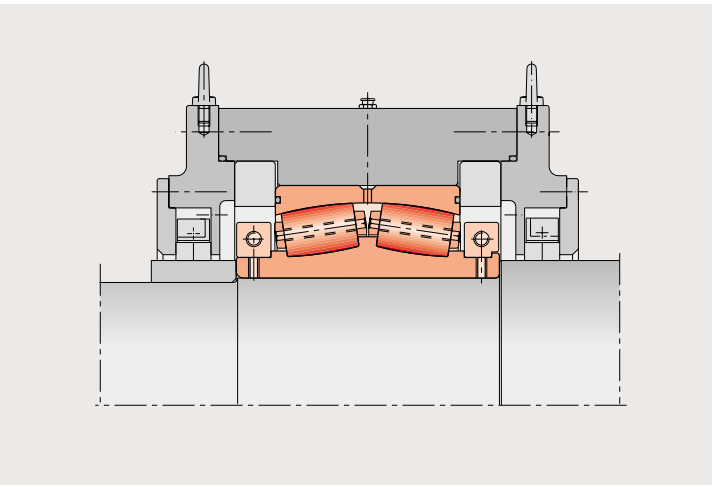
FAG

ROLLING BEARING MOUNTINGS FOR CONVERTERS



FAG OEM und Handel AG

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PREFACE

The OEM/Distribution Business Unit of FAG Kugelfischer Georg Schäfer AG supplies rolling bearings, housings, accessories and services to original equipment manufacturers in the sectors of machinery and plant construction and to customers in the sectors distribution and replacement. With their extensive know-how, competent advice and comprehensive customer services, FAG are a most important partner of their customers. Development and further development of our products are guided by the requirements of practical operation. In the ideal case, the spectrum of requirements is defined jointly by our researchers, application engineers, the machine producers and users. This is the basis for technologically and economically convincing solutions.

The Business Unit produces at locations in Germany, Italy, Portugal, India, Korea (Rep.) and the USA. The market is supplied through subsidiaries and trading partners in nearly all countries of the world.

1 REQUIREMENTS ON THE TRUNNION BEARINGS FOR CONVERTERS

1 Requirements on the Trunnion Bearings for Converters

When filled, large converter vessels weigh several hundred tons. The resulting loads must be accommodated by the trunnion bearings. Since only slow swinging motions occur the bearings must primarily feature a high static load carrying capacity. In addition, shock-type loads must be accommodated daily in converters.

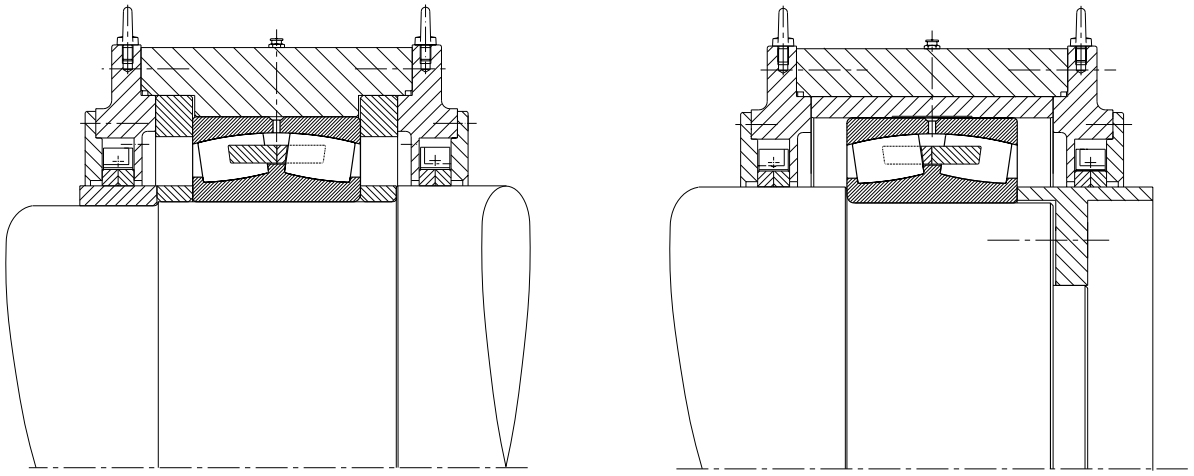
The bearings must also be able to compensate for housing misalignments and deflections of the construction. Moreover, considerable length variations caused by the temperature changes during converter heat-up and cool-down as well as changes of the trunnion ring form must be compensated for.

Today, converters are usually fitted with spherical roller bearings. Apart from their great radial and axial load carrying capacity and their insusceptibility to impacts they can also compensate for significant misalignments.

Usually, the locating bearing at the drive end provides axial guidance for the converter. A sleeve in which the bearing outer ring can shift axially, fig. 1, is inserted in the housing at the floating bearing end.

Spherical roller bearings featuring the main dimensions of series 249 meet the requirements on converter bearings. These bearings have proved to be particularly suitable in regard to axial displaceability.

At the floating bearing end unsplit bearings are used whereas at the locating bearing end the preferred choice for replacement bearings are split spherical roller bearings whose dimensions are adapted to those of series 249. The split bearings facilitate bearing replacement without dismounting the drive unit, cp. section 2.2.



Locating bearing

Floating bearing

1: Trunnion bearing arrangement for a converter with two spherical roller bearings

Spherical Roller Bearings

2 Rolling Bearings and Housings for Converters

The technical data of the FAG spherical roller bearings and plummer block housings for converters are indicated in chapter 6.

2.1 Spherical Roller Bearings

FAG spherical roller bearings are rolling bearings designed for heavy duty applications. They contain two rows of symmetrical barrel rollers which align smoothly in the spherical raceway of the outer ring. In this way shaft deflections and misalignments of the bearing seats are compensated for.

FAG spherical roller bearings for converters usually feature the main dimensions of the standardized series 249.

Depending on design, bearing components are bonderized and/or Molykoted. The bearings are available either with a cylindrical bore or with a tapered bore (taper 1:30).

Spherical roller bearings with a cylindrical bore are mounted directly on the converter trunnion, fig. 1 on page 3. Bearings with a tapered bore are mounted on tapered sleeves, fig. 2.

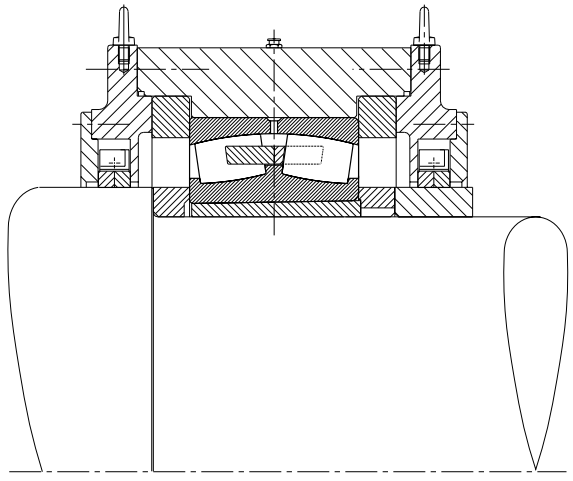
2.1.1 Compensation of Misalignment

Static misalignment

Vertical or lateral housing offset may lead to misalignment, fig. 3.

This so-called static misalignment may be due, for instance, to foundation settling. Static misalignment is harmless as long as the rollers have full length contact with the outer ring raceway. The misalignment angle specified for static misalignment is 1.5° for all FAG spherical roller bearings.

Experience has shown that, when mounting the housing, static misalignment should be limited to 10 angular minutes. This value may seem small compared with the permissible misalignment but it should be borne in mind that a gradual subsidence of the foundations or thermal influences may result in major positional changes of the housing.



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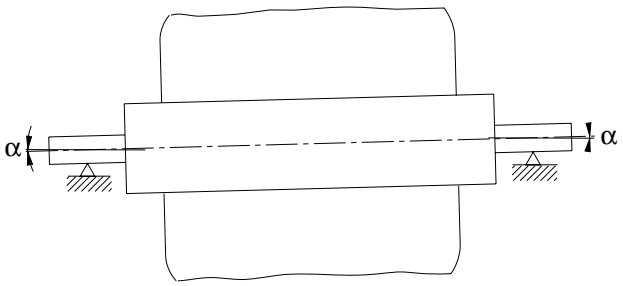


3

2: Spherical roller bearing as a locating bearing on a sleeve

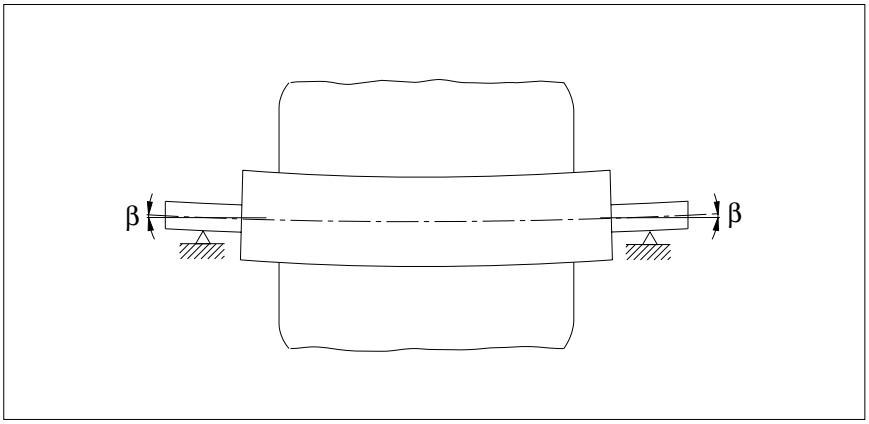
3: Static misalignment α

Dynamic misalignment

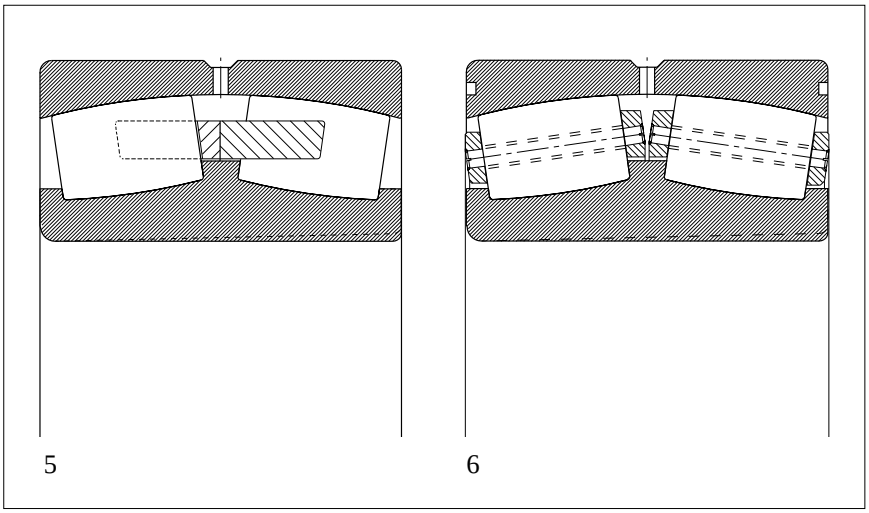
The bearing centre distances of large converters are between 7 and 12 meters. When the vessel is being swung deflections may occur which vary in magnitude with the momentary vessel position. However the alignment motion the bearing has to take up during rotation is relatively slight.

The influence of the temperature differential in the trunnion ring is greater. It produces a misalignment which causes distortion of varying magnitude. As a result the trunnions become offset to each other. The wobbling of the trunnions when the vessel swings is called dynamic misalignment, fig. 4.

This means that each swinging motion of the vessel imposes on the rolling elements in the bearings an axial displacement in addition to circumferential rolling. This is associated with sliding friction. In order to avoid extra strain on the contact points in the bearing the distortion of the trunnion ring should be minimized.



4: Dynamic misalignment β



5: Spherical roller bearing for converters with machined brass cage

6: Spherical roller bearing for converters with pin-type cage

Data from the field have shown the dynamic misalignment of converter bearings to be in the order of 20 to 50 angular minutes after several years of operation. In spite of these deviations from the geometrical axis the extra loads can be accommodated since they were taken into account in the internal design of the FAG bearings. The outer ring raceways or the rollers feature a special coating which reduces friction.

2.1.2 Cages

Depending on the strain to be accommodated, FAG spherical roller bearings for converters are fitted with machined brass cages (fig. 5) or with pin-type cages and through-bored rollers (fig. 6).

Pin-type cages consist of lateral cage washers to which the bolts are attached that pass through the rollers. With this pin-type cage a larger number of rollers can be accommodated and thus a higher load rating be achieved. These cages are also particularly strong.

2.1.3 Tolerances, Bearing Clearance

FAG spherical roller bearings for converters have the normal tolerances of radial bearings (tolerance class PN), see also FAG catalogue WL 41 520. Deviations for split bearings, see section 2.2.

The radial clearance of the spherical roller bearings is selected according to the operating temperature and the mounting fits.

2.1.4 Lubricating Groove, Lubricating Holes

To simplify lubrication, the FAG spherical roller bearings for converters feature a circumferential lubricating groove and three lubricating holes in the outer ring, see figs. 5 and 6.

2.1.5 Heat Treatment

FAG spherical roller bearings for converters are heat-treated in such a way that they are dimensionally stable up to an operating temperature of 200 °C.

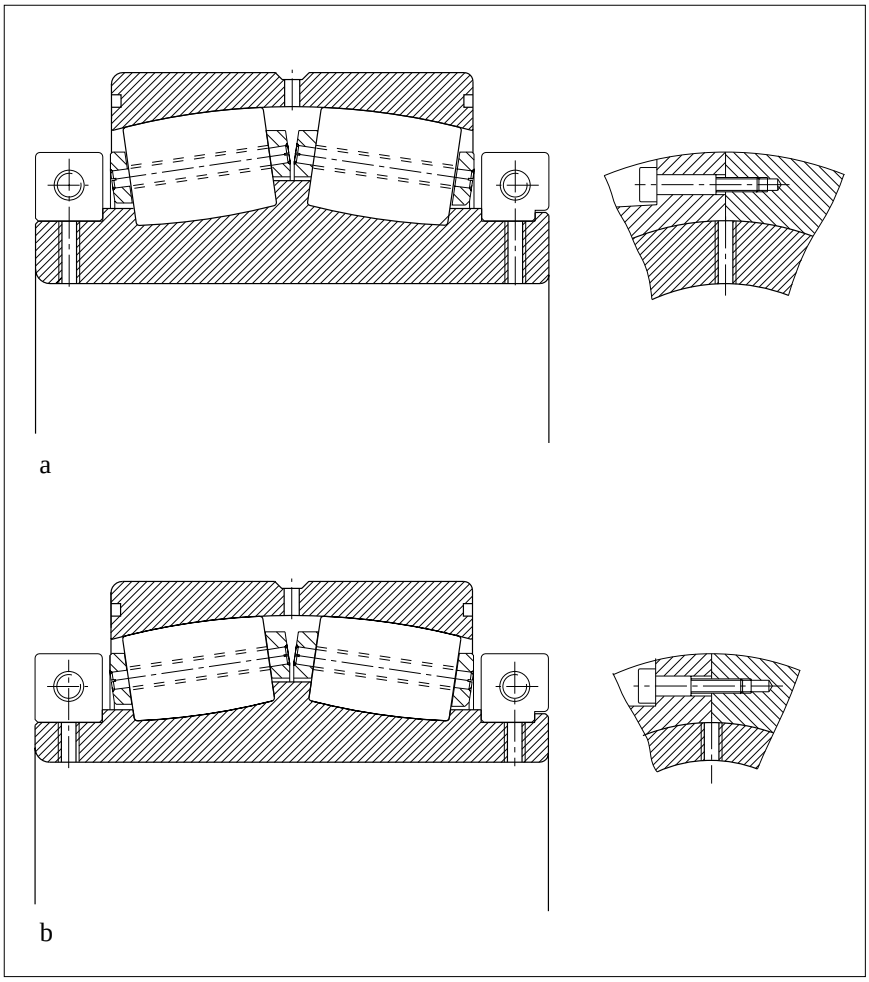
2.2 Split Spherical Roller Bearings

Steel works often demand that the bearing at the drive end (locating bearing) of a converter can be replaced without dismounting the drive unit. This is possible with split spherical roller bearings, fig. 7. For price reasons split bearings are usually used as replacement bearings.

The main dimensions of split spherical roller bearings are adapted to those of unsplit bearings with a tapered bore and a wedge sleeve (fig. 7a) or with a cylindrical bore (fig. 7b). Rings and cages of split bearings are split horizontally. Due to the split clamping rings the split inner rings are considerably wider than the inner rings of unsplit bearings.

The bore tolerance is such that a tight fit is obtained with trunnion tolerances of h7 to m6.

In split bearings not only the outer ring raceways are bonderized and Molykoted, but the rollers are bonderized as well.



7: Split spherical roller bearings
a: Replacement for an unsplit bearing with a tapered bore and wedge sleeve
b: Replacement for an unsplit bearing with a cylindrical bore

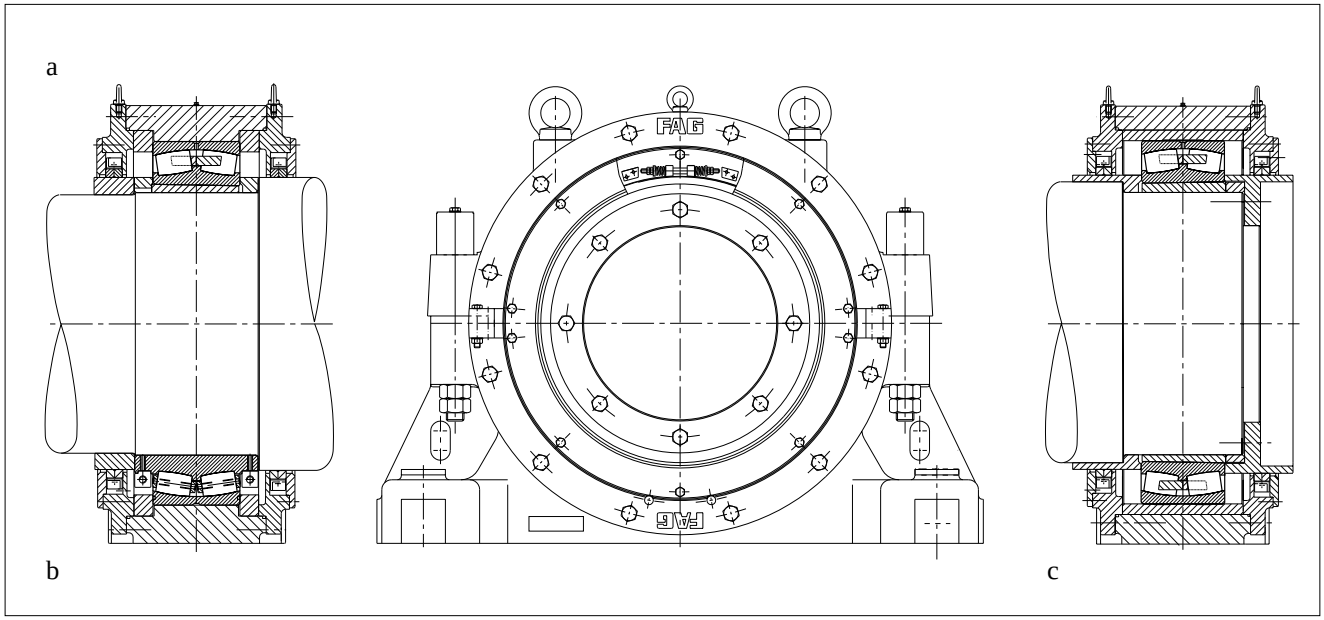
2.3 KPG49 Housings

The split plummer block housings of series KPG49 are made of cast steel and feature a tensile strength of more than 400 N/mm^2. This provides good support for the bearing outer ring, which is of great importance for achieving a good distribution of pressure within the bearing. Three housing designs are available.

In housings of design KPG49...F (fig. 8a) the locating bearing function is achieved by arranging locating rings on both sides of the bearing's outer ring. These housings are used for spherical roller bearings with a tapered bore which are mounted on the shaft with wedge sleeves.

Housings of design KPG49...FG (fig. 8b) are locating bearing housings. They accommodate split spherical roller bearings which replace unsplit bearings with a tapered bore and wedge sleeve.

In housings of design KPG49…L (fig. 8c) the outer ring of the floating bearing can shift axially within a sleeve. Spherical roller bearings with a tapered bore and wedge sleeve are mounted into these housings.

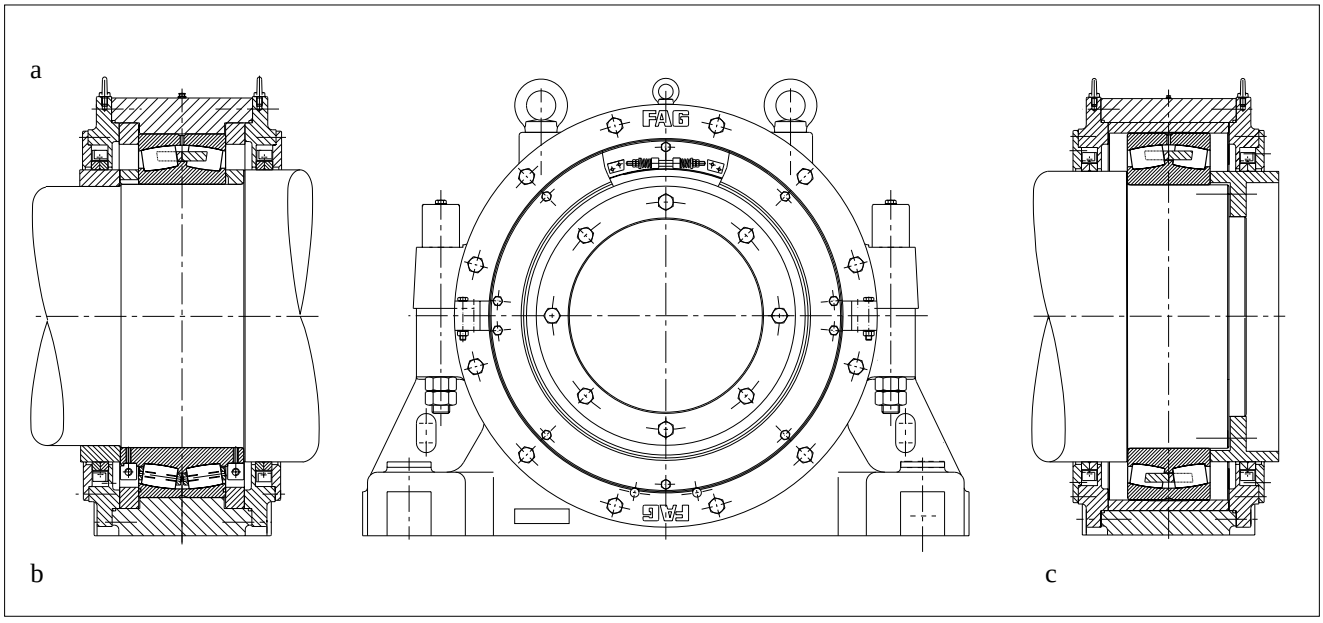


8: Split plummer block housings KPG49 for converters
Locating bearing housing KPG49…F (a) and KPG49…FG (b)
Floating bearing housing KPG49…L (c)

2.4 KPGZ49 Housings

Split plummer block housings of series KPGZ49, unlike KPG49 housings, are designed for bearings with a cylindrical bore that are mounted directly on the shaft.

These housings are also available as designs F and L for unsplit spherical roller bearings (locating bearing housings fig. 9a, floating bearing housings fig. 9c). Housings of design FG (fig. 9b) are locating bearing housings for split spherical roller bearings.



9: Split plummer block housings KPGZ49 for converters
Locating bearing housing KPGZ49…F (a) and KPGZ49…FG (b)
Floating bearing housing KPGZ49…L (c)

3 Bearing Dimensioning

Converter bearings perform swinging motions and are rotated up to 360° only occasionally. When the converter swings, bearing speeds range from 0.1 to 1 min^{-1}.

During decarburization the converter is at rest, the blowing process causes vibrations.

These conditions require bearing dimensions that are based on static criteria.

The bearings' service life is determined by wear. Wear is caused by:

- deflection
  due to the large bearing centre distance or due to deformation of the trunnion ring
- axial displacement
  due to temperature changes in the converter.

Wear can be reduced by phosphatizing and/or Molykoting the bearing components.

Index of static stressing, f_s

Usually, the index of static stressing required for converter bearings is

$f_s \geq 2$

$f_s = C_0/P_0$

C_0 static load rating [kN] as indicated in bearing tables
P_0 equivalent static load [kN]

Locating bearing

$P_{0F} = F_{rF} + Y_0 \cdot (F_a + F_{a1})$ [kN]

Floating bearing

$P_{0L} = F_{rL} + Y_0 \cdot F_{a1}$ [kN]

F_{rF} = maximum radial load on locating bearing [kN] *
F_{rL} = maximum radial load on floating bearing [kN] *
Y_0 = thrust factor (bearing tables)
F_a = maximum external thrust [kN] *
F_{a1} = $\mu \cdot F_{rL}$ reaction force from floating bearing displacement [kN]
μ = 0.15 coefficient of friction of sleeve

* with possible shock loads

The calculated results are entered in the calculation sheet (sheet B in section 5.8).

4 Design of Adjacent Parts

4.1 Fits

4.1.1 Trunnions

Recommended machining tolerances:

h7	if a tapered sleeve is used
m6	if the bearing is mounted directly on the trunnion

Heavy converter bearings are best mounted on a tapered sleeve. It makes mounting easier and reduces the requirements on the seat quality. The out-of-roundness and taper should not exceed 40 % of tolerance field h7.

For a cylindrical bearing bore the trunnion must be machined to m6 (tight fit). Prior to mounting, large bearings must be heated in an oil bath; we recommend to dismount them hydraulically. A sliding fit may also be chosen if the trunnion surface can withstand the resulting strain.

4.1.2 Housing Bore

Recommended machining tolerances:

H7 for floating bearings and locating bearings

For floating bearings the bore of the displacement sleeve, depending on the diameter, is 0.120 to 0.400 mm larger than the nominal bearing O.D.; roughness depth < 6 µm.

The unsplit sleeve is roughly as thick as the outer ring.

The O.D. of FAG spherical roller bearings is phosphatized and Molykoted so that the frictional resistance during displacement is reduced.

4.2 Seals

Two types of seals have proved to be suitable for this application. In Europe high-pressure packings are mainly used whereas in America rubber-profile seals are preferred.

4.2.1 High-Pressure Packings

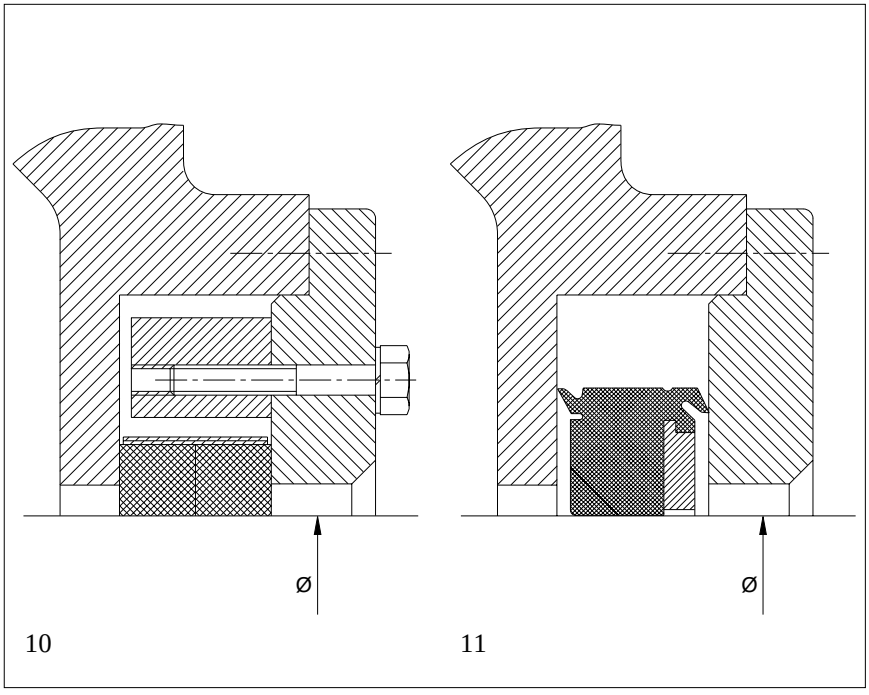
Order example:

PRFL.1799-30x30x3850/Hecker or equivalent

4.2.2 Rubber-Profile Seals

Order example (for d = 1135 mm):

PRFL.GSH1003/1135.155330



10: High-pressure packing **11: Rubber-profile seal**

5 Mounting, Lubrication and Maintenance

The bearings' service life is determined to a great degree by correct mounting and maintenance.

Large bearings should be mounted by skilled personnel only.

A specialized bearing fitter should always be available to supervise the mounting work and ensure the fitting work is carried out in accordance with the mounting instructions.

5.1 Preparations for Mounting

Smooth mounting of converter bearings requires some preparation.

- Prepare tools
- Check hoisting equipment and position it correctly (some bearings weigh several tons)
- Have a sufficient amount of the specified grease ready (see section 5.5)
- Check adjacent parts (form and dimensional accuracy, surface finish, cleanliness)
- Enter measured values (trunnion diameter, housing bore) in data sheets E or F (section 5.8)

Bearing mounting requires that

- the converter vessel and trunnion ring are already suspended above the foundation
- the housing bases of locating and floating bearings are aligned on the foundations
- the bearings can be premounted in a workshop if necessary

For bearings with a **cylindrical bore** that are heated in an oil bath

- an oil container suitable for the bearing size and a ring burner must be provided at the mounting site
- a device must be provided which axially presses the warm bearing against the shaft shoulder until it has cooled down

For bearings with a **tapered bore** that are mounted on sleeves

- hydraulic tools are required (see section 5.2.2)

Unpack bearings only after these preparatory steps have been accomplished.

Then check the bearings for transport damage.

Measure radial clearance over both roller rows by means of a feeler gauge and enter the values in data sheet E or F (section 5.8).

5.2 Mounting Unsplit Bearings

5.2.1 Bearings with a Cylindrical Bore (fig. 1)

The tight fit (m6) on the cylindrical trunnion requires previous heating of the bearings in an oil bath. At a temperature of 80 to 90 °C the inner ring expands sufficiently to permit the bearing to be pushed onto the trunnion unimpeded. A temperature limit of 120 °C must not be exceeded because otherwise the material structure may change.

The bearings shall be supported in the oil container on a grid. This prevents contaminants in the oil which have deposited on the bottom from penetrating into the bearings. It also ensures an even heating of the bearings.

When a bearing has a temperature of 80 to 90 °C lift it out of the oil container. Let the oil drip off and wipe the bearing bore until it is nearly dry. Then push the bearing onto the trunnion. Adjust it axially against the shaft shoulder until it has cooled down (adjust it again during this period). Fill the bearing cavities with grease. Before mounting the bearing at the opposite end, wrap the already mounted bearing in oiled paper to protect it from contamination.

More measures are described in section 5.4.

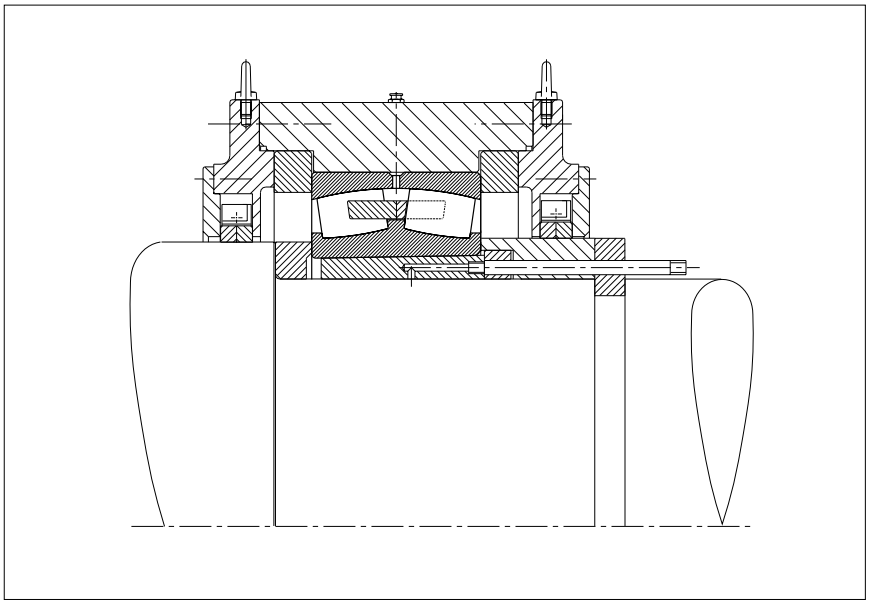
5.2.2 Bearings with a Tapered Bore and Sleeve (fig. 2)

The bearing seat on the trunnion is machined to h7. A tight fit of bearing, sleeve and trunnion is obtained by axially pressing the tapered sleeve a specified distance into the bearing bore. To prevent axial displacement, the bearing is located on both sides of the inner ring.

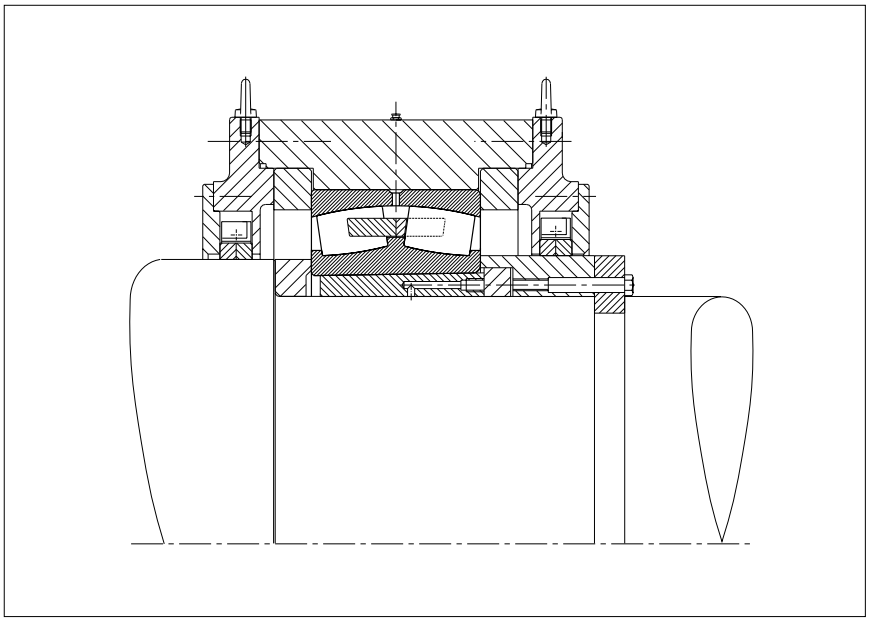
The tapered sleeves are always suitable for hydraulic mounting, which requires only one fifth of the force that would be necessary for dry mounting.

Prior to mounting, measure the radial clearance over both roller rows by means of a feeler gauge and enter the measured values in data sheet E or F (section 5.8).

Then place the bearing on the trunnion and insert the sleeve until the bearing is centered and the inner ring abuts the shaft shoulder or the intermediate sleeve. Press oil into the fitting joints by means of a pump, fig. 12a. At the same time the sleeve is pressed into the bearing bore, by means of several screws provided in the sleeve face, fig. 12b, until the specified radial clearance reduction has been achieved (see project sheet A in section 5.8). The remaining radial clearance is entered in data sheet E or F.

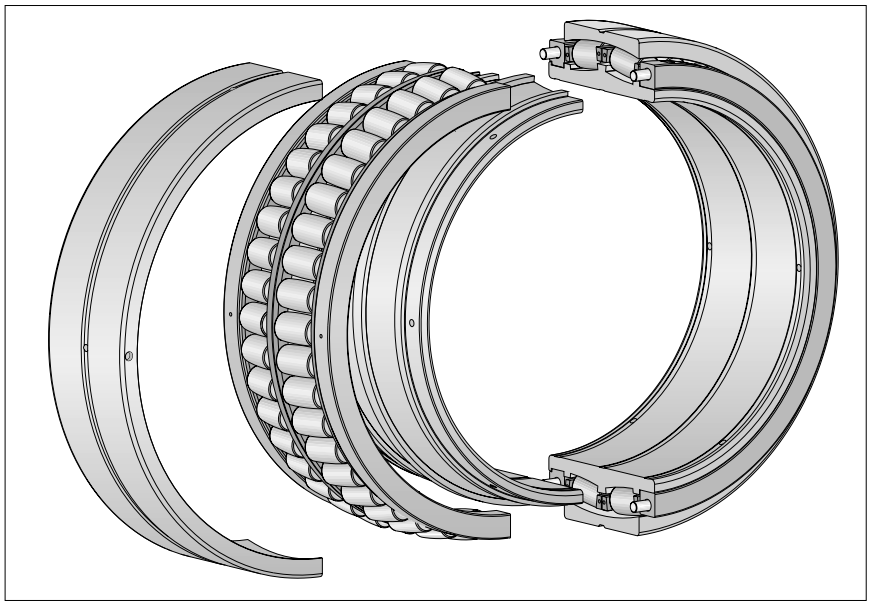


12a: Oil supply via oil ducts



12b: Arrangement of the pressure screws for sleeve positioning

About 20 minutes after pressing the sleeve into the bore the mounting aids may be removed. Fill the bearing cavities with grease. Prior to mounting the second bearing, wrap the already mounted bearing in oiled paper to protect it from contamination.



5.3 Mounting Split Bearings

Split bearings are preferably used as replacement bearings at the drive end. Since the drive unit is not dismounted there is only limited space to work in. So the bearing location is accessible only from above.

When the bearings are mounted care must be taken that at each end the right bearing components are installed. Apart from the bearing code (six-digit number) on the stamped side, the components are marked with a manufacturing number, e.g. 501. The components for the stamped side bear this number at the separating joints. The components on the opposite side are additionally marked by an A, for example 501A.

The bearing components feature tapped holes for easier handling.

The inner ring is mounted on the shaft with an interference fit, resulting in a gap at the separating joints of the inner ring halves.

Before the replacement bearing can be mounted the unsplit bearing must be removed (recommendations, see 5.7.1). Then check the bearing seat on the trunnion and measure the trunnion diameter. Enter the measured values in the data sheet.

Local irregularities in the trunnion surface (fretting corrosion, cold weldings) must be reworked. At any rate the diameter of the seat for the split bearing must ensure an interference fit.

The inner ring halves are mounted first (mounting sketch, figs. a – d). Mount the clamping rings in the same manner (fig. e). The gaps between the two separating joints of the inner ring must be horizontal (fig. d) and identically sized. The separating joints of the clamping rings (fig. e) shall be offset by only such a distance that the connection bolts of the clamping rings can be tightened comfortably from above (tightening torque, see project sheet A in section 5.8).

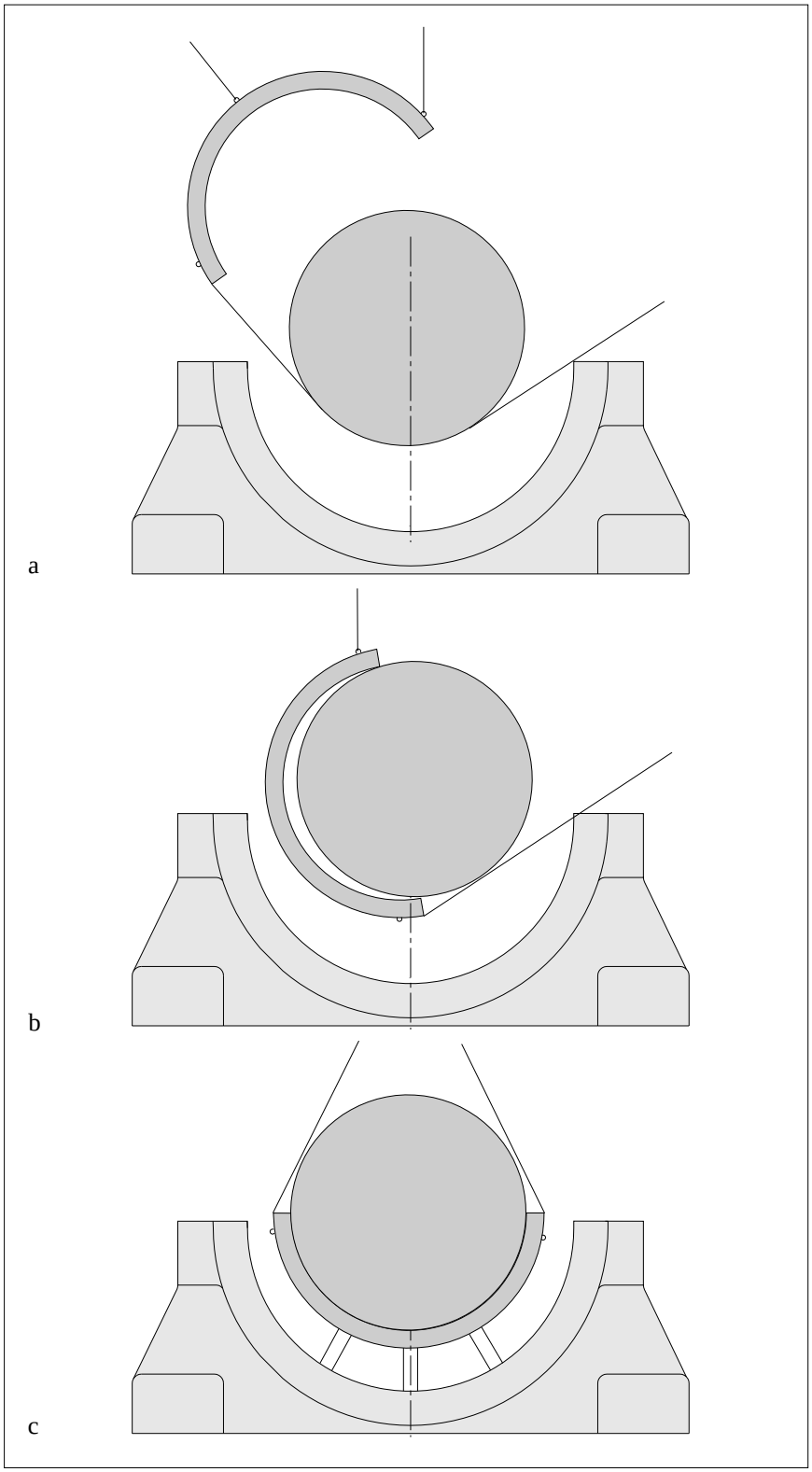
Mount the other bearing components as shown in figs. f – i. Make sure that the bore provided in the outer ring faces for the anti-rotation device is exactly vertical. As shown in fig. h, the halves of the roller-cage assembly shall be braced against the inner ring raceways by means of strong wire before the converter is lowered into the housing bases.

Before lowering the converter,
- the bearing at the opposite end must be mounted,
- the housing bases must be positioned correctly relative to the trunnions.

Then
- insert the two other roller-cage assembly halves (remove wire and eye bolts of the other halves first),
- fill in lubricant
- mount the second outer ring half.

Additional measures are described in section 5.4.

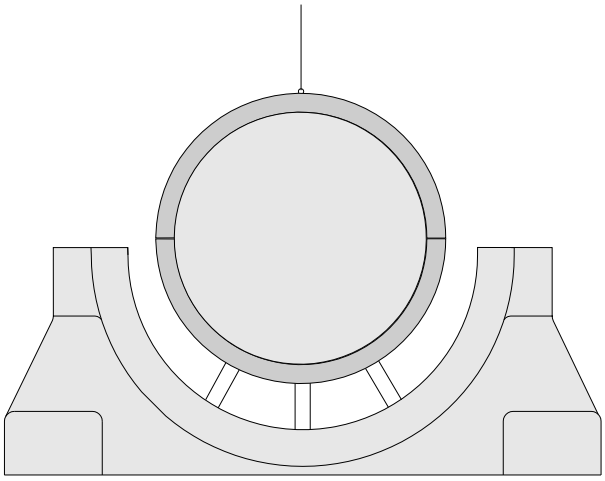
Mounting Split Bearings



Mounting sketch for split replacement bearings

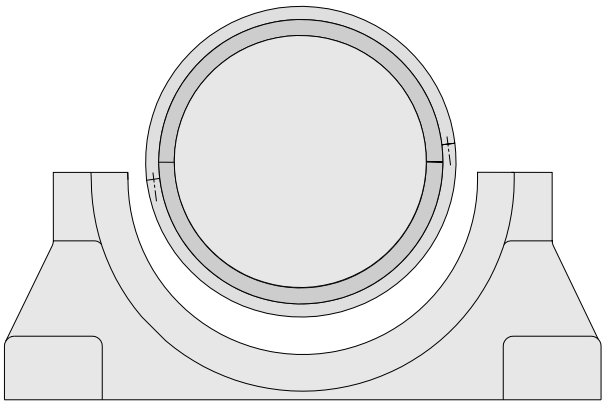
a-c Insert inner ring half under the trunnion and adjust it against the trunnion from below by means of wooden wedges. Make sure that the wooden wedges do not cover the seats for the clamping rings.

d



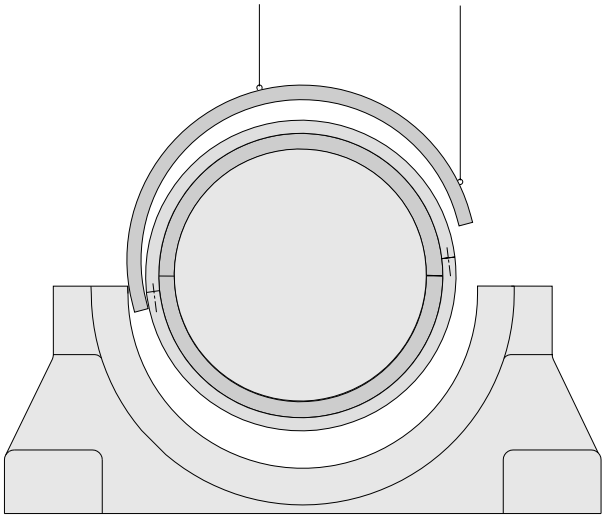
d Position second inner ring half.

e



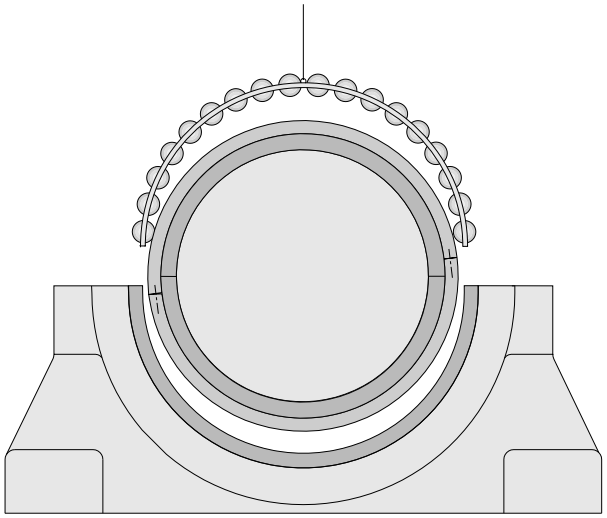
e Insert clamping rings in the same manner as the inner ring halves. Then wedge and bolt them together. The separating joints of the clamping rings shall be slightly offset against the separating joints of the inner ring.

f



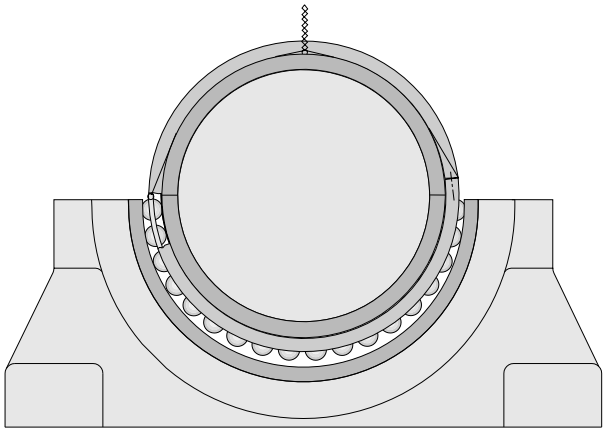
f Insert outer ring half and lower it into the housing base.

Mounting Split Bearings



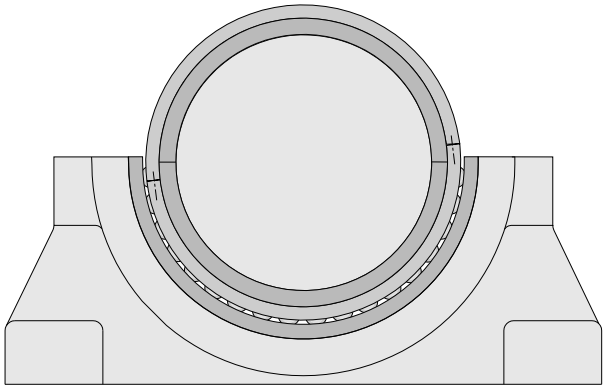
g

g Suspend roller-cage assembly halves and roll them over the outer ring.



h

h – i Brace the roller-cage assembly halves against the inner ring raceway.
Now the converter can be lowered.
All other components are mounted later.



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5.4 Measures to be taken after Mounting

After both bearings are mounted the following measures must be taken:

- Check position of the housing bases in relation to the trunnion and correct it if necessary (static misalignment, cp. 5.4.1)
- Check position of floating bearing housing relative to the trunnion and correct it if necessary (displacement possible?)
- Lower converter
- Measure bearing clearance of unsplit bearings
- Position housing cap
- Fill in lubricant (fill ca. 60 % of the cavities at the left and right of the bearing)
- Bolt lateral cover to housing
- Correct dynamic misalignment as stated in 5.4.2 (vertical error compensated for and housing in correct position relative to the trunnion, cp. 5.4.1) and enter values in data sheet (section 5.8)
- Determine axial elongation in operation (1st campaign) and enter value in the data sheet (section 5.8); displacement for floating bearing, see 5.4.3)

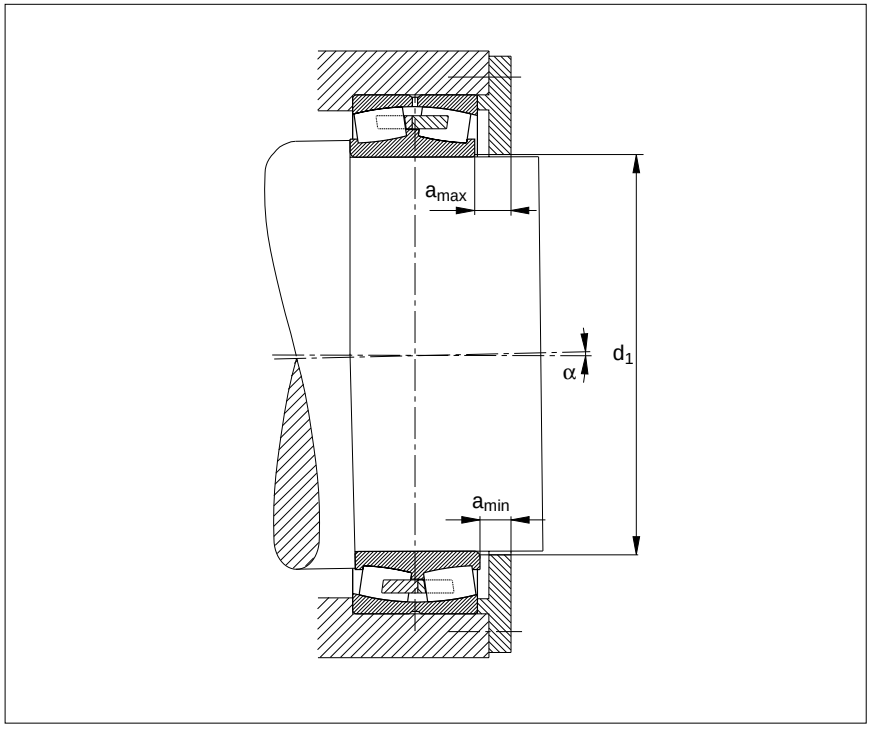
5.4.1 Checking the Static Misalignment (vessel at rest)

Measure the maximum and the minimum distance between the inner ring face and a machined face of the housing cover. The static misalignment is calculated from the difference between these distances and the diameter on which the values were measured:

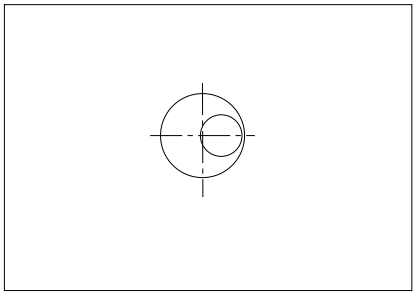
$\tan \alpha = (a_{max} - a_{min})/d_1$

Required: $\alpha \leq 10$ min, i.e.
$\tan \alpha \leq 0.003$ and consequently

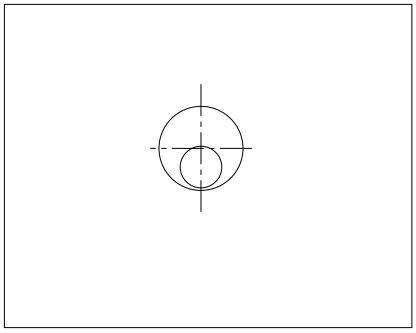
$(a_{max} - a_{min})/d_1 \leq 0.003$



Measuring the static misalignment



Housing in incorrect position relative to the trunnion



Vertical error

Measures to be taken after Mounting

5.4.2 Checking the Dynamic Misalignment (vessel swinging)

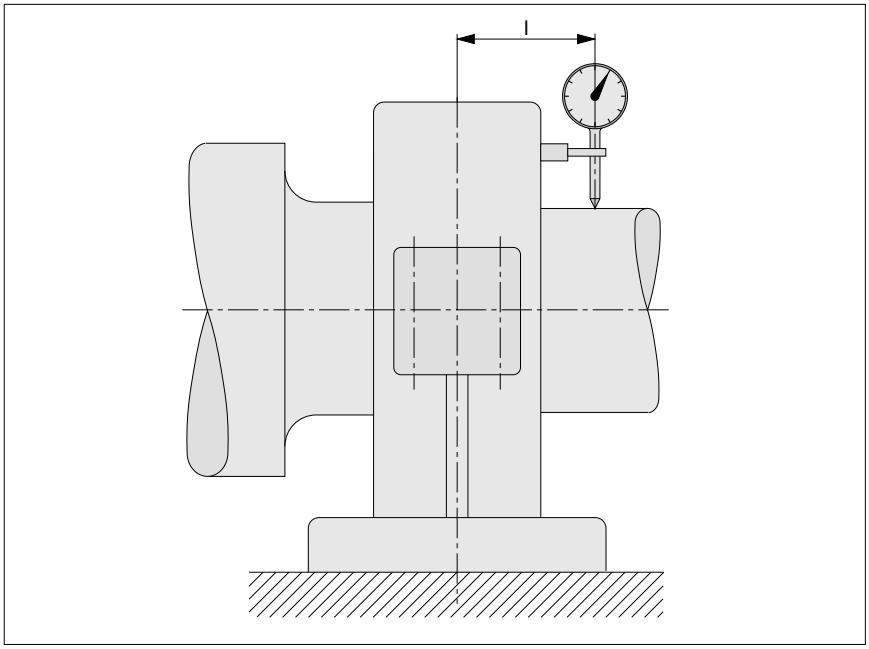
Attach a dial gauge to the housing as shown in the sketch, and place the stylus on the trunnion at a distance l from the bearing center. Then rotate the converter through 360° and take the maximum reading b on the dial gauge. The dynamic misalignment is:

$\tan \beta = b/(2 \cdot l)$

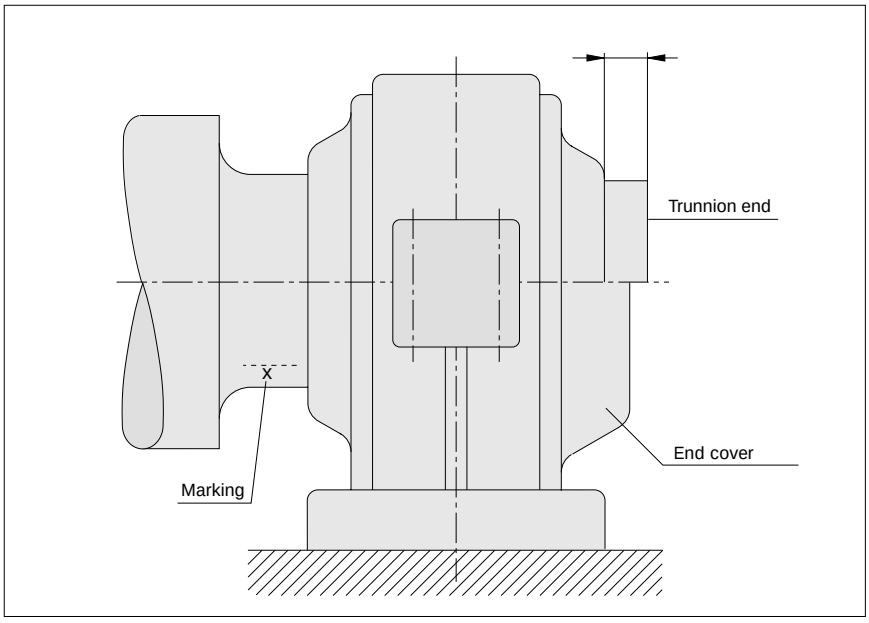
The measured values include the out-of-roundness of the trunnion. However, the permissible out-of-roundness of the trunnion is much less than the deviation from the geometrical axis of rotation.

The measured values shall be entered in the **data sheet**.

The present state of manufacturing accuracy makes misalignment of more than 10 angular minutes very unlikely for new plants. By repeating the measurements it is possible to determine any variation in trunnion position at later stages. In view of the slightness of the deviations engineers often refrain from making a measurement when erecting new converters.



Measuring the dynamic misalignment



Measuring the axial displacement of the floating bearing

5.4.3 Checking the Displacement of the Floating Bearing

During the first campaign of the converter the floating bearing displacement shall be measured. Based on the position of the floating bearing when the converter is cold, the displacement resulting after several days of operation is measured. With an open end cover trunnion (upper picture) the displacement is determined from the distance between the trunnion end and the housing cover face.

If the housing features a closed end a mark is made on that portion of the trunnion which points to the converter (picture below).

Enter the measured values in data sheet E (cp. 5.8) for future reference.

5.5 Lubrication

FAG spherical roller bearings for converters feature a lubricating groove and lubricating holes in the middle of the outer ring. With each relubrication, the lubricant is fed from there directly into the bearings.

The bearings shall be lubricated with lithium soap base greases containing effective EP and anti-corrosion additives, if possible also an MoS_2 additive.

A high base oil viscosity in conjunction with a not-too-soft consistency (NLGI class 2) ensures a good lubricating condition.

If possible, the bearings shall be relubricated with the same grease blend that was used for initial greasing (see project sheet A in section 5.8).

The lubricant for the bearings shall always be used to relubricate the seals as well if grease chambers are provided.

Amount of grease for initial lubrication, replenishment quantity and relubrication intervals, see project sheet A in section 5.8).

5.6. Maintenance

Maintenance of the converter bearings shall be effected as follows:

a ... a b a ... a c a ... a b a etc.

a Activities after commissioning and during operation, see 5.6.1

b Intermediate inspection after 1 to $1^1/_2$ years

c Main inspection after 2 to 3 years

5.6.1 After Commissioning/Between Inspections:

1 After first “campaign” measure floating bearing displacement

2 After every “campaign” relubricate seal (depending on plant)

3 After every “campaign” lubricate displacement sleeve (floating bearing end)

4 Lubricate bearings every 2 to 3 months

5.6.2 Intermediate Inspection after 1 to $1^1/_2$ Years:

1 Remove lateral covers and remove spent grease

2 Check lubricant for contaminants on the spot

3 Check seals and replace them if necessary

4 Replenish lubricant

5.6.3 Main Inspection after 2 to 3 Years

1 Remove lateral covers and housing cap and remove spent grease

2 Take lubricant samples at different distances from the bearing and examine them

3 Remove remaining lubricant

4 Determine possible axial displacement of the floating bearing (inward and outward), compare with the values recorded during original mounting and enter it in data sheet

5 Measure radial clearance and enter value in data sheet (old bearing position)

6 Lift converter until all bearing outer rings are exposed

7 Check surfaces of raceways and rolling elements (record condition in data sheet)

8 Mark four 90° arcs on the outer rings of unsplit bearings

9 Rotate outer ring and roller-cage assemblies 90° and enter old and new position of the outer ring in data sheet

10 Rotate outer ring halves and roller-cage assembly halves of split bearings 180°

11 Lower converter in this position

12 Measure radial clearance and enter the value beside “New bearing position”

13 Fill in fresh lubricant

14 Renew seals

15 Check angular misalignment, compare it with previous records and enter it in data sheet

5.7 Dismounting

Basically, dismounting shall be effected in the reverse order of mounting.

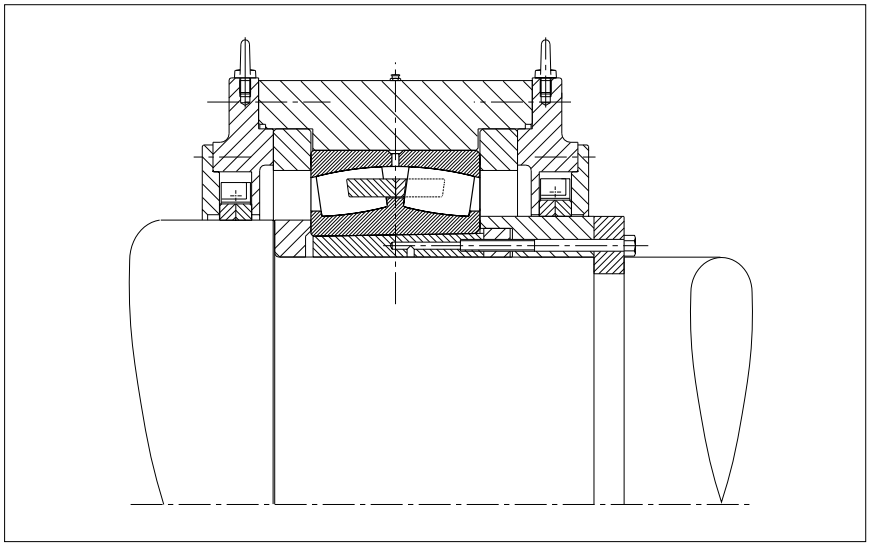
5.7.1 Bearings with a Cylindrical Bore

Bearings with a cylindrical bore which are mounted tightly on the trunnion cannot be dismounted in a conventional manner.

Instead, the bearings may, for example, be dismounted hydraulically using additional auxiliary extraction tools. This, however, requires holes and circular grooves in the trunnions for pressing in the pressure oil. The design featuring a cylindrical seat is intended for a split replacement bearing (locating bearing at the drive end). Since the gear is not dismounted the hydraulic method cannot be used to dismount the locating bearing. Because of the considerable effort involved, it generally is not eligible for the floating bearing end either.

As a rule, converter bearings with a cylindrical bore are destroyed during dismounting because fatigue has rendered them useless. Cut up outer rings and cages with a cutting torch. Try by all means to remove the inner ring by cracking. If this is not possible and the inner ring has to be cut up by means of a cutting torch, make tangential cuts to ensure that the trunnion is not damaged.

After cutting up and removing the outer ring and the two cages, use a welding torch to heat the inner ring well (ca. 300 °C) successively at two opposite points (over the entire width of the ring). Then quench it with a jet of cold water. It is important to quickly produce, by means of the water jet, a great temperature difference between the surface and the core of the material because the resulting tensile stress causes the ring to crack. Because of the risk of accident, the cracking area must be covered.



Position of the extraction bolts for the dismounting process

5.7.2 Bearings with a Tapered Bore and Hydraulic Sleeve

To dismount bearings with a tapered bore and hydraulic sleeve the press fit between trunnion, sleeve and bearing must be slackened. First, loosen the parts which axially locate the bearing toward the trunnion end and arrange them in such a way that the sleeve can shift 0.008 · d (with taper 1:12) or 0.02 · d (with taper 1:30) (d = nominal bearing bore diameter). Then connect the pumps, via extreme-pressure hoses and adapters, to the connections provided in the hydraulic sleeve. Loosen and remove the sleeve from the bearing bore by means of the pressure oil which is then pressed into the fitting joints and by means of the extraction bolts. The position of the extraction bolts is shown in the picture opposite.

5.8 Maintenance Forms

A Project Sheet
B Calculation Sheet
C Replacement
D Sequence of Mounting Steps
E Data Sheet (Original Mounting)
F Data Sheet (Main Inspection)

A Project Sheet

Manufacturer: _____

Project: _____

Code word: _____

Installation site: _____

Vessel capacity: _____

Blowing process: _____

Original equipment: *Locating bearing end*

Housing FAG _____

Data see dwg. no. _____

Bearing FAG _____

Data see dwg. no. _____

Floating bearing end

Housing FAG _____

Data see dwg. no. _____

Bearing FAG _____

Data see dwg. no. _____

Replacement: *Locating bearing* FAG _____

Split spherical roller bering Data see dwg. no. _____

Floating bearing FAG _____

Spherical roller bearing Data see dwg. no. _____

Fit: *Trunnion diameter* _____

Housing diameter (locating bearing) _____

Housing diameter (floating bearing) _____

Displacement in the housing _____

Lubrication: *Arcanol rolling bearing grease (FAG)* _____

Relubricate with the same lubricant as used for initial greasing

Lubricating quantity: *Initial charge*

Bearings 100 %

Housings 60 %

Floating bearing housing [kg] _____

Locating bearing housing [kg] _____

Relubrication

Bearings ca. 8 % of the initial grease fill

_____ kg every 3 months

Sliding area for axial displacement ca. 0.8 % of the initial grease fill after every campaign

Seal after every campaign until fresh grease is supplied (depending on specific plant)

Equipment: _____

Maintenance Forms

B Calculation Sheet

Manufacturer: _____
Project: _____
Code word: _____
Installation site: _____
Design: _____

Determination of the index of static stressing, f_s, for trunnion bearings

Input parameters: _____

Bearing designation: _____
Dimensions: _____ mm
Static load rating: C_0 = _____ kN
Thrust factor: Y_0 = _____

Radial load (floating bearing end, vertical): F_{rL1} = _____ kN
Radial load (floating bearing end, horizontal) F_{rL2} = _____ kN
Radial load (locating bearing end, vertical) F_{rF1} = _____ kN
Radial load (locating bearing end, horizontal) F_{rF2} = _____ kN
Axial load resulting from the blowing process F_a = _____ kN

Coefficient of friction μ = _____

Calculation result
Spherical roller bearing (floating bearing end): f_s = _____
P_{0L} = _____ kN
F_{a1} = _____ kN

Calculation result
Spherical roller bearing (locating bearing end): f_s = _____
P_{0F} = _____ kN
$F_{a\ total}$ = _____ kN

C Replacement

Replacement (floating bearing)

1 - FAG	_____	Spherical roller bearing, unsplit
1 - RG.	_____	Displacement sleeve

Replacement (locating bearing)

1 - FAG	_____	Spherical roller bearing, split

Replacement (sealing/housing)

4 - PRFL.	_____	Sealing
2 - BTL.	_____	Parts for preloading band
2 - BTL.	_____	
8 - MTL.	_____	
4 - BLZ.	_____	
16 - MU.	_____	
8 - BGSH.	_____	
2 - FED.	_____	

Maintenance Forms

D Sequence of Mounting Steps

	Locating bearing	Floating bearing
Measure the trunnion diameter or manufacturer's acceptance report	☐	☐
Measure the housing bores	☐	☐
Check the radii (bearing and shaft shoulder)	☐	☐
Check ancillary parts		
Dimensional and form accuracy	☐	☐
Surface finish	☐	☐
Cleanliness	☐	☐
Measure the bearing's radial clearance (enter values in data sheet)	☐	☐
Mount bearings on trunnions	☐	☐
Grease bearings	☐	☐
Mount housings and accessories	☐	☐
Check position of housings relative to trunnion and adjust it if necessary (take into account permissible misalignment; vertical error, housing not in correct position relative to trunnion)	☐	☐
Height must be recorded appropriately	☐	☐
Check position of floating bearing housing relative to trunnion and adjust it if necessary (displacement possible?)	☐	☐
Lower vessel until it is suspended ca. 2 mm above the platform, check again	☐	☐
Grease bearing location	☐	☐
Insert seal	☐	☐
Close bearing housing	☐	☐
Measure misalignment (static) **and adjust it** (trunnion diameter concentric with cover bore?)	☐	☐

E Data Sheet (Original Mounting)

Bearings Locating bearing _____
Floating bearing _____

		Locating bearing	**Floating bearing**
Radial clearance prior to mounting	[mm]		
Actual dimension (trunnion)	[mm]		
Radial clearance after mounting[*1]	[mm]		
Actual dimension (housing)	[mm]		
Misalignment resulting from housing being incorrectly positioned relative to trunnion			
Misalignment resulting from vertical error			
Total static misalignment			
Possible axial displacement of the floating bearing			
inward	[mm]		
outward	[mm]		
Grease used			

Remarks:

[*1] calculated value

Maintenance Forms

F Data Sheet (Main Inspection)

Total static misalignment (old position of the outer rings) _____ _____

Remove spent lubricant from housing and check for contaminants on the spot.
Result of grease inspection _____

Possible axial displacement of the floating bearing
inward [mm] _____
outward [mm] _____

Bearings Locating bearing _____
Floating bearing _____

Radial clearance (old position) [mm] _____

Lift converter until bearing outer rings are exposed

Check surfaces (raceway and rolling elements)
Condition _____
_____

The service life can be increased by rotating the outer rings and roller-cage assemblies 90° (split bearings: 180°). Enter old and new positions in the data sheet.
Old position (outer ring) _____ _____
New position (outer ring) _____ _____
If necessary, radial clearance of new bearing position [mm] _____ _____

Lower converter

Replenish lubricant _____

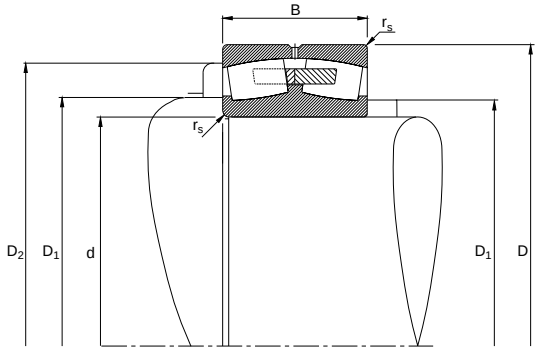
Inspect seal _____ **Replace if necessary** _____

Total static misalignment (new position of the outer rings) _____ _____

6 DIMENSIONAL TABLES FOR CONVERTER BEARINGS AND HOUSINGS

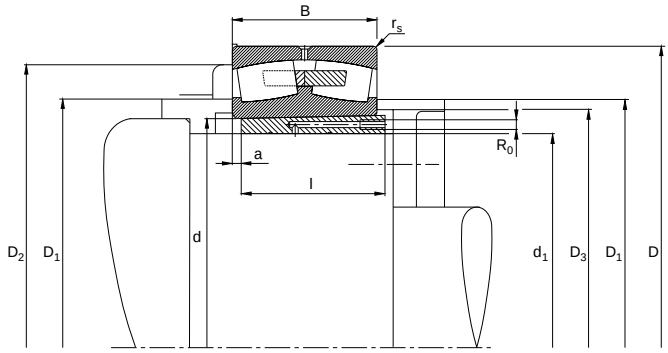
FAG SPHERICAL ROLLER BEARINGS FOR CONVERTERS

**Bearings of dimensional series 49 with machined brass cage (MB)
with a cylindrical bore or with a tapered bore and wedge sleeve**



Cylindrical bore

Code Bearing	Sleeve	**Dimensions** Bearing d	d_1	D	B	r_s min	Sleeve l	a ≈	R_o
FAG	**FAG**	mm							
528739		460		620	160	4			
528739K30	**H.528816**	460	440	620	160	4	160	18	M 8
528740		480		650	170	5			
528740K30	**H.528817**	480	460	650	170	5	170	20	M 8
528741		500		670	170	5			
528741K30	**H.524974**	500	470	670	170	5	170	20	$G^1/_8$
528742		530		710	180	5			
528742K30	**H.524976**	530	500	710	180	5	180	20	$G^1/_8$
528743		560		750	190	5			
528743K30	**H.524978**	560	530	750	190	5	190	20	$G^1/_8$
528744		600		800	200	5			
528744K30	**H.524980**	600	570	800	200	5	200	20	$G^1/_4$
528745		630		850	218	6			
528745K30	**H.524982**	630	600	850	218	6	218	22	$G^1/_4$
528746		670		900	230	7.5			
528746K30	**H.524984**	670	630	900	230	7.5	230	22	$G^1/_4$
528747		710		950	243	6			
528747K30	**H.524986**	710	670	950	243	6	243	22	$G^1/_4$
528748		750		1000	250	6			
528748K30	**H.524988**	750	710	1000	250	6	250	22	$G^1/_4$
528749		800		1060	258	7.5			
528749K30	**H.524990**	800	750	1060	258	7.5	258	22	$G^1/_4$
528750		850		1120	272	6			
528750K30	**H.524992**	850	800	1120	272	6	272	22	$G^1/_4$
528751		900		1180	280	6			
528751K30	**H.524994**	900	850	1180	280	6	280	25	$G^1/_4$
528752		950		1250	300	7.5			
528752K30	**H.524996**	950	900	1250	300	7.5	300	25	$G^1/_4$
528753		1000		1320	315	7.5			
528753K30	**H.524998**	1000	950	1320	315	7.5	315	25	$G^1/_4$

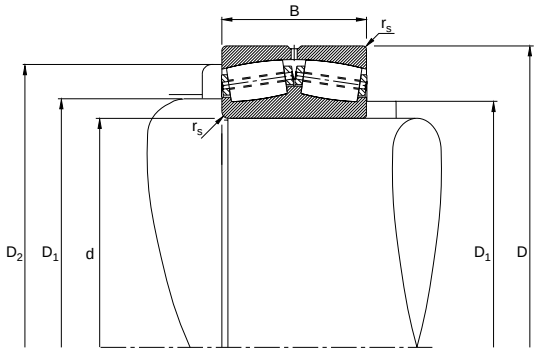


K30, tapered bore (taper 1:30)

Load rating stat.	**Factor**	**Abutment dimensions**			**Grease quantity** ≈	**Mass** ≈	
C_0	Y_0	D_1	D_2	D_3	Initial greasing	Bearing	Sleeve
kN	-	mm			kg	kg	
6100	2.9	494	590		4	140	
6100	2.9	494	590	475	4	140	20
6800	2.9	517	615		4	160	
6800	2.9	517	615	495	4	160	22
7100	3	540	640		5	170	
7100	3	540	640	515	5	170	33
8000	3	570	675		5	210	
8000	3	570	675	545	5	210	38
9300	3	600	710		6	240	
9300	3	600	710	575	6	240	44
10400	3.1	645	755		7	280	
10400	3.1	645	755	615	7	280	50
11800	3	675	805		9	355	
11800	3	675	805	645	9	355	60
13400	3	720	850		10	420	
13400	3	720	850	685	10	420	78
15300	3	760	900		12	490	
15300	3	760	900	725	12	490	95
16600	3.1	800	950		14	550	
16600	3.1	800	950	765	14	550	105
18300	3.2	860	1010		15	625	
18300	3.2	860	1010	820	15	625	140
20000	3.2	910	1070		18	725	
20000	3.2	910	1070	870	18	725	155
22000	3.3	960	1120		20	820	
22000	3.3	960	1120	920	20	820	175
25000	3.2	1015	1190		25	1000	
25000	3.2	1015	1190	970	25	1000	200
27000	3.3	1065	1250		30	1180	
27000	3.3	1065	1250	1025	30	1180	225

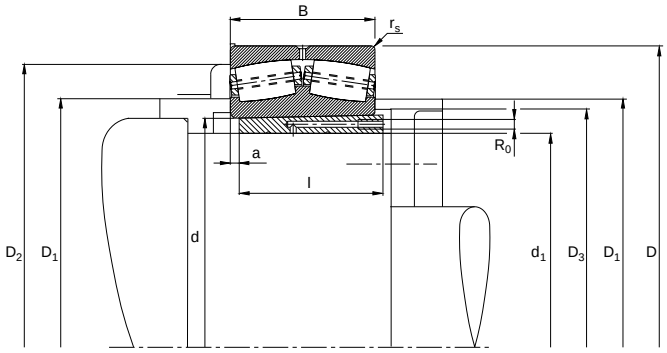
FAG SPHERICAL ROLLER BEARINGS FOR CONVERTERS

Bearings of dimensional series 49 with pin-type cage
with a cylindrical bore or with a tapered bore and wedge sleeve



Cylindrical bore

Code		**Dimensions**							
Bearing	Sleeve	Bearing					Sleeve		
		d	d_1	D	B	r_s min	l	a ≈	R_o
FAG	**FAG**	mm							
249/500.541821		500		670	170	5			
249/500K30.541821	**H.524974**	500	470	670	170	5	170	20	$G^1/_8$
249/530.541822		530		710	180	5			
249/530K30.541822	**H.524976**	530	500	710	180	5	180	20	$G^1/_8$
249/560.541823		560		750	190	5			
249/560K30.541823	**H.524978**	560	530	750	190	5	190	20	$G^1/_8$
249/600.541824		600		800	200	5			
249/600K30.541824	**H.524980**	600	570	800	200	5	200	20	$G^1/_4$
249/630.541825		630		850	218	6			
249/630K30.541825	**H.524982**	630	600	850	218	6	218	22	$G^1/_4$
249/670.541826		670		900	230	6			
249/670K30.541826	**H.524984**	670	630	900	230	6	230	22	$G^1/_4$
249/710.541827		710		950	243	6			
249/710K30.541827	**H.524986**	710	670	950	243	6	243	22	$G^1/_4$
249/750.541828		750		1000	250	6			
249/750K30.541828	**H.524988**	750	710	1000	250	6	250	22	$G^1/_4$
249/800.541829		800		1060	258	6			
249/800K30.541829	**H.524990**	800	750	1060	258	6	258	22	$G^1/_4$
249/850.541830		850		1120	272	6			
249/850K30.541830	**H.524992**	850	800	1120	272	6	272	22	$G^1/_4$
249/900.541831		900		1180	280	6			
249/900K30.541831	**H.524994**	900	850	1180	280	6	280	25	$G^1/_4$
249/950.541832		950		1250	300	7.5			
249/950K30.541832	**H.524996**	950	900	1250	300	7.5	300	25	$G^1/_4$
249/1000.541833		1000		1320	315	7.5			
249/1000K30.541833	**H.524998**	1000	950	1320	315	7.5	315	25	$G^1/_4$
249/1060.541834		1060		1400	335	7.5			
249/1060K30.541834	**H.525000**	1060	1000	1400	335	7.5	335	25	$G^1/_4$
249/1120.541835		1120		1460	335	7.5			
249/1120K30.541835	**H.525001**	1120	1060	1460	335	7.5	335	27	$G^1/_4$
249/1180.541836		1180		1540	355	7.5			
249/1180K30.541836	**H.525003**	1180	1120	1540	355	7.5	355	27	$G^1/_4$
249/1250.541837		1250		1630	375	7.5			
249/1250K30.541837	**H.525005**	1250	1180	1630	375	7.5	375	27	$G^1/_4$
249/1320.541838		1320		1720	400	7.5			
249/1320K30.541838	**H.525007**	1320	1250	1720	400	7.5	400	28	$G^1/_4$

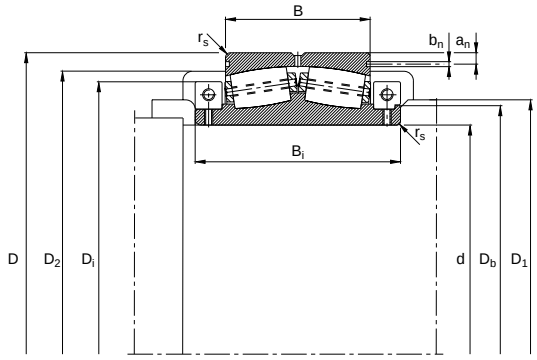


K30, tapered bore (taper 1:30)

Load rating stat.	**Factor**	**Abutment dimensions**			**Grease quantity** ≈	**Mass** ≈	
C_0	Y_0	D_1	D_2	D_3	Initial greasing	Bearing	Sleeve
kN	-	mm			kg	kg	
9000	3	540	640		5	175	
9000	3	540	640	515	5	175	33
10000	3	570	675		5	210	
10000	3	570	675	545	5	210	38
11400	3	600	710		6	250	
11400	3	600	710	575	6	250	44
12700	3	645	755		7	290	
12700	3	645	755	615	7	290	50
15000	2.9	675	805		9	370	
15000	2.9	675	805	645	9	370	60
16600	3	720	850		10	435	
16600	3	720	850	685	10	435	78
18600	2.9	760	900		12	510	
18600	2.9	760	900	725	12	510	95
20000	3	800	950		14	575	
20000	3	800	950	765	14	575	105
22400	3.1	860	1010		15	655	
22400	3.1	860	1010	820	15	655	140
24500	3.1	910	1070		18	760	
24500	3.1	910	1070	870	18	760	155
27500	3.2	960	1120		20	855	
27500	3.2	960	1120	920	20	855	175
31000	3.2	1015	1190		25	1040	
31000	3.2	1015	1190	970	25	1040	200
34500	3.2	1065	1250		30	1225	
34500	3.2	1065	1250	1025	30	1225	225
37500	3.2	1135	1325		35	1470	
37500	3.2	1135	1325	1085	35	1470	290
40500	3.3	1195	1385		37	1540	
40500	3.3	1195	1385	1145	37	1540	305
46500	3.3	1260	1460		43	1820	
46500	3.3	1260	1460	1205	43	1820	340
51000	3.3	1330	1550		50	2150	
51000	3.3	1330	1550	1275	50	2150	390
57000	3.3	1400	1640		60	2500	
57000	3.3	1400	1640	1350	60	2500	485

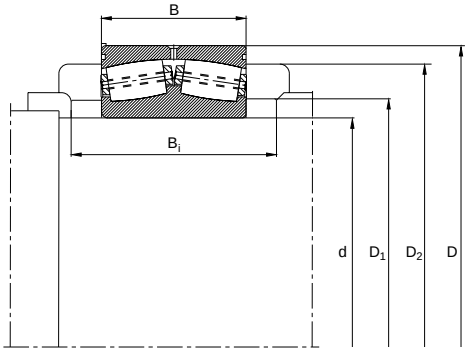
FAG SPLIT SPHERICAL ROLLER BEARINGS FOR CONVERTERS

Main dimensions adapted to those of spherical roller bearings of series 249



Split spherical roller bearing

Code Split bearing	**Dimensions**								
	d	D	B	r_s min	B_i	D_b	D_i	a_n	b_n
FAG	mm								
537276	500	670	170	5	250	534	608	13	14
537277	530	710	180	5	260	566	644	15	15
537278	560	750	190	5	270	600	678	15	15
533761	600	800	200	5	290	636	724	15	15
537279	630	850	218	6	310	678	768	18	18
537280	670	900	230	7.5	325	720	810	18	18
526073	710	950	243	6	350	756	860	18	20
533414	750	1000	250	7.5	355	800	900	15	13
532063	800	1060	258	7.5	370	856	960	17.5	16
537281	850	1120	272	6	385	910	1020	20	20
537282	900	1180	280	6	390	958	1068	22.5	20
534826	950	1250	300	7.5	410	1016	1130	20	20
533567	1000	1320	315	7.5	450	1070	1205	17.5	13
537283	1060	1400	335	7.5	475	1134	1268	25	20
537284	1120	1460	335	7.5	475	1194	1328	25	20
536806	1180	1540	355	7.5	500	1256	1400	25	25
537285	1250	1630	375	7.5	545	1336	1498	25	20

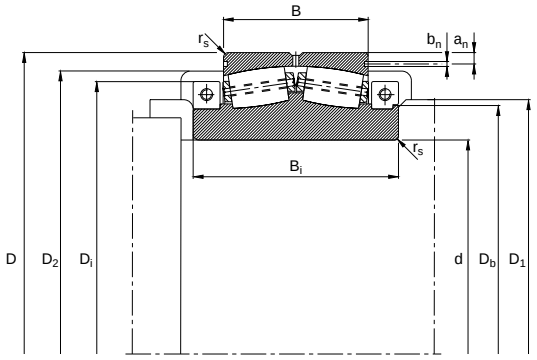


replaces unsplit spherical roller bearing
with lateral spacer rings

Load rating stat.	**Factor**	**Abutment dimensions**		**Grease quantity** ≈ Initial greasing	**Mass** ≈ Bearing
C_0	Y_0	D_1	D_2		
kN	-	mm		kg	kg
7650	3	540	620	5	225
8650	3	570	660	5	270
10200	3	600	695	6	305
11200	3.1	645	745	7	360
13200	3	675	785	9	460
15000	3	720	830	10	540
16000	3	760	880	12	640
19000	3	800	930	14	740
20400	3.2	860	980	15	810
22000	3.2	910	1040	18	940
23600	3.3	960	1100	20	1050
28500	3.2	1015	1160	25	1250
32000	3.2	1065	1230	30	1565
36000	3.2	1135	1300	35	1820
36500	3.4	1195	1360	37	1920
40500	3.3	1260	1440	43	2240
45000	3.4	1330	1530	50	2700

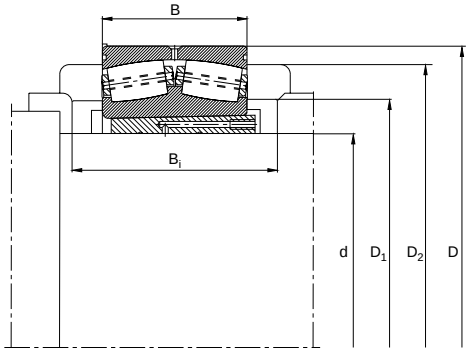
FAG SPLIT SPHERICAL ROLLER BEARINGS FOR CONVERTERS

Main dimensions adapted to those of spherical roller bearings of series 249 with a tapered bore and wedge sleeve



Split spherical roller bearing

Code Split bearing	**Dimensions**								
	d	D	B	r_s min	B_i	D_b	D_i	a_n	b_n
FAG	mm								
529173	470	670	170	5	250	515	595	15	15
528441	500	710	180	5	260	545	630	15	15
529223	530	750	190	5	270	580	665	15	15
529224	570	800	200	5	290	625	710	15	15
529225	600	850	218	6	310	660	752	18	20
529226	630	900	230	6	330	690	790	20	20
529227	670	950	243	6	350	740	842	20	20
527943	710	1000	250	6	360	765	895	18	20
529228	750	1060	258	6	370	825	940	20	20
529229	800	1120	272	6	390	870	990	20	20
529230	850	1180	280	6	400	925	1050	22	25
527254	900	1250	300	7.5	420	980	1115	22	25
529231	950	1320	315	7.5	460	1035	1180	25	25
529232	1000	1400	335	7.5	490	1100	1255	25	25
529233	1060	1460	335	7.5	490	1160	1315	25	25
529234	1120	1540	355	7.5	520	1220	1385	25	25
529128	1180	1630	375	7.5	550	1280	1465	25	25
529215	1250	1720	400	7.5	580	1370	1545	25	25

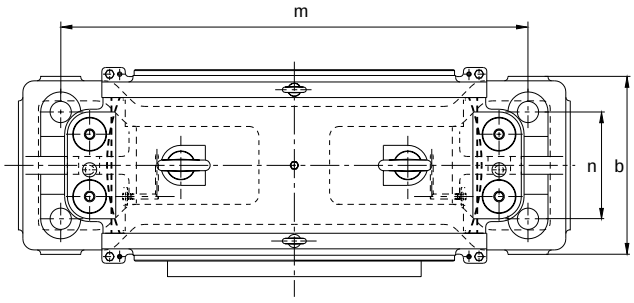


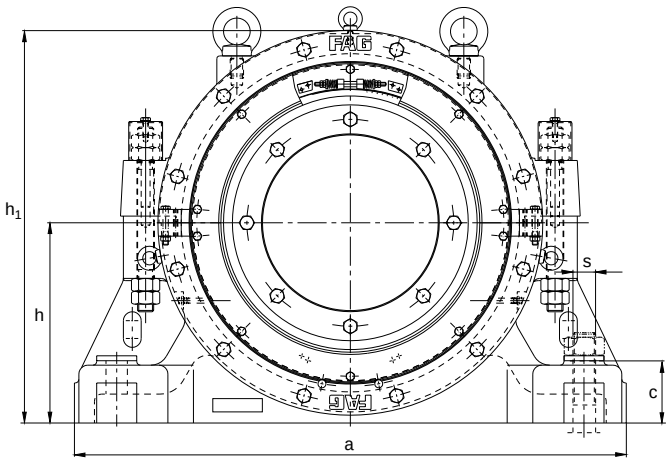
replaces unsplit spherical roller bearing with wedge sleeve and lateral spacer rings

Load rating stat.	**Factor**	**Abutment dimensions**		**Grease quantity** ≈ Initial greasing	**Mass** ≈ Bearing
C_0	Y_0	D_1	D_2		
kN	-	mm		kg	kg
7350	3	540	620	5	265
8650	2.9	570	660	5	310
9300	2.9	600	695	6	355
10400	2.9	645	745	7	410
12200	2.9	675	780	9	525
13200	2.9	720	830	10	630
15600	2.9	760	880	12	740
17300	3.1	800	930	14	850
19000	3	860	980	15	950
20400	3	910	1040	18	1100
23200	3.1	960	1100	20	1250
25500	3.1	1015	1160	25	1490
28500	3.1	1065	1230	30	1800
32500	3	1135	1300	35	2180
35500	3.3	1195	1360	37	2300
37500	3.3	1260	1440	43	2650
43000	3.3	1330	1520	50	3150
49000	3.3	1400	1610	60	3800

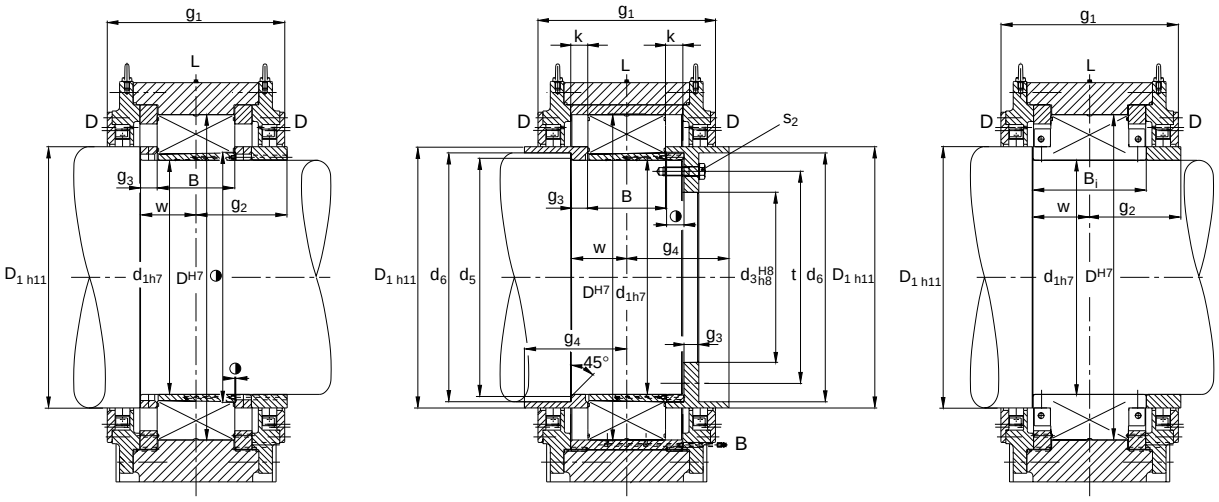
SPLIT FAG PLUMMER BLOCK HOUSINGS FOR CONVERTERS

Locating bearing housings KPG49..F and KPG49..FG,
floating bearing housings KPG49..L
for spherical roller bearings with a tapered bore and wedge sleeve
for split spherical roller bearings





Housing	Bearing			Sleeve	Dimensions											
	MB cage	Pin-type cage	split		d_1	D	B	B_1	D_1	d_3	d_5	d_6	w	t	s_2 DIN931	s_2 Number
FAG	FAG	FAG	FAG	FAG	mm											
KPG49/470F	**528741K30**	**249/500K30.541821**		**H.524974**	470	670	170		540				125			
KPG49/470L	**528741K30**	**249/500K30.541821**		**H.524974**	470	670	170		540	375	480	505	125	437.5	M20x70	8
KPG49/470FG			**529173**		470	670	170	250	540				125			
KPG49/500F	**528742K30**	**249/530K30.541822**		**H.524976**	500	710	180		570				130			
KPG49/500L	**528742K30**	**249/530K30.541822**		**H.524976**	500	710	180		570	400	510	535	130	465	M20x70	8
KPG49/500FG			**528441**		500	710	180	260	570				130			
KPG49/530F	**528743K30**	**249/560K30.541823**		**H.524978**	530	750	190		600				135			
KPG49/530L	**528743K30**	**249/560K30.541823**		**H.524978**	530	750	190		600	420	540	565	135	490	M20x70	8
KPG49/530FG			**529223**		530	750	190	270	600				135			
KPG49/570F	**528744K30**	**249/600K30.541824**		**H.524980**	570	800	200		645				145			
KPG49/570L	**528744K30**	**249/600K30.541824**		**H.524980**	570	800	200		645	450	580	610	145	525	M20x80	8
KPG49/570FG			**529224**		570	800	200	290	645				145			
KPG49/600F	**528745K30**	**249/630K30.541825**		**H.524982**	600	850	218		675				155			
KPG49/600L	**528745K30**	**249/630K30.541825**		**H.524982**	600	850	218		675	475	612	640	155	552.5	M20x80	8
KPG49/600FG			**529225**		600	850	218	310	675				155			
KPG49/630F	**528746K30**	**249/670K30.541826**		**H.524984**	630	900	230		720				165			
KPG49/630L	**528746K30**	**249/670K30.541826**		**H.524984**	630	900	230		720	505	642	675	165	587.5	M24x90	8
KPG49/630FG			**529226**		630	900	230	330	720				165			
KPG49/670F	**528747K30**	**249/710K30.541827**		**H.524986**	670	950	243		760				175			
KPG49/670L	**528747K30**	**249/710K30.541827**		**H.524986**	670	950	243		760	535	682	715	175	622.5	M24x90	8
KPG49/670FG			**529227**		670	950	243	350	760				175			
KPG49/710F	**528748K30**	**249/750K30.541828**		**H.524988**	710	1000	250		800				180			
KPG49/710L	**528748K30**	**249/750K30.541828**		**H.524988**	710	1000	250		800	565	722	755	180	657.5	M30x100	8
KPG49/710FG			**527943**		710	1000	250	360	800				180			
KPG49/750F	**528749K30**	**249/800K30.541829**		**H.524990**	750	1060	258		860				185			
KPG49/750L	**528749K30**	**249/800K30.541829**		**H.524990**	750	1060	258		860	600	762	805	185	700	M30x100	8
KPG49/750FG			**529228**		750	1060	258	370	860				185			



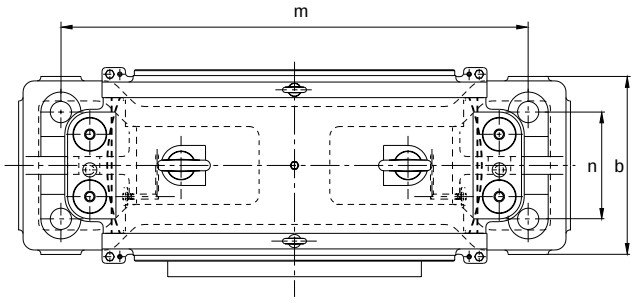
KPG49..F KPG49..L KPG49..FG

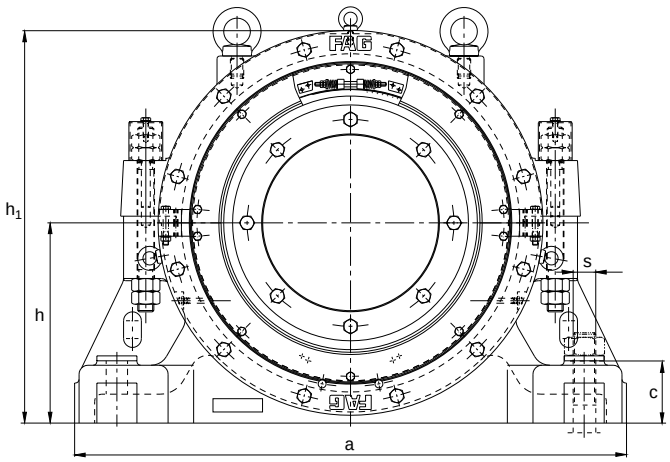
L Bearing relubrication D Seal relubrication B Sleeve relubrication

Housing dimensions													Grease quantity ≈ Initial greasing	Mass ≈ Housing	Bearing	Sleeve
a	b	c	g_1	g_2	g_3	g_4	h	h_1	k	m	n	s				
mm													kg	kg		
1170	375	130	400	210	40		425	820		975	230	M42	10	945	170	33
1170	375	130	400		40	230	425	820	40	975	230	M42	14	945	170	33
1170	375	130	400	210			425	820		975	230	M42	8	945	265	
1240	400	140	410	215	40		450	875		1050	240	M42	10	1050	210	38
1240	400	140	410		40	235	450	875	40	1050	240	M42	14	1050	210	38
1240	400	140	410	215			450	875		1050	240	M42	8	1050	310	
1320	420	145	420	220	40		475	930		1100	255	M48	13	1365	240	44
1320	420	145	420		40	240	475	930	40	1100	255	M48	15	1365	240	44
1320	420	145	420	220			475	930		1100	255	M48	10	1365	355	
1400	440	155	460	240	45		500	980		1150	270	M52	15	1575	280	50
1400	440	155	460		45	260	500	980	40	1150	270	M52	20	1575	280	50
1400	440	155	460	240			500	980		1150	270	M52	12	1575	410	
1500	480	165	480	250	46		535	1040		1225	295	M56	20	2205	355	60
1500	480	165	480		46	270	535	1040	40	1225	295	M56	24	2205	355	60
1500	480	165	480	250			535	1040		1225	295	M56	15	2205	525	
1570	500	175	500	260	50		570	1110		1300	310	M56	22	2625	420	78
1570	500	175	500		50	280	570	1110	40	1300	310	M56	25	2625	420	78
1570	500	175	500	260			570	1110		1300	310	M56	18	2625	630	
1660	535	185	560	290	53.5		600	1170		1375	325	M64	26	2835	490	95
1660	535	185	560		53.5	317.5	600	1170	50	1375	325	M64	30	2835	490	95
1660	535	185	560	290			600	1170		1375	325	M64	20	2835	740	
1750	550	195	590	305	55		630	1240		1450	335	M64	30	2940	550	105
1750	550	195	590		55	332.5	630	1240	50	1450	335	M64	35	2940	550	105
1750	550	195	590	305			630	1240		1450	335	M64	24	2940	850	
1850	570	205	600	310	56		670	1310		1550	345	M72	35	3465	625	140
1850	570	205	600		56	337.5	670	1310	50	1550	345	M72	40	3465	625	140
1850	570	205	600	310			670	1310		1550	345	M72	26	3465	950	

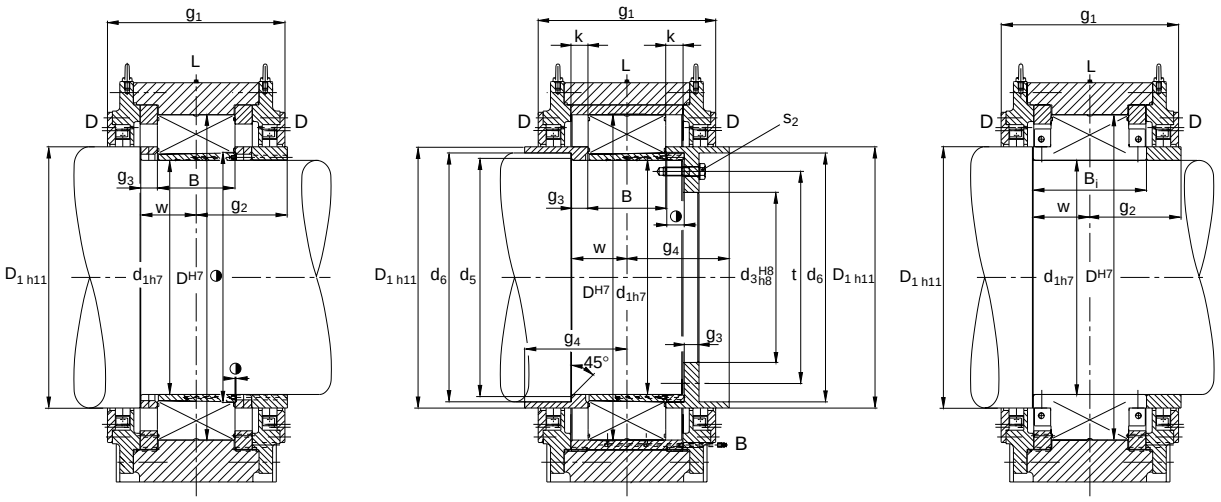
SPLIT FAG PLUMMER BLOCK HOUSINGS FOR CONVERTERS

Locating bearing housings KPG49..F and KPG49..FG,
floating bearing housings KPG49..L
for spherical roller bearings with a tapered bore and wedge sleeve
for split spherical roller bearings





Housing	Bearing			Sleeve	Dimensions											
	MB cage	Pin-type cage	split		d_1	D	B	B_i	D_1	d_3	d_5	d_6	w	t	s_2 DIN931	s_2 Number
FAG	FAG	FAG	FAG	FAG	mm											
KPG49/800F	**528750K30**	**249/850K30.541830**		**H.524992**	800	1120	272		910				195			
KPG49/800L	**528750K30**	**249/850K30.541830**		**H.524992**	800	1120	272		910	640	812	855	195	745	M30x110	8
KPG49/800FG			**529229**		800	1120	272	390	910				195			
KPG49/850F	**528751K30**	**249/900K30.541831**		**H.524994**	850	1180	280		960				200			
KPG49/850L	**528751K30**	**249/900K30.541831**		**H.524994**	850	1180	280		960	675	862	905	200	787.5	M30x110	8
KPG49/850FG			**529230**		850	1180	280	400	960				200			
KPG49/900F	**528752K30**	**249/950K30.541832**		**H.524996**	900	1250	300		1015				210			
KPG49/900L	**528752K30**	**249/950K30.541832**		**H.524996**	900	1250	300		1015	715	915	960	210	832.5	M36x110	8
KPG49/900FG			**527254**		900	1250	300	420	1015				210			
KPG49/950F	**528753K30**	**249/1000K30.541833**		**H.524998**	950	1320	315		1065				230			
KPG49/950L	**528753K30**	**249/1000K30.541833**		**H.524998**	950	1320	315		1065	750	965	1010	230	875	M36x130	8
KPG49/950FG			**529231**		950	1320	315	460	1065				230			
KPG49/1000F		**249/1060K30.541834**		**H.525000**	1000	1400	335		1135				245			
KPG49/1000L		**249/1060K30.541834**		**H.525000**	1000	1400	335		1135	795	1015	1070	245	927.5	M36x130	8
KPG49/1000FG			**529232**		1000	1400	335	490	1135				245			
KPG49/1060F		**249/1120K30.541835**		**H.525001**	1060	1460	335		1195				245			
KPG49/1060L		**249/1120K30.541835**		**H.525001**	1060	1460	335		1195	840	1075	1130	245	980	M42x140	8
KPG49/1060FG			**529233**		1060	1460	335	490	1195				245			
KPG49/1120F		**249/1180K30.541836**		**H.525003**	1120	1540	355		1260				260			
KPG49/1120L		**249/1180K30.541836**		**H.525003**	1120	1540	355		1260	885	1135	1190	260	1032.5	M42x140	8
KPG49/1120FG			**529234**		1120	1540	355	520	1260				260			
KPG49/1180F		**249/1250K30.541837**		**H.525005**	1180	1630	375		1330				275			
KPG49/1180L		**249/1250K30.541837**		**H.525005**	1180	1630	375		1330	940	1195	1255	275	1095	M42x150	8
KPG49/1180FG			**529128**		1180	1630	375	550	1330				275			
KPG49/1250F		**249/1320K30.541838**		**H.525007**	1250	1720	400		1400				290			
KPG49/1250L		**249/1320K30.541838**		**H.525007**	1250	1720	400		1400	990	1265	1325	290	1155	M48x180	8
KPG49/1250FG			**529215**		1250	1720	400	580	1400				290			



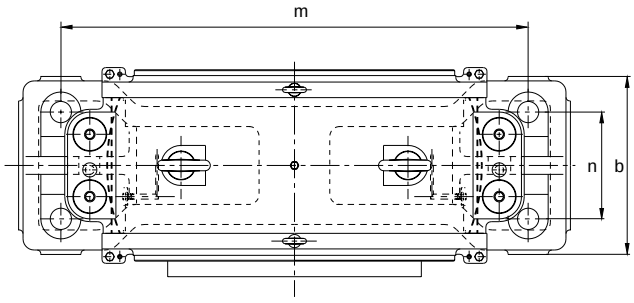
KPG49..F KPG49..L KPG49..FG

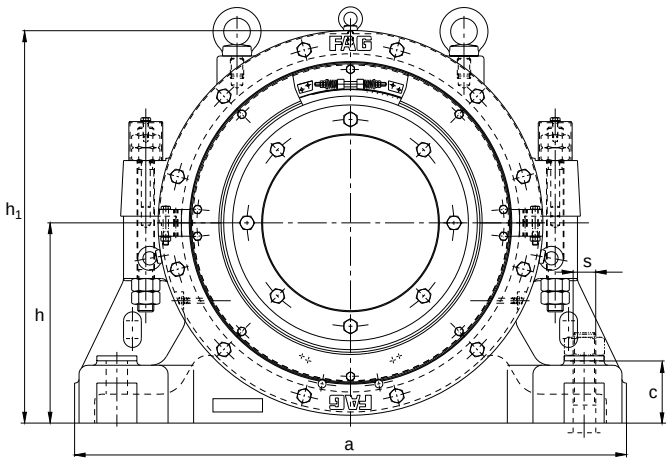
L Bearing relubrication D Seal relubrication B Sleeve relubrication

Housing dimensions													**Grease quantity** ≈	**Mass** ≈		
a	b	c	g_1	g_2	g_3	g_4	h	h_1	k	m	n	s	Initial greasing	Housing	Bearing	Sleeve
mm													kg	kg		
1960	600	220	630	325	59		710	1390		1600	360	M72	40	3885	725	155
1960	600	220	630		59	352.5	710	1390	50	1600	360	M72	50	3885	725	155
1960	600	220	630	325			710	1390		1600	360	M72	30	3885	1100	
2060	620	230	660	340	60		740	1450		1700	370	M80	45	4515	820	175
2060	620	230	660		60	375	740	1450	60	1700	370	M80	55	4515	820	175
2060	620	230	660	340			740	1450		1700	370	M80	35	4515	1250	
2200	660	250	680	350	60		800	1550		1820	390	M90	55	5460	1000	200
2200	660	250	680		60	385	800	1550	60	1820	390	M90	65	5460	1000	200
2200	660	250	680	350			800	1550		1820	390	M90	45	5460	1490	
2330	650	255	720	370	72.5		830	1620		1980	360	M90	65	5660	1180	225
2330	650	255	720		72.5	412.5	830	1620	70	1980	360	M90	80	5660	1180	225
2330	650	255	720	370			830	1620		1980	360	M90	50	5660	1800	
2450	740	275	780	400	77.5		880	1710		2000	460	M100	75	7140	1420	290
2450	740	275	780		77.5	435	880	1710	60	2000	460	M100	95	7140	1420	290
2450	740	275	780	400			880	1710		2000	460	M100	60	7140	2190	
2560	740	285	800	410	77.5		920	1780		2150	460	M100	80	8400	1500	290
2560	740	285	800		77.5	452.5	920	1780	70	2150	460	M100	100	8400	1500	290
2560	740	285	800	410			920	1780		2150	460	M100	65	8400	2300	
2700	780	300	820	420	82.5		970	1880		2300	480	M110	95	9450	1750	330
2700	780	300	820		82.5	462.5	970	1880	70	2300	480	M110	110	9450	1750	330
2700	780	300	820	420			970	1880		2300	480	M110	75	9450	2650	
2850	820	320	850	435	87.5		1010	1985		2400	510	M110	110	11550	2070	390
2850	820	320	850		87.5	477.5	1010	1985	70	2400	510	M110	130	11550	2070	390
2850	820	320	850	435			1010	1985		2400	510	M110	85	11550	3150	
3000	850	340	900	460	90		1080	2100		2500	520	M125	125	13440	2460	485
3000	850	340	900		90	502.5	1080	2100	70	2500	520	M125	170	13440	2460	485
3000	850	340	900	460			1080	2100		2500	520	M125	100	13440	3800	

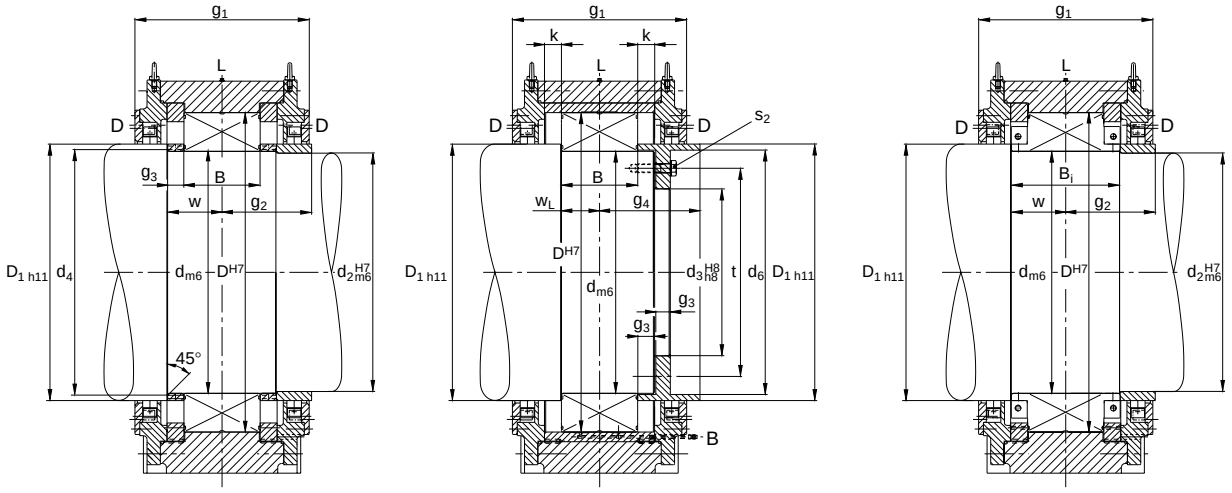
SPLIT FAG PLUMMER BLOCK HOUSINGS FOR CONVERTERS

Locating bearing housings KPGZ49..F and KPGZ49..FG,
floating bearing housings KPGZ49..L
for spherical roller bearings with a cylindrical bore
for split spherical roller bearings





Housing	Bearing			Dimensions													
	MB cage	Pin-type cage	split	d	D	B	B_i	D_1	d_2	d_3	d_4	d_6	w	w_L	t	s_2 DIN931	s_2 Number
FAG	FAG	FAG	FAG	mm													
KPGZ49/500F	**528741**	**249/500.541821**		500	670	170		540	495		510		125				
KPGZ49/500L	**528741**	**249/500.541821**		500	670	170		540		375		505		85	437.5	M20x70	8
KPGZ49/500FG			**537276**	500	670	170	250	540	495				125				
KPGZ49/530F	**528742**	**249/530.541822**		530	710	180		570	525		540		130				
KPGZ49/530L	**528742**	**249/530.541822**		530	710	180		570		400		535		90	465	M20x70	8
KPGZ49/530FG			**537277**	530	710	180	260	570	525				130				
KPGZ49/560F	**528743**	**249/560.541823**		560	750	190		600	555		570		135				
KPGZ49/560L	**528743**	**249/560.541823**		560	750	190		600		420		565		95	490	M20x70	8
KPGZ49/560FG			**537278**	560	750	190	270	600	555				135				
KPGZ49/600F	**528744**	**249/600.541824**		600	800	200		645	595		610		145				
KPGZ49/600L	**528744**	**249/600.541824**		600	800	200		645		450		610		100	525	M20x80	8
KPGZ49/600FG			**533761**	600	800	200	290	645	595				145				
KPGZ49/630F	**528745**	**249/630.541825**		630	850	218		675	625		642		155				
KPGZ49/630L	**528745**	**249/630.541825**		630	850	218		675		475		640		109	552.5	M20x80	8
KPGZ49/630FG			**537279**	630	850	218	310	675	625				155				
KPGZ49/670F	**528746**	**249/670.541826**		670	900	230		720	665		682		162.5				
KPGZ49/670L	**528746**	**249/670.541826**		670	900	230		720		505		675		115	587.5	M24x90	8
KPGZ49/670FG			**537280**	670	900	230	325	720	665				162.5				
KPGZ49/710F	**528747**	**249/710.541827**		710	950	243		760	695		722		175				
KPGZ49/710L	**528747**	**249/710.541827**		710	950	243		760		535		715		121.5	622.5	M24x90	8
KPGZ49/710FG			**526073**	710	950	243	350	760	695				175				
KPGZ49/750F	**528748**	**249/750.541828**		750	1000	250		800	745		762		177.5				
KPGZ49/750L	**528748**	**249/750.541828**		750	1000	250		800		565		755		125	657.5	M30x100	8
KPGZ49/750FG			**533414**	750	1000	250	355	800	745				177.5				
KPGZ49/800F	**528749**	**249/800.541829**		800	1060	258		860	795		812		185				
KPGZ49/800L	**528749**	**249/800.541829**		800	1060	258		860		600		805		129	700	M30x100	8
KPGZ49/800FG			**532063**	800	1060	258	370	860	795				185				



KPGZ49..F KPGZ49..L KPGZ49..FG

L Bearing relubrication D Seal relubrication B Sleeve relubrication

Housing dimensions													Grease quantity ≈	Mass ≈	
a	b	c	g_1	g_2	g_3	g_4	h	h_1	k	m	n	s	Initial greasing	Housing	Bearing
mm													kg	kg	
1170	375	130	400	210	40		425	820		975	230	M42	10	900	170
1170	375	130	400		40	230	425	820	40	975	230	M42	14	900	175
1170	375	130	400	210			425	820		975	230	M42	8	900	220
1240	400	140	410	215	40		450	875		1050	240	M42	10	1000	210
1240	400	140	410		40	235	450	875	40	1050	240	M42	14	1000	210
1240	400	140	410	215			450	875		1050	240	M42	8	1000	260
1320	420	145	420	220	40		475	930		1100	255	M48	13	1300	240
1320	420	145	420		40	240	475	930	40	1100	255	M48	15	1300	250
1320	420	145	420	220			475	930		1100	255	M48	10	1300	300
1400	440	155	460	240	45		500	980		1150	270	M52	15	1500	280
1400	440	155	460		45	260	500	980	40	1150	270	M52	20	1500	290
1400	440	155	460	240			500	980		1150	270	M52	12	1500	360
1500	480	165	480	250	46		535	1040		1225	295	M56	20	2100	355
1500	480	165	480		46	270	535	1040	40	1225	295	M56	24	2100	370
1500	480	165	480	250			535	1040		1225	295	M56	15	2100	450
1570	500	175	500	260	47.5		570	1110		1300	310	M56	22	2500	420
1570	500	175	500		47.5	280	570	1110	40	1300	310	M56	25	2500	435
1570	500	175	500	260			570	1110		1300	310	M56	18	2500	540
1660	535	185	560	290	53.5		600	1170		1375	325	M64	26	2700	490
1660	535	185	560		53.5	317.5	600	1170	50	1375	325	M64	30	2700	510
1660	535	185	560	290			600	1170		1375	325	M64	20	2700	640
1750	550	195	590	305	52.5		630	1240		1450	335	M64	30	2800	550
1750	550	195	590		52.5	332.5	630	1240	50	1450	335	M64	35	2800	575
1750	550	195	590	305			630	1240		1450	335	M64	24	2800	740
1850	570	205	600	310	56		670	1310		1550	345	M72	35	3300	635
1850	570	205	600		56	337.5	670	1310	50	1550	345	M72	40	3300	655
1850	570	205	600	310			670	1310		1550	345	M72	26	3300	810

SPLIT FAG PLUMMER BLOCK HOUSINGS FOR CONVERTERS

Locating bearing housings KPGZ49..F and KPGZ49..FG,
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for spherical roller bearings with a cylindrical bore
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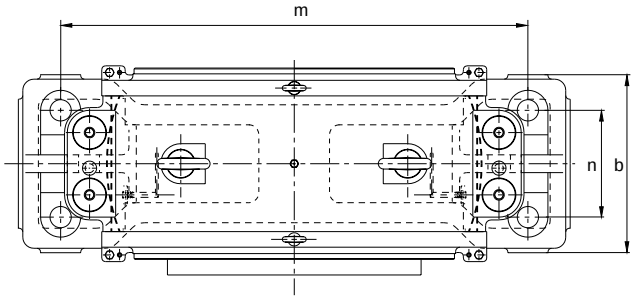
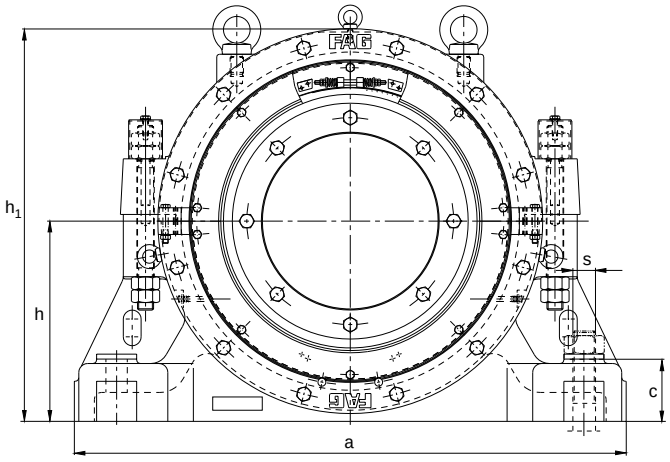
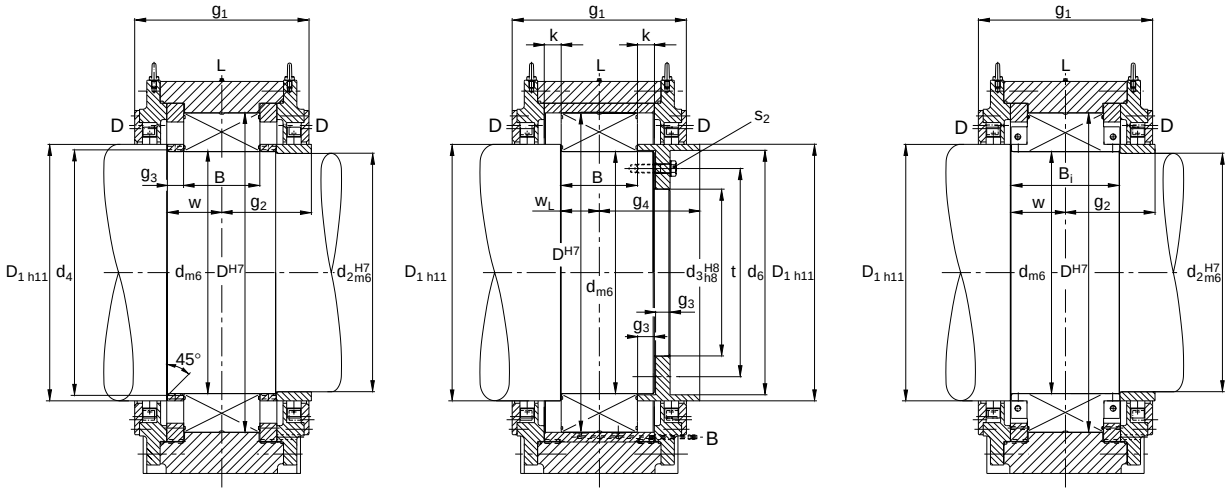




Housing	Bearing			Dimensions													
	MB cage	Pin-type cage	split	d	D	B	B_i	D_1	d_2	d_3	d_4	d_6	w	w_L	t	s_2 DIN931	s_2 Number
FAG	**FAG**	**FAG**	**FAG**	mm													
KPGZ49/850F	**528750**	**249/850.541830**		850	1120	272		910	845		862		192.5				
KPGZ49/850L	**528750**	**249/850.541830**		850	1120	272		910		640		855		136	745	M30x110	8
KPGZ49/850FG			**537281**	850	1120	272	385	910	845				192.5				
KPGZ49/900F	**528751**	**249/900.541831**		900	1180	280		960	895		912		195				
KPGZ49/900L	**528751**	**249/900.541831**		900	1180	280		960		675		905		140	787.5	M30x110	8
KPGZ49/900FG			**537282**	900	1180	280	390	960	895				195				
KPGZ49/950F	**528752**	**249/950.541832**		950	1250	300		1015	945		965		205				
KPGZ49/950L	**528752**	**249/950.541832**		950	1250	300		1015		715		960		150	832.5	M36x110	8
KPGZ49/950FG			**534826**	950	1250	300	410	1015	945				205				
KPGZ49/1000F	**528753**	**249/1000.541833**		1000	1320	315		1065	985		1015		225				
KPGZ49/1000L	**528753**	**249/1000.541833**		1000	1320	315		1065		750		1010		157.5	875	M36x130	8
KPGZ49/1000FG			**533567**	1000	1320	315	450	1065	985				225				
KPGZ49/1060F		**249/1060.541834**		1060	1400	335		1135	1055		1075		237.5				
KPGZ49/1060L		**249/1060.541834**		1060	1400	335		1135		795		1070		167.5	927.5	M36x130	8
KPGZ49/1060FG			**537283**	1060	1400	335	475	1135	1055				237.5				
KPGZ49/1120F		**249/1120.541835**		1120	1460	335		1195	1115		1135		237.5				
KPGZ49/1120L		**249/1120.541835**		1120	1460	335		1195		840		1130		167.5	980	M42x140	8
KPGZ49/1120FG			**537284**	1120	1460	335	475	1195	1115				237.5				
KPGZ49/1180F		**249/1180.541836**		1180	1540	355		1260	1175		1195		250				
KPGZ49/1180L		**249/1180.541836**		1180	1540	355		1260		885		1190		177.5	1032.5	M42x140	8
KPGZ49/1180FG			**536806**	1180	1540	355	500	1260	1175				250				
KPGZ49/1250F		**249/1250.541837**		1250	1630	375		1330	1245		1265		272.5				
KPGZ49/1250L		**249/1250.541837**		1250	1630	375		1330		940		1255		187.5	1095	M42x150	8
KPGZ49/1250FG			**537285**	1250	1630	375	545	1330	1245				272.5				
KPGZ49/1320F		**249/1320.541838**		1320	1720	400		1400	1315		1335		290				
KPGZ49/1320L		**249/1320.541838**		1320	1720	400		1400		990		1325		200	1155	M48x180	8
KPGZ49/1320FG			**545161**	1320	1720	400	580	1400	1315				290				



KPGZ49..F KPGZ49..L KPGZ49..FG

L Bearing relubrication D Seal relubrication B Sleeve relubrication

Housing dimensions													Grease quantity ≈	Mass ≈	
a	b	c	g_1	g_2	g_3	g_4	h	h_1	k	m	n	s	Initial greasing	Housing	Bearing
mm													kg	kg	
1960	600	220	630	325	56.5		710	1390		1600	360	M72	40	3700	725
1960	600	220	630		56.5	352.5	710	1390	50	1600	360	M72	50	3700	760
1960	600	220	630	325			710	1390		1600	360	M72	30	3700	930
2060	620	230	660	340	55		740	1450		1700	370	M80	45	4300	820
2060	620	230	660		55	375	740	1450	60	1700	370	M80	55	4300	855
2060	620	230	660	340			740	1450		1700	370	M80	35	4300	1050
2200	660	250	680	350	55		800	1550		1820	390	M90	55	5200	1000
2200	660	250	680		55	385	800	1550	60	1820	390	M90	65	5200	1040
2200	660	250	680	350			800	1550		1820	390	M90	45	5200	1250
2330	650	255	720	370	67.5		830	1620		1980	360	M90	65	5770	1200
2330	650	255	720		67.5	412.5	830	1620	70	1980	360	M90	80	5390	1225
2330	650	255	720	370			830	1620		1980	360	M90	50	5680	1565
2450	740	275	780	400	70		880	1710		2000	460	M100	75	6800	1420
2450	740	275	780		70	435	880	1710	60	2000	460	M100	95	6800	1470
2450	740	275	780	400			880	1710		2000	460	M100	60	6800	1750
2560	740	285	800	410	70		920	1780		2150	460	M100	80	8000	1500
2560	740	285	800		70	452.5	920	1780	70	2150	460	M100	100	8000	1540
2560	740	285	800	410			920	1780		2150	460	M100	65	8000	1900
2700	780	300	820	420	72.5		970	1880		2300	480	M110	95	9000	1750
2700	780	300	820		72.5	462.5	970	1880	70	2300	480	M110	110	9000	1820
2700	780	300	820	420			970	1880		2300	480	M110	75	9000	2240
2850	820	320	850	435	85		1010	1985		2400	510	M110	110	11000	2070
2850	820	320	850		85	477.5	1010	1985	70	2400	510	M110	130	11000	2150
2850	820	320	850	435			1010	1985		2400	510	M110	85	11000	2750
3000	850	340	900	460	90		1080	2100		2500	520	M125	125	12800	2460
3000	850	340	900		90	502.5	1080	2100	70	2500	520	M125	170	12800	2500
3000	850	340	900	460			1080	2100		2500	520	M125	100	12800	3120

7 References

FAG works together with all builders of converter plants. To date, more than 200 converters all over the world have been fitted with FAG bearings and housings.

Examples of new converters fitted with FAG rolling bearings and housings are presented in our "Examples from Application Engineering", copies of which we will send you on request.

Moreover, FAG supplies replacement bearings for existing converters all the time.

8 Selection of Special FAG Publications

Catalogue WL 41 520	FAG Rolling Bearings
Publ. No. WL 00 106	W.L.S. Rolling Bearing Learning System
Publ. Nr. WL 17 107	Moderne Lagerungen in Stahl- und Walzwerken (available in German only)
Publ. No. 80 100	Mounting and Dismounting of Rolling Bearings
Publ. No. 80 102	How to Mount and Dismount Rolling Bearings Hydraulically
Publ. No. 80 111	Rolling Bearing Mounting Cabinet and Mounting Sets – a fundamental course for vocational training
Publ. No. 80 123	All About the Rolling Bearings – FAG Training Course on Rolling Bearings Theory and Practice
Publ. No. 80 134	FAG Video: Mounting and Dismounting Rolling Bearings
Publ. No. 80 135	FAG Video: Hydraulic Methods for Mounting and Dismounting Rolling Bearings
Publ. No. WL 81 115	Rolling Bearing Lubrication
Publ. No. WL 81 116	Arcanol · Rolling-Bearing Tested Grease
Publ. No. WL 82 102	Rolling Bearing Damage
TI No. WL 00-11	FAG Videos on Rolling Bearings
TI No. WL 80-14	Mounting and Dismounting of Spherical Roller Bearings with Tapered Bore
TI No. WL 80-46	FAG Hand Pump Sets

9 Specification

Original equipment	For which operator		
Replacement	Built by? Year of construction		
Code word			
Converter size			
Design	- Trunnion ring		One-piece/multiple-piece/closed/horseshoe
	- Slag removal		Slags are burnt/knocked off
	- Drive system		Single-ended/double-ended
Systems	- Oxygen top blowing		
	- Oxygen bottom blowing		
	- Combined blowing process		
	- Specially developed processes		
Sub-assembly	- Housing	- With displacement sleeve KPG49/KPGZ49	
		- With linear bearing	
		- Other (double displacement sleeve, cylindrical roller bearing)	
	- Bearing	- Spherical roller bearing	
		- Spherical roller bearing, split	
Collective loads	(Bearing loads F_r and F_a must be determined for every bearing location)		
	- Maximum radial load (locating bearing)	F_{rF} =	
	- Maximum radial load (floating bearing)	F_{rL} =	
	- Maximum external thrust load	F_a =	
Kinematics	Speed; swinging angle; number of swings		
Ambient influences	Bearing ambient temperature, moisture, dust etc.		
Lubrication	Grease lubrication		- Grease type
			- Replenishment quantity
			- Relubrication interval
Sealing	- High-pressure packing		
	- US rubber profile		
Mounting space	(if possible, enclose assembly drawing or sketch)		
	- Location		Locating bearing/floating bearing
	- Bearing seat		Cylindrical/mounting on sleeve
	- Seat diameter		Shaft/housing/fits
	- Bearing design		Split/unsplit
Other requirements	- Design		- Max. misalignment
			- Mounting requirements
			- Max. axial displaceability
			- Lubricant distribution
			- Wearing parts
			- Required housing material
			- Temperature of trunnion and housing
	- Technical specifications		- Packing
			- Housing design
			- Preservation
			- Measuring report
			- Acceptance test reports
			- Plant test reports
	- Other		- Warranty
			- Mounting instructions
			- Language

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WL 17 104/2 EA/97/7/00