2								0		6 H	0,3					

***Sizes 6, 8, 20, 25 and 35 to 50 correspond to the rod ends on page 14.** ****Safety factor Co see page 7**

Material

Series SFCP...CETOP

Outer part: Up to size 14 free-cutting steel 1.0718, from size 16 material 1.0501, galvanized and chromalized to DIN 50961.

Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59, galvanized, lined with permanently affixed sliding foil, consisting of PTFE with a bronze supporting fabric.

Inner ring: Roller bearing steel 1.3505, hardened, ground and polished.

Series SFXCP...CETOP

Outer part: Material 1.7225 tempered or similar, galvanized and chromalized to DIN 50961.

Bushings: As for SFCP..

Inner ring: As for SFCP..

Series SFRCP...CETOP

Outer part: Stainless steel 1.4305, from size 16 forged.

Bushings: As for SFCP.., if required stainless steel.

Inner ring: As for SFCP.. but hard-chromed; if required stainless steel.

Design

Bearing slackness: Depending on size, between 0.002 and 0.020 mm radially. See page 6 for precise details.
Designation example SFC 10 **C 2** CETOP.

Thread: DIN 13 – 6 H r.h. or l.h. L.h. thread designation example SF**L** CP 10 CETOP.

Stainless inner ring: From size 5 with stainless steel inner ring of material 1.4034 possible.
Designation example SFRCP 10 **IR** CETOP.

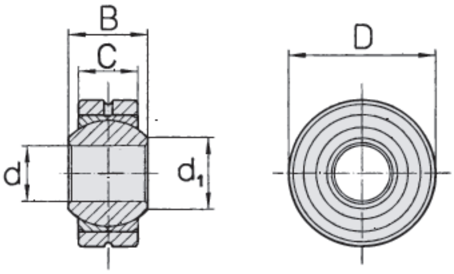
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring (on bearing surface only).
Designation example SFCP 10 **IH** CETOP.

Hard-chromed outer part and inner ring:
Designation example SFCP 10 **H** CETOP.

Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

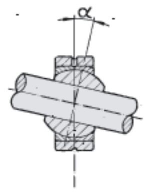
Relubricatable heavy-duty spherical bearings

Friction pairing steel on heavy-duty bronze



Series **SSC..**

SSRC.. (rustproof)



Series SSC..	d	D	B	C	d_1	K Ball dia ∅	Bearing capacities dynamic C N	 static Co* N	Angle of- misalign. α°	Weight each ≈ g
2	2	9	4,8	3,6	3,6	6,000	900	2 450	16	3
3	3	12	6	4,5	5,2	7,937	1 500	4 200	15	4
4	4	14	7	5,25	6,4	9,520	2 260	5 900	14	6
5	5	16	8	6	7,7	11,112	3 250	19 000	13	9
6	6	18	9	6,75	8,9	12,700	4 300	25 000	13	13
8	8	22	12	9	10,4	15,875	7 200	41 000	13	24
10	10	26	14	10,5	12,9	19,050	10 000	58 000	13	40
12	12	30	16	12	15,4	22,225	13 400	78 000	13	80
14	14	34	19	13,5	16,8	25,400	17 000	100 000	15	110
16	16	38	21	15	19,3	28,575	21 600	125 000	15	130
18	18	42	23	16,5	21,8	31,750	26 000	155 000	15	170
20	20	46	25	18	24,3	34,925	31 500	186 000	15	230
22	22	50	28	20	25,8	38,100	38 000	228 000	15	280
25	25	56	31	22	29,6	42,850	47 500	284 000	15	390
30	30	66	37	25	34,8	50,800	64 000	384 000	15	610
35	35	78	43	30	40,3	59,000	90 000	510 000	16	850
40	40	87	49	35	44,2	66,000	120 000	675 000	15	1420
50	50	108	60	45	55,8	82,000	190 000	1 100 000	14	2630
Tolerance ±	H7	h6**	0 0,12	0 0,2	--	--	--	--	--	--

****recommended housing hole M 7, see page 6** ***Security factor Co see page 7**

Sizes 2, 3, 4 will be delivered without oil groove.

Material

Series SSC..
Outer part: Free-cutting steel 1.0718, browned.
Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59.
Inner ring: Roller bearing steel 100 Cr 6, material 1.3505, hardened, ground and polished.

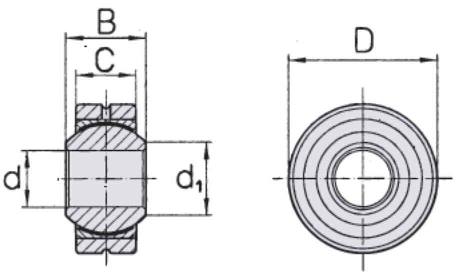
Series SSRC.. (available from size 5)
Outer part: Stainless steel, material 1.4305.
Bushings: As for SSC..
Inner ring: As for SSC.. but hard-chromed, if required stainless steel.

Design

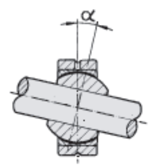
Bearing slackness: Depending on size, between 0.01 and 0.09 mm radially. With reduced or increased slackness see page 6. Designation example SSC 10 **C 2**.
Lubrication: Through an annular lubrication groove on the outer ring.
Stainless inner ring: From size 5 stainless steel inner ring of material 1.4034 possible.
Designation example SSRC **10 IR**.
Hard-chromed inner ring: From size 5 available with hard-chromed inner ring.
Designation example SSC 10 **IH**.
Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

Maintenance-free heavy-duty spherical bearings

Friction pairing steel on PTFE bronze fabric



Angle of misalignment



Series **SSCP..**

SSRCP.. (rustproof)

Series SSCP..	d	D	B	C	d_1	K Ball dia ∅	Bearing capacities dynamic C N	 static Co* N	Angle of misalign. α°	Weight each ≈ g
2										
3	3	12	6	4,5	5,2	7,937	4 700	7 300	15	4
4	4	14	7	5,25	6,4	9,520	6 700	11 000	14	6
5	5	16	8	6	7,7	11,112	7 800	15 000	13	9
6	6	18	9	6,75	8,9	12,700	10 900	21 000	13	12
8	8	22	12	9	10,4	15,875	18 000	36 000	13	20
10	10	26	14	10,5	12,9	19,050	27 000	53 000	13	35
12	12	30	16	12	15,4	22,225	36 000	71 000	13	75
14	14	34	19	13,5	16,8	25,400	48 000	93 000	15	105
16	16	38	21	15	19,3	28,575	60 000	116 000	15	120
18	18	42	23	16,5	21,8	31,750	74 000	143 000	15	160
20	20	46	25	18	24,3	34,925	90 000	173 000	15	220
22	22	50	28	20	25,8	38,100	110 000	212 000	15	260
25	25	56	31	22	29,6	42,850	136 000	263 000	15	370
30	30	66	37	25	34,8	50,800	186 000	358 000	15	580
35	35	78	43	30	40,3	59,000	264 000	500 000	16	850
40	40	87	49	35	44,2	66,000	348 000	660 000	15	1420
50	50	108	60	45	55,8	82,000	550 000	1 000 000	14	2630
Tolerance ±	H7	h6**	0 0,12	0 0,2	--	--	--	--	--	--

****recommended housing hole M 7, see page 6**

***Security factor C_0 see page 7**

Sizes 2, 3, 4 will be delivered without oil groove.

Material

Series SSCP..

Outer part: Free-cutting steel 1.0718, browned.

Bushings: Cu Sn 8/Cu Zn 40 Al 2 F59 galvanized, lined with permanently affixed sliding foil, consisting of PTFE with a bronze supporting fabric.

Inner ring: Roller bearing steel 100 Cr 6, material 1.3505, hardened, ground and polished.

Series SSRCP.. (available from size 5)

Outer part: Stainless steel, material 1.4305.

Bushings: As for SSCP.., if required stainless steel.

Inner ring: As for SSCP.. but hard-chromed, if required stainless steel.

Design

Bearing slackness: Depending on size, between 0.002 and 0.020 mm radially. See page 6 for precise details.

Designation example SSCP 10 **C 2**.

Stainless inner ring: From size 5 stainless steel inner ring of material 1.4034 possible.

Designation example SSCP 10 **IR**.

Hard-chromed inner ring: From size 5 available with hard-chromed inner ring.

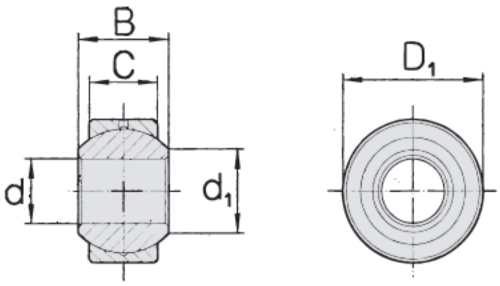
Designation example SSCP 10 **IH**.

Sealed design: Sizes 8–30 can be supplied with replaceable sealing sleeves (see page 21).

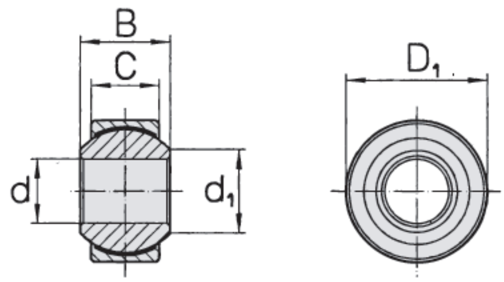
Heavy-duty spherical bearings

Friction pairing steel on heavy-duty bronze

Steel on PTFE bronze fabric
relubricatable maintenance-free



Series **SC..**



Series **SCP..**

Series	d	D_1	B	C	d_1	K Ball dia ∅	Bearing cap. relubricatable dynamic C N	Bearing cap. relubricatable static C_o* N	Bearing cap. maintenance-free dynamic C N	Bearing cap. maintenance-free static C_o* N	Angle of misalign. $\alpha°$	Weight each ≈ g
2												
3												
4												
5	5	13	8	6	7,7	11,112	3 250	15 300	7 800	12 000	13	9
6	6	16	9	6,75	8,9	12,700	4 300	20 000	10 900	17 000	13	10
8	8	19	12	9	10,4	15,875	7 200	33 000	18 000	29 000	13	15
10	10	22	14	10,5	12,9	19,050	10 000	46 000	27 000	42 000	13	25
12	12	26	16	12	15,4	22,225	13 400	63 000	36 000	57 000	13	55
14	14	29	19	13,5	16,8	25,400	17 000	80 000	48 000	75 000	15	70
16	16	32	21	15	19,3	28,575	21600	100 000	60 000	93 000	15	85
18	18	35	23	16,5	21,8	31,750	26 000	124 000	74 000	115 000	15	100
20	20	40	25	18	24,3	34,925	31 500	150 000	90 000	138 000	15	160
22	22	42	28	20	25,8	38,100	38 000	182 000	110 000	170 000	15	180
25	25	47	31	22	29,6	42,850	47 500	227 000	136 000	210 000	15	250
30	30	55	37	25	34,8	50,800	64 000	307 000	186 000	286 000	15	390
35												
40	Sizes 2–4 and 35–50 are not available as spherical bearings.											
50												
Tolerance ±	H7	h6**	0 0,12	0 0,2	--	--	--	--	--	--	--	

****recommended housing hole M 7, see page 6.**

***Security factor Co see page 7**

Material

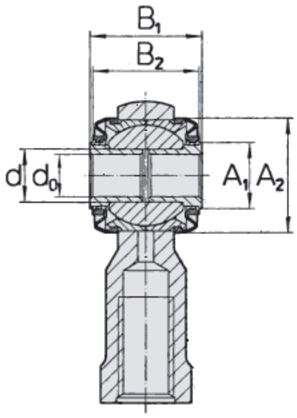
Series SC..
Outer part/bushing: Cu Sn 8.
Inner ring: Roller bearing steel 100 Cr 6, material 1.3505, hardened, ground and polished.

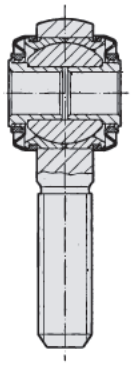
Series SCP..
Outer part/bushing: Stainless steel material 1.4305.
Lined and covered with sliding foil of PTFE with bronze supporting fabric.
Inner ring: As for SC..

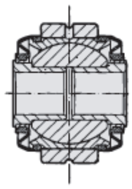
Design

Bearing slackness: In the case of SC.. between 0.010 and 0.090 mm depending on the size. In the case of SCP.. between 0.005 and 0.010 mm depending on the size. See page 6 for precise details.
Slackness C3 not possible.
Stainless inner ring: Available with stainless steel inner ring of material 1.4034.
Designation example SC 10 **IR**.
Hard-chromed inner ring: Available with hard-chromed inner ring.
Designation example SC 10 **IH**.

Sealed rod ends and spherical bearings







SSC/SSCP..2 RS

SFC/SFCP..2 RS

SMC/SMCP..2 RS,

Series **2 RS..**

Series ..RS	d	d_0	A_1	A_2	B_1	B_2	Angle of misa. $\alpha°$
2							
3							
4							
5							
6							
8	8	6	10,5	18,5	19	18,5	10
10	10	8	12,5	21,5	21	20	10
12	12	10	14,5	25,5	23	22,5	10
14	14	12	16,5	29,5	26	24,5	12
16	16	14	19	32,5	28	27	12
18	18	16	21	35,5	30	29	12
20	20	18	23	39	32	31	12
22	22	20	25,5	42,5	35	34	12
25	25	22	29	46,5	38	37	12
30	30	25	33,5	55	44	43	12
35							
40	Sizes 2–6 and 35–50 are not available in sealed design.						
50							
Tolerance ±	--	H7	--	--	0 0,2	--	--

Material

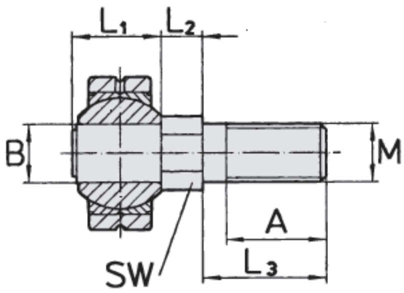
Sealing sleeve: Butadiene acrylnitrile copolymer Viton®.
Oil and ozone resistant, temperature resistant from –25° to +250° C.
Slip ring: Brass.
Bore bushing: Stainless steel, material 1.4305.

Viton® is a registered trademark of DuPont Performance Elastomers.

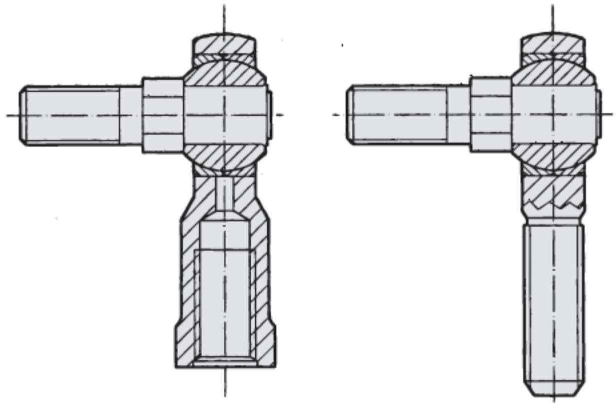
Design

The relubricatable and maintenance-free rod ends and spherical bearings of sizes 8 to 30 can be provided with replaceable sealing sleeves to protect the bearing from coarse dirt, dust and splashing water.
The elastic sealing sleeve is pulled on the outside over the specially extended and grooved bushing, and on the inside over a slip ring.
Designation example SFC 10.**2 RS**.

Threaded bolts for rod ends and spherical bearings



Series **..W**



The lubricating nipple is on the reverse

Series ..W	B	L_1	L_2	L_3	A	M	SW ⬡		Weight each (only bolts) ≈ g
2									
3									
4									
5	5	9	5	11	8	M 5	7		4
6	6	10	5,5	13	10	M 6	7		5
8	8	13	6,5	17	13	M 8	11		16
10	10	15	7	21	17	M 10	11		26
12	12	17	7,5	25	20	M 12	14		43
14	14	20	8,5	29	22	M 14	14		67
16	16	22	9,5	33	24	M 16	17		100
18									
20	20	26	12	45	35	M 20	22		200
22									
25									
30									
35		Sizes 2-4 and 18, 22-50 are not made in series.							
40									
50									
Tolerance ±	m6	--	0,1 0,1	0,3 0,3	0 1,0	DIN13 6g			--

Material

Stainless steel, material 1.4305, hexagon bare.
Other materials such as 1.7225 browned. Special dimensions on request.

Design

All series of rod ends and spherical bearings, except the sealed ..2 RS design, can be fitted with threaded bolts and used as angle joints. The bolt is pressed and riveted into the inner ring.
Designation example SF C 10 **W.**

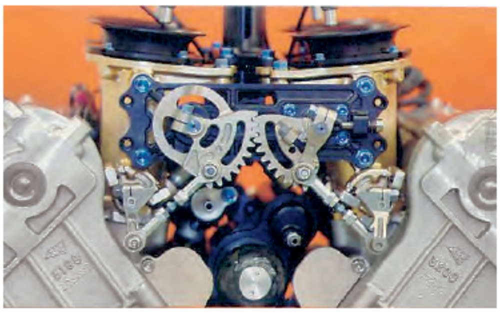
Applications and typical installations

Agricultural machinery

Bakery machines
Bottle-washing machines
Brick-making machines
Cardboard-making machines
Cigarette making machines
Construction machines
Conveying systems
Driving machinery
Engine building
Engraving machines
Filling machines
Gas producers
Handling machines
Hydraulic cylinders
Knitting machines
Labeling machines
Leather-working machines
Lifts
Machine tools
Mining machines
Mixing machines
Motor vehicles
Packaging machines
Pneumatic cylinders
Power engineering
Preforming machines
Printing machines
Road-building machinery
Sail planes
Separating equipment
Sewing machines
Signaling equipment
Snow-clearing machines
Space industrie
Spinning machine
Textile machinery
Water turbines
Weighs
Welding machines
Wine-bottling machines
Woodworking machines and many more

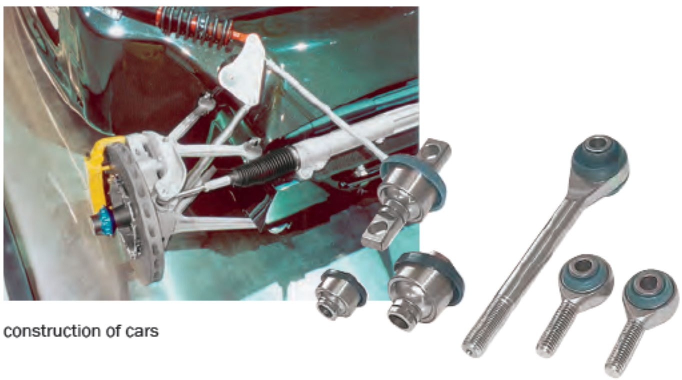
aircraft construction

shipbuilding industry



engine construction

scales



construction of cars

Form sheet for an inquiry

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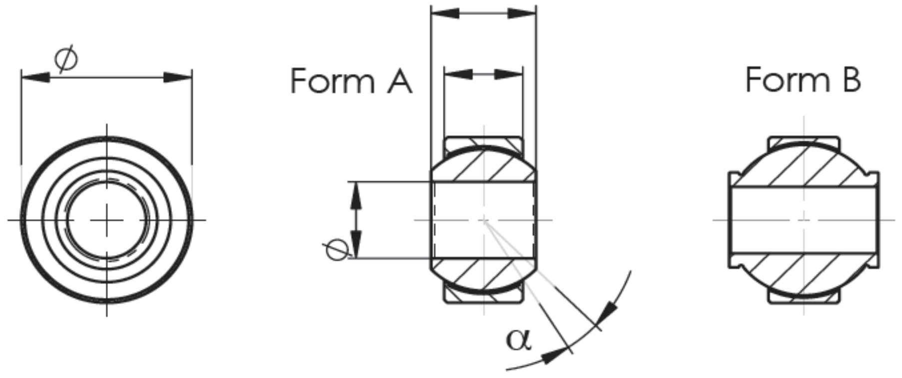
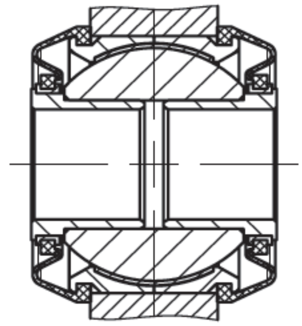
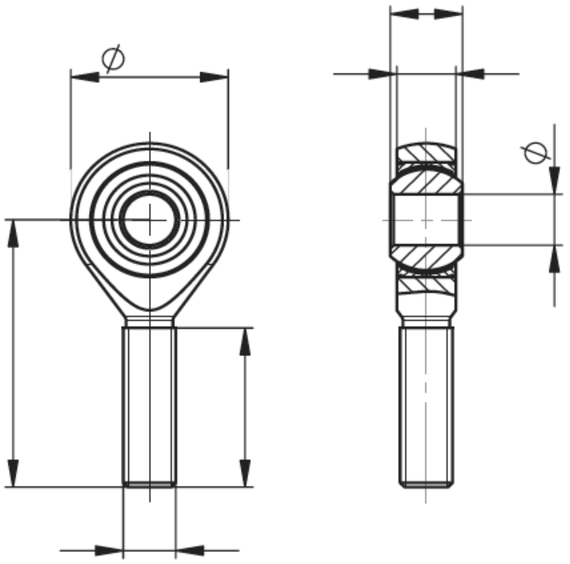


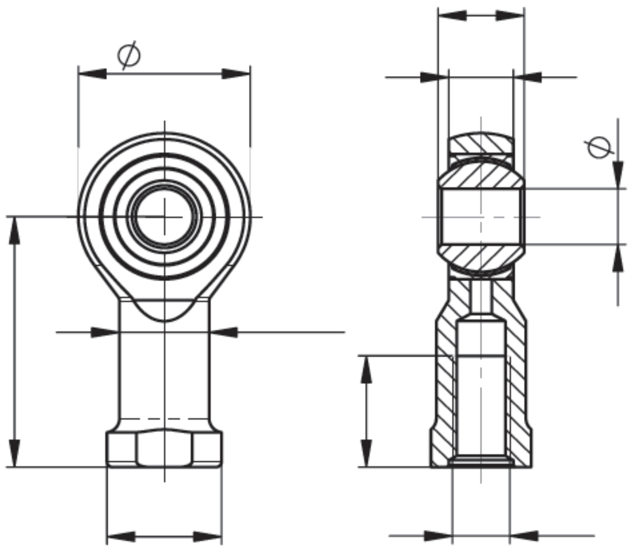


sealed Version

Form : A ☐ B ☐
Material Inner ring : _______________
Material Outer ring : _______________
Maintenance free : yes ☐ no ☐
sealed : ☐
Angle of misalignment α?:?__________
Quantity : _____



Material Rod End : _________________
Material Inner ring : ________________
Material Outer ring : ________________
Maintenance free : yes ☐ no ☐
sealed : ☐
Angle of misalignment α : __________
Quantity : _____



Material Rod End : _________________
Material Inner ring : ________________
Material Outer ring : ________________
Maintenance free : yes ☐ no ☐
sealed : ☐
Angle of misalignment α : __________
Quantity : _____

Form sheet for an inquiry

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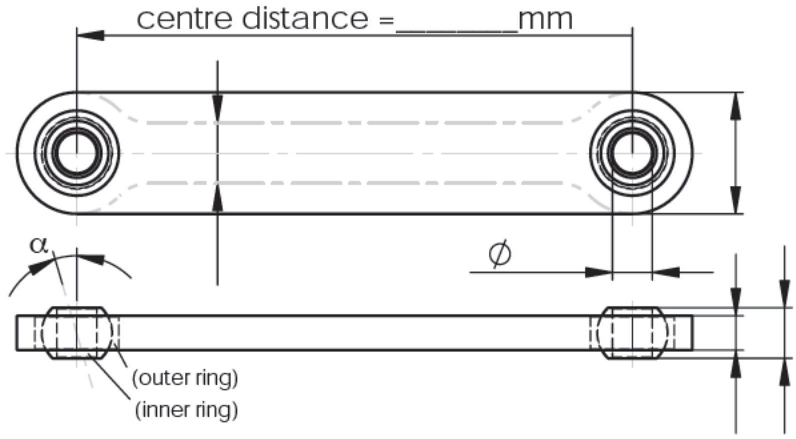
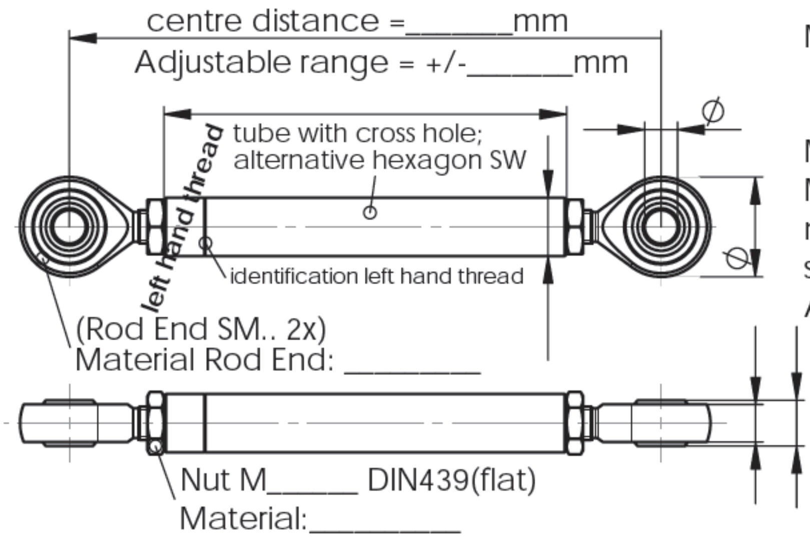


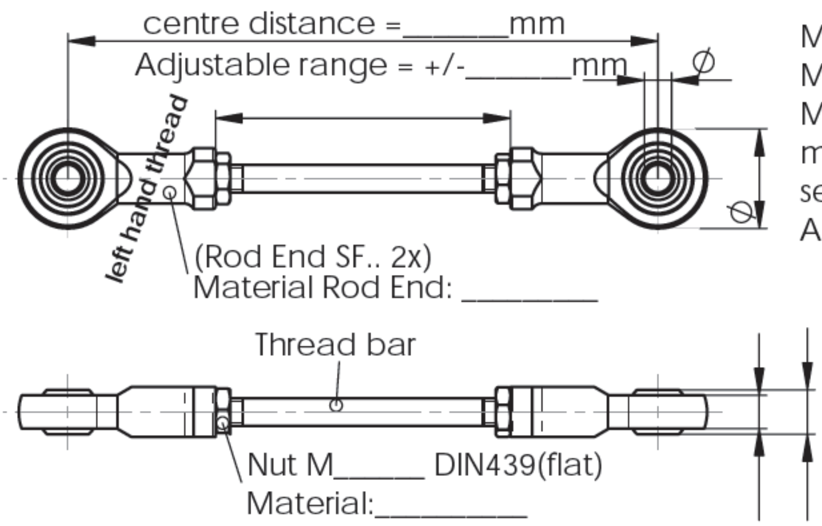
Material outer part : ____________
Form A : ☐
Form B : ☐
Material Inner ring : ____________
Material outer ring : ______________
maintenance free : yes ☐ no ☐
Angle of misalignment α : ____

Quantity : _____



Material outer part : ____________
tube : ☐ Ø............
hexagon : ☐ SW ....
Material Inner ring : ____________
Material outer ring : ____________
maintenance free : yes ☐ no ☐
sealed : ☐
Angle of misalignment α : ____

Quantity : _____



Material thread bar: ______________
Material Inner ring : _____________
Material outer ring : ______________
maintenance free : yes ☐ no ☐
sealed : ☐
Angle of misalignment α : ____

Quantity : _____

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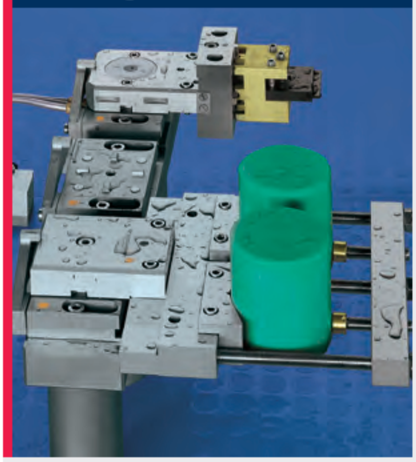

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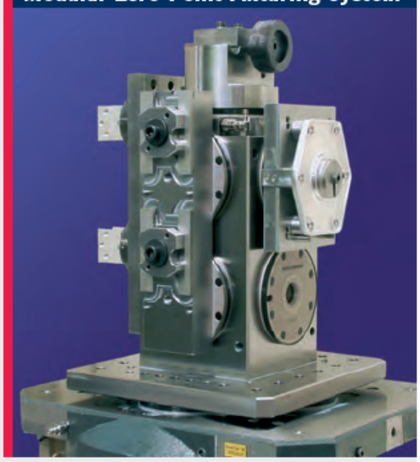

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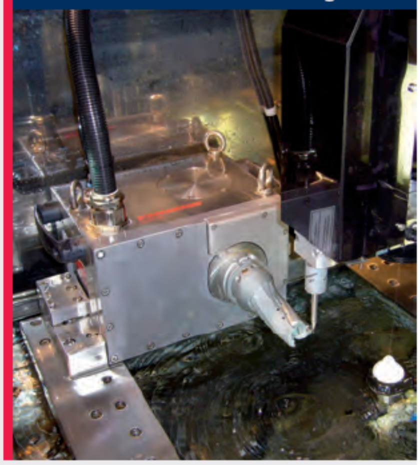

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