Spherical roller bearings

Technical Information

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Application handbook

SKF Explorer spherical roller bearings for vibratory applications

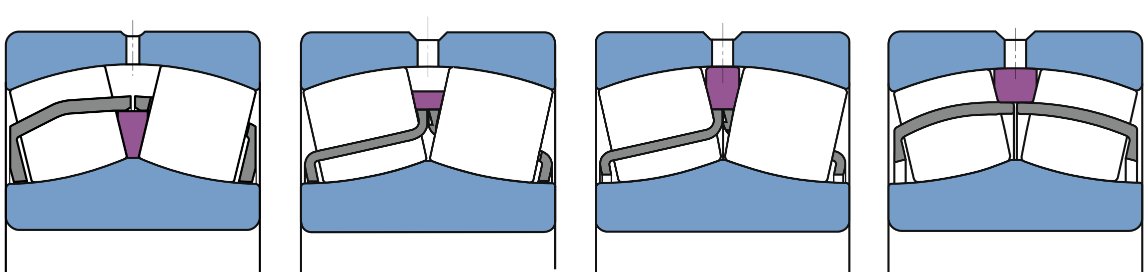
For machines with inherent eccentric motion such as vibrating screens and compactors, SKF developed the range of strong and robust spherical roller bearings for vibratory applications. The bearing are available in the 223 series with cylindrical or tapered bore for 40 to 240 mm shafting. In recent years they were uprated to the SKF Explorer specifications.

Bearings with the current basic design have been in service since the early 1990's and have proven to reduce the operating temperatures and extended the service life of the machinery. Operating temperatures have been observed to be 5 to 10 °C cooler than the bearings having the previous design with one or two piece brass cages. Bearing service lives have been observed to increase by a factor of two.

The choice of spherical roller bearing depends on the vibration level (g force) developed by the vibrating screen, feeder, or compactor.

- The SKF standard E design spherical roller bearing has proved to be effective at lower vibration levels, <5g.
- For higher vibration levels and demanding applications the SKF spherical roller bearing specially developed for vibratory applications, suffix VA405 or VA406, is required.

Beside the description of the bearings, this leaflet also includes relevant recommendations about their application and lubrication, and is completed with product tables.



E/VA405 40 ≤ d ≤ 50 mm | **E/VA405** 50 < d ≤ 70 mm | **EJA/VA405** 70 < d ≤ 110 mm | **CCJA/W33VA405** 110 < d ≤ 240 mm

SKF Industrial Division
Development Centre Göteborg
SE-415 50 GÖTEBORG, Sweden
Fax: +46 31 3371841

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"SKF spherical roller bearings for vibratory applications are easily distinguished by their yellow-brown coloured cages"

The spherical roller bearings for vibratory applications have two window-type hardened steel cages and a floating guide ring between the row of rollers. This allows independent motion of the rollers to minimize friction.

Larger size bearings, d > 70 mm, have an outer ring centred guide ring to support and guide the cages. This provides the lowest friction in the bearings and is demonstrated by more than ten years successful experience operating these bearings in vibratory applications.

The bearings are manufactured to the E design in the range 40 ≤ d ≤ 110 mm – larger bearings are manufactured to the CC design. All bearings belong to the SKF Explorer performance class.

The bearings with d > 85 mm are made from the patented SKF Xbite material for increased service life and increased wear and abrasion resistance. This feature is particularly important in the highly contaminated vibration screen, feeder and compacting equipment environment. They can replace vibratory bearings having specialty steels or surface treatments, and case hardened materials and other special heat treatments.

Bearing designs

The principal dimensions and other catalogue data for the spherical roller bearings for vibratory applications are the same as standard bearings of the same series. The common features of the 223 series bearings for vibratory applications are their wear-resistant, nitro-carburized surface-hardened, window-type steel cages and floating guide ring, higher precision class than Standard, and C4 radial internal clearance.

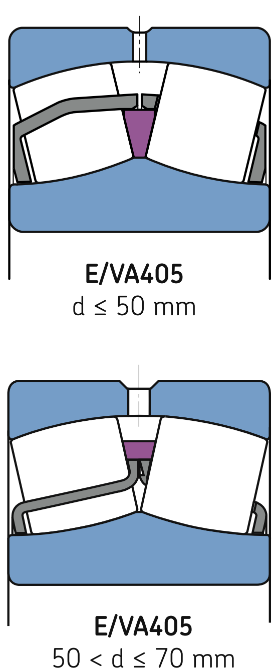
The small size bearings have an inner ring centred guide ring while the medium and larger size bearings have an outer ring centred guide ring (suffix JA).

The dimensional accuracy of the bore and outside diameters of the bearings corresponds to P5 and P6 tolerances, respectively.

Effective lubrication is essential to the long service life of bearings in vibratory machinery. This is why the SKF spherical roller bearings for vibratory applications are, as standard, supplied with a lubrication groove and three lubrication holes in the outer ring – the W33 features.

The bearings are manufactured to four designs according to size:

Fig. 1



223 series E/VA405

The bearings in the size range 22308 through 22314 have the same suffix, E/VA405 design (→ **Fig. 1**). Sizes 22308-10 were recently redesigned and incorporate upgraded "CC" design cages to make space for optimized rollers. Sizes 22311-14 are designwise similar to corresponding standard E design bearings.

The E/VA405 bearings have nitrocarburized surface hardened, window type steel cages and a floating guide ring inside or outside the cages between the rows of rollers.

Designation example: 22311 E/VA405

223 series EJA/VA405

The bearings in the size range 22315 through 22322 have the EJA/VA405 design with nitrocarburized surface-hardened, window-type steel cages and a nitrocarburized surface hardened, floating guide ring (suffix JA), between the cages and the two rows of rollers, centred in the outer ring (→ **Fig. 2**).

Designation example: 22320 EJA/VA405

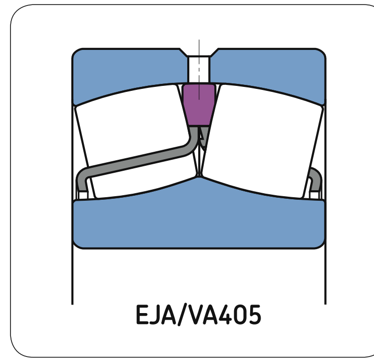


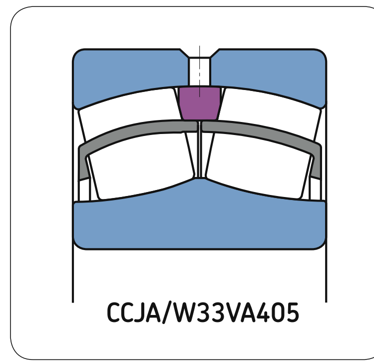
Fig. 2

223 series CCJA/W33VA405

The bearings in the range 22324 through 22348 have the CCJA design with nitrocarburized surface-hardened, window-type steel cages and a nitrocarburized surface hardened, floating guide ring (suffix JA), between the cages and the two rows of rollers, centred in the outer ring (→ **Fig. 3**).
The guide ring guides the rollers and centres the cages.

Designation example: 22324 CCJA/W33VA405

Fig. 3



223 series variant with PTFE coated bore (suffix VA406)

The SKF spherical roller bearings for vibratory applications are optionally supplied with a PTFE (polytetrafluoroethylene) coated cylindrical bore (suffix VA406). In all other respects these bearings are similar to the bearings with suffix VA405 and fully interchangeable.

The PTFE bore coating adds favourable cost saving advantages to the application:

- virtually eliminates fretting corrosion,
- makes it possible to eliminate special features or shaft sleeves on the shaft aimed at reducing fretting corrosion damage,
- avoids induced axial forces in the bearing arrangement.

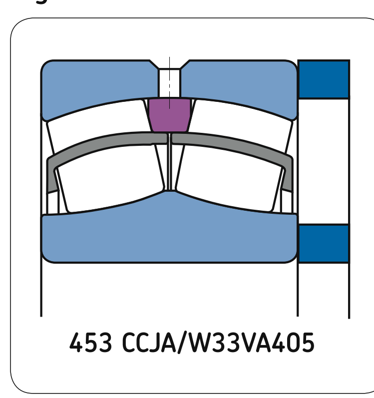
SKF also makes bearings of other series and types suitable for vibratory applications:

453 CCJA/W33VA405 (233) bearing kits for vibrating screens

SKF makes the 453 bearing kits incorporating SKF Explorer 223 series bearings for vibratory applications. The kit combines a 223 series bearing and inner and outer ring spacers to provide easy replacement for the older 453 (233) series bearings (→ **Fig. 4**). These bearings, because of their SKF Explorer performance have equal or longer service life than the 233 or older design 453 (brass cage, flanged inner ring) series bearings. Some slight modification of the bearing housing may be necessary to accommodate these bearings if they are grease lubricated through the outer ring.

Designation example: 453328 CCJA/W33VA405

Fig. 4



222 series E and CC designs

Spherical roller bearings of the 222 series are also used effectively in vibrating screens, feeders, and compaction equipment where the vibration level is low (< 5g). E design bearings in the 222 series have hardened cages as a standard feature. Larger bearings having the CC design should be specially made with hardened cages (VU053 suffix).

Bearings with tapered bore (suffix K)

The spherical roller bearings for vibratory applications are also available with tapered bore, taper 1:12.

Designation example: 22324 CCKJA/W33VA405

Bearing data

Dimensions and tolerances

The principal dimensions of the SKF spherical roller bearings for vibratory machinery in the 223 series are in accordance with ISO 15-1998. The values of the tolerances are in accordance with ISO 492-2002. They are listed in the SKF General Catalogue (tables 3 to 5 starting on page 125).

SKF Explorer spherical roller bearings for vibratory applications, however, are produced to higher precision than the ISO Normal tolerances:

- The dimensional accuracy of the bore and the outside diameter is within P5 and P6 tolerance class respectively (→ **Table 1**).
- The running accuracy is to tolerance class P5 as standard.

Table 1

Dimensional accuracy of bore and outside diameters of SKF spherical roller bearings

Bore diameter	Tolerance class				Outside diameter	Tolerance class			
	Normal		**P5**			Normal		**P6**	
d	High	Low	High	Low	D	High	Low	High	Low
mm	µm		µm		mm	µm		µm	
30 to 50	0	-12	**0**	**-8**	**80 to 120**	0	-15	**0**	**-13**
50 to 80	0	-15	**0**	**-9**	**120 to 150**	0	-18	**0**	**-15**
80 to 120	0	-20	**0**	**-10**	**150 to 180**	0	-25	**0**	**-18**
120 to 180	0	-25	**0**	**-13**	**180 to 250**	0	-30	**0**	**-20**
180 to 250	0	-30	**0**	**-15**	**250 to 315**	0	-35	**0**	**-25**
					315 to 400	0	-40	**0**	**-28**
					400 to 500	0	-45	**0**	**-33**

Bearing radial internal clearance

Bearings for vibratory applications in the 223 series are made as standard with the C4 radial internal clearance. This clearance is included in the VA405 and VA406 specifications. For the bearings in the 222 series it is necessary to specify the bearing internal clearance. Bearings with C4 clearance are recommended. On request, bearings for vibratory applications can be supplied with other clearances than C4. In such cases please consult the SKF application engineering service to check the possibilities and delivery conditions.

The limits for C4 radial internal clearance are in accordance with ISO 5753-1991 and are valid for bearings before mounting under zero measuring load. Values are listed in **Table 2**.

Permissible angular misalignment

Bearings in the 223 series have a permissible angular misalignment of 3° (≈ 50 mrad) under constant load direction and otherwise normal operating conditions. The permissible misalignment is reduced for bearings operating with rotating imbalance loads and "rotating deflection" of the shaft (→ **Fig. 5**). In these cases the angular misalignment of the inner ring relative to the outer ring should not normally exceed 0,1° because of the increased bearing friction and the resulting heat generation. Misalignment as high as 0,2°- 0,3° is possible depending on the lubrication and cooling conditions.

Table 2

Radial internal clearance of spherical roller bearings

Bore diameter d		Cylindrical bore C4		Tapered bore C4	
over	incl.	min	max	min	max
mm		µm		µm	
30	**40**	60	80	65	85
40	**50**	75	100	80	100
50	**65**	90	120	95	120
65	**80**	110	145	120	150
80	**100**	135	180	140	180
100	**120**	160	210	170	220
120	**140**	190	240	200	260
140	**160**	220	280	230	300
160	**180**	240	310	260	340
180	**200**	260	340	290	370
200	**225**	290	380	320	410
225	**250**	320	420	350	450

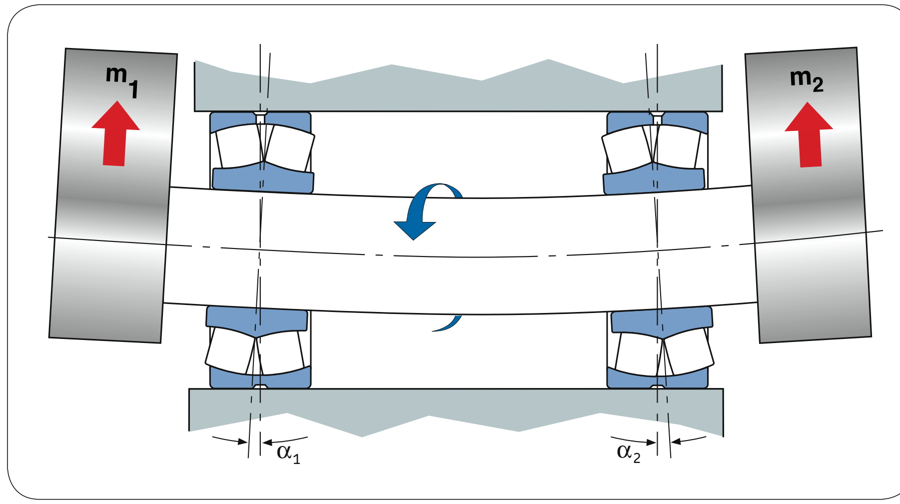


Fig. 5

Influence of operating temperature on bearing material

SKF spherical roller bearings are subjected to a special heat treatment as standard so that they can operate at temperatures up to 200 °C without significant dimensional changes occurring. This temperature limit also applies to the steel cages in the bearings.

Axial load carrying capacity

The internal designs of the E and CC spherical roller bearings provide lower friction than other design spherical roller bearings, especially when supporting axial loads. This allows the bearings to support heavier axial loads with acceptable operating temperatures. For vertical shafts or heavier axial load ($F_a/F_r > e$) SKF recommends more frequent grease relubrication (→ section “Lubrication” starting on page 19).

Permissible acceleration

SKF spherical roller bearings for vibratory applications can operate with considerably higher accelerations than the corresponding standard bearings. The permissible acceleration depends on the type of accleration (rotating or linear) applied to the bearings (→ **Fig. 6**) and how the bearings are lubricated (grease or oil). Higher accelerations are possible with oil lubrication and with greases having greater NLGI consistency. Values for individual bearings are found in Table 3 on page 9 and in the product table.

Rotating acceleration

The bearing is subjected to a rotating outer ring load and a rotating acceleration field. This generates cyclic loads on the cages by the unloaded rollers. Typical examples are vibrating screens and planetary gears.

Linear acceleration

The bearing is subjected to impact loads and thus linear accelerations. This causes hammering in the cage pockets by the unloaded rollers. A linear acceleration is generated, for example, when rail wheels are rolling over rail joints. An analogous application using bearings for vibratory applications is the road roller where the roller is vibrating against a relatively hard surface. Road rollers are subject to a mix of rotating and linear accelerations.

Equivalent dynamic bearing load

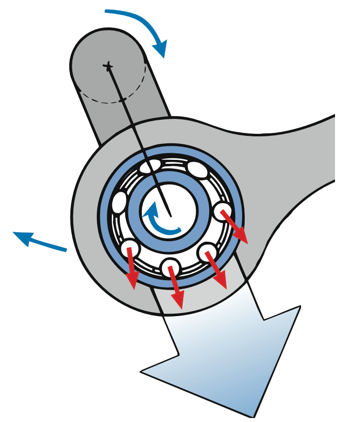
For normal (non-vibratory) applications, the standard formulas for calculating equivalent dynamic bearing load P is used:

$$P = F_r + Y_1 F_a \quad \text{when} \quad F_a / F_r \leq e$$

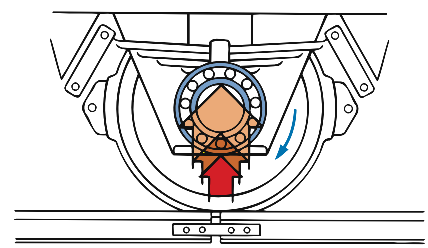
$$P = 0{,}67 F_r + Y_2 F_a \quad \text{when} \quad F_a / F_r > e$$

Appropriate values of the calculation factors e, Y_1 and Y_2 are found in the product table for each individual bearing (→ pages 27 and 29).

The equivalent bearing load P for vibratory applications depends on the type of vibratory mechanism used (circular, eccentric or linear) and the magnitude of the vibration (acceleration) forces. It is best to consult the equipment manufacturer for details. The loads within the bearings are, in part, dynamic loads induced by the circular, eccentric or linear motion of the bearing itself. If the selected bearing is too large in size, the induced loads, notably those from the rolling elements, will impair the performance of the bearing. It is best to select a bearing with sufficient rating life and with a robust but lightweight cage system having inherently low friction. It is recommended that bearings should be selected to give SKF rating life L_{10mh} in the order of 2 000 to 15 000 hours. Suitable equations for determining the equivalent dynamic bearing load are given on pages 10 - 13.



Typical rotating acceleration
(e.g. screens and planetary gears)



Typical linear acceleration
(e.g. rail wheels)

Cage strength vs L_{10mh} life

Note that cage strength is not considered in the L_{10mh} equation. The equation is only a measure of the raceway fatigue life.

In “normal” applications with standard bearings this is generally a good life indicator. However, in bearings for vibratory applications the cages often limit the service life.

Consequently, in order to use the L_{10mh} equation with no limitation the permissible acceleration limit must not be exceeded.

Fig. 6

① Linear acceleration is related to the bearing. Therefore, linear acceleration has to be measured as close as possible to the bearing. Furthermore, it is important to take the frequency into consideration. Frequencies higher than 500 Hz make the linear acceleration more or less harmless to the bearing.

② This recommendation is valid for the relubrication intervals listed in Table 8 on page 21.

Higher accelerations can be permitted if shorter intervals are used.

③ Use the lowest permissible value when the application involves both rotating and linear accelerations.

Short duration peak accelerations twice as high as those listed in the table can be permitted.

Note:

The listed values are maximum values when lubrication is optimal. This implies that the bearing has to be oil lubricated.

With this prerequisite the limiting factor is cage fatigue and not the lubricant. Accordingly, if the oil lubrication is less than optimal the permissible values should be reduced.

The table does not apply to CARB VG114 design bearings. See note on page 13.

Permissible acceleration ① in SKF spherical roller bearings for vibratory applications

Bearing bore diameter d	Acceleration limit for grease ② Grease consistency			Acceleration limit for the bearing ③ – Optimal oil lubrication	
mm	NLGI1	NLGI2	NLGI3	Rotating acceleration	Linear acceleration
40	7,5g	15g	23g	125g	31g
45	7g	14g	21g	102g	29g
50	6g	12g	18g	90g	28g
55	5,5g	11g	17g	70g	26g
60	5g	10g	15g	70g	25g
65	5g	10g	15g	69g	24g
70	4,5g	9g	14g	61g	23g
75	4g	8g	12g	88g	23g
80	4g	8g	12g	80g	22g
85	3,5g	7g	11g	74g	21g
90	3,5g	7g	11g	68g	21g
95	3,5g	7g	11g	64g	20g
100	3g	6g	9g	56g	20g
110	3g	6g	9g	53g	19g
120	2,5g	5g	7,5g	96g	21g
130	2,5g	5g	7,5g	87g	20g
140	2,5g	5g	7,5g	78g	20g
150	2g	4g	6g	72g	19g
160	2g	4g	6g	69g	18g
170	2g	4g	6g	65g	18g
180	2g	4g	6g	59g	17g
190	1,5g	3g	4,5g	57g	17g
200	1,5g	3g	4,5g	55g	17g
220	1,5g	3g	4,5g	49g	16g
240	1,5g	3g	4,5g	45g	15g

g = standard acceleration of free fall, m/s^2

Table 3

Calculation of equivalent dynamic bearing load for different vibrating screen arrangements

Vibrating screens with free movement or two-bearing screens

The frame of this type of vibrating screen is supported by springs and has a single shaft supported by bearings (→ **Fig. 7**). The axis of this shaft traditionally passes through the centre of gravity of the screen frame. The screen movement is achieved by means of rotating counterweights on the shaft. The counterweights can be positioned between the bearings or outside the bearings or both. The counterweights outside the bearings can usually be adjusted to obtain the desired vibration amplitude. When in operation, the screen frame moves in a circular or elliptical orbit around the common centre of gravity (denoted T in Fig. 7) of the screen frame and the counterweights.

$$P_r = 10^{-3} \frac{f}{S} G\, r\, \omega^2 \qquad \text{Eq. 1}$$

Where

P_r = equivalent radial load, kN

f = application factor. Varies between 1 and 1,2 depending on screen manufacturer

G = mass of the screen frame without material load, kg

r = radius of vibration, m

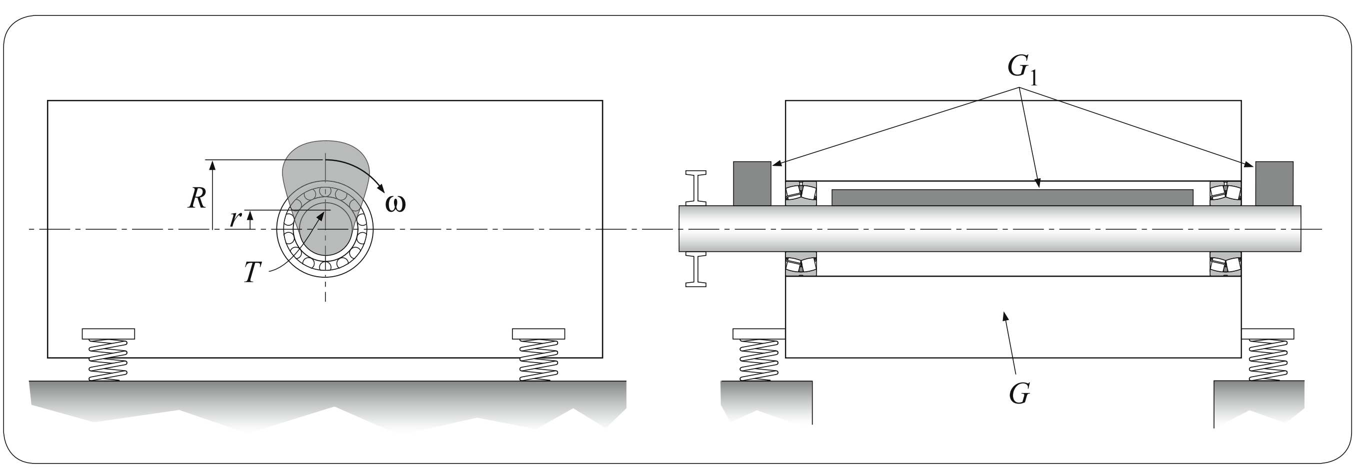
$\omega = \frac{\pi n}{30}$ = angular velocity, rad/s

n = rotational speed, r/min

S = number of bearings

In cases where the radius of vibration is not known it is possible to use the state of equilibrium as expressed in Eq. 2 to estimate the radii.

Fig. 7



$$G\,r = G_1\,(R - r) \qquad \text{Eq. 2}$$

Where

G_1 = mass of counterweights, kg

R = distance between the common center of gravity of the counterweights and the shaft axis, m

When this is solved for ”r” and the result inserted in the Eq. 1 the following equation is obtained:

$$P_r = 10^{-3}\,\frac{f\,G\,G_1\,R\,\omega^2}{S\,(G + G_1)} \qquad \text{Eq. 3}$$

Circular motion or four-bearing vibrating screens

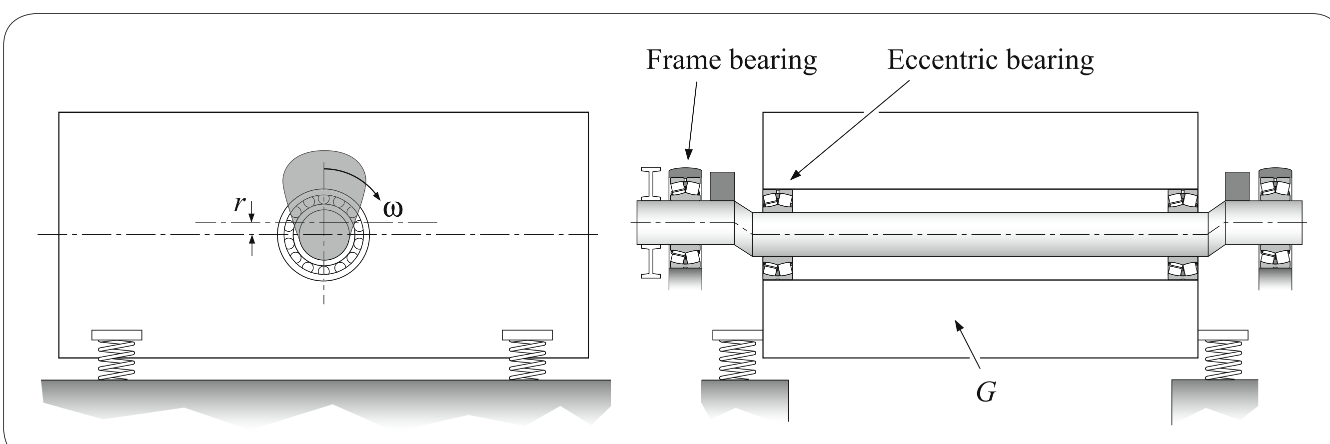
In this type of vibrating screen, the screen frame is supported by an eccentric shaft supported by bearings in the screen frame and separate bearings in the stationary base beneath the screen (→ **Fig. 8**). The two bearings supporting the shaft in the screen frame have a separate rotational axis than the two bearings supporting the shaft from the stationary base. The resulting circular motion of the screen frame is dependent on the eccentric radius ”r” between the two shaft axes.

It is estimated that 70% of the screen frame is supported by the springs and the remainder of the force is supported by the frame bearings and via the eccentric bearings.

The equivalent radial load on each eccentric bearing, P_{re}, is calculated by the following equation:

$$P_{re} = 10^{-3}\,\frac{f}{S_e}\,G\,(r\,\omega^2 + 0{,}3\,g) \qquad \text{Eq. 4}$$

Fig. 8



where

P_{re} = equivalent radial bearing load on eccentric bearings, kN

f = application factor. Varies between 1 and 1,2 depending on screen manufacturer

G = mass of the screen frame without material, kg

r = eccentric radius, m

ω = angular velocity, rad/s

g = acceleration due to gravity, m/s^2

S_e = number of eccentric bearings

It is estimated that the frame bearings support 30% of the screen frame since optimal balance of the counterweights is seldom attained. Therefore, the equivalent radial load on the frame bearings, P_{rf}, is calculated from the following equation:

$$P_{rf} = 10^{-3} \frac{f}{S_f} G \left(0{,}3\, r\, \omega^2 + 0{,}3\, g\right) \quad \text{Eq. 5}$$

Vibrating screens with linear motion

Separate vibrator units are attached to the vibrating screen or shakeout unit to have a linear frame motion. The reciprocating motion, rather than circular or elliptical motion, is developed by rotation of dual shafts having counter-rotating balance weights – the centrifugal forces of each acting and counteracting in unison. The screen frame or shake-out unit is arranged to have oscillating linear motion at a certain angle to the horizontal (→ **Fig. 9**).

The equivalent bearing load P_r varies sinusoidally when the shafts are in rotation.

$$P_r = 10^{-3} \frac{f}{S} \omega^2 \left(0{,}32\, G\, r_{max} + 0{,}68\, G_1\, R\right) \quad \text{Eq. 6}$$

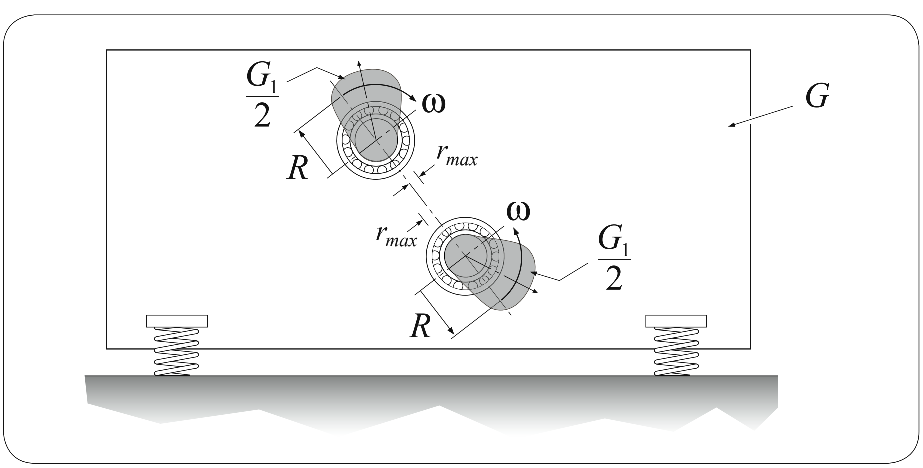


Fig. 9

Where
P_r = equivalent radial bearing load, kN
G = mass of screen frame or shakeout unit without material, kg
r_{max} = maximum displacement from axis of motion, m
ω = angular velocity, rad/s
S = number of bearings
G_1 = combined mass of counterweights, kg
R = distance between counterweight centre and shaft axis, mm

If either the radii r_{max} or R are not known, this can be calculated by means of the equilibrium equation

$$G\, r = G_1\,(R - r) \qquad \text{Eq. 7}$$

NB. All the above calculations presume no or only small axial loads are applied to the bearings. Induced axial loads can substantially affect bearing service life. It is recommended that solutions such as the use of the spherical roller bearing with PTFE coating in the bore (suffix VA406) or CARB® toroidal roller bearings (suffix VG114) be used to eliminate or minimize axial loads. **CARB VG114 bearings are well suited for vibrating screens as they can accomodate accelerations up to 10g**.

SKF rating life

Bearing rating life in vibratory applications is very much dependant on the factors:

- equivalent bearing load P (kN),
- rotational speed n (r/min),
- contamination level η_c,
- lubricant viscosity ν at the operating temperature (mm^2/s),
- ovality (form error) of the bearing housing a_{OV}.

The SKF rating life, L_{10mh} is calculated by the following equation:

$$L_{10mh} = a_{skf}\, a_{ov} \left(\frac{10^6}{60\, n}\right)\left(\frac{C}{P}\right)^{\frac{10}{3}} \qquad \text{Eq. 8}$$

Where
L_{10mh} = SKF rating life, hours
a_{SKF} = SKF life modification factor (→ **Diagram 1**)
a_{ov} = Adjustment factor for ovalized housings (→ **Diagram 2**)
P = Equivalent dynamic bearing load, kN
C = Basic dynamic load rating, kN

Cleanliness is a prerequisite for long service life. The influence of contaminants on bearing life can be calculated by means of the SKF rating life equation. Use the SKF CADalog or the SKF Interactive Engineering Catalogue online at www.skf.com.

Guideline values for the contamination level, η_c, in vibratory applications are given in Table 4.

Table 4

Contamination factor η_c for vibrating screens ①			
Sealing design	**Grease lubrication**	**Oil bath**	**Circulating oil ②**
Simple labyrinth or garter spring seal	0,001 - 0,1	0,05 - 0,15	Not recommended
Labyrinth with V-ring or garter spring seal	0,1 - 0,2	0,15 - 0,2	0,2 - 0,4
Multi-stage labyrinth with V-ring seal and grease purge	0,2 - 0,3	0,25 - 0,35	0,3 and greater

① The η_c value may vary depending on the operating conditions and maintenance performed

② Depends on the filtration rate. Oil loss may occur with poor sealing

Diagram 1

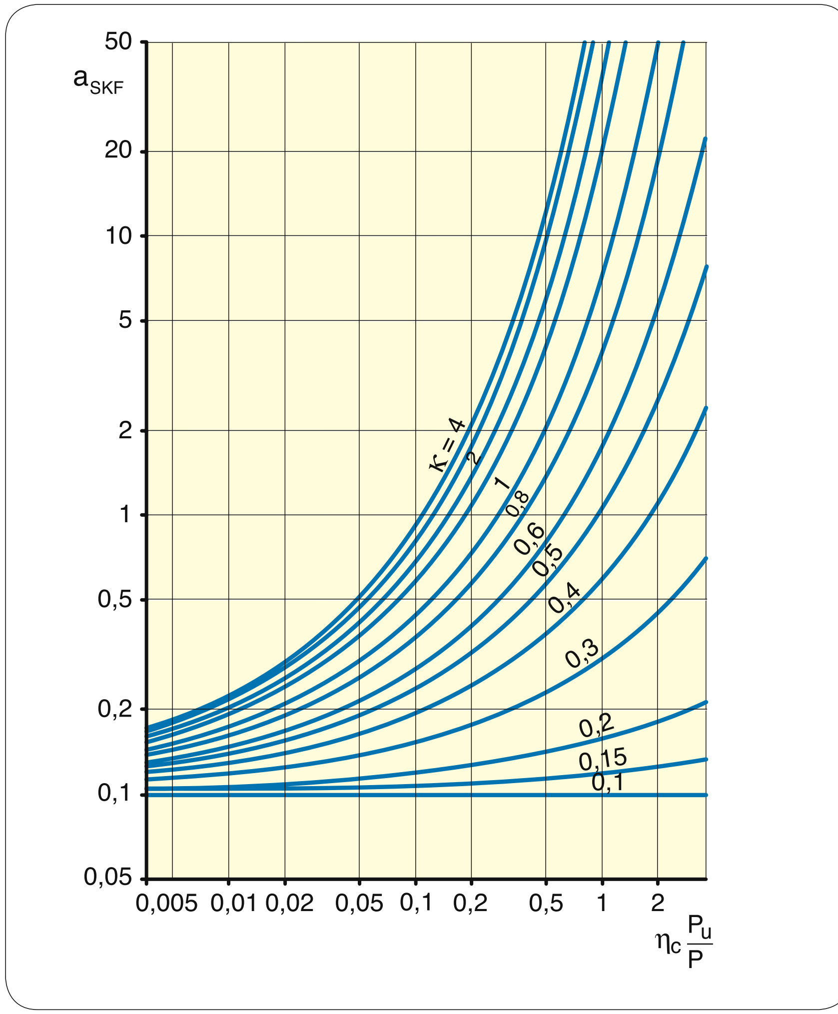
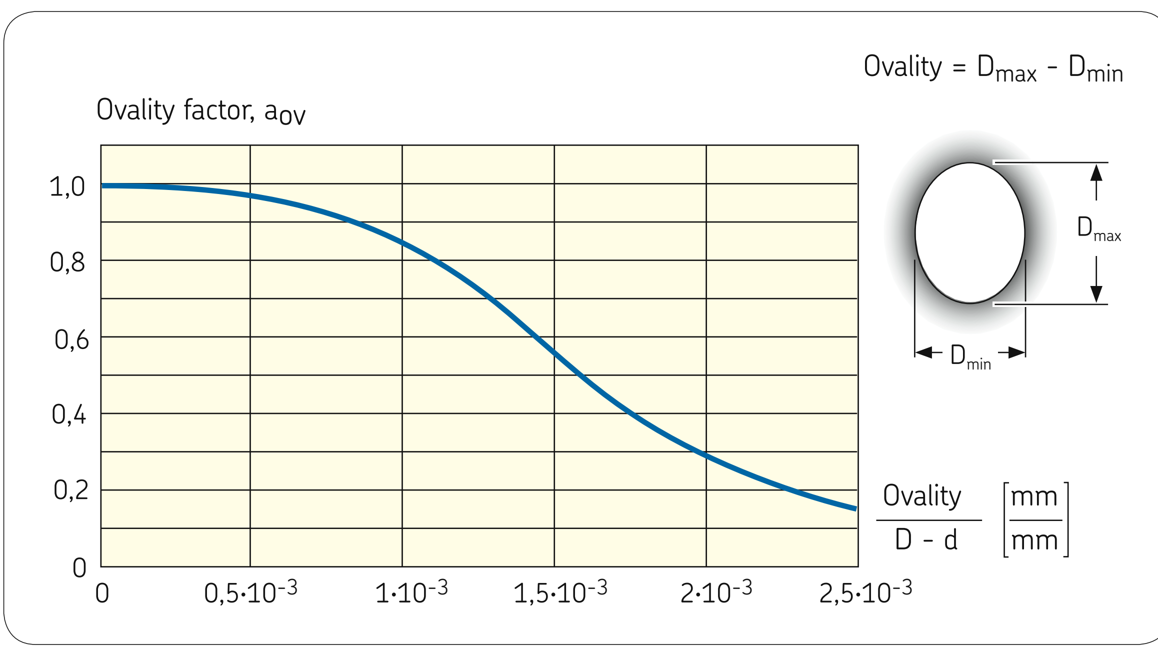


Diagram 2



Bearing arrangement

The service life of the bearing is strongly affected by the design and manufacture of the associated components (shaft, housing and seals). For vibratory applications there are some aspects that are especially important to consider.

Shafts

Thermal expansion of the shaft and the frame must be taken by the bearing arrangement. Otherwise an axial load will be induced that can shorten bearing life substantially (→ **Fig. 10**). If the arrangement consists of two spherical roller bearings, one of the bearings must be axially free on either the shaft or in the housing.

In a vibrating application with rotating load, it is necessary to fit the bearing outer ring in the housing with an interference fit. Otherwise the outer ring will rotate in the housing causing housing bore wear and bearing overheating. Since it is necessary for the outer ring to have an interference fit in the housing, the inner ring is mounted with a loose fit on the shaft. The non-locating bearing should have some axial clearance with the shaft shoulder as well. The recommended tolerances for shaft dimensions, form and surface roughness are listed in Table 6 on page 18. The risk of fretting corrosion between the inner ring and shaft can be minimized if the following measures are met:

- The recommended shaft diameter tolerance is used
- The shaft is as hard as possible. The harder the better.
- The shaft is carefully checked (surface errors, form errors etc.), repaired if needed – and properly lubricated before mounting.

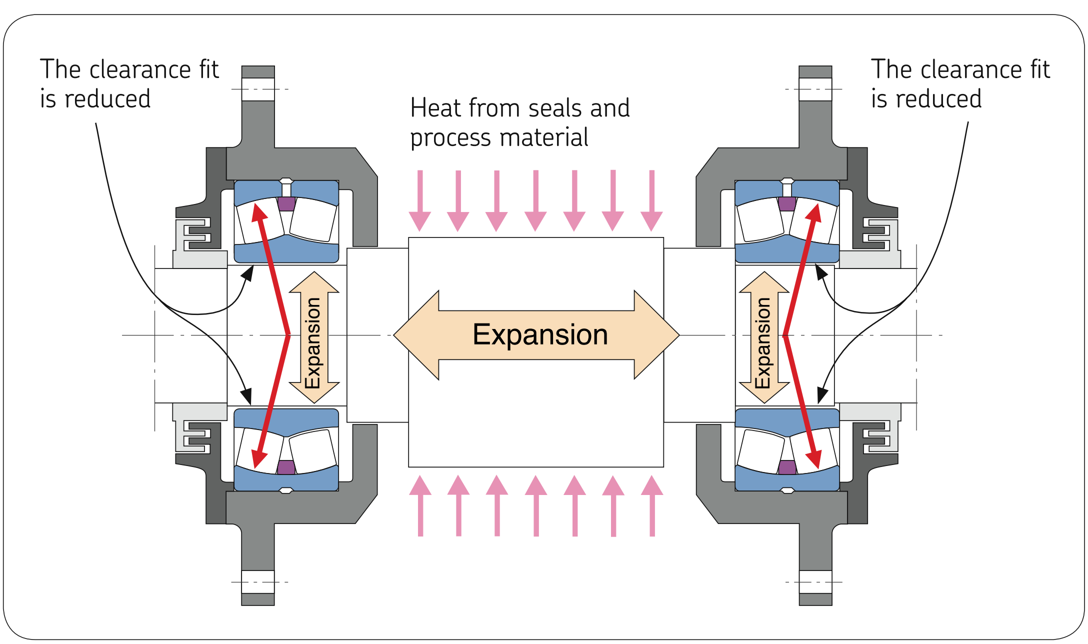


Fig. 10

Spherical roller bearings with PTFE-coated bore (suffix VA406) or a CARB toroidal roller bearings are excellent alternatives in vibrating screens to minimize fretting corrosion. CARB VG114 bearings are well suited for vibrating screens as they can accomodate accelerations up to 10g.

Housings

SKF recommends bearing housings be made of steel or good quality ductile iron such as EIN-GJS-400-18. The wall thickness of the housing in the radial direction should correspond to about 40% of the bearing width (B) in order to minimize the risk of deformation. Housings should be relieved of residual stresses during manufacture. This will reduce the possibility of their gradual degradation over time and the "pounding out" and ovalization of the housing bore. Due to the rotating outer ring load, the bearing outer ring must have an interference fit in the housing as to avoid relative movement between the outer ring and housing seating.

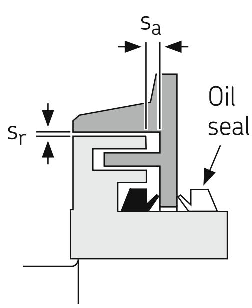
The housing should be as symmetrical as possible with reference to the axis of the shaft and the center line of the bearing, otherwise the housing and the bearing outer ring could be deformed unevenly resulting in reduced service life. As a result of the interference fit, the "outer form" of the housing is "copied" by the bearing outer ring raceway. Deviations from the recommended dimensional and form accuracy (cylindricity) of the housing bore have a great effect on the geometry of the bearing raceways and the service life of the bearings. The recommended tolerances for housing dimensions, form and surface roughness are listed in Table 6 on page 18. See also section "SKF rating life" on page 13, that states the influence of housing ovality on bearing life.

During assembly, it is important to consider the possibility of housing deformation when bolting down into position on the frame.

A deformed frame can distort the bearing housing resulting in an ovalization of the housing bore and the pinching of the non-locating bearing. This can result in an increase in axial forces in the bearings, increased operating temperatures and reduced service life.

Table 5

Recommended gap widths for labyrinth seals



Bore diameter		Labyrinth gap width	
		Radial	Axial
d		s_r	s_a
over	incl.		
mm		mm	
35	75	0,6	2,5
75	100	0,7	3,0
100	150	0,8	3,5
150	200	0,9	4,0
200	240	1,0	4,5

Seals

Since vibratory machinery usually operates in harsh environments (dust, dirt, moisture etc.), it is recommended to use effective labyrinth seals to prevent the entry of contaminants and reduction of bearing service life. Values for recommended gap openings of labyrinth seals (s_r and s_a) are listed in Table 5. The labyrinth should always be filled with grease. A V-ring seal is recommended to prevent contaminants from entering the bearing and excess grease to escape.

When oil lubrication is used, an extra V-ring seal can be fitted to prevent oil leakage (→ fig in **Table 5**).

Table 6

SKF application tolerance recommendations for vibrating screens ①

Bearing designation	Shaft seating					Housing bore seating					Residual clearance after mounting	
	Nominal tolerance	Deviations		Cylin-dricity②	Surface roughness	Nominal tolerance	Deviations		Cylin-dricity②	Surface rough-ness		
		high	low	max	$R_{a,max}$		high	low	max	$R_{a,max}$	max	min
–	mm	µm		µm	µm	mm	µm		µm	µm	µm	
22308 E/VA405	40/g6	-9	-25	5,5	1,6	90/N6	-16	-38	5	1,6	40	70
22309 E/VA405	45/g6	-9	-25	5,5	1,6	100/N6	-16	-38	5	1,6	50	90
22310 E/VA405	50/g6	-9	-25	5,5	1,6	110/N6	-16	-38	5	1,6	50	90
22311 E/VA405	55/g6	-10	-29	6,5	1,6	120/N6	-16	-38	5	1,6	65	105
22312 E/VA405	60/g6	-10	-29	6,5	1,6	130/N6	-20	-45	6	1,6	65	105
22313 E/VA405	65/g6	-10	-29	6,5	1,6	140/N6	-20	-45	6	1,6	65	105
22314 E/VA405	70/g6	-10	-29	6,5	1,6	150/N6	-20	-45	6	1,6	75	130
22315 EJA/VA405	75/g6	-10	-29	6,5	1,6	160/P6	-36	-61	6	1,6	75	120
22316 EJA/VA405	80/g6	-10	-29	6,5	1,6	170/P6	-36	-61	6	1,6	75	120
22317 EJA/VA405	85/f6	-36	-58	7,5	1,6	180/P6	-36	-61	6	1,6	95	150
22318 EJA/VA405	90/f6	-36	-58	7,5	1,6	190/P6	-41	-70	7	1,6	95	150
22319 EJA/VA405	95/f6	-36	-58	7,5	1,6	200/P6	-41	-70	7	1,6	95	150
22320 EJA/VA405	100/f6	-36	-58	7,5	1,6	215/P6	-41	-70	7	1,6	95	150
22322 EJA/VA405	110/f6	-36	-58	7,5	1,6	240/P6	-41	-70	7	1,6	115	175
22324 CCJA/W33VA405	120/f6	-36	-58	7,5	1,6	260/P6	-47	-79	8	1,6	115	175
22326 CCJA/W33VA405	130/f6	-43	-68	9	1,6	280/P6	-47	-79	8	1,6	140	205
22328 CCJA/W33VA405	140/f6	-43	-68	9	1,6	300/P6	-47	-79	8	1,6	140	205
22330 CCJA/W33VA405	150/f6	-43	-68	9	1,6	320/P6	-51	-87	9	1,6	160	240
22332 CCJA/W33VA405	160/f6	-43	-68	9	1,6	340/P6	-51	-87	9	1,6	160	240
22334 CCJA/W33VA405	170/f6	-43	-68	9	1,6	360/P6	-51	-87	9	1,6	175	265
22336 CCJA/W33VA405	180/f6	-43	-68	9	1,6	380/P6	-51	-87	9	1,6	175	265
22338 CCJA/W33VA405	190/f6	-50	-79	10	1,6	400/P6	-51	-87	9	1,6	195	290
22340 CCJA/W33VA405	200/f6	-50	-79	10	1,6	420/P6	-55	-95	10	1,6	195	290
22344 CCJA/W33VA405	220/f6	-50	-79	10	1,6	460/P6	-55	-95	10	1,6	220	315
22348 CCJA/W33VA405	240/f6	-50	-79	10	1,6	500/P6	-55	-95	10	1,6	220	315

① The values in the table are not valid for CARB® toroidal roller bearings.
② This parameter is related to the radius and corresponds to the definition DIN-ISO 1101. Accordingly, the value can be doubled when the measurement is related to the diameter. **Note**: The circularity tolerance is confined by the cylindricity tolerance

SKF

Lubrication

Spherical roller bearings in vibratory machinery are subjected to much heavier vibration forces (g) than bearings in conventional machines. Therefore, the lubricants used must be of high quality when it comes to mechanical stability. Table 7 lists the generic recommendations for greases used in vibrating screens.

Operating conditions, bearing size and machine user requirements dictate whether grease lubrication (manual or continuous), oil bath lubrication or circulating oil lubrication is used.

Grease lubrication

In many cases spherical roller bearings for vibratory machinery are lubricated with grease. Follow the recommendations of the screen or compactor manufacturer for the grease type, quantity and relubrication interval for a specific machine. SKF LGEP2 grease is recommended for operating temperatures up to 75 °C and SKF LGHB2 grease for higher operating temperatures up to 95 °C. Detailed information about SKF greases is given in the SKF General Catalogue and the SKF Interactive Engineering Catalogue online at www.skf.com.

The following points should be considered with grease lubrication:

- Regreasing must be performed in such a way that grease really passes through the bearing. The most reliable way is to fill through the W33

Table 7

Recommended properties of greases for vibrating screens

Property	Stipulation	Test prodedure
Base oil type	Generally mineral oil (1)	IR analysis
Base oil viscosity	100 - 220 mm2/s at 40 °C	DIN 51 562
Mechanical stability		
Worked penetration		
– After 60 cycles	– 220 - 295, 10-1 mm	– DIN-ISO 2137
– After 10^5 cycles	– Max. +50 units change from the value given at 60 cycles	– DIN-ISO 2137
Shell roll stability	– Max. +50 units change after 50 hours at 80 °C	DIN 51804/2
V2F	Rating “M”	SKF method
Drop point	≥ 180 °C	DIN-ISO 2176
Water resistance	1 at 90 °C	DIN 51 807
Corrosion protection SKF EMCOR Test	0/0	to DIN 51802
4-ball Weld load	≥ 2800 N	to DIN 51350
Temperature range	-20 °C to +120 °C	–

(1) SKF LGEP2 grease is suitable for normal applications and temperatures.

holes during rotation. Use SKF LGEP2 grease or other well-proven greases based on Lithium thickeners, consistency class NLGI 2 or NLGI 3. A mineral base oil can normally be used. In some applications, e.g. screens for hot material, the bearing temperature may become too high because of the external heat. In these cases it is recommended to use the SKF LGHB2 grease or a synthetic oil grease. Do not switch from one brand/grade of grease to another without checking if the greases can be mixed.

- To avoid contamination use only grease guns with replaceable cartridges.
- Clean the grease nipple before applying the grease gun.
- Keep supply pipes to lubrication points as short as possible. Fill the pipes with grease as part of the mounting operation. Make sure that the supply pipes are not broken from the vibration.
- Make sure that the grease gun delivers the requested quantity of grease to the bearings. The rate of grease discharged from the grease gun can vary between brands and also deteriorate between applications.
- Relubricate bearings when they are rotating, never relubricate during standstill. Wait until the machine has reached its operating temperature before relubricating the bearings. To improve the corrosion protection, it is recommended to relubricate the bearings just before the machine is to be shut down.

Generic regreasing intervals and charges for manual relubrication of bearings in vibrating screens are found in Table 8. The table is based on typical acceleration levels around 5g and operating temperatures up to 70 °C.

For other applications, accelerations and operating temperatures, intervals and grease quantities have to be estimated from case to case. Basically, higher temperatures and accelerations necessitate shorter intervals.

Grease pockets on both sides of the bearing enhances lubrication. The vibrations make the grease move around and enter the bearing. On the other hand, if the grease pockets are too large there is a risk for churning of the grease and deterioration of the grease thickener.

Grease lubrication of bearings mounted on a vertical shaft is generally more restrictive. The regreasing intervals must be shortened with at least a factor 2. The grease inlet should be positioned above the bearing and the outlet under the bearing. It is also recommended to use a grease with higher consistency, e.g. NLGI 3.

When a centralized grease lubrication system is used, the recommended regreasing rate for each bearing with continuous relubrication can be calculated from the following equation:

$$G = 3 \cdot 10^{-5}\, D\, B \qquad \text{Eq. 9}$$

where

G = grease quantity to be continuously supplied, g/h

D = bearing outside diameter, mm

B = bearing width, mm

Table 8

Grease quantities and relubrication intervals when relubricating SKF spherical roller bearings in vibrating screens ①

Bearing size	Grease quantity		Relubrication interval at speed (r/min)				
	Initial charge	Regreasing	500	900	1200	1500	2000
–	g		Operating hours				
22308	20	5	500	300	200	150	50
22309	25	5	500	300	200	150	50
22310	30	5	450	300	200	100	50
22311	35	5	450	300	200	100	50
22312	45	5	400	250	150	100	50
22313	55	10	400	250	150	100	50
22314	60	10	400	250	150	100	50
22315	90	10	350	200	100	50	50
22316	110	10	350	200	100	50	50
22317	120	15	350	200	100	50	50
22318	140	15	300	150	100	50	10
22319	160	15	250	150	100	50	10
22320	200	20	200	100	50	50	10
22322	250	20	200	100	50	10	10
22324	350	20	200	100	50	10	
22326	400	30	200	100	50	10	
22328	450	30	100	50	10		
22330	550	30	100	50	10		
22332	650	40	100	50	10		
22334	750	40	50	10			
22336	900	50	50	10			
22338	1000	50	20	10			
22340	1200	50	20	10			
22344	1400	60	15	7			
22348	1600	70	15	7			

① The table is valid for accelerations ≤ 5 g and operating temperatures ≤ 70 °C.

If the bearing operating temperature is very high, when hot material is being screened for instance, it will be necessary to regrease much more frequently; under certain circumstances as often as several times a day.

In the case of frame bearings on eccentric screens the grease quantities can be halved or the relubrication intervals can be doubled.

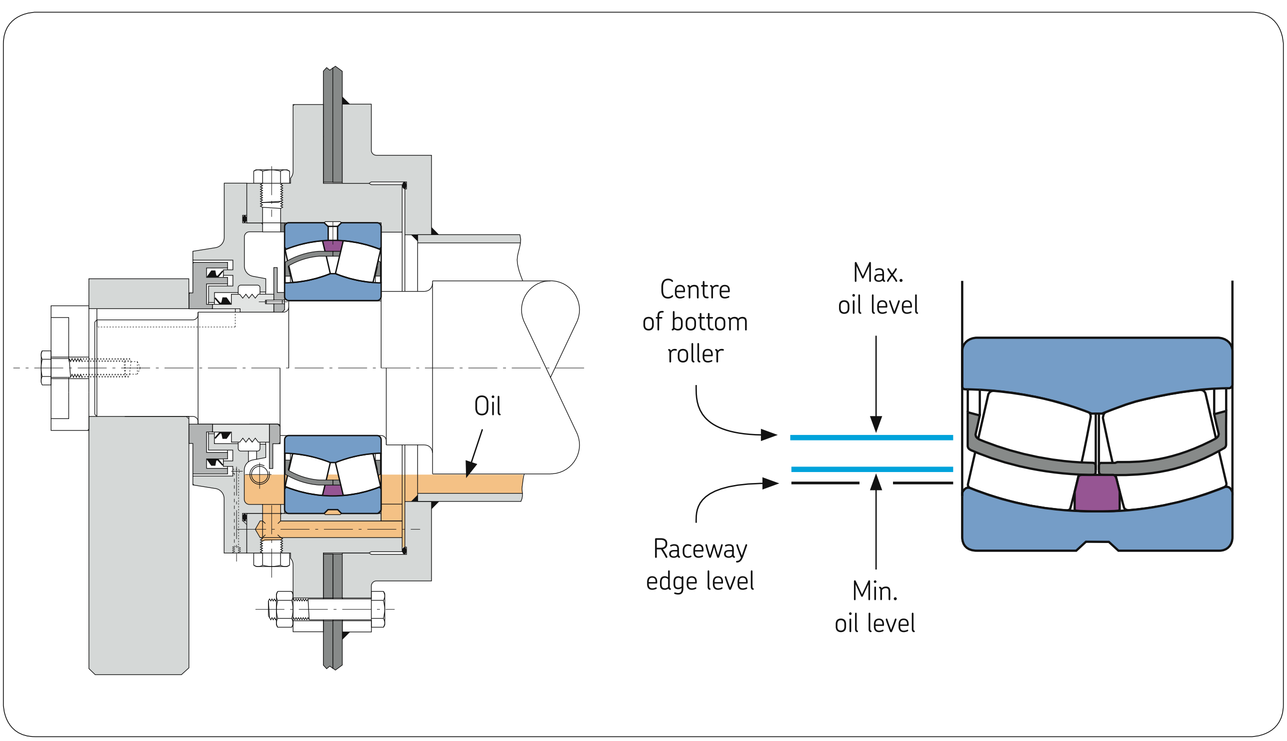
Oil lubrication

Oil bath

Oil bath lubrication is recommended for vibratory machinery where higher operating speeds, higher temperatures, or maintenance requirements (oil changes for contamination) preclude the use of grease. The oil used should be in accordance with the recommendations of the manufacturer of the screen or compactor. A good quality ISO VG150 mineral oil with EP, rust inhibitor, and anti-foam additives is recommended for operating temperatures up to 75 °C. Above this temperature an ISO VG 220 oil is recommended. Synthetic oils, of the same viscosity grades (VG) can also be used. The oil must be sufficiently clean prior to use. It is recommended that the oil has the cleanliness code -/15/12, according to ISO 4406:1999.

Most vibrating screens are designed with an oil splash lubricating system. For screens that are designed for an oil level in the bearings, the level of the oil should be below the centre of the bottom rollers but 2-3 mm above the edge of the outer ring raceway under static conditions (→ **Fig. 11**). The oil level should be checked regularly to ensure it is neither too high, nor too low. Excessive oil level will cause the bearings to overheat and reduce the service life of the oil and bearing. It is recommended to use a visual oil sight glass to view that the oil is at the correct level range. The bearing housing should have a passage-way beneath the bearing to allow the oil to freely circulate in the housing (→ **Fig. 11** and **Fig. 12**).

Fig. 11



Circulating oil

Circulating oil lubrication provides the bearings with a continuous flow of clean, cool oil at the correct quantity and viscosity. The oil should be filtered to remove contaminants. The oil drain connection and piping must be sufficiently large to prevent overflow and seal leakage. The bearing housing should have a passageway beneath the bearing to allow the oil to freely circulate in the housing (→ **Fig. 11** and **Fig. 12**).

A lower viscosity grade (VG) mineral or synthetic oil can be used depending on the oil inlet temperature when entering the bearing housing. The oil must be efficiently filtered. It is recommended that the oil has the clean-liness code -/15/12, according to ISO 4406/1999.

The oil inlet flow (pressure and rate), outlet flow and temperature should be monitored continuously. The use of the following guideline equation is recommended when calculating the oil flow rate.

$$V = 3 \cdot 10^{-5} \, D \, B \qquad \text{Eq. 10}$$

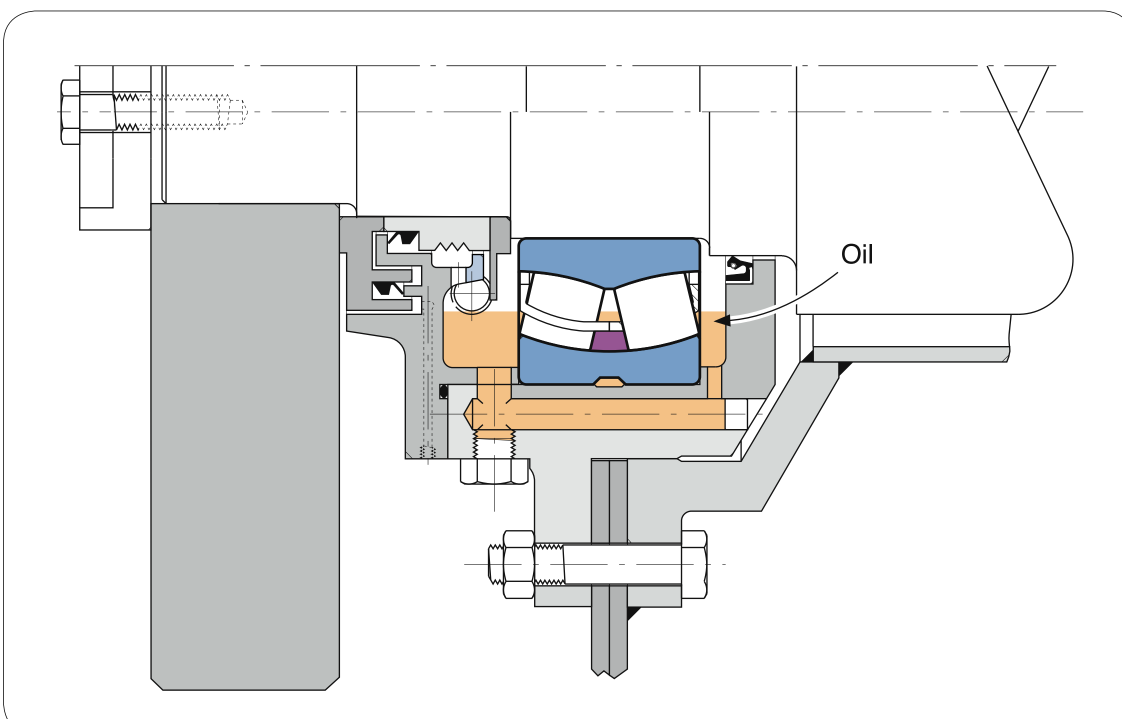
where

V = oil flow, l/min

D = bearing outside diameter, mm

B = bearing width, mm

Fig. 12



Different vibratory applications

Vibrating screens and exciters

Typical operational conditions are:

- Rotating acceleration: 5g to 10g,
- Speed: 1000 r/min to 2000 r/min,
- Temperature – cold material: 70 °C to 100 °C,
  – hot material: up to 200 °C

Road rollers

Vibratory rollers are very demanding applications. Operational speed and temperature are relatively high and the heavy linear and rotating accelerations induce unfavourable forces in the bearings. The linear acceleration is especially demanding for the cages. Typical operating conditions are:

- Rotating acceleratios: 6g to 30g,
- Linear acceleration: peak levels up to 60g,
- Speed: 1500 r/min to 3000 r/min,
- Temperature: 100 °C to 150 °C
- Oil lubrication.

Planetary gears

Planetary gears induce heavy rotating accelerations in the bearings. The reason is the relatively long distance to the planetary centre and the comparatively high speeds involved. Typical operating conditions are:

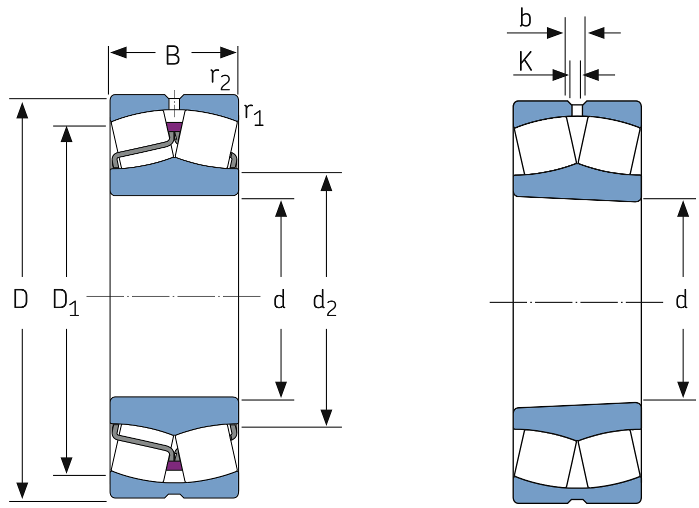
- Rotating acceleration: 70g to 100g,
- Speed: approximately 3000 r/min,
- Temperature: 60 °C to 100 °C,
- Oil lubrication

SKF Copperhead system solutions for mineral processing equipment

The SKF Copperhead is a system solution for vibrating screens, crushers, mills, conveyors and other mineral processing equipment. It enables fault detection monitoring of the equipment, including the bearing arrangements using vibration and temperature sensors. The SKF Copperhead system comprises the appropriate SKF Explorer spherical roller bearings, CARB toroidal roller bearings, sensors and monitoring units. The systems extend the equipment service life and reduce costly unplanned downtime. Either manual periodic or continuous monitoring is available. The SKF spherical roller bearings for vibratory applications (VA405 and VA406) are sometimes now referred to as the SKF Copperhead bearings. For more information on SKF Copperhead can be found online at *www.skf.com/copperhead*.

Spherical roller bearings for vibratory applications

d 40 - 130 mm

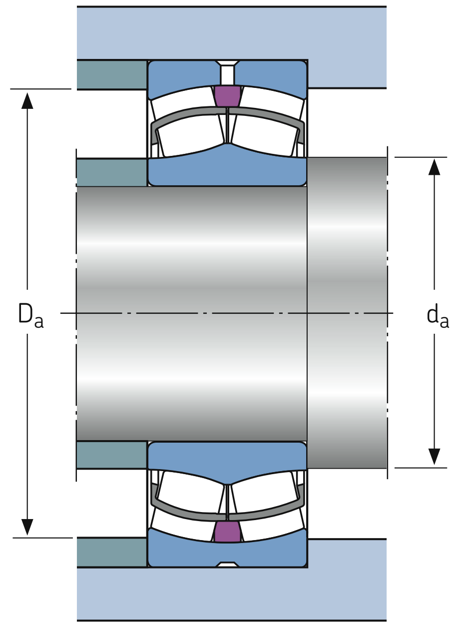


Cylindrical bore

Tapered bore

Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations ①	
			dyn.	stat.		Reference speed	Limiting speed		Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
40	90	33	150	140	15	6000	8000	1,10	**22308 E/VA405**	**22308 EK/VA405**
45	100	36	183	183	19,6	5300	7000	1,40	**22309 E/VA405**	**22309 EK/VA405**
50	110	40	220	224	24	4800	6300	1,90	**22310 E/VA405**	**22310 EK/VA405**
55	120	43	270	280	30	4300	5600	2,45	**22311 E/VA405**	**22311 EK/VA405**
60	130	46	310	335	36,5	4000	5300	3,10	**22312 E/VA405**	**22312 EK/VA405**
65	140	48	340	360	38	3800	5000	3,75	**22313 E/VA405**	**22313 EK/VA405**
70	150	51	400	430	45	3400	4500	4,55	**22314 E/VA405**	**22314 EK/VA405**
75	160	55	440	475	48	3200	4300	5,55	**22315 EJA/VA405**	**22315 EKJA/VA405**
80	170	58	490	540	54	3000	4000	6,60	**22316 EJA/VA405**	**22316 EKJA/VA405**
85	180	60	550	620	61	2800	3800	7,65	**22317 EJA/VA405**	**22317 EKJA/VA405**
	180	60	550	620	61	2800	3800	7,65	**22317 EJA/VA406**	**22317 EKJA/VA406**
90	190	64	610	695	67	2600	3600	9,05	**22318 EJA/VA405**	**22318 EKJA/VA405**
95	200	67	670	765	73,5	2600	3400	10,5	**22319 EJA/VA405**	**22319 EKJA/VA405**
100	215	73	815	950	88	2400	3000	13,5	**22320 EJA/VA405**	**22320 EKJA/VA405**
	215	73	815	950	88	2400	3000	13,5	**22320 EJA/VA406**	**22320 EKJA/VA406**
110	240	80	950	1120	100	2000	2800	18,4	**22322 EJA/VA405**	**22322 EKJA/VA405**
	240	80	950	1120	100	2000	2800	18,4	**22322 EJA/VA406**	**22322 EKJA/VA406**
120	260	86	965	1120	100	2000	2600	23,0	**22324 CCJA/W33VA405**	**22324 CCKJA/W33VA405**
	260	86	965	1120	100	2000	2600	23,0	**22324 CCJA/W33VA406**	**22324 CCKJA/W33VA406**
130	280	93	1120	1320	114	1800	2400	29,0	**22326 CCJA/W33VA405**	**22326 CCKJA/W33VA405**
	280	93	1120	1320	114	1800	2400	29,0	**22326 CCJA/W33VA406**	**22326 CCKJA/W33VA406**

① All bearings are SKF Explorer bearings

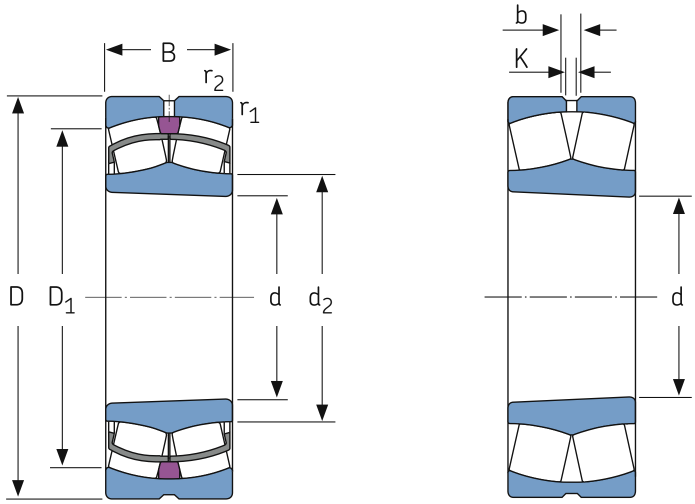


Dimensions						Abutment and fillet dimensions			Calculation factors				Permissible accelerations ② for oil lubrication	
d	d_2	D_1	$r_{1,2,min}$	b	K	$d_{a,min}$	$D_{a,max}$	$r_{a,max}$	e	Y_1	Y_2	Y_0	rotational	linear
mm						mm			–				m/s^2	
40	49,7	74,3	1,5	5,5	3	49	81	1,5	0,37	1,8	2,7	1,8	115g	31g
45	56,4	83,4	1,5	5,5	3	54	91	1,5	0,37	1,8	2,7	1,8	97g	29g
50	62,1	91,9	2	5,5	3	61	99	2	0,37	1,8	2,7	1,8	85g	28g
55	70,1	102	2	5,5	3	66	109	2	0,35	1,9	2,9	1,8	78g	26g
60	77,9	110	2,1	8,3	4,5	72	118	2	0,35	1,9	2,9	1,8	70g	25g
65	81,6	118	2,1	8,3	4,5	77	128	2	0,35	1,9	2,9	1,8	69g	24g
70	90,3	128	2,1	8,3	4,5	82	138	2	0,33	2	3	2	61g	23g
75	92,8	135	2,1	8,3	4,5	87	148	2	0,35	1,9	2,9	1,8	88g	23g
80	98,3	143	2,1	8,3	4,5	92	158	2	0,35	1,9	2,9	1,8	80g	22g
85	108	154	3	8,3	4,5	99	166	2,5	0,33	2	3	2	74g	21g
	108	154	3	8,3	4,5	99	166	2,5	0,33	2	3	2	74g	21g
90	113	161	3	11,1	6	104	176	2,5	0,33	2	3	2	68g	21g
95	118	168	3	11,1	6	109	186	2,5	0,33	2	3	2	64g	20g
100	130	184	3	11,1	6	114	201	2,5	0,33	2	3	2	56g	20g
	130	184	3	11,1	6	114	201	2,5	0,33	2	3	2	56g	20g
110	143	204	3	13,9	7,5	124	226	2,5	0,33	2	3	2	53g	19g
	143	204	3	13,9	7,5	124	226	2,5	0,33	2	3	2	53g	19g
120	152	216	3	13,9	7,5	134	246	2,5	0,35	1,9	2,9	1,8	96g	21g
	152	216	3	13,9	7,5	134	246	2,5	0,35	1,9	2,9	1,8	96g	21g
130	164	233	4	16,7	9	147	263	3	0,35	1,9	2,9	1,8	87g	20g
	164	233	4	16,7	9	147	263	3	0,35	1,9	2,9	1,8	87g	20g

② For details regarding permissible accelerations, see Page 9.

Spherical roller bearings for vibratory applications

d 140 - 240 mm ①



Cylindrical bore

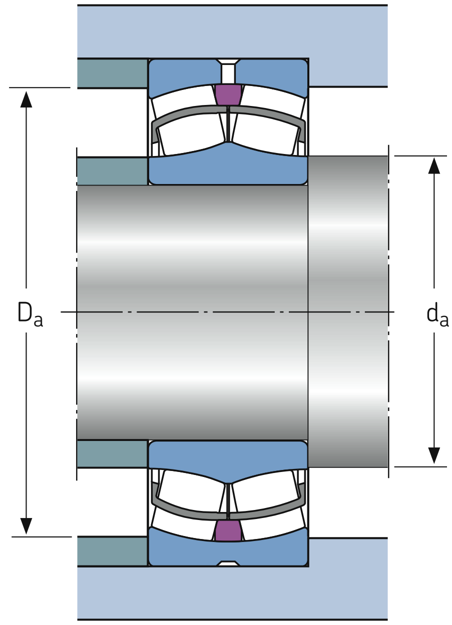
Tapered bore

Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designations ②	
			dyn.	stat.		Refer-ence speed	Limiting speed		Bearings with cylindrical bore	tapered bore
d	D	B	C	C_0	P_u					
mm			kN		kN	r/min		kg	–	
140	300	102	1290	1560	132	1700	2200	36,5	**22328 CCJA/W33VA405**	**22328 CCKJA/W33VA405**
	300	102	1290	1560	132	1700	2200	36,5	**22328 CCJA/W33VA405**	**22328 CCKJA/W33VA405**
150	320	108	1460	1760	146	1600	2000	43,5	**22330 CCJA/W33VA405**	**22330 CCKJA/W33VA405**
	320	108	1460	1760	146	1600	2000	43,5	**22330 CCJA/W33VA405**	**22330 CCKJA/W33VA405**
160	340	114	1600	1960	160	1500	1900	52,0	**22332 CCJA/W33VA405**	**22332 CCKJA/W33VA405**
	340	114	1600	1960	160	1500	1900	52,0	**22332 CCJA/W33VA405**	**22332 CCKJA/W33VA405**
170	360	120	1760	2160	176	1400	1800	61,0	**22334 CCJA/W33VA405**	**22334 CCKJA/W33VA405**
	360	120	1760	2160	176	1400	1800	61,0	**22334 CCJA/W33VA405**	**22334 CCKJA/W33VA405**
180	380	126	2000	2450	193	1300	1700	71,5	**22336 CCJA/W33VA405**	**22336 CCKJA/W33VA405**
	380	126	2000	2450	193	1300	1700	71,5	**22336 CCJA/W33VA405**	**22336 CCKJA/W33VA405**
190	400	132	2120	2650	208	1200	1600	82,5	**22338 CCJA/W33VA405**	**22338 CCKJA/W33VA405**
	400	132	2120	2650	208	1200	1600	82,5	**22338 CCJA/W33VA405**	**22338 CCKJA/W33VA405**
200	420	138	2320	2900	224	1200	1500	95,0	**22340 CCJA/W33VA405**	**22340 CCKJA/W33VA405**
	420	138	2320	2900	224	1200	1500	95,0	**22340 CCJA/W33VA405**	**22340 CCKJA/W33VA405**
220	460	145	2700	3450	260	1000	1400	120	**22344 CCJA/W33VA405**	**22344 CCKJA/W33VA405**
240	500	155	3100	4000	290	950	1300	155	**22348 CCJA/W33VA405**	**22348 CCKJA/W33VA405**

① Larger bearings can be supplied on special order

② All bearings are SKF Explorer bearings

SKF

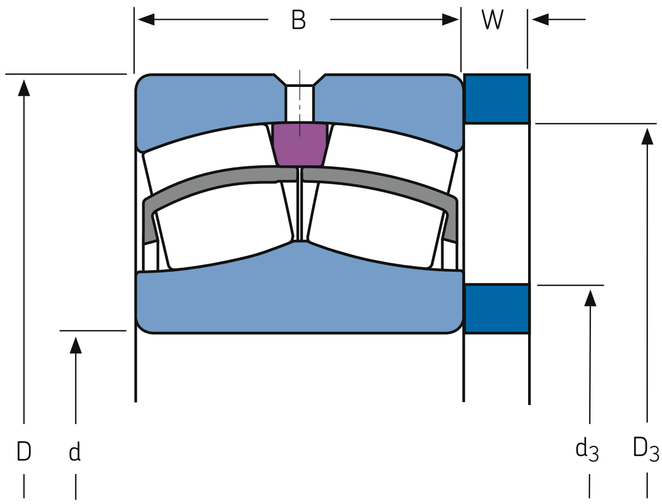


Dimensions						Abutment and fillet dimensions			Calculation factors				Permissible accelerations ③ for oil lubrication	
d	d_2	D_1	$r_{1,2,min}$	b	K	$d_{a,min}$	$D_{a,max}$	$r_{a,max}$	e	Y_1	Y_2	Y_0	rotational	linear
mm						mm			–				m/s^2	
140	175	247	4	16,7	9	157	283	3	0,35	1,9	2,9	1,8	78g	20g
	175	247	4	16,7	9	157	283	3	0,35	1,9	2,9	1,8	78g	20g
150	188	266	4	16,7	9	167	303	3	0,35	1,9	2,9	1,8	72g	19g
	188	266	4	16,7	9	167	303	3	0,35	1,9	2,9	1,8	72g	19g
160	200	282	4	16,7	9	177	323	3	0,35	1,9	2,9	1,8	69g	18g
	200	282	4	16,7	9	177	323	3	0,35	1,9	2,9	1,8	69g	18g
170	213	300	4	16,7	9	187	343	3	0,35	2	3	2	65g	18g
	213	300	4	16,7	9	187	343	3	0,35	2	3	2	65g	18g
180	224	317	4	22,3	12	197	363	3	0,35	1,9	2,9	1,8	59g	17g
	224	317	4	22,3	12	197	363	3	0,35	1,9	2,9	1,8	59g	17g
190	236	333	5	22,3	12	210	380	4	0,35	1,9	2,9	1,8	57g	17g
	236	333	5	22,3	12	210	380	4	0,35	1,9	2,9	1,8	57g	17g
200	248	351	5	22,3	12	220	400	4	0,33	2	3	2	55g	17g
	248	351	5	22,3	12	220	400	4	0,33	2	3	2	55g	17g
220	279	389	5	22,3	12	240	440	4	0,31	2,2	3,3	2,2	49g	16g
240	303	423	5	22,3	12	260	480	4	0,31	2,2	3,3	2,2	45g	15g

③ For details regarding permissible accelerations (→ **Page 9**).

453 CCJA/W33VA405-406 (233) bearing kits

d 90 - 240 mm



Principal dimensions				Spacer abutment dimensions		Designations
d	D	B	W	d_3	D_3	
mm						–
90	190	64	9	105	170	**453318 EJA/VA405**
100	215	73	9,6	130	190	**453320 EJA/VA405**
110	240	80	12,1	130	220	**453322 EJA/VA405**
	240	80	12,1	130	220	**453322 EJA/VA406**
120	260	86	20	145	235	**453324 CCJA/W33VA405**
	260	86	20	145	235	**453324 CCJA/W33VA406**
130	280	93	19	155	255	**453326 CCJA/W33VA405**
	280	93	19	155	255	**453326 CCJA/W33VA406**
140	300	102	16	165	270	**453328 CCJA/W33VA405**
	300	102	16	165	270	**453328 CCJA/W33VA406**
150	320	108	20	180	290	**453330 CCJA/W33VA405**
	320	108	20	180	290	**453330 CCJA/W33VA406**
160	340	114	22	190	310	**453332 CCJA/W33VA405**
	340	114	22	190	310	**453332 CCJA/W33VA406**
190	400	132	23	230	350	**453338 CCJA/W33VA405**
	400	132	23	230	350	**453338 CCJA/W33VA406**
200	420	138	27	250	375	**453340 CCJA/W33VA405**
	420	138	27	250	375	**453340 CCJA/W33VA406**

For more information please contact your local SKF representative