Trunnion bearing housings for grinding mills FSDR .. K series

Bearing types
- Spherical roller bearings

Bearing dimension series
- 39, 48 and 49

Shaft diameter range
- 825 to 1 460 mm

Typical bearing-shaft combinations
- Stepped shaft with bearing on an unthreaded sleeve

Seals
- Labyrinth, V-ring, PTFE strip

Lubrication
- Grease

Materials
- Grey cast iron
- Spheroidal graphite cast iron

Mounting
- Four-bolt mounting

Compliance to standards
- Not standardized

FSDR .. K housings are large low-weight plummer (pillow) block housings designed specifically for grinding mills. They operate under arduous conditions in highly contaminated environments. With their highly effective sealing solution, they enable the incorporated bearing to achieve maximum service life by preventing the ingress of contaminants and enabling easy access for inspection and maintenance when necessary.

Trunnion bearing housings for grinding mills FSDR .. K series

Designations

Designation system for FSDR .. K trunnion bearing housings

FSDR_ 39/1060 K/P45

Series

FSDR Trunnion bearing housing for grinding mills

Material

– Grey cast iron
D Spheroidal graphite cast iron

Size identification

../.. Bearing dimension series / bearing bore diameter [mm]

Suffixes[1)]

– Housing with metric threads and G threads for grease fittings
K Housing for bearings with a tapered bore on a split unthreaded sleeve and a stepped shaft
N9 Housing with inch threads and NPTF threads for grease fittings
/P... Painting variant according to customer specification (P01 to P999)

1) When multiple suffixes are used, they are listed in the same order as shown here.

Designation system for V-ring seals

1280 VRME R

Size identification

... Diameter of the V-ring seal

Design

VRME V-ring seal with longer lip to allow larger axial movements

Material

R Acrylonitrile-butadiene rubber (NBR)

Standard housing design

FSDR .. K plummer (pillow) block housings are split housings consisting of a cap and base, and two covers (→ **fig. 1**). The cap has two integral flanges, with a hole cast into each one. The base has four cast holes for attachment bolts. The split covers, which contain an eye bolt in each half, are attached to the housing body with eight bolts. The labyrinth rings are supplied with eye bolts that can be removed after mounting.

Features and benefits

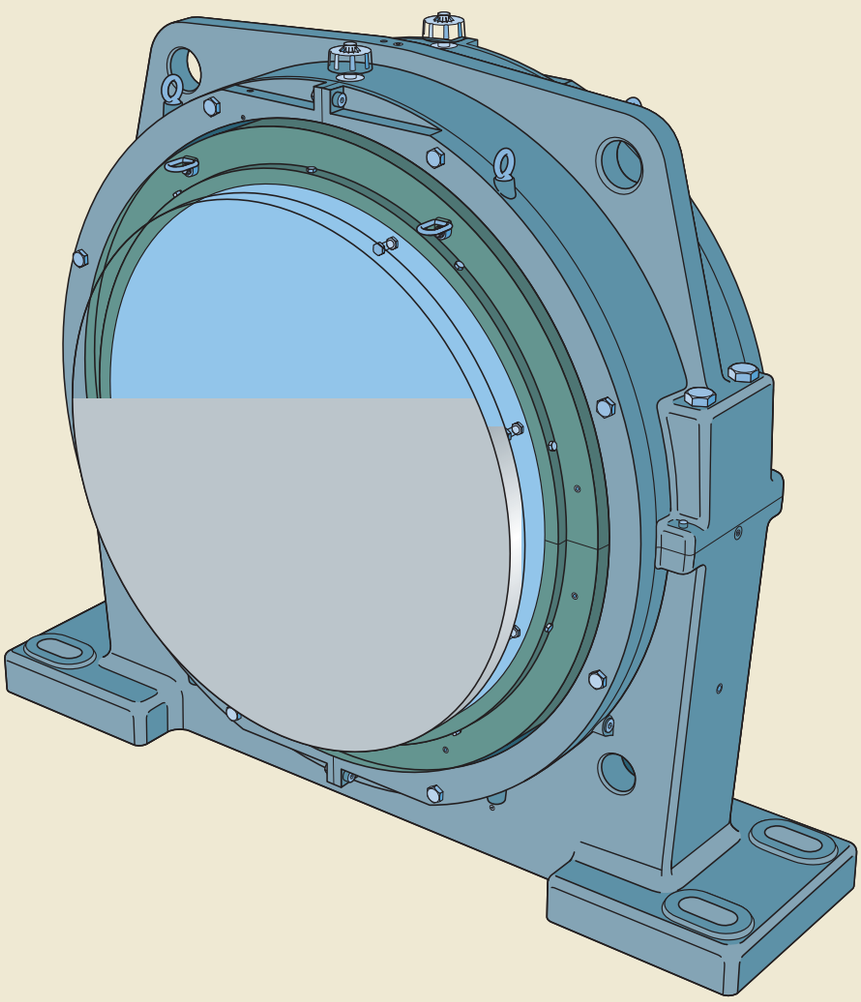
FSDR .. K housings have the following features and benefits:

Superior sealing solution

The SKF multi-stage labyrinth seal, which is standard for all trunnion bearing housings, is a highly effective sealing solution that can prevent the ingress of contaminants even during high-pressure wash downs.

The inclined outside face of the labyrinth ring helps to prevent water and contaminants from entering the labyrinth (→ **fig. 2**).

Fig. 1



Reduced grease consumption

Trunnion bearing housings typically require large amounts of grease at frequent intervals, to purge contaminants from the bearing and housing. With SKF grinding mill housings however, the highly effective multi-stage labyrinth seal makes it possible to extend relubrication intervals, helps to eliminate overgreasing and reduce grease consumption.

Easy access for inspection and maintenance

The covers and labyrinth rings are split for easy removal. This enables the housing, bearing and seals to be inspected, or replaced, and used grease to be removed, without dismounting the housing.

Machined base ends

The base ends of FSDR .. K housings are machined to make alignment easier and to provide a flat surface for stops (→ **fig. 3**).

Ventilating valves

Ventilating valves are supplied with the housing (→ **fig. 4**). They help to prevent high pressures, which can be caused by heat, from building up in the housing. The valves have a 2 µm dirt filter.

Fig. 2

Sealing solution with one V-ring seal

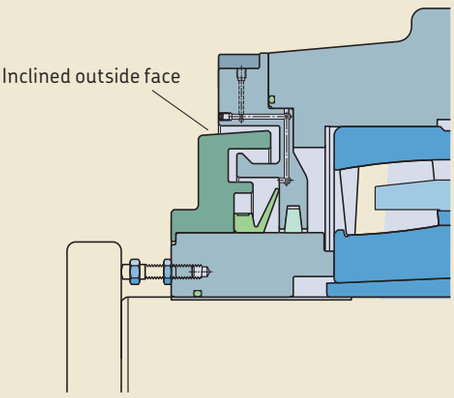


Fig. 3

Machined base ends

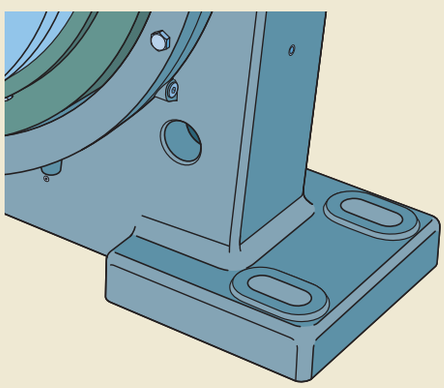
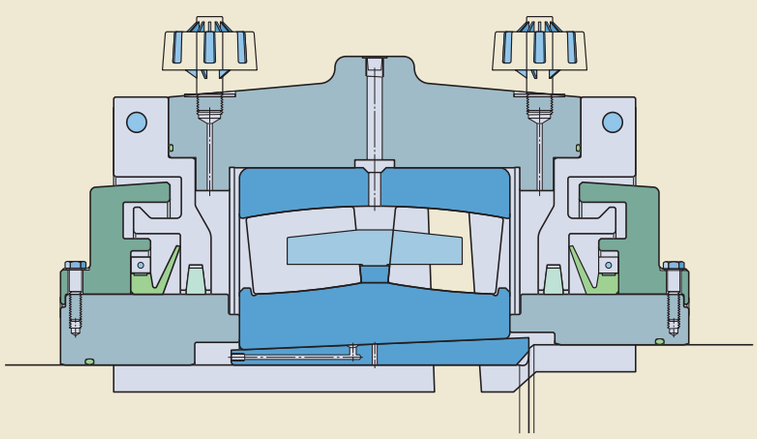


Fig. 4



Housing material

FSDR .. K housings are made of grey cast iron.

Paint, corrosion protection

FSDR .. K housings are painted black (RAL 9005) using a solvent based acryl paint. The paint protects the housing in accordance with ISO 12944-2, corrosivity category C2 (i.e. exterior atmospheres with low level of pollution, interior atmospheres where condensation may occur). The paint is not affected by most lubricating or engine oils, cutting fluids or alkalescent washing chemicals. Housings can be repainted with most water or solvent based 1- or 2-component paints.

Unpainted surfaces are protected with a solventless rust inhibitor.

Dimension standards

The boundary dimensions of FSDR .. K housings are not standardized either nationally or internationally.

Housing variants

In addition to standard design FSDR .. K housings, a number of variants are also available.

Housing material

For applications where extra strength is needed, the housings are available in spheroidal graphite cast iron, designation FSDRD .. K.

Inch thread connections

FSDR .. K housings can be supplied with UNC or NPTF threads for grease fittings. The housings are identified by the designation suffix N9, e.g. FSDR 39/1060 KN9. For additional information, contact the SKF application engineering service.

Special paint

FSDR .. K housings can be supplied painted according to customer specification. The housings are identified by the designation suffix P, followed by a two or three-digit number, e.g. FSDR 39/1060 K/P45.

Sealing solutions

FSDR .. K housings are designed for two sealing solutions (→ **fig. 5**):

- a labyrinth seal in combination with one V-ring seal and a PTFE strip, for all housings except size 49/1320
- a labyrinth seal in combination with two V-ring seals, for housings size 49/1320

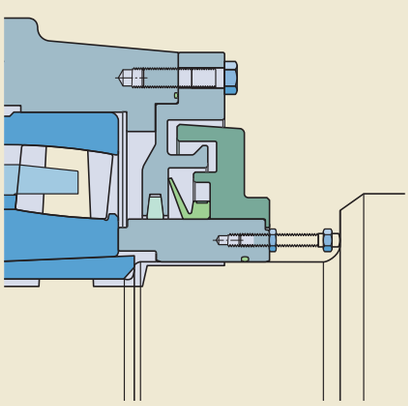
Table 1, **page 646**, provides an overview of the characteristics and suitability of both sealing solutions. Additional information is provided in the following text. This information should be used as a guideline, which cannot substitute for testing a seal in its application.

The labyrinth seal consists of two parts: the housing cover and a labyrinth ring. Both are split. The cover is bolted to the housing body and does not rotate. The labyrinth ring is bolted onto a shaft sleeve and rotates with the shaft. The V-ring seals have a long seal lip that seals axially against the cover. They are located radially by steel clamping bands and axially by the labyrinth ring. For housings with one V-ring seal, a PTFE strip, mounted in a groove in the cover, provides additional protection.

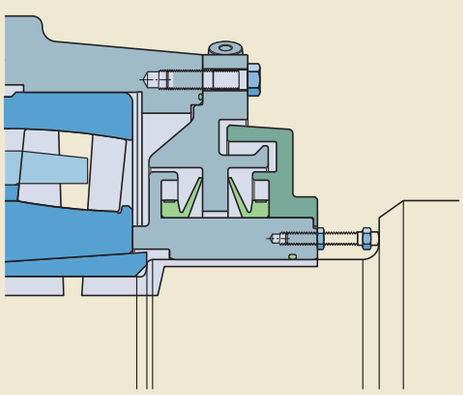
Labyrinth seals are supplied together with the housing, but can also be ordered separately. Contact SKF for additional information. Shaft sleeves are also supplied with the housing.

NOTE: V-ring seals and band clamps must be ordered separately. Appropriate V-ring seals and band clamps are listed in **table 2**, **page 647**.

Fig. 5



Labyrinth seal with one V-ring seal

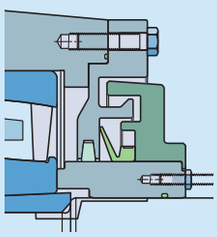


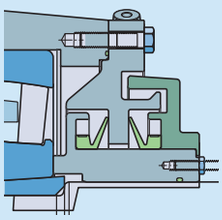
Labyrinth seal with two V-ring seals

Trunnion bearing housings for grinding mills

Table 1

Seals for FSDR .. K trunnion bearing housings for grinding mills





Seal		
Type	labyrinth seal with 1 V-ring seal	labyrinth seal with 2 V-ring seals
Housing size range	39/850, 39/1060, 39/1180 and 48/1500	49/1320
Material		
labyrinth seal	grey cast iron	grey cast iron
V-ring seals	rubber (NBR)	rubber (NBR)
PTFE strip	PTFE impregnated fibres (ramie)	n/a
Application conditions and requirements		
Temperature [°C]	–40 to +100	–40 to +100
Temperature [°F]	–40 to +210	–40 to +210
Max. circumferential speed [m/s]	2	10
Max. misalignment [°]	0,5	0,5
Low friction	+	++
Axial shaft displacement [mm]	± 10	± 10
Replacement	++	++
Shaft tolerance class	h9Ⓔ	h9Ⓔ
Shaft roughness R_a [µm]	≤ 3,2	≤ 3,2
Sealing suitability		
Dust	++	++
Fine particles	++	++
Coarse particles	++	++
Chips	++	++
Liquids when sprayed	++	++
Direct sunlight	++	++

Symbol:
- n/a not applicable
- ++ very suitable
- + suitable
- – limited suitability
- –– unsuitable

Table 2

Clamping bands for V-ring seals

Housing Size	**V-ring seal** Designation	**Clamping bands** Qty.	Designation
FSDR 39/850 K	960 VRME R	2	RM 15 Art. No. 25538099 Length 1500
		2	RM 10 Art. No. 25537099 Length 1000
		2	RM ADJUST Art. No. 25539099 Length 600
FSDR 39/1060 K	1180 VRME R	4	RM 15 Art. No. 25538099 Length 1500
		2	RM ADJUST Art. No. 25539099 Length 700
FSDR 39/1180 K	1280 VRME R	4	RM 15 Art. No. 25538099 Length 1500
		2	RM 10 Art. No. 25537099 Length 1000
FSDR 49/1320 K	1425 VRME R	12	RM 15 Art. No. 25538099 Length 1500
FSDR 48/1500 K	1575 VRME R	6	RM 15 Art. No. 25538099 Length 1500
		2	RM ADJUST Art. No. 25539099 Length 600

Design considerations

For general information about design considerations, refer to the following sections:

- *Typical shaft-bearing combinations* (→ **page 41**)
- *Locating/non-locating bearing arrangements* (→ **page 40**)
- *Specifications for shafts and housing support surfaces* (→ **page 45**)
- *Axial load carrying capacity for bearings on a sleeve* (→ **page 44**)

For additional information about rolling bearings, refer to the product information available online at skf.com/bearings.

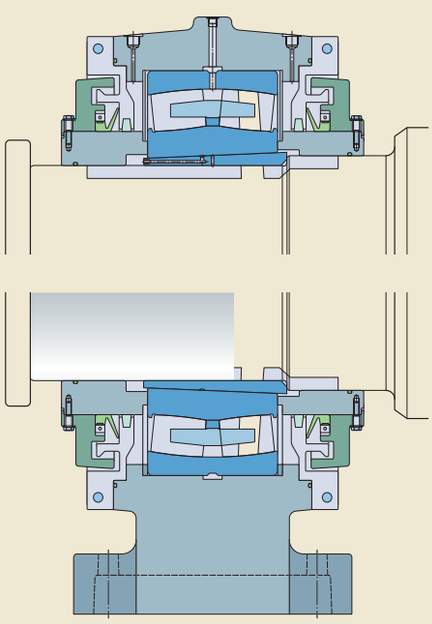
Typical shaft-bearing combinations

FSDR .. K housings accommodate bearings with a tapered bore on an unthreaded sleeve on stepped shafts (→ **fig. 6**).

Locating and non-locating bearing positions

FSDR .. K housings can be used for both the locating and non-locating bearing positions.

Fig. 6



The housings are machined standard for bearings in the non-locating position. The bearing seat is sufficiently wide to allow axial displacement of the bearing. The seat tolerance provides a loose fit for the bearing even if there is a temperature difference between the bearing outer ring and housing.

Bearings in the locating position must be secured in the housing on both sides with locating rings. These are supplied with the housings.

Load carrying capacity

FSDR .. K housings are intended for loads acting perpendicularly toward the support surface as well as the forces created in the process. In cases like this, the housing can withstand the same loads as the bearing. If loads acting in other directions occur, contact the SKF application engineering service.

Additional housing support

As the housings are subjected to loads acting parallel to the support surface, a stop must be provided to counter the load. The housings can be secured to the support with keys or welded stops.

The stop should be sufficiently strong to accommodate the loads acting parallel to the support surface.

Operating temperature

The permissible operating temperature is limited by the seals (→ **table 1**, **page 646**). For temperature limits of SKF bearings and lubricants, refer to the product information available online at skf.com/bearings.

The housing material does not have any additional temperature limits, except for very low temperatures where impact strength could be a factor.

The housing paint is heat resistant up to 80 °C (*175 °F*) material temperature or 100 °C (*210 °F*) ambient temperature.

When temperatures outside the permissible range are expected, contact the SKF application engineering service.

Operating speed

The seals limit the permissible operating speed. Speed limits for the seals are provided in **table 1** on **page 646**.

Shaft specifications

The bearing seat should be machined according to the requirements for bearings mounted on an adapter sleeve (→ *Specifications for shafts and housing support surfaces*, **page 45**), i.e. with a shaft tolerance class h9 Ⓔ and a cylindricity tolerance of IT5/2. The seal counterface should also comply with these specifications.

Attachment bolt recommendations

In typical applications, 8.8 class hexagon head bolts in accordance with ISO 4014 can be used together with washers in accordance with ISO 7089 or 7090. If the load does not act perpendicularly toward the base, it may be necessary to use stronger 10.9 class bolts.

SKF housings can withstand loads resulting from tightening the attachment bolts to the torque values recommended by bolt manufacturers (→ **table 3**). They are valid for oiled, but otherwise untreated, thread surfaces. SKF cannot guarantee that tightening to the recommended value provides sufficient anchoring. Make sure that attachment bolts, stops, and a sufficiently strong support can accommodate all occurring loads.

Table 3

Torques values for cap bolts and attachment bolts

Housing	**Cap bolts**		**Attachment bolts**	
Size	Size	Tightening torque	Size	Tightening torque[1)]
–	–	Nm	–	Nm
FSDR 39/850 K	M 36	600	M 48	5 450
FSDR 39/1060 K	M 36	600	M 52	6 990
FSDR 39/1180 K	M 36	600	M 52	6 990
FSDR 49/1320 K	M 42	850	M 52	6 990
FSDR 48/1500 K	M 42	850	M 52	6 990

[1)] Recommended by bolt manufacturers.

Lubrication

FSDR .. K housings are intended for grease lubrication. The lubricant should be selected based on the operating conditions of the bearings. For additional information about lubricant selection, refer to the product information available online at skf.com/bearings.

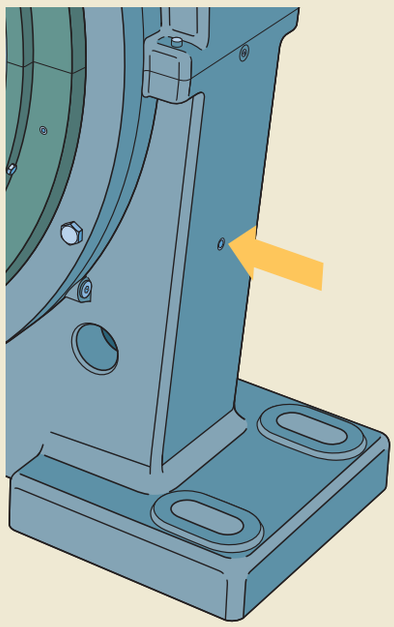
Initial grease fill

If no other requirements exist, the free space in the bearing as well as the gaps of the labyrinth seals should be completely filled with grease. The seal counterfaces should be thoroughly greased. No extra grease is required for the housing.

During start up, additional grease (typically 20 to 60 kg, depending on bearing size) should be added to the bearing over a 30-minute period via the annular groove and relubrication holes in the bearing outer ring.

Detailed information about the initial grease fill is provided in the mounting instructions, which are available on request.

Fig. 7



Relubrication

The spherical roller bearings used in FSDR .. K housings can be relubricated via two drilled and tapped G 3/8 holes in the housing base (→ **fig. 7**). SKF recommends using an automatic lubrication system like the SKF MultiLube pumping unit (→ *Centralized lubrication systems*, **page 48**).

Relubrication instructions (which form part of the mounting instructions for the housings) are available on request.

Relubricating the seals

FSDR .. K housings with one V-ring per side have two drilled and tapped G 1/8 holes in the cover on each side of the housing. Grease introduced in either of the holes will relubricate both the V-ring and the labyrinth seal. Choose the hole that is most convenient (→ **fig. 8**).

FSDR .. K housings size 49/1320 with two V-rings per side have three drilled and tapped holes in the cover on each side of the housing. The hole that supplies grease to the space between the two V-rings has two alternative grease inlets (both G 3/8). Choose the one that is most convenient (→ **fig. 9**). The single hole (G 1/8) supplies lubricant to the labyrinth seal (→ **fig. 10**).

Renewal

Used grease should be replaced with fresh grease on a regular basis, typically every two to three years. Grease samples should be drawn and analyzed, and the interval adjusted accordingly. To simplify the renewal process, the covers and labyrinth rings are split and can be removed without removing the cap.

Fig. 8

Relubricating the labyrinth between the outer seal and cover (one V-ring)

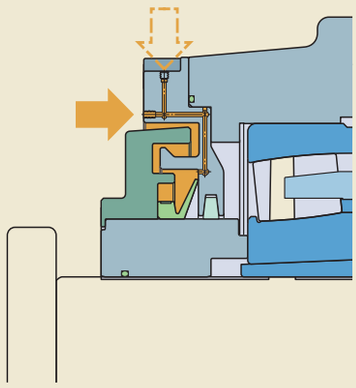


Fig. 9

Relubricating the space between two V-rings

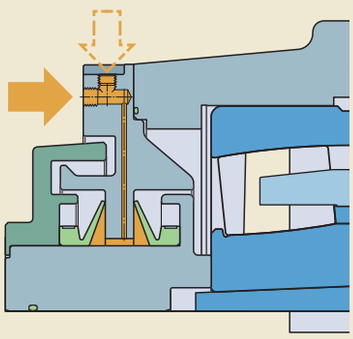
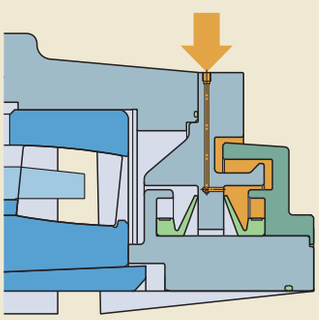


Fig. 10

Relubricating the labyrinth between the outer seal and cover (two V-rings)



Mounting

FSDR .. K housings must be mounted properly using the appropriate tools and state of the art mechanical mounting methods.

Mounting instructions for the housings are available on request.

Torque specifications

The M 24 cover bolts supplied with all housings should be tightened to 665 Nm. The cover bolts are in accordance with ISO 4014.

The M 12 labyrinth ring bolts (in accordance with ISO 4017) supplied with the labyrinth seals should be tightened to 80 Nm.

Cap bolts should be tightened to the torque values listed in **table 3** on **page 649**.

For information about attachment bolts, refer to *Attachment bolt recommendations* on **page 649**.

Ventilating valves

The ventilating valves should be installed on top of the housing cap for use when the housing is in operation. The holes for the valves are plugged on delivery.

Eye bolts and lifting holes

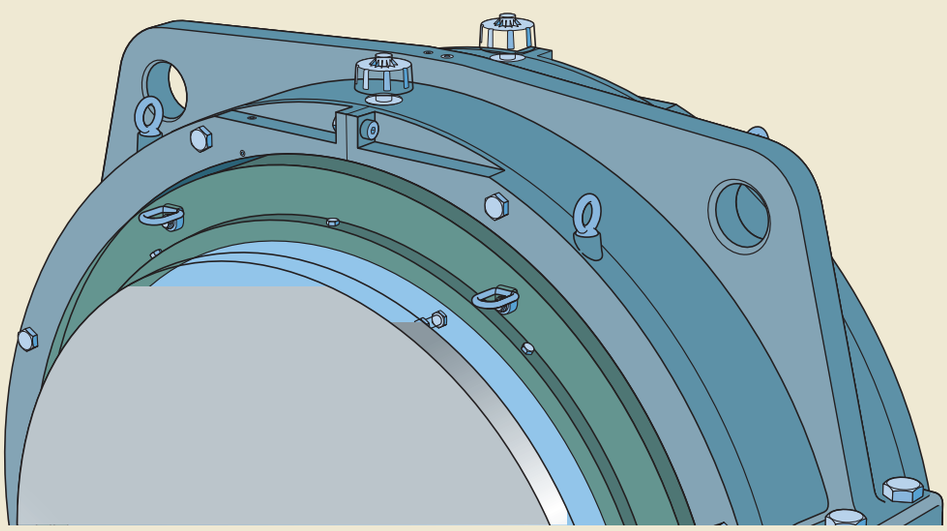
FSDR .. K housings have a cast hole in each integral flange on the cap and one M 16 eye bolt in each cover half (→ **fig. 11**) for safe, easy handling. The labyrinth rings are equipped with adjustable eye bolts (VLBG 0.63t M 10 with bolt, except for size 49/1320, which has M 10 eye bolts) that can be removed after mounting.

Supporting the housing

FSDR housings require two stops, one on each side of the housing, to accommodate loads acting parallel to the housing support surface.

Fig. 11

Eye bolts



Condition monitoring

FSDR .. K grinding mill housings have seven drilled and tapped M8 holes for condition monitoring sensors (→ **fig. 12**).

Position 1 and **position 2** (on both sides of the housing) are perpendicular to the shaft.

Positions 3 and **4** (both positions available on both sides of the housing) are parallel to the shaft.

All positions are in accordance with ISO 10816-1.

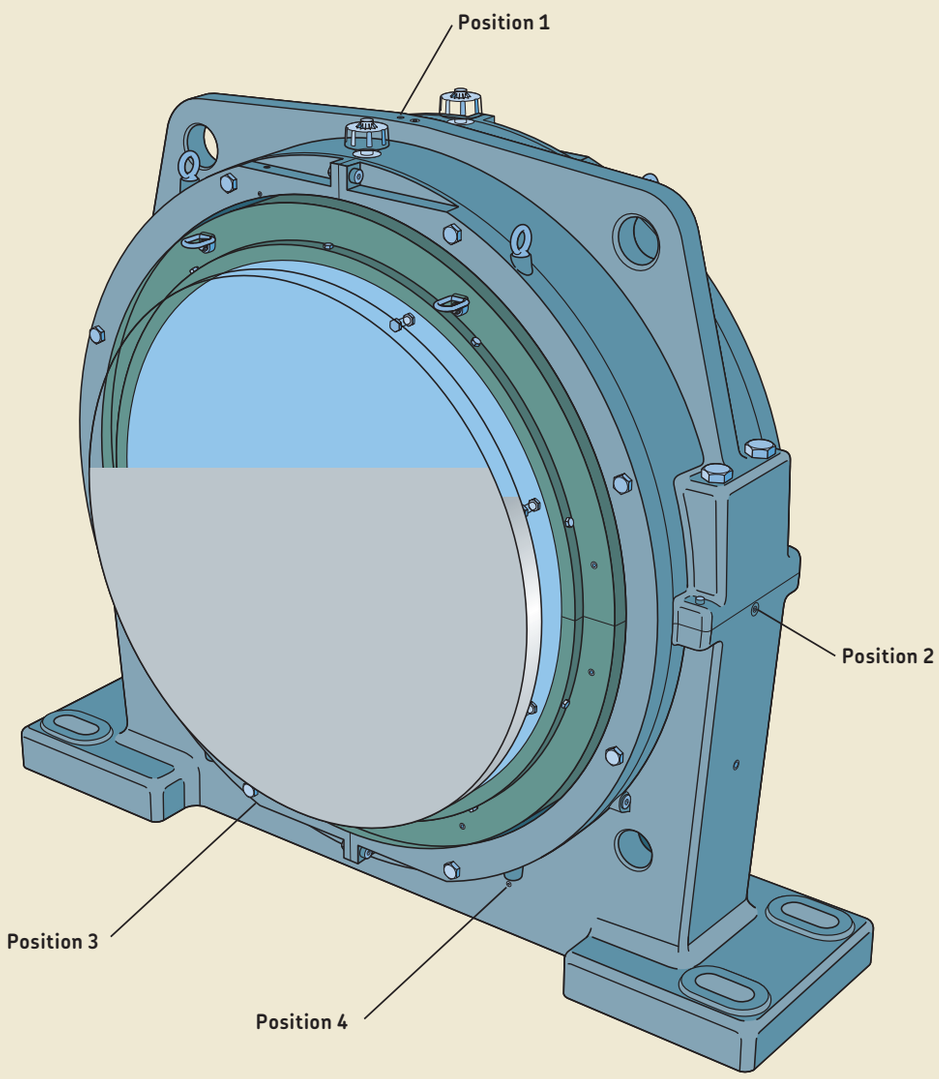
Accessories

The following accessories are available for FSDR .. K housings:

- Automatic lubricator: SKF MultiLube pumping unit
- Condition monitoring sensors

For additional information, refer to the section *SKF tools and products* (→ **page 47**).

Fig. 12



Ordering information

FSDR .. K housings are supplied with the following components:

- housing
- 2 covers, including O-rings and 8 hexagon head bolts per cover (16 in total)
- 2 labyrinth rings, including 10 hexagon head bolts per labyrinth ring (20 in total)
- 2 shaft sleeves, including O-rings
- 2 locating rings
- 2 ventilating valves
- 2 PTFE strips (for all housings except size 49/1320)

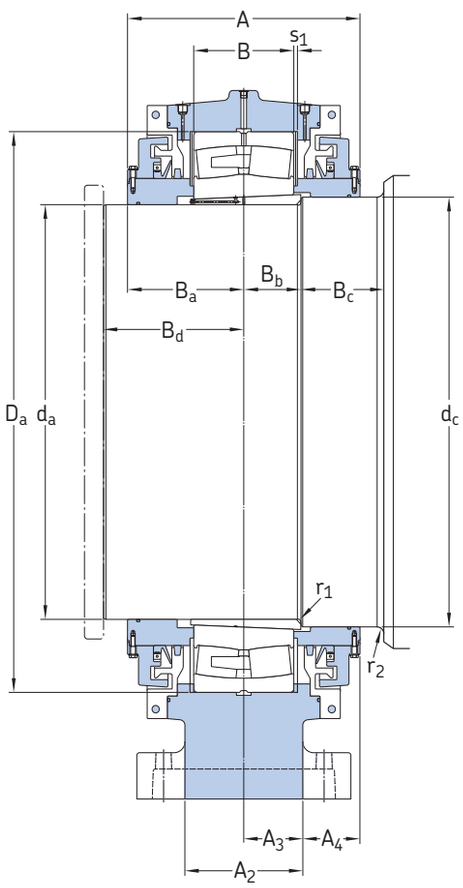
The bearings, bearing sleeves, V-ring seals, and clamping bands must be ordered separately.

Order example

A trunnion bearing housing (with metric thread connections) is required for a 239/1060 CAK/W33 spherical roller bearing. The following items should be ordered:

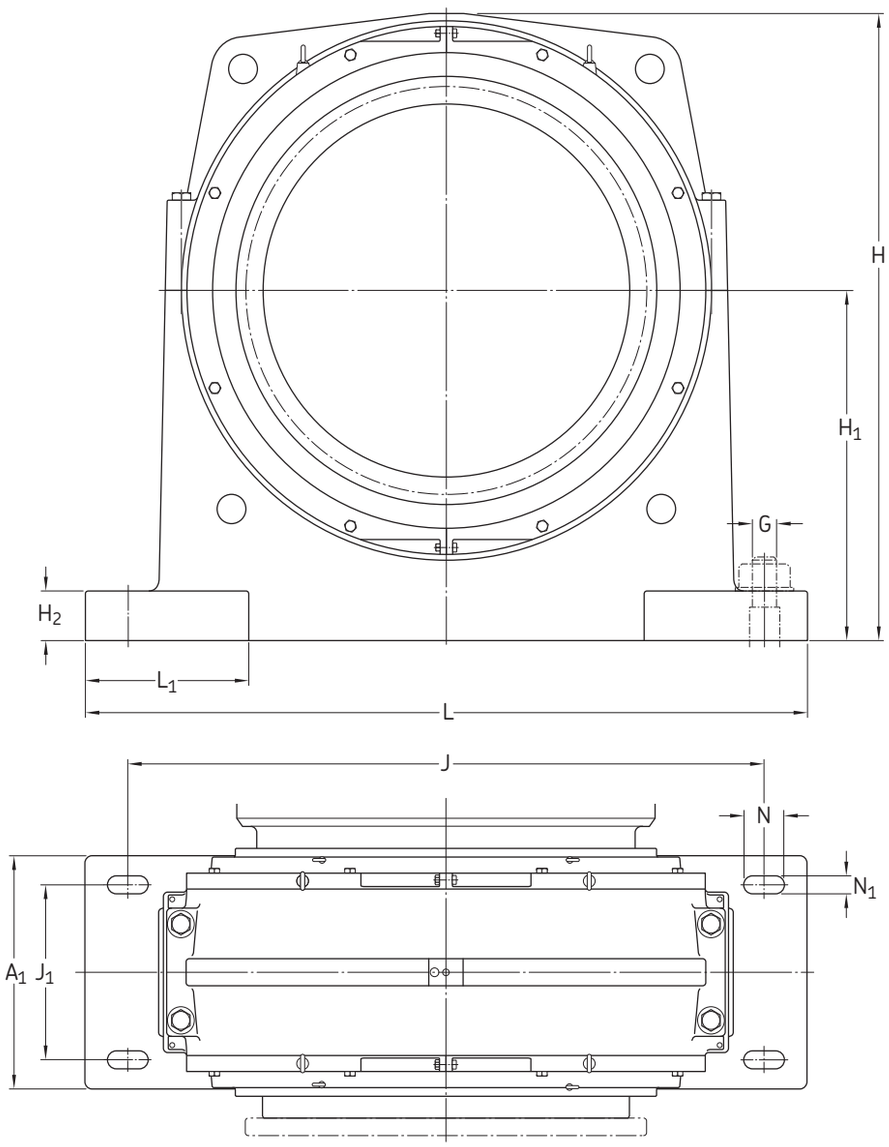
- 1 housing FSDR 39/1060 K
- 1 bearing 239/1060 CAK/W33
- 1 bearing sleeve KOH 39/1060
- 2 V-ring seals 1180 VRME R
- 4 clamping bands
  RM 15 Art. No. 25538099 Length 1500
- 2 clamping bands
  RM ADJUST Art. No. 25539099 Length 700

15.1 FSDR .. K grinding mill housings
d_a **825 – 1 460** mm



Shaft diameter d_a	**Housing** Designation	**Appropriate parts** Bearing	Unthreaded sleeve	V-ring seal	**Dimensions** Housing A	A_1	A_2	A_3	A_4
mm	–	–			mm				
825	**FSDR 39/850 K**	239/850 CAK/W33	KOH 9/850	960 VRME R[1]	510	450	235	117,5	137,5
1 030	**FSDR 39/1060 K**	239/1060 CAKF/W33	KOH 9/1060	1180 VRME R[1]	545	560	265	132,5	140
1 150	**FSDR 39/1180 K**	239/1180 CAKF/W33	KOH 39/1180	1280 VRME R[1]	632	560	285	142,5	173,5
1 280	**FSDR 49/1320 K**	249/1320 CAK30F/W33	236696-1	1425 VRME R[2]	810	800	440	220	185
1 460	**FSDR 48/1500 K**	248/1500 CAK30FA/W20	236558	1575 VRME R[1]	585	800	360	180	112,5

[1] Two seals are required for each housing.
[2] Four seals are required for each housing.



Shaft diameter	Dimensions Housing												Dimensions Shaft abutment and fillet							Mass Housing
d_a	D_a	B	H	H_1	H_2	J	J_1	L	L_1	N	N_1	s_1	G	d_c	B_a [1]	B_b [1]	B_c	B_d [1]	r_1	r_2	
mm														mm							kg
825	1 120	200	1 420	700	100	1 500	290	1 715	430	125	55	10	48	860	255	118	252	310	10	20	2 300
1 030	1 400	250	1 700	870	120	1 850	370	2 105	520	132	62	10	52	1 070	272,5	147	233	360	12	15	3 400
1 150	1 540	272	1 830	950	110	2 000	370	2 250	500	142	62	10	52	1 190	316	155	245	380	12	20	3 500
1 280	1 720	400	2 150	1 200	170	2 220	600	2 520	570	142	62	10	52	1 320	405	217	283	500	12	20	6 590
1 460	1 820	315	2 225	1 200	170	2 320	600	2 620	620	142	62	10	52	1 500	292,5	173	182	355	8	25	6 650

[1] Dimension varies depending on the drive-up of the bearing onto the sleeve.