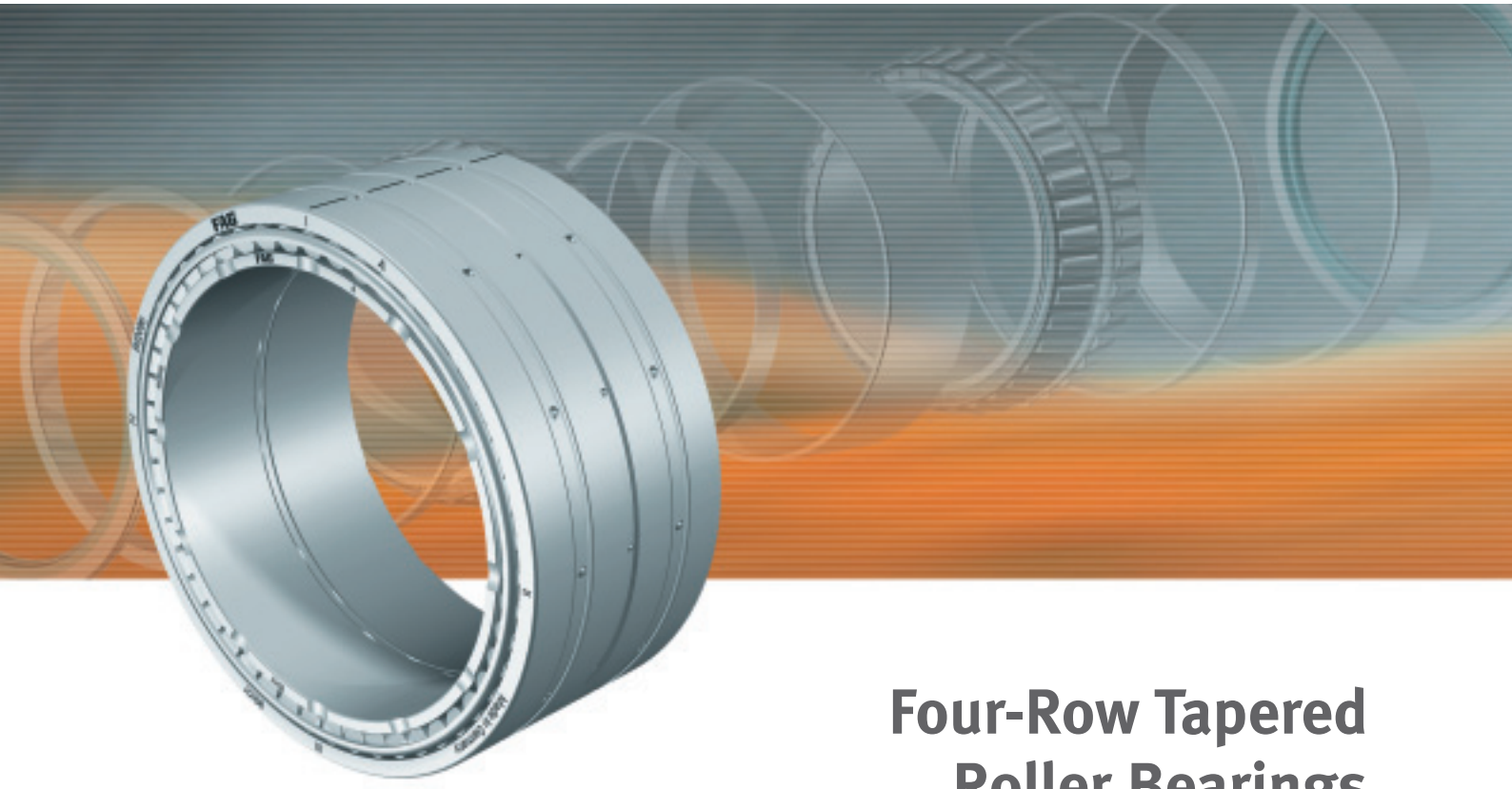
FAG



Four-Row Tapered Roller Bearings

Mounting Instructions

SCHAEFFLER GROUP
INDUSTRIAL

Contents

Mounting instructions for four-row tapered roller bearings

Mounting instructions for four-row tapered roller bearings

Please read these instructions carefully before starting the mounting procedure.

Make sure that the assembly and mounting drawings are at hand.

1. Preparations for mounting

The mounting site must be clean and dry.
FAG tapered roller bearings are precision products whose service life is considerably reduced by contamination.
For this reason, please remove the original packing only after you have completed the following preparations.
Clean the bearing seats in the chock and on the roll neck thoroughly.
If any damage such as scratches or turning marks is found, the bearing seats must be reworked.

Clean all lubricating and ventilating holes with compressed air and remove any chips using a magnetic rod.
Check all mating parts for dimensional and form accuracy.
Any burrs must be removed, and all sharp edges must be broken off.
Check the dimensional and form tolerances of the bearing seats on the roll neck and in the chock.

2. Checking the roll neck and chock

To obtain accurate dimensional and form measurement results, the following measurements must be conducted:

- The roll necks must be measured in three cross sections (along the bearing seat) and
- the chock bores must be measured in four cross sections. All measurements must be carried out on four diameters each (offset by 45°).

The recommended tolerances for new rolls and chocks are indicated in tables 1a and 1b (for inch-size bearings) and in 1c and 1d (for metric bearings). After an extended operating period, the rough operating conditions change the form of the chocks. The operating conditions, and a relative movement between cone and roll neck cause wear of the roll neck.
In tables 1a to 1d, the permissible dimensional and form deviations are listed as well. If deviations exceed these limits, we recommend overhauling/reworking of the bearing seats.

Bearing bore [mm]	Tolerance New roll neck [mm]	Max. permissible dimensional deviation [mm]
Up to 127,0	-0,100...-0,125	-0,430
127,0...152,4	-0,130...-0,155	-0,510
152,4...203,2	-0,150...-0,175	-0,580
203,2...304,8	-0,180...-0,205	-0,670
304,8...609,6	-0,200...-0,249	-0,850
609,6...914,4	-0,250...-0,334	-1,150
over 914,4	-0,300...-0,400	-1,400

Table 1a: Permissible dimensional deviations of the **roll neck for inch-size tapered roller bearings.**

Bearing outside diameter [mm]	Tolerance New chock bore [mm]	Max. permissible dimensional deviation [mm]	Deviation from cylindricity [mm]
Up to 304,8	+0,055...+0,080	+0,200	0,130
304,8...609,6	+0,101...+0,150	+0,380	0,260
609,6...914,4	+0,156...+0,230	+0,580	0,400
914,4...1219,2	+0,202...+0,300	+0,760	0,510
1219,2...1524,0	+0,257...+0,380	+1,000	0,670

Table 1b: Permissible dimensional and form deviations of the **chock for inch-size tapered roller bearings.**

Bearing bore [mm]	Tolerance New roll neck [mm]	Max. permissible dimensional deviation [mm]
Up to 180	-0,125...-0,175	-0,400
180...315	-0,180...-0,230	-0,650
315...630	-0,240...-0,300	-0,900
630...800	-0,325...-0,410	-1,100
800...1000	-0,350...-0,450	-1,250
over 1000	-0,400...-0,500	-1,450

Table 1c: Permissible dimensional deviations of the **roll neck for metric tapered roller bearings.**

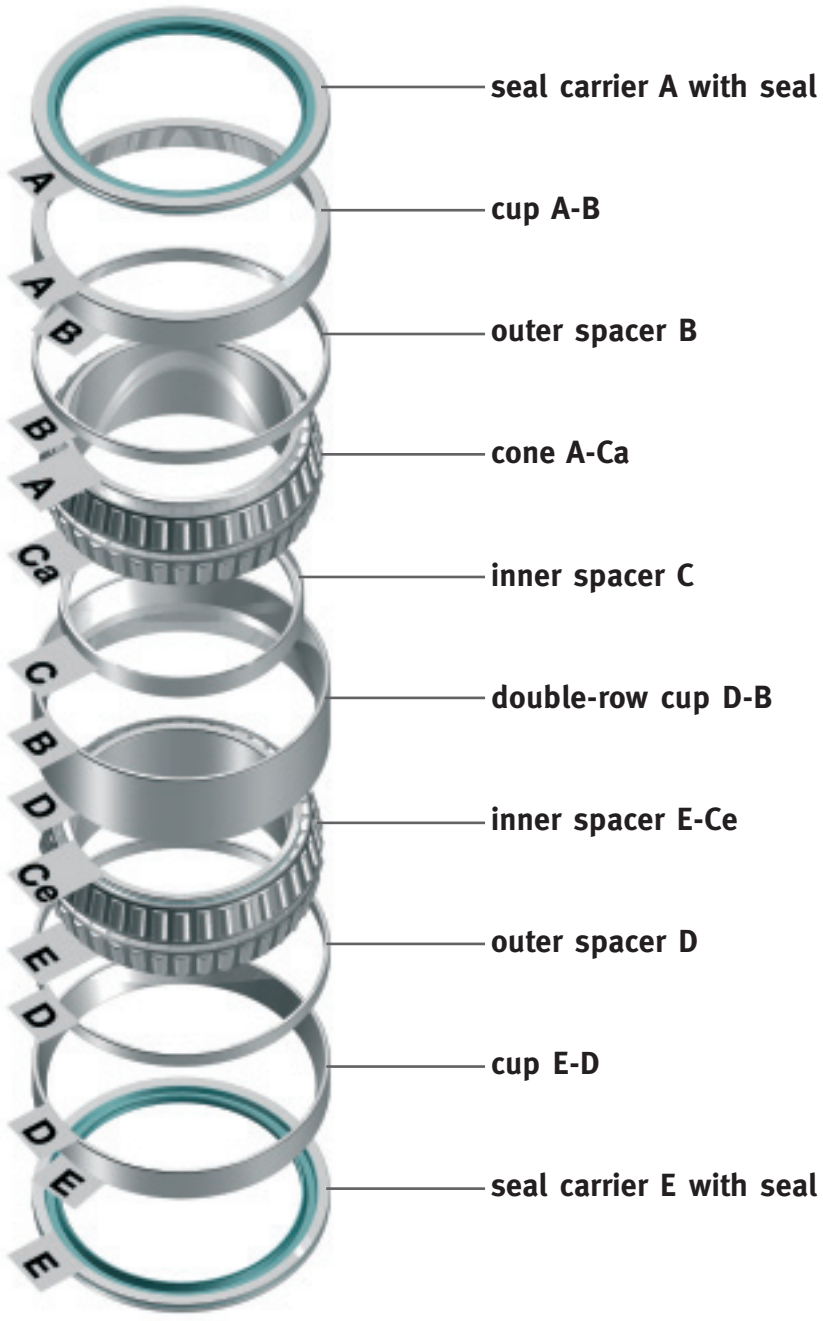
Bearing outside diameter [mm]	Tolerance New chock bore [mm]	Max. permissible dimensional deviation [mm]	Deviation from cylindricity [mm]
Up to 315	+0,000/+0,032 (H6)	+0,170	0,130
315...400	+0,000/+0,036 (H6)	+0,200	0,150
400...500	+0,000/+0,040 (H6)	+0,240	0,170
500...630	+0,000/+0,044 (H6)	+0,290	0,200
630...800	+0,000/+0,050 (H6)	+0,360	0,240
800...1000	+0,000/+0,090 (H7)	+0,450	0,300
1000...1250	+0,000/+0,105 (H7)	+0,560	0,390
1250...1600	+0,000/+0,125 (H7)	+0,690	0,520

Table 1d: Permissible dimensional and form deviations of the **chock for metric tapered roller bearings.**

3. Arranging the bearing set

Remove the packing from the bearing set. Do not wash out the anti-corrosion oil. It does not react with any of the commonly used rolling bearing lubricants.

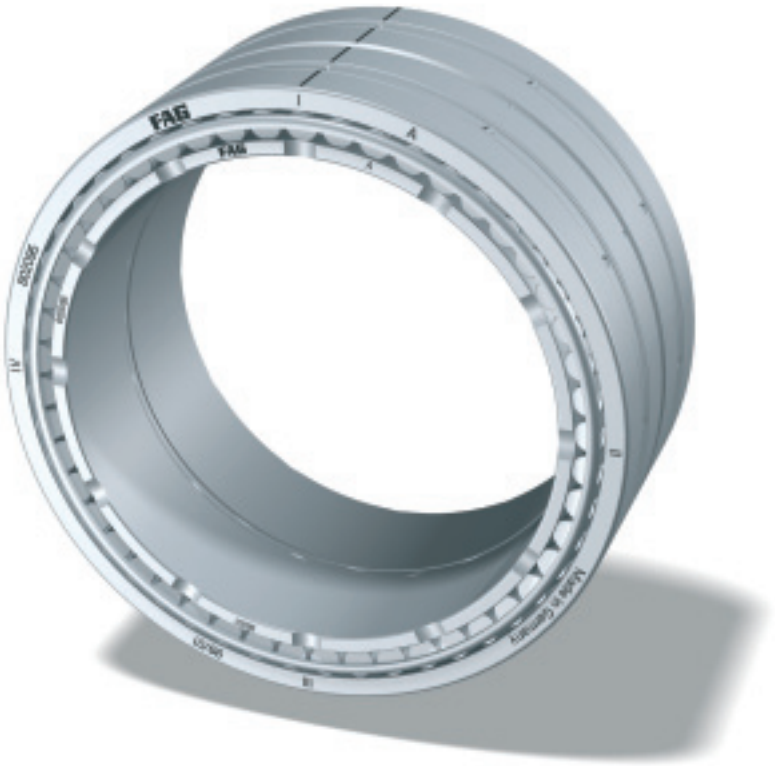
The bearing set consists of:
2 single-row cups, 1 double-row cup,
2 outer spacers, 2 cones with roller-cage assemblies,
1 inner spacer and with sealed bearings,
2 seal carriers with seals (Fig. 1).



1: Standard design of a sealed four-row tapered roller bearing with marking system

Make sure that the bearing set is complete.
Check the markings on the ring faces. The bearing designation, the year and the consecutive number must be identical on all parts. To ensure that the bearing works properly, all parts of the bearing set must be assembled and mounted in the order of the letters A to E on the faces of the rings and on the outside diameters of the spacers (Fig. 1).

The bearing parts must not be interchanged!
4 load zones are marked on the faces of the cups with the Roman numerals I to IV, offset by 90° each. In addition, the position of load zone I is marked by an axial etched line on the outside diameter of the cups. When assembling the bearing set, make sure that the load zone markings are aligned in a row (Fig. 2).

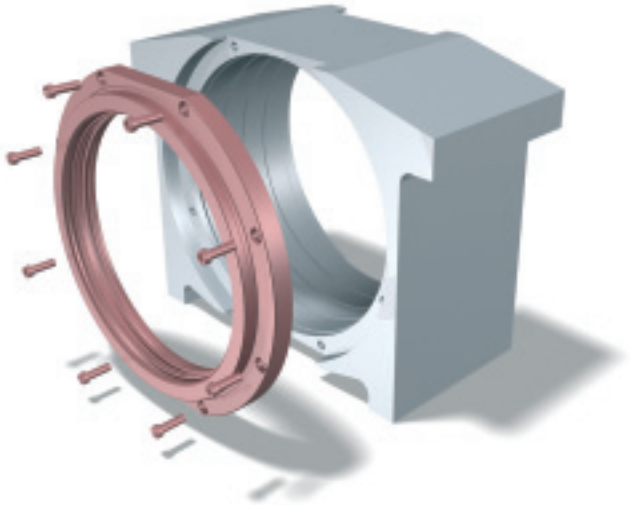


2: Markings on the bearing rings

4. Mounting

To protect the bearing seats on the roll neck and in the chock from fretting corrosion, they must be coated thinly with a mounting paste (e. g. FAG ARCA.MOUNTINGPASTE).
Please observe the mounting instructions in the mounting and assembly drawings. Bolt the cover on the roll body side securely to the chock (Fig. 3).
Place the chock on a level support with the open side up (vertical axis).
The mounting procedure described in the following depends on the bearing design (bearings with a pressed cage, bearings with a pin-type cage or sealed bearings).

Note: In the following mounting instructions, the part currently being mounted is shown red.

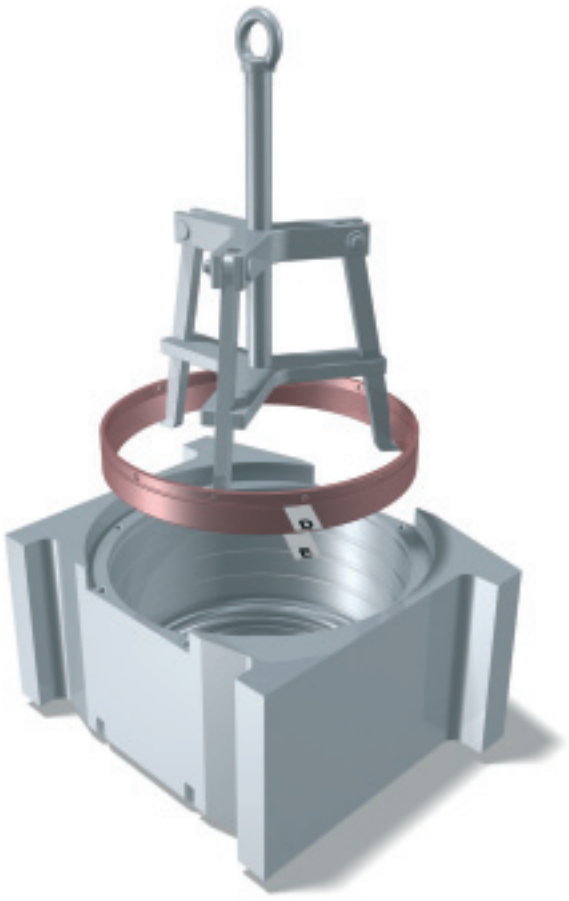


3: Fastening the cover on the roll body side

4.1 Mounting the bearing parts

Lift the parts of the bearing set and lower them into the chock in the specified order, starting with cup D-E. The load zone I markings on the cups must be aligned. We recommend to position load zone I in load direction.

Make sure that adjacent parts abut each other completely and the seat in the chock does not get damaged by jamming.
Lift the single-row cup marked D-E with side E down and the outer spacer D into the chock (Fig. 4).



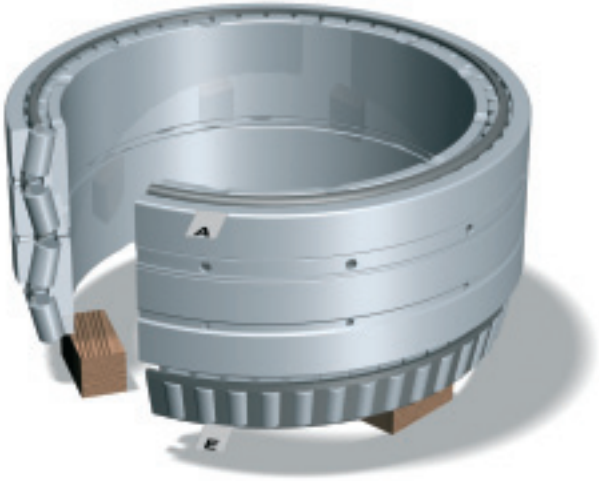
4: Mounting the cup D-E and spacer D

Bearings with a pressed cage

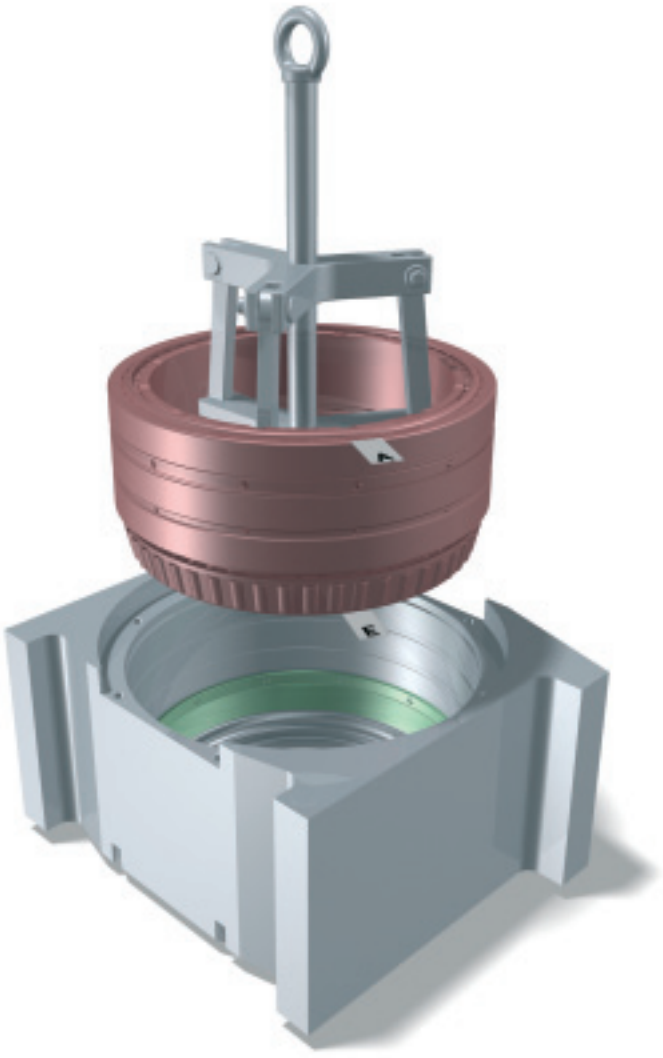
Place cone E-Ce flat on supports (side E down). Then place the other parts on top in the correct order (Fig. 4a).

Use the lifting device to lift the complete bearing set into the chock (Fig. 4b).

Make sure that load zone I is aligned correctly.



4a: Completing the bearing set (bearings with a pressed cage)



4b: Mounting the preassembled bearing set

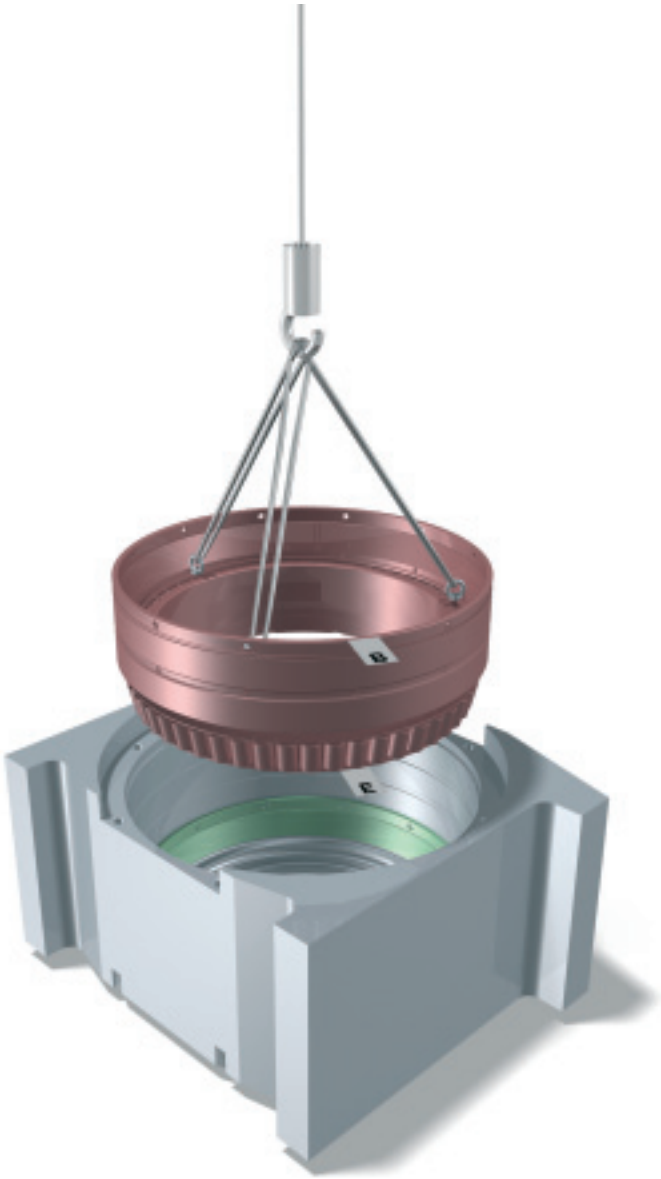
Bearings with a pin-type cage

Lift cone E-Ce with side E down, the inner spacer C with the retaining lip down, the double-row cup B-D and the outer spacer B into the chock (Fig. 5).

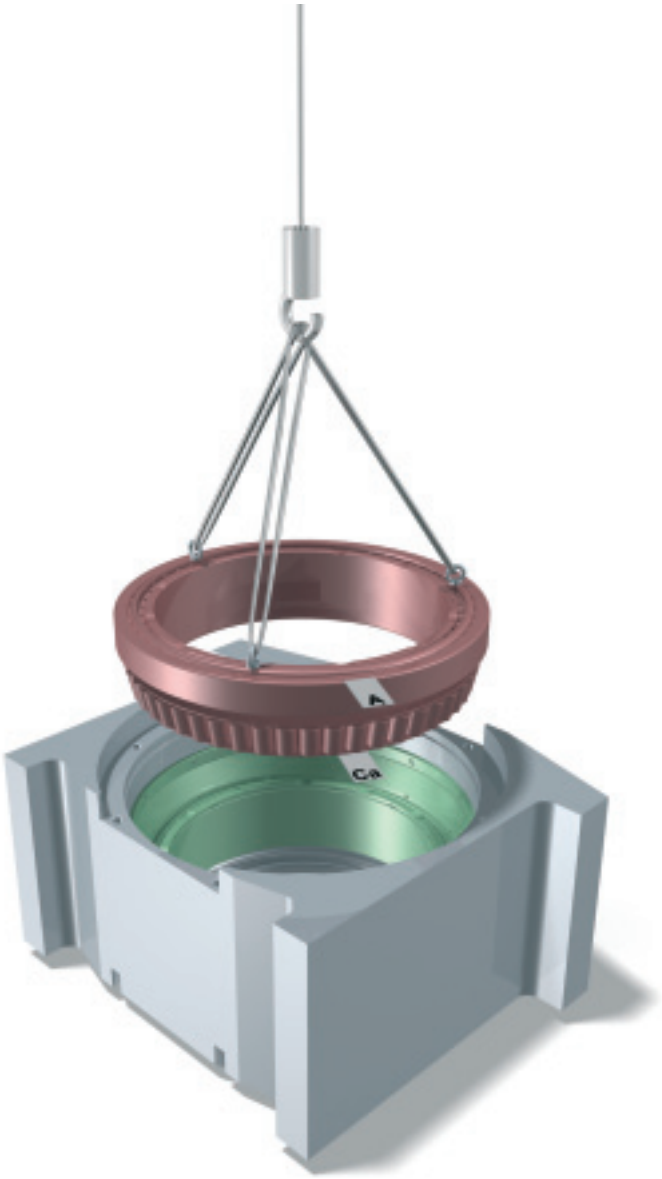
Lift cone A-Ca and the single-row cup A-B into the chock (Fig. 6).

Make sure that load zone I is aligned correctly.

Bearings with a pin-type cage can be mounted, like bearings with a pressed cage, with the help of a lifting device (Fig. 4b).



5: Mounting cone E-Ce, spacer C, cup B-D and spacer B (bearings with a pin-type cage)



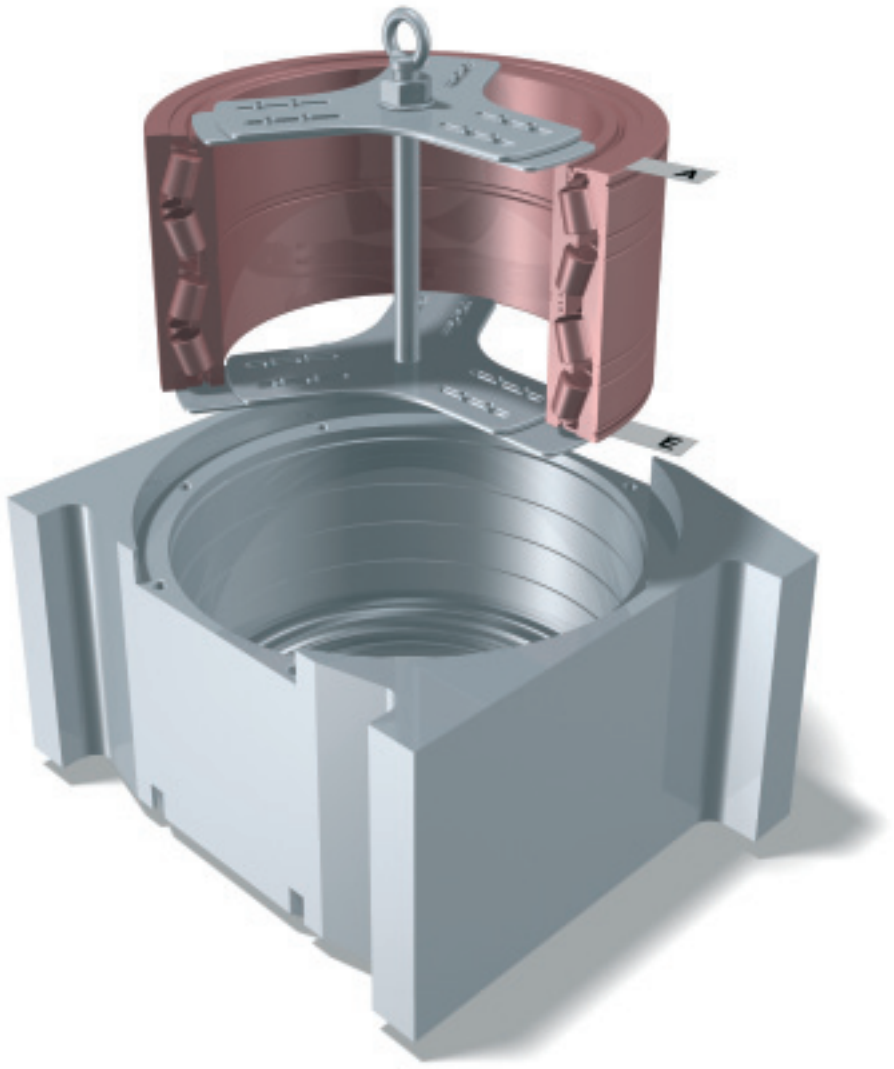
6: Mounting cone A-Ca and cup A-B

Sealed bearings

Sealed tapered roller bearings are mounted with the help of a special lifting device. The bearing is assembled completely on the lifting device in the specified order (Fig. 1). Start with seal carrier ring E.
When assembling grease-lubricated bearings, the roller-cage assemblies must be greased manually.
The required grease quantity will be indicated by FAG on request.

Then lift the completely assembled bearing into the chock (Fig. 6a).

Make sure that load zone I is aligned correctly.



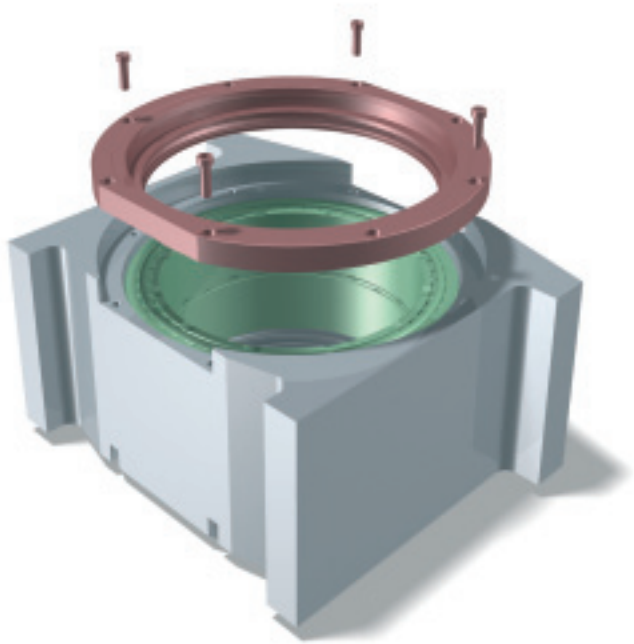
6a: Mounting a sealed bearing

4.2 Turning in the bearings

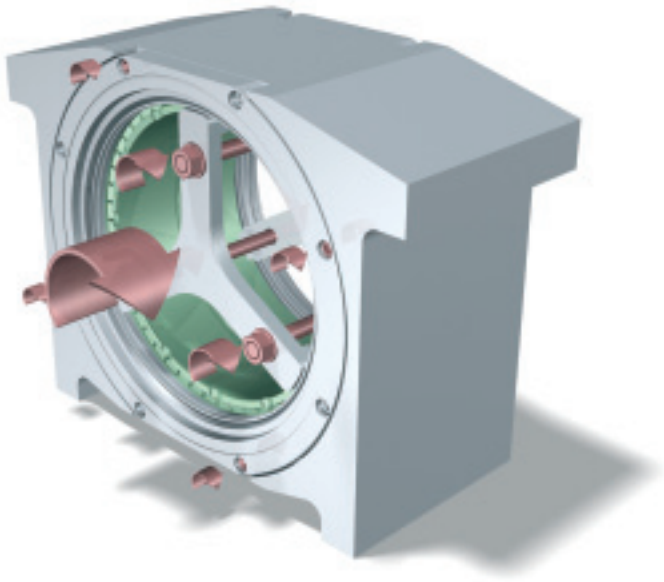
Slightly bolt the second chock cover to the chock using four diametrically opposed bolts (Fig. 7).

Tilt the chock by 90° into a horizontal position (level axis). Brace the clamping fixture on the cone faces with the tie rods, slightly at first. The clamping fixture must touch only the cone faces. The cage must not get jammed (Fig. 8).

With sealed bearings, the lifting device also serves as clamping fixture. To turn in the bearing, push in the holding ledges until they touch only the cone face.



7: Mounting the chock cover without sealing ring



8: Turning in with the clamping fixture

Tighten the tie rod nuts and the cover bolts gradually and evenly, constantly turning the cones, until the cones abut the inner spacer C over their entire circumference without clearance.
Keep checking this with a feeler gauge.

Measure the width of gap S between cover and chock with a feeler gauge (Fig. 9).

Determine the thickness of the seal.
a) Seal made of inflexible material

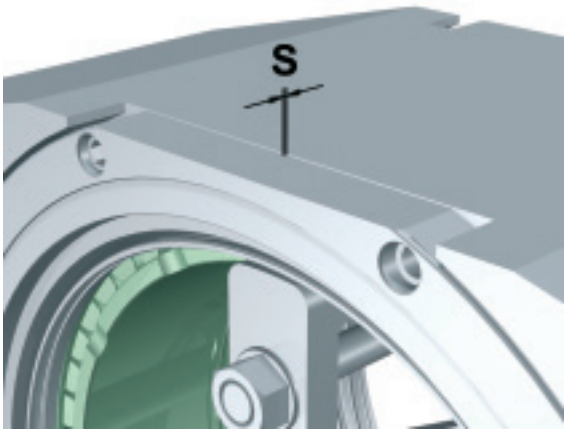
B = S – (0,05 to 0,1) mm

b) Elastic seal:

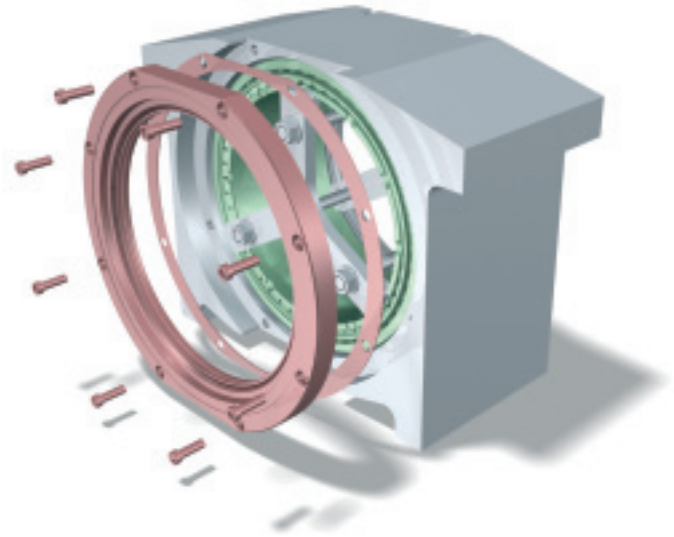
B = S + 0,2 x S mm

Loosen the cover bolts and remove the cover again.
Insert a seal of the required thickness into the cover.

Bolt the cover tightly to the chock, tightening the bolts crosswise. Remove the clamping fixture and coat the cone bore with grease.



9: Gap between cover and chock

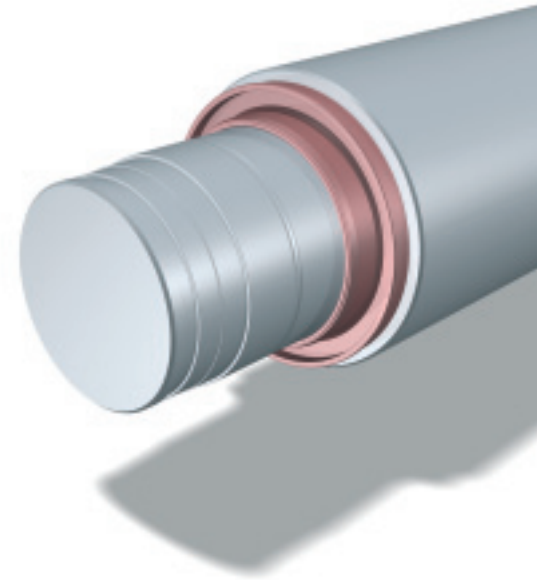


10: Monting the seal and the cover

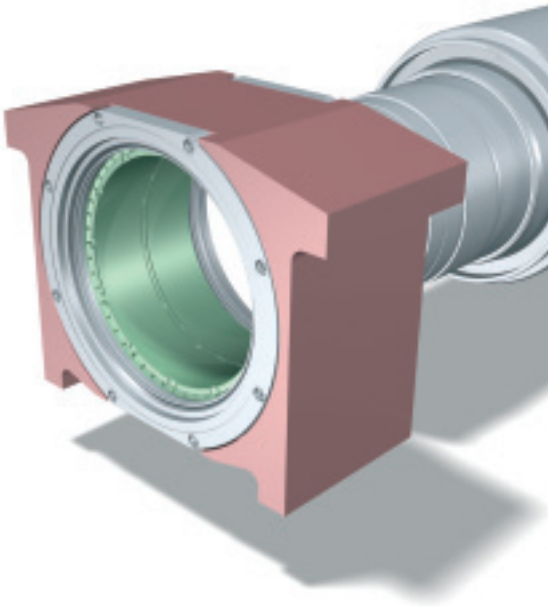
4.3 Final mounting

Push the labyrinth ring you have heated in an oil bath onto the roll neck together with the O-ring. While the labyrinth ring cools down, it must be pressed tightly against the roll body face (Fig. 11).

Push the assembled chock onto the roll neck (Fig. 12).



11. Mounting the labyrinth ring



12: Pushing the assembled chock onto the roll neck

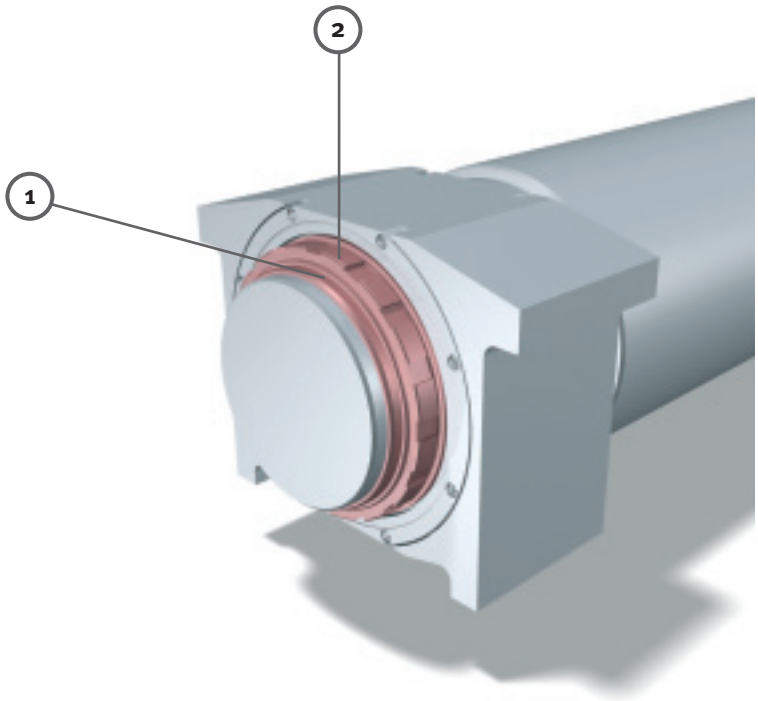
If the bearing mounting is secured axially by means of a quick catch, please observe the relevant guidelines.
If the bearing mounting is secured axially by means of a split groove ring (position 1) and a locknut (position 2), push the spacer ring and the locknut onto the roll neck one by one.
Fix the split groove ring in the roll neck groove.
Tighten the locknut only moderately at first while moving the chock constantly to the right and to the left so that the cones abut the mating parts and the bearing is aligned.
Tighten the locknut securely against the groove ring.

Loosen the locknut until a clearance of 0.2 to 0.6 mm is obtained.
Secure the locknut to prevent it from accidentally being turned (Fig. 13).

If the unit is to be lubricated with grease, make sure that the labyrinth and bearing are packed with grease before use (see page 17, item 5).

The unit has now been mounted completely.

Dismounting is effected in the reverse order of mounting.



13: Axially securing the bearing with a locknut

5. Lubrication

Grease lubrication

We recommend to lubricate the roll bearings with a lithium soap base grease with EP (high-pressure) additives and a high level of corrosion protection (see Arcanol rolling bearing-tested grease, publication WL 81116).

Unsealed bearings should be greased only after mounting as otherwise the bearing may get contaminated. Press grease into the bearing by means of a grease gun until excess grease escapes on both sides of the bearing over the entire circumference.
If no grease gun is available, the roller-cage assemblies must be greased manually before being inserted into the chock.

Sealed bearings see page 12.
The required grease quantity for your application will be indicated on request.

The relubrication interval and the replenishment quantity are determined for each specific application on the basis of the prevailing operating conditions.

Oil lubrication

Depending on the operating and environmental conditions, four-row tapered roller bearings can be operated using the following oil lubrication methods:

- oil sump
- oil-air (oil mist)
- oil circulation

The required oil quality is determined on a case-to-case basis.

Labyrinth lubrication

When being mounted for the first time, the labyrinths should be filled well with grease and then relubricated at regular intervals/on the occasion of roll changes.
The same applies to oil-lubricated bearings.

6. Measures to be taken with sealed bearings

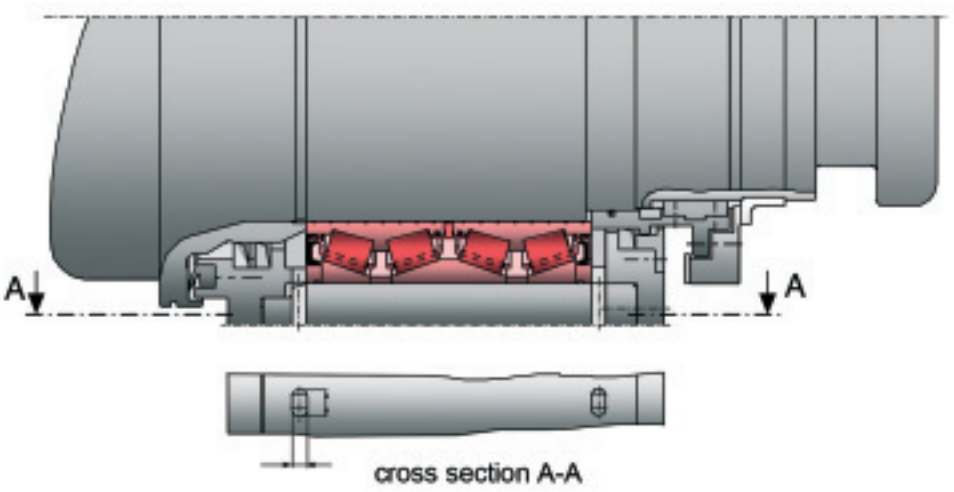
With sealed bearings, the roll neck must be lubricated at least every 8 hours if no automatic roll neck relubrication is provided.

Drain holes must be provided in the underside of the chocks (Fig. 14).

Please consult FAG about the dimensions.

The drain holes

- prevent excessive pressure in front of the bearing seal
- permit water to drain from the chock cavities
- must be kept free from grease and contaminants



14: Drain holes in the chock

7. Maintenance

Check the effectiveness of the chock seals and the temperature of the bearing regularly. If the bearing works properly, its temperature increases slowly to operating temperature and then remains constant. If you detect even the slightest damage, the seal must be replaced.

FAG recommends an inspection and a shift of load zones after every 1,000 to 1,200 operating hours.
Dismount the bearings in the reverse order of mounting. Clean the bearing parts thoroughly with petroleum ether and oil them immediately afterwards. Check all raceways and rollers for visible damage.

- If there is any damage in raceways and on rollers: Consult an FAG engineer.
- Check the axial clearance (see items 8.1 and 8.2).
- Pack the bearing with fresh grease.
- Mount the bearing, in accordance with the mounting instructions, shifting to the next load zone. The cups should be turned inside the chock by 180° when changing load zones the first time. If, for example, load zone I was aligned in load direction before dismounting, align the cups in such a way that the load zone III markings are now aligned in load direction. The next times, turn to load zone II and then IV.
- Enter all inspections and maintenance work performed on the bearing in the rolling bearing inspection card (example on page 25).

With sealed tapered roller bearings, we recommend to perform additional inspections after 300, 600 and 900 operating hours, proceeding as follows:
Withdraw the chock and remove the cover.

- Check the grease quantity and the condition of the grease in the bearing and in the labyrinths. If the grease is discoloured or contaminated, we recommend to pack bearing and labyrinths with fresh grease.
- The bearing seal must be checked carefully and replaced if even the slightest damage is found.
- Enter the checks and maintenance work in the rolling bearing inspection card (example on page 25).

8. Checking the axial clearance

8.1 Bearings with outside diameters of up to 450 mm

Measuring arrangement 1: black

Place the single-row cup A-B on level supports. Place the other bearing parts, without spacers, on top of it in the specified order (the bearing cage must not be supported).

Load the bearing via the upper cone with about half the bearing weight.

Turn the cups until all roller rows abut the guiding lips.

Measure the distance D-D and the distance B-B between the cups and the distance C-C of the cones at four points each.

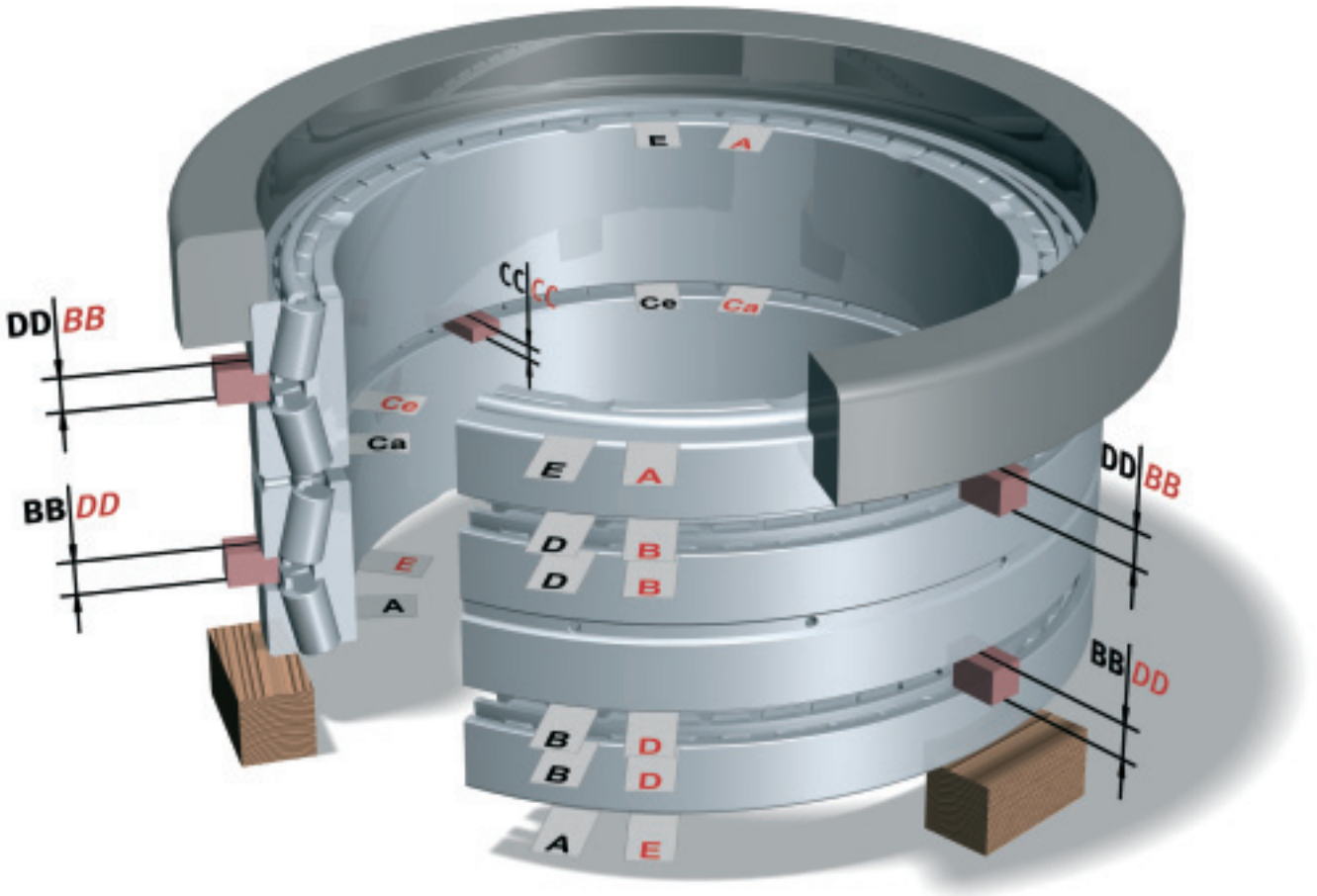
Enter the results into the measuring report (see page 21).

Measuring arrangement 2: red

To obtain more precise measurement results, we recommend to arrange the bearing parts in reverse order and conduct a second measurement. Start with cup E-D.

Carry out the steps described under measuring arrangement 1.

Enter the results into the measuring report (see page 21).



Measuring arrangement 1: black
Measuring arrangement 2: red

Measuring report

		Measurement of gap B-B		Measurement of gap D-D		Measurement of gap C-C	
		Measurement 1	Measurement 2	Measurement 1	Measurement 2	Measurement 1	Measurement 2
Measurement value 1	**W1**						
Measurement value 2	**W2**						
Measurement value 3	**W3**						
Measurement value 4	**W4**						
Mean values Sm for (B-B), (D-D) and (C-C) e.g.: Sm(B-B)=(W11+W12+...+W24)/8	**Sm**						
Original axial clearance A	**A**						
Target axial clearance L = A * 1.3	**L**						
Spacer width Sm(B-B)+L	**B**						
Spacer width Sm(D-D)+L	**D**						
Spacer width Sm(C-C)+L	**C**						

Measured values
Reading
Calculated values

The value of the original clearance is marked on the spacers. When the amount of axial clearance has doubled in the course of operation, the spacers must be reground.

The spacer are reground to the calculated values. The target axial clearance correspond to 1.3 times the original axial clearance.

8.2 Bearings with outside diameters larger than 450 mm

Step 1: Width of spacer C

Measuring arrangement 1: black

Place cone A-Ca level on supports and put cup B-D on top (the cage must not be supported).

Turn the cup until all rollers in the upper row abut the guiding lip.

Measure – as shown in the picture – the distance M at four points around the circumference using a micrometer and a rail.

Measure the width of the double-row cup K.

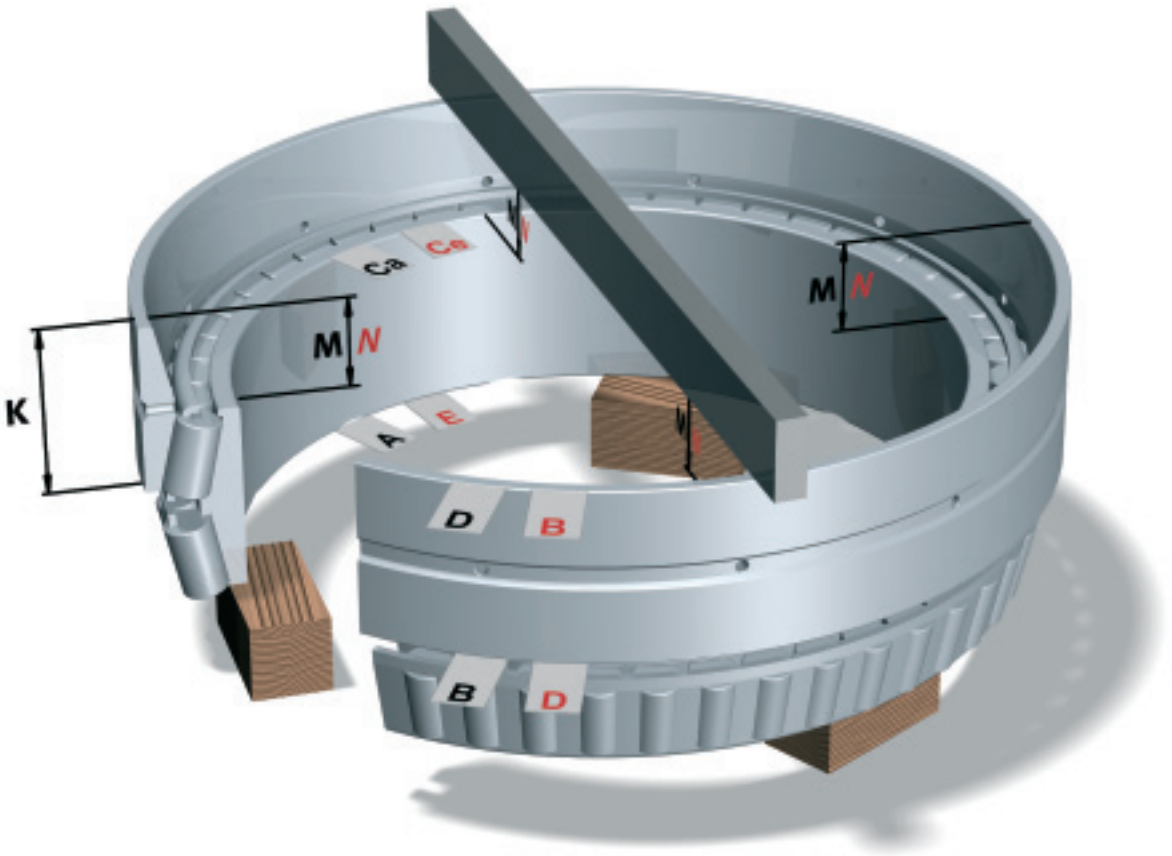
Enter the results into the measuring report (see page 24).

Measuring arrangement 2: red

Place cone E-Ce level onto supports and put cup D-B on top (the cage must not be supported). Turn the outer ring until the rollers in the upper row abut the guiding lip.

Measure the distance N at four points around the circumference.

Enter the results into the measuring report(see page 24).



Measuring arrangement 1: black
Measuring arrangement 2: red

Step 2: Width of the outer spacers D and B

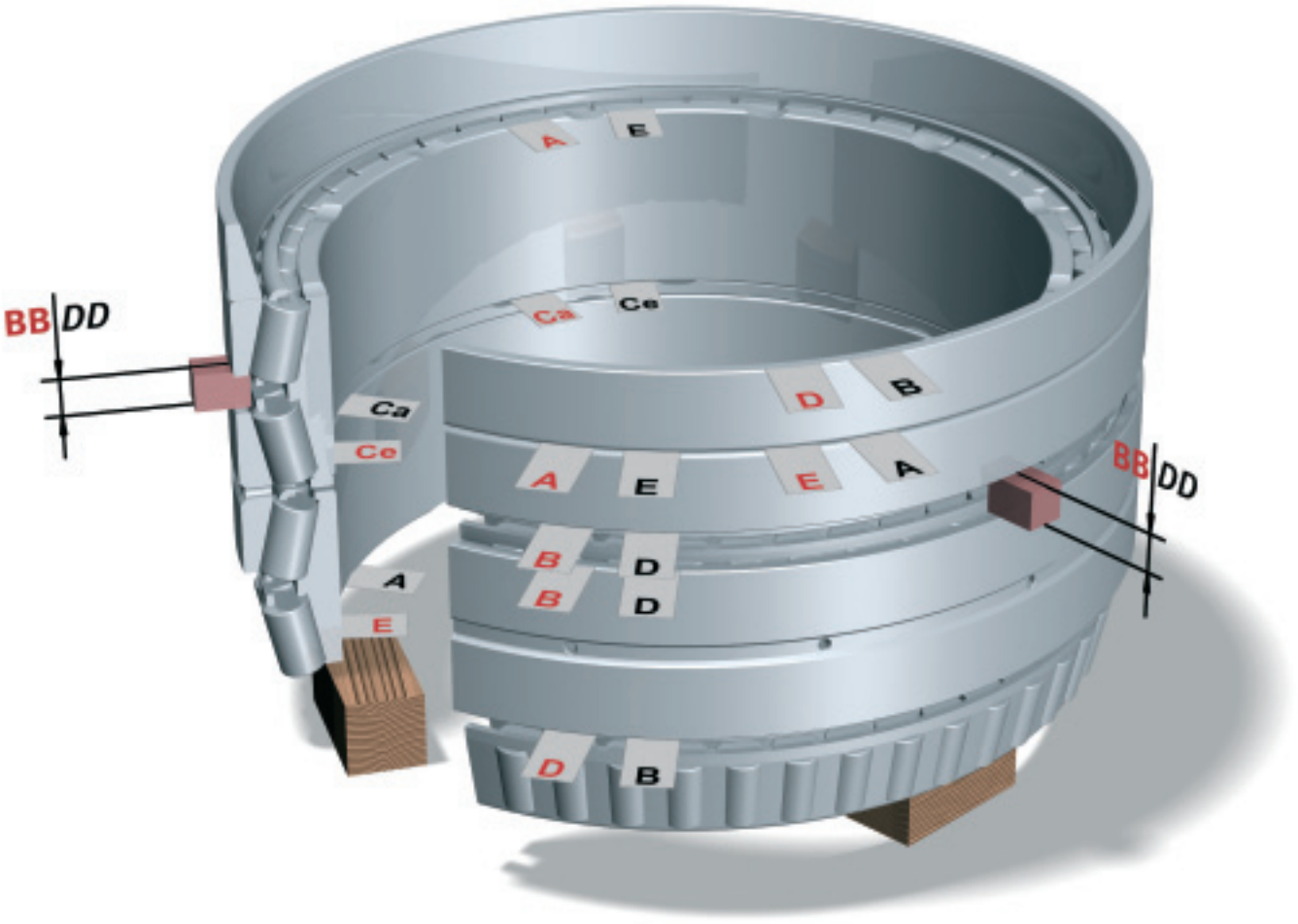
Measuring arrangement 1: gap B-B – red

Place cone E-Ce level onto supports and put the other bearing parts, with a reworked or new inner spacer C, on top in the specified order (the bearing cage must not be supported).
Omit the outer spacers. Place cup D-E onto cup A-B as a measuring load.
Turn the cups until the first (upper) and the third roller row abut the guiding lips. Measure the gap B-B at four points around the circumference using a parallel end block.
Enter the results into the measuring report (see page 24).

Measuring arrangement 2: gap D-D – black

Arrange the bearing parts in the reverse order, starting with cone A-Ca.
Carry out the steps described under measuring arrangement 1.
Measure – as shown in the picture – the gap D-D at four points around the circumference using parallel end blocks.
Enter the results into the measuring report (see page 24).

The outer spacers must be ground to the calculated values (corresponding to 1.3 times the amount of original axial clearance).



Measuring arrangement 1: red
Measuring arrangement 2: black

Measuring report for spacer C

		Double-row cup width K	Measurement of distance M	Measurement of distance N
Measurement value 1	**W1**			
Measurement value 2	**W2**			
Measurement value 3	**W3**			
Measurement value 4	**W4**			
Mean value Sm from K, M and N e.g. SmK=(W1+W2+W3+W4)/4	**Sm**			
Original axial clearance A	**A**			
Target axial clearance L = A * 1.3	**L**			
C=SmM+SmN-SmK+L	**C**			

Measuring report for spacers B and D

		Measurement of gap B-B	Measurement of gap D-D
Measurement value 1	**W1**		
Measurement value 2	**W2**		
Measurement value 3	**W3**		
Measurement value 4	**W4**		
Mean values Sm for (B-B) and (D-D)	**Sm**		

Measured values
Reading
Calculated values

The value of the original clearance is marked on the spacers. When the amount of axial clearance has doubled in the course of operation, the spacers must be reground.

Spacer C is either reground or a new one must be provided. The target axial clearance correspond to 1.3 times the original axial clearance.

9. Statistical records

On delivery of the bearings, it is advisable to create a record card for each bearing in order to be able to evaluate the performance of a bearing more accurately.

An example of such a record card is shown below.

FAG Rolling Bearing Check Card

Mill — Back-up roll ○

Train — Work roll ○

Bearing type	Bearing No.		Serial No.	Date of order
Bore dia.	Double row	Radial Clearance	Lubricant	Date of delivery
O. D.				1 st installation
Width	Four-row	Axial Clearance	Lubr. Intervals	Hrs. total
				Total (tons)

Install No.	Mounted	Dism.	Stand No.	Chock No.	Roll No.	Loaded zone	Top Roll Bot. Drive Side Inner	Drive Side Outer	With. Side Inner	With. Side Outer	Running (hours)	Total run (hrs.)	Production (tons)	Total production (tons)	Remarks
1							8 i	a	8 i	a					
2							8 i	a	8 i	a					
3							8 i	a	8 i	a					
4							8 i	a	8 i	a					
5							8 i	a	8 i	a					
6							8 i	a	8 i	a					
7							8 i	a	8 i	a					
8							8 i	a	8 i	a					
9							8 i	a	8 i	a					
10							8 i	a	8 i	a					
11							8 i	a	8 i	a					
12							8 i	a	8 i	a					
13							8 i	a	8 i	a					
14							8 i	a	8 i	a					
15							8 i	a	8 i	a					
16							8 i	a	8 i	a					
17							8 i	a	8 i	a					
18							8 i	a	8 i	a					
19							8 i	a	8 i	a					
20							8 i	a	8 i	a					

Install No.	Mounted	Dism.	Stand No.	Chock No.	Roll No.	Loaded zone	Top Roll Bot. Drive Side Inner	Drive Side Outer	With. Side Inner	With. Side Outer	Running (hours)	Total run (hrs.)	Production (tons)	Total production (tons)	Remarks
21							8 i	a	8 i	a					
22							8 i	a	8 i	a					
23							8 i	a	8 i	a					
24							8 i	a	8 i	a					
25							8 i	a	8 i	a					
26							8 i	a	8 i	a					
27							8 i	a	8 i	a					
28							8 i	a	8 i	a					
29							8 i	a	8 i	a					
30							8 i	a	8 i	a					
31							8 i	a	8 i	a					
32							8 i	a	8 i	a					
33							8 i	a	8 i	a					
34							8 i	a	8 i	a					
35							8 i	a	8 i	a					

For Inspection of Four Row Tapered Roller Bearings

Date	Gap	Spacer width	Clearance	Ground to	New clearance	Date	Gap	Spacer width	Clearance	Ground to	New clearance	Date	Gap	Spacer width	Clearance	Ground to	New clearance
	B						B						B				
	C						C						C				
	D						D						D				
	B						B						B				
	C						C						C				
	D						D						D				

10. Storage

Spare bearings should be stored in their original packing, lying in a dry warehouse, supported over their entire circumference. Used bearings must be cleaned carefully with petroleum ether, oiled immediately afterwards, wrapped in oiled paper and placed in a suitable wooden crate (ideally their original packing) before being warehoused.

Prior to extended storage periods, grease-lubricated bearings must be regreased.

If the chocks are withdrawn from the roll neck, they must be covered to protect the bearings inside from moisture and dirt.

00/01/07 Printed in Germany by Druckhaus WEPPERT GmbH

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