FAG Journal Roller Bearings TAROL

Mounting, maintenance, repair

FAG Industrial Bearings AG

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FAG Industrial Bearings AG
Railway & Transport
Postfach 1260 · D-97419 Schweinfurt
Telefon +49-97 21-91 39 98 · Telefax +49-97 21-91 37 88
E-mail: proeschel_e@fag.de
www.fag.de

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For the operation, mounting, maintenance and repair of journal roller bearings, including the tapered roller bearing units TAROL described in this publication, the industrial safety specifications of each state and/or railway company apply.

The FAG tapered roller bearing units are predominantly used as journal roller bearings for rail vehicles. The designation is derived from Tapered Roller Bearing. The unit is a double row tapered roller bearing which is axially adjusted, greased and sealed at both ends. Such tapered roller bearing units are mounted into rail vehicles all over the world. They are also increasingly used for rolling mills, in crane construction, in conveyor plants etc. The units come with special advantages: They are very compact and can carry high loads, they can be mounted without problem, and they function over many years without maintenance.

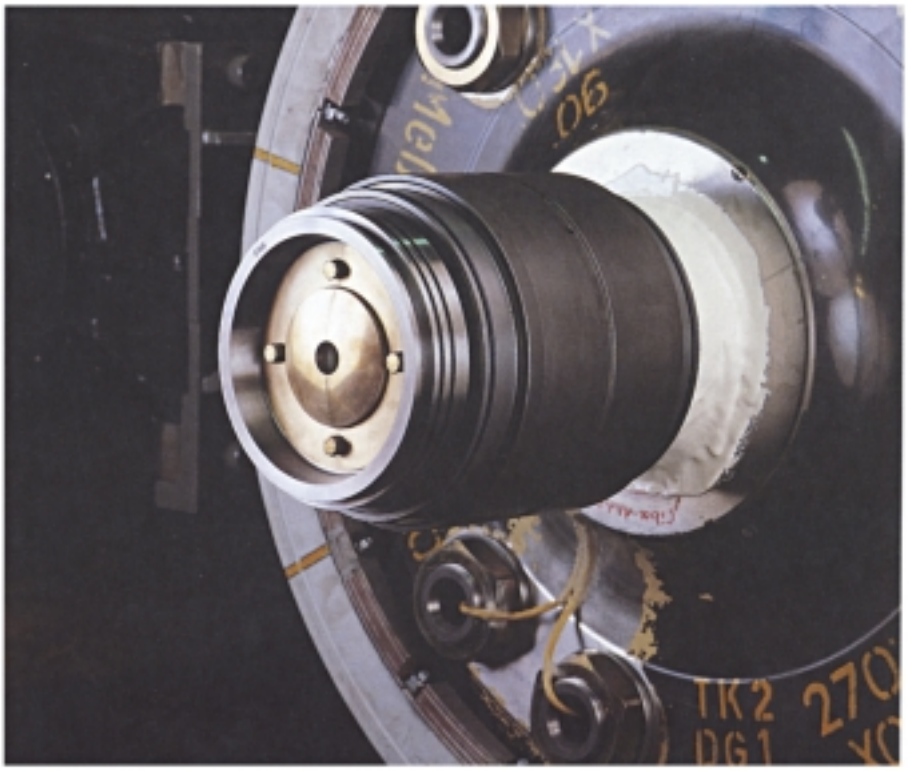
FAG offers TAROL units both in inch dimensions and in metric dimensions for all standardized axle journals of rail vehicles. FAG supplies these units also in other inch or metric dimensions.

The FAG TAROL journal roller bearings are licensed with AAR certificate by the Association of American Railroads. The standard designs in inch dimensions for the AAR field are listed in the table on page 7. The most important TAROL designs in metric dimensions are shown on page 9.

As expected, the tapered roller bearing units have gained acceptance also in modern rail vehicle engineering. Some typical examples are the high-speed train Intercity Experimental/ Express (ICE) of the Deutsche Bundesbahn (DB), many other new developments and last but not least the low-platform cars. These bearing units have proven to be very reliable journal roller bearings both at normal and at very high speeds.

FAG supplies the TAROL units complete or in parts for repair, for example the TAROL basic unit (bearing, grease, seals), end cap set, backing ring set, or parts of the double row tapered roller bearing: cup, cone with roller set (cages of glass fibre reinforced polyamide or of sheet steel), spacer ring. The programme also covers tools, devices and equipment for the mounting and dismounting of bearing units and for repair, as well as housings, adapters and greases.

High-speed train Intercity Express (ICE) of the Deutsche Bundesbahn (DB) and an already assembled TAROL unit on a measuring wheel set.



Reference examples

TAROL units have a fairly small section height and are thus extremely suitable for the wheelsets of low-platform cars.

Packing and storage of the TAROL units

In their original packing the TAROL units are protected from dust and atmospheric influences. The bearings are packed individually or on pallets. The bore axis shall always be in a vertical position. The end cap with lock washer and hexagonal head bolts are packed on top of the units. The complete unit remains in its original packing until it is mounted.

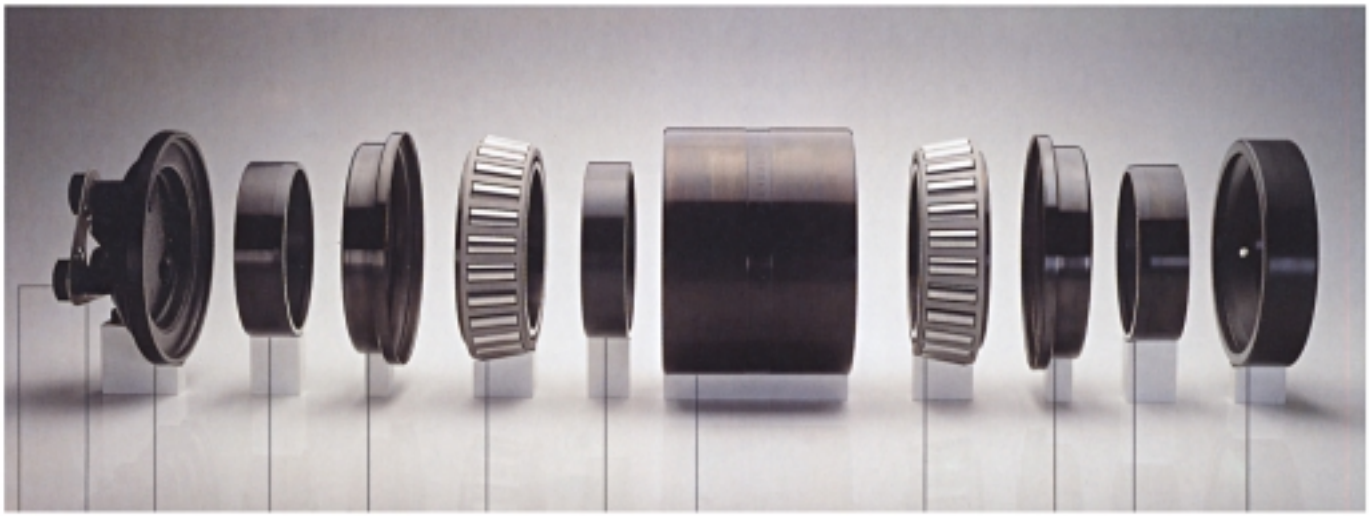
The storage rooms must be dry, clean, cool and free from corrosive chemicals such as acids, ammonia, chlorinated lime etc.

TAROL units which are shipped already mounted to wheel sets or into rail vehicles are protected from the generation of standstill marks, which are caused by micromovements, by tightly clamping bearings and shafts.

TAROL units on a transport pallet. The individually or pallet packed TAROL units are always positioned with their bore axis perpendicular to the ground.

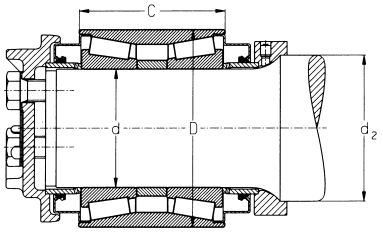
FAG journal roller bearings TAROL
in inch dimensions according to AAR specifications

Components of the TAROL unit with sealing rings



An assembled TAROL unit

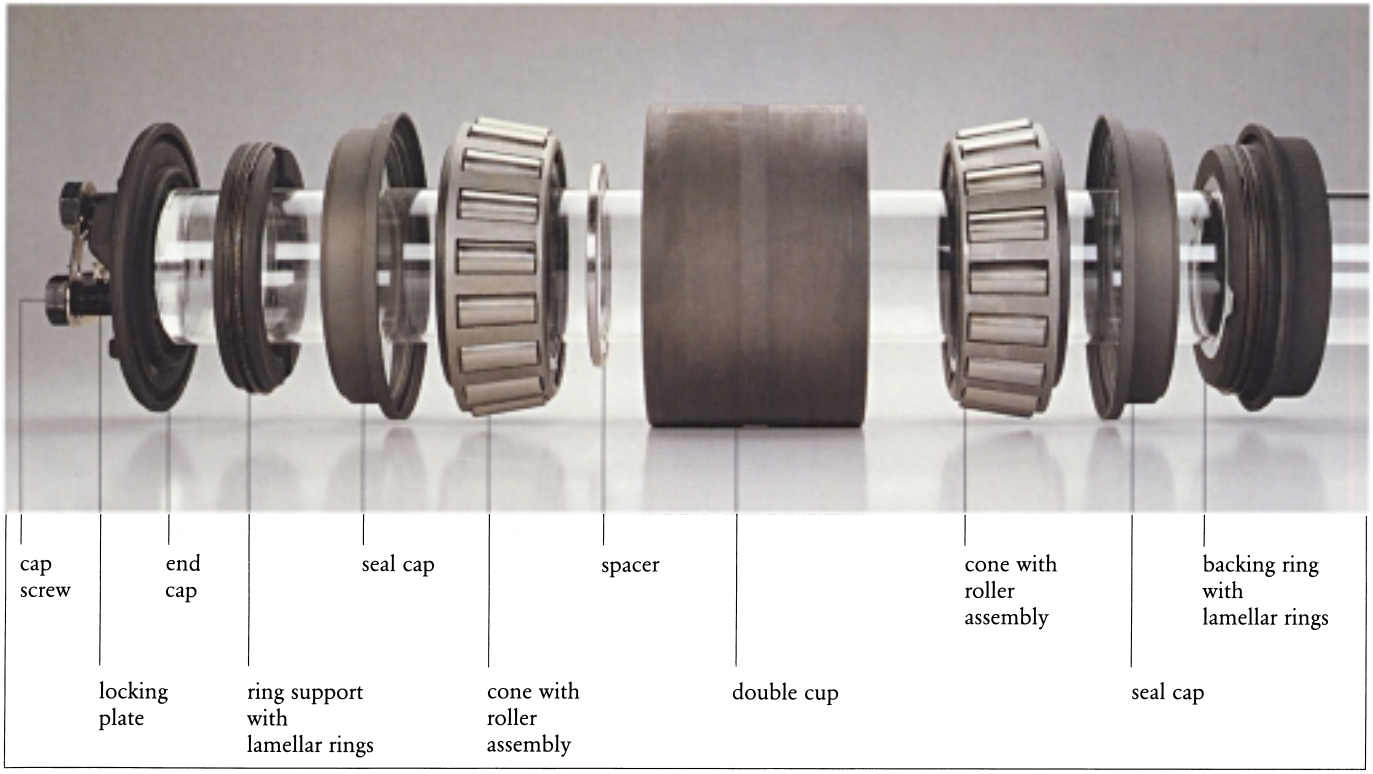
TAROL units of FAG according to the Standard of the Association of American Railroad (AAR)



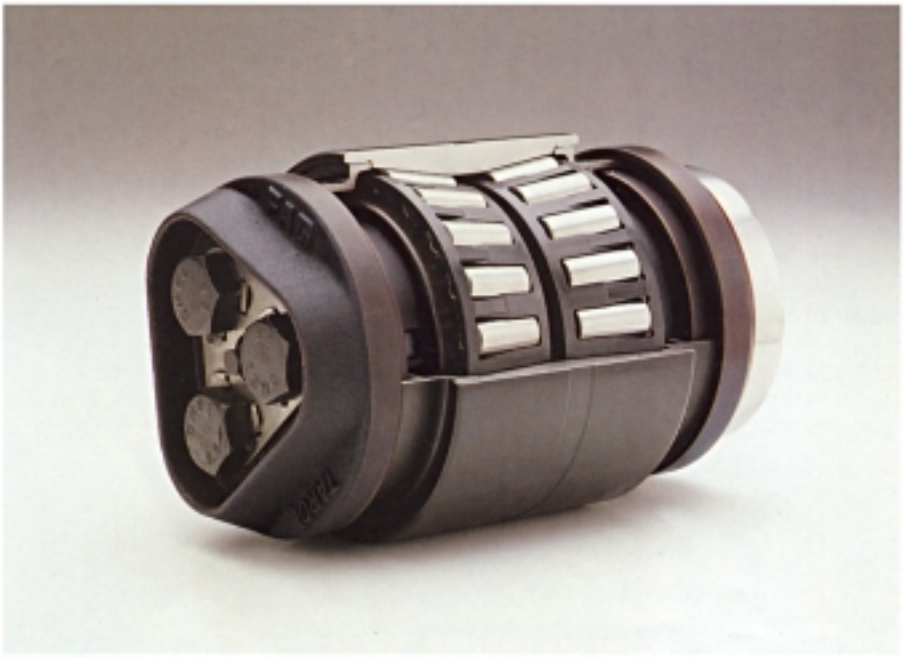
Grade	Dimensions						Load rating dyn. C	Max. load shaft	Weight ≈ TAROL unit
	Axle d max	d min	d_2	Bearing d	D	C			
	inch mm						lbs kN	lbs kN	lbs kg
B 4¼ x 8	4,004 101,702	4,003 101,676	5 127	4 101,6	6,5 165,1	4,5 114,3	101100 450	24000 107	40,0 18,1
C 5 x 9	4,6915 119,164	4,6905 119,139	5,875 149,225	4,6875 119,0625	7,6875 195,263	5,625 142,875	139300 620	33500 149	67,0 30,4
D 5½ x 10	5,1915 131,864	5,1905 131,839	6,375 161,925	5,187 131,7498	8,1875 207,963	6 152,4	155100 690	42000 187	60,4 27,4
E 6 x 11	5,6915 144,564	5,6905 144,539	7,03/7,032 178,562/178,613	5,687 144,4498	8,6875 220,663	6,437 163,5	161800 720	52500 234	74,3 33,7
F 6½ x 12	6,1915 157,264	6,1905 157,239	7,53/7,532 191,262/191,313	6,187 157,1498	9,9375 252,413	7,25 184,15	224700 1000	63000 280	111,9 50,7
G 7 x 12	7,004 177,902	7,003 177,876	8/8,002 203,200/203,250	6,9995 177,7873	10,875 276,225	7,312 185,725	251700 1120	76000 338	137,8 62,5

FAG journal roller bearings TAROL
in metric dimensions

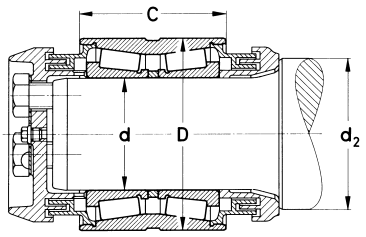
Components of the TAROL unit with lamellar rings



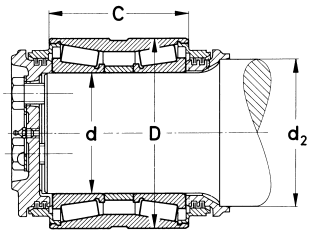
An assembled TAROL unit



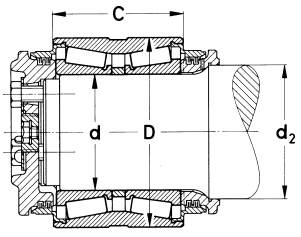
TAROL unit designs in metric dimensions



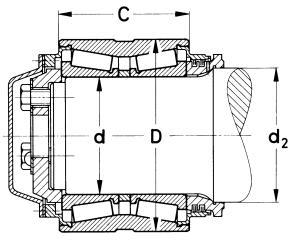
90-design



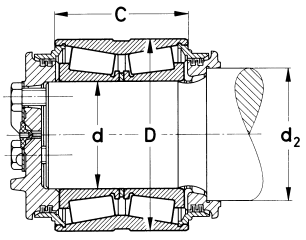
SK-design



MK-design



MK..C-design



UIC-design

Grade	Dimensions						Load rating	Weight ≈
	Axle d max mm	d min	d_2	Bearing d	D	C	dyn. C kN	TAROL unit kg
90	90,035	90,013	120	89,99	154,1	115	425	14,9
90 SK	90,035	90,013	110	89,99	154,1	115	425	11,9
100 SK	100,059	100,037	126	99,98	165	114,3	450	13,9
MK 120	120,059	120,037	138,162	119,982	195	131,4	620	21,5
MK120C	120,059	120,037	138,162	119,982	195	131,4	620	19
MK 130	130,068	130,043	150,174	129,992	210	132	690	25,5
MK 130C	130,068	130,043	150,174	129,992	210	132	690	22
UIC 130C	130,068	130,043	160,174	130	230	160	1020	34
MK 140	140,068	140,043	160,174	139,992	220	140	720	30
MK 140C	140,068	140,043	160,174	139,992	220	140	720	27
MK 150	150,068	150,043	170,186	149,992	250	160	1000	46
MK 150C	150,068	150,043	170,186	149,992	250	160	1000	40

Backing ring and end cap can be adapted to an existing axle journal.
The bearings can be relubricated via a plug or a lubrication nipple in the end cap or at the double cup between the roller rows.

Prior to mounting

The mounting site must be clean, dry and spacious, away from machine tools, welding units and compressed air installations.

Axle journal inspection

- Thoroughly remove dirt, chips and antirust coating.
- Polish any blow marks and traces of corrosion by means of fine abrasives. The bearing seat shall be smooth and free from scores and notches.
- Demagnetize any magnetized axles prior to mounting.
- Measure axle journals; make sure that axle and tool have the same temperature.

The axle journal is measured by means of the snap gauge which was calibrated by means of the master disk. The dimensions of the axle journals must be within the values which are listed in the bearing tables.

Tolerances of the axle journals in the AAR range:

The regulation M101 for dimensional and form accuracy applies. It specifies the following:
- The out-of-roundness of the axle journal must not exceed 0.02 mm (0.0008”). Three cross sections of the bearing seat are measured.
- The conicity of the axle journal over the entire bearing seat must not exceed 0.025 mm (0.001”).

Tolerances of the axle journals in metric dimensions:

The general specification applies, according to which the cylindricity tolerance must not exceed 0.01 mm.

There are three tapped holes for hexagonal head bolts in the face of the axle journal by means of which the end cap is fastened to the axle journal. It has to be checked whether the pitch circle diameter is dimensionally accurate and concentric to the axle journal, whether the three holes have intact threads and run parallel to the axle. A device with three pins is used for this purpose (see drawing). One such device must be available and ready for every axle journal size.

Device with three pins for checking the pitch circle diameter and the parallelism of the fastening holes at the face of the axle journal

Mounting the TAROL units

The tapered roller bearing units TAROL are compact, assembled and greased, sealed and axially adjusted journal roller bearings which are pressed onto the axle in a single operation step. If the axle journal diameter is within the specified tolerance, the necessary axial clearance is obtained by the interference fit of the bearing.

- Apply a thin layer of a mounting paste to the axle journal, for example Arcanol L144V (FAG) so that the normally bright surface is just dulled. In this way the generation of marks during mounting the unit is prevented (a).
- Screw the guiding sleeve to the axle journal (b).
- Unpack TAROL unit and push it onto the guiding sleeve. The seal wear ring of bearing units with rubber seals must not slip out of the seal cap (c).
- Move motor press into position, preposition spindle and mounting sleeve (d).
- Check whether the hydraulic tubular piston press is ready to use (e).
- Push the mounting sleeve onto the spindle of the tubular piston press (f).

Mounting the TAROL units · Press-on force

– Align the hydraulic press to the TAROL unit and axle journal (a).
– Screw spindle of the tubular piston press into the guiding sleeve by means of the crank (b).
– Hydraulically press the bearing unit from the guiding sleeve onto the axle journal while rotating the cup back and forth manually so that the rollers will not get jammed (c).

When the backing ring axially touches the axle shoulder, the pressure increases quickly. The maximum press-on force should be higher by 50 kN than the one which is obtained during the mounting process, i.e. during the axial movement of the bearing. The press-on forces for the different bearing sizes is listed in the tables below.

By means of a feeler gauge with a thickness of 0.05 mm (0.002") it is checked whether the backing ring correctly touches the axle shoulder (d). If necessary, the maximum press-on force plus 50 kN is applied again.

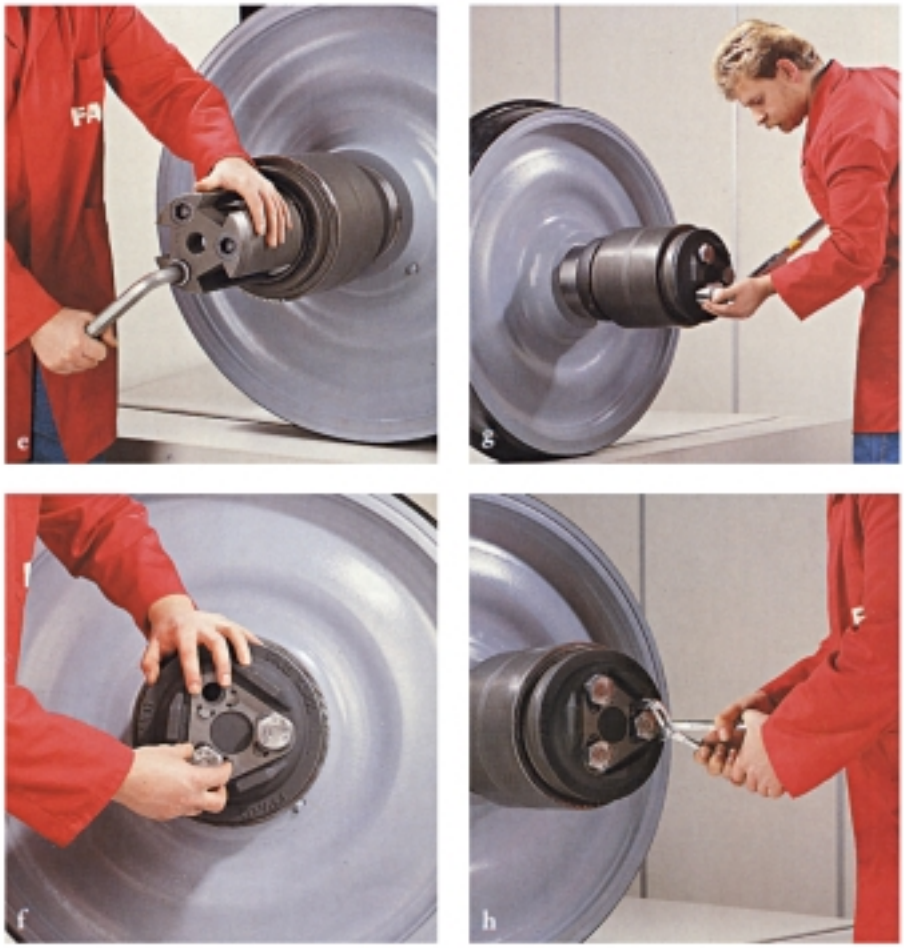
Press-on force with which the TAROL units in inch dimension are pressed onto the axle journals:

TAROL unit in inch dimensions	Press-on force	
Grade/Size	kN	lbs
B 4 1/4x8	350 ± 50	79 000 ± 11 000
C 5x9	350 ± 50	79 000 ± 11 000
D 5 1/2x10	500 ± 50	112 000 ± 11 000
E 6x11	500 ± 50	112 000 ± 11 000
F 6 1/2x12	500 ± 50	112 000 ± 11 000
G 7x12	650 ± 50	146 000 ± 11 000

Press-on force with which the TAROL units in metric dimensions are pressed onto the axle journals:

TAROL unit in metric dimensions	Press-on force
Size	kN
90	300 ± 50
100	350 ± 50
120	350 ± 50
130	500 ± 50
140	500 ± 50
150	500 ± 50

– Unscrew spindle from the guiding sleeve.
– Unscrew guiding sleeve from axle journal (e).
– Screw end cap to the axle face together with locking plate (f).
– Tighten end cap bolts with the tightening torque specified in the tables (g).
– Bend the two tabs of the locking plate at all end cap bolts (h).



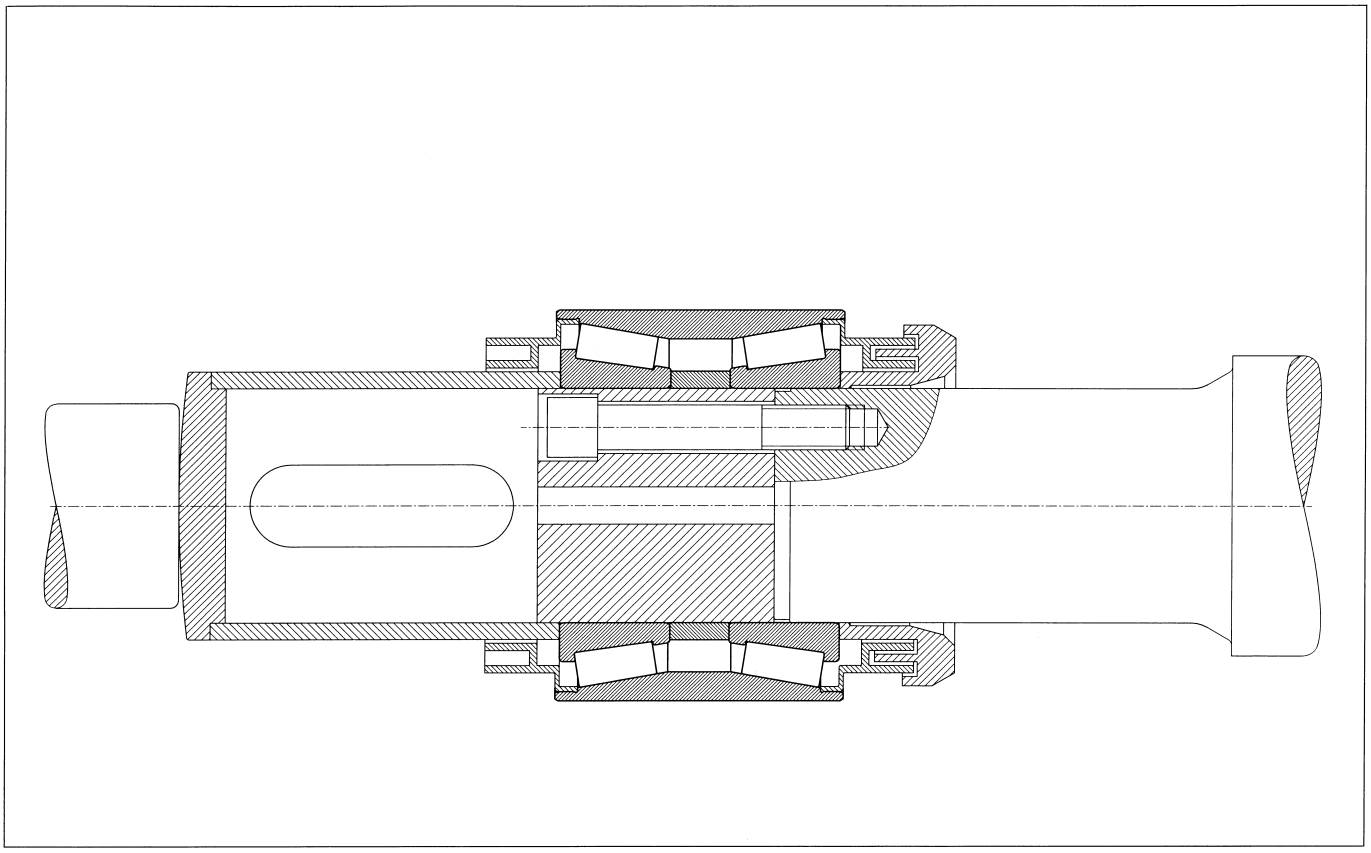
Tightening torque for the end cap bolts for TAROL units in inch dimensions

Thread dimensions of the end cap bolt	Tightening torque	
	N m	ft lbs
3/4"	160...170	110...120
7/8"	200...210	140...150
1"	350...370	250...270
1 1/8"	500...540	360...390
1 1/4"	600...640	430...460

Tightening torque for the end cap bolts for TAROL units in metric dimensions

Bearing design	Tightening torque	
	Normal bolts N m	VERBUS-ripp-bolts N m
90	180...200	230...250
100	180...200	230...250
120	100...120	140...160
130x210, 130x220	100...120	140...160
130x230	180...200	230...250
140x220	100...120	140...160
150x250	180...200	230...250

Mounting the TAROL units



For designs with cover plate (MK…C):
– After having tightened and locked the end cap bolts with the specified tightening torque, mount the cover plate over the end cap.

TAROL units can also be mounted by means of stationary bearing or wheel mounting presses. For large quantities, two presses are used and the two bearing units mounted to the wheel set at the same time.

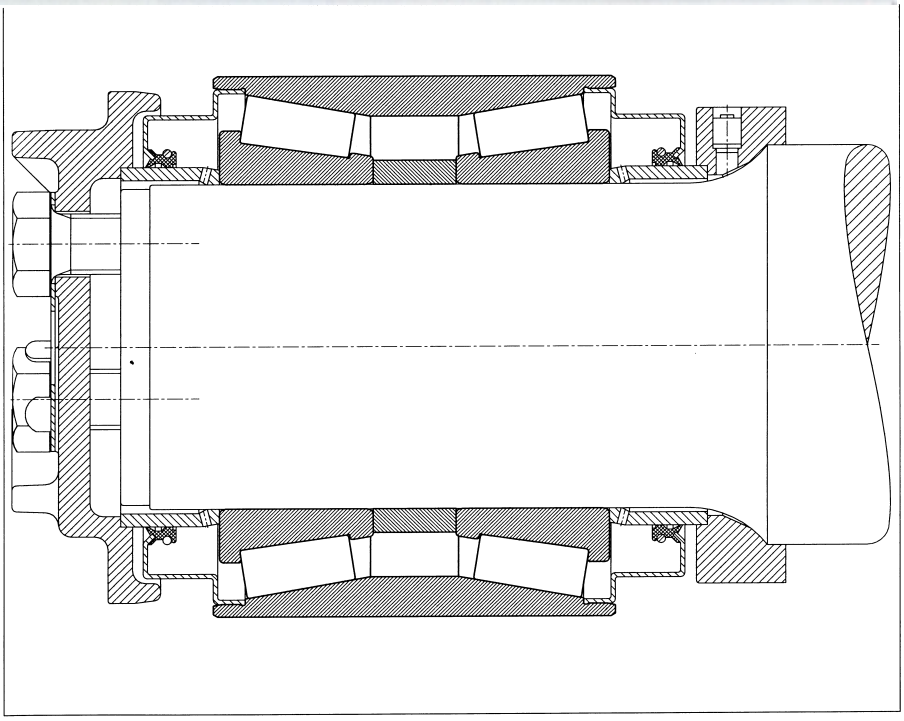
Maintenance of the TAROL units

Design without relubrication

The TAROL programme of FAG is very varied and thus fit to meet any possible customer requirements. The NFL design (no field lubrication) of the TAROL units is a standard design in the AAR field.

No relubrication is provided for the NFL design. As specified by AAR, these bearings are only regreased during overhauling works, i.e. after they were dismounted, cleaned and checked.

TAROL unit without relubrication hole. The so-called NFL design (no field lubrication) is one of the standard journal roller bearings especially in the AAR field.

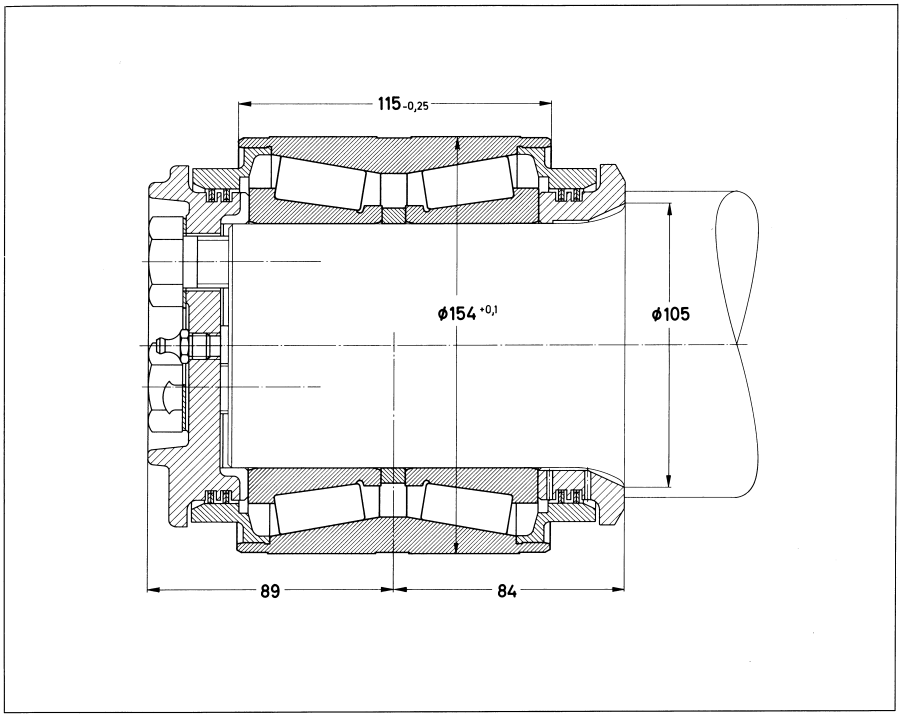


Maintenance of the TAROL units

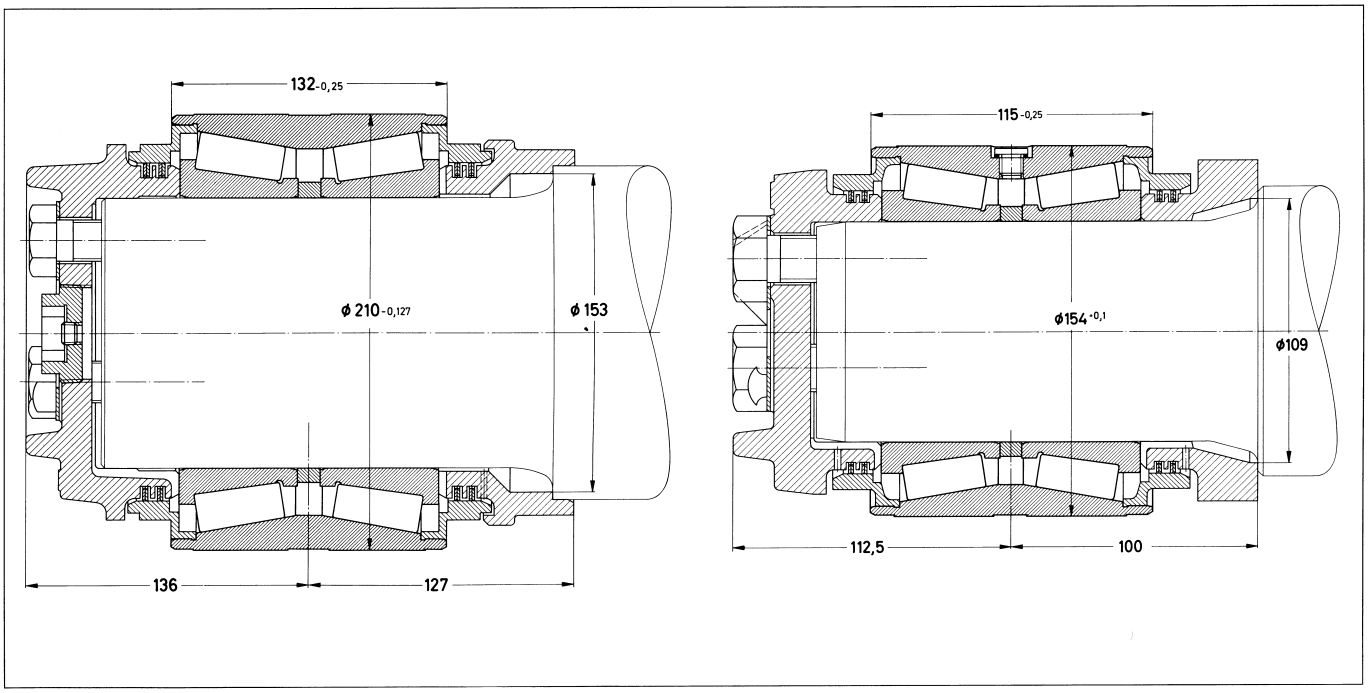
Regreasable TAROL units

The demand for relubricatable journal roller bearings is met by FAG by means of TAROL units with lubricating nipples or with a plug in the end cap or cup.

TAROL unit with lubricating nipple in the end cap



TAROL unit with lubricating hole and plug in the end cap
TAROL unit with lubricating hole and plug in the double cup



Relubrication

Relubrication of TAROL units in inch dimensions

AAR recommends in its "Interchange rule 66A and P.C. rule 7" relubrication intervals of 3 to 4 years for relubricatable journal roller bearings, depending on the environmental and operating conditions. Only the greases recommended by FAG are to be used as lubricants, which are in accordance with the AAR Specification M 942-81. The grease quantities for relubrication are specified for each bearing size and listed in the table.

Replenishment quantities for TAROL units in inch dimensions

TAROL unit Grade/Size	Replenishment quantity kg	Ounce
B 4 1/4x8	0,17	6
C 5x9	0,20	7
D 5 1/2x10	0,23	8
E 6x11	0,26	9
F 6 1/2x12	0,35	12
G 7x12	0,35	12

Relubrication of TAROL units in metric dimensions

The replenishment quantities and intervals for TAROL units in metric dimensions are specified for each application. The relubrication conditions are drawn up in cooperation with FAG experts.

Prior to replenishing clean the faces of the end caps.

Loosen any plugs and screw in lubricating nipple.

Replenish.

Remove lubricating nipple and tighten plug with the torque specified in the table.

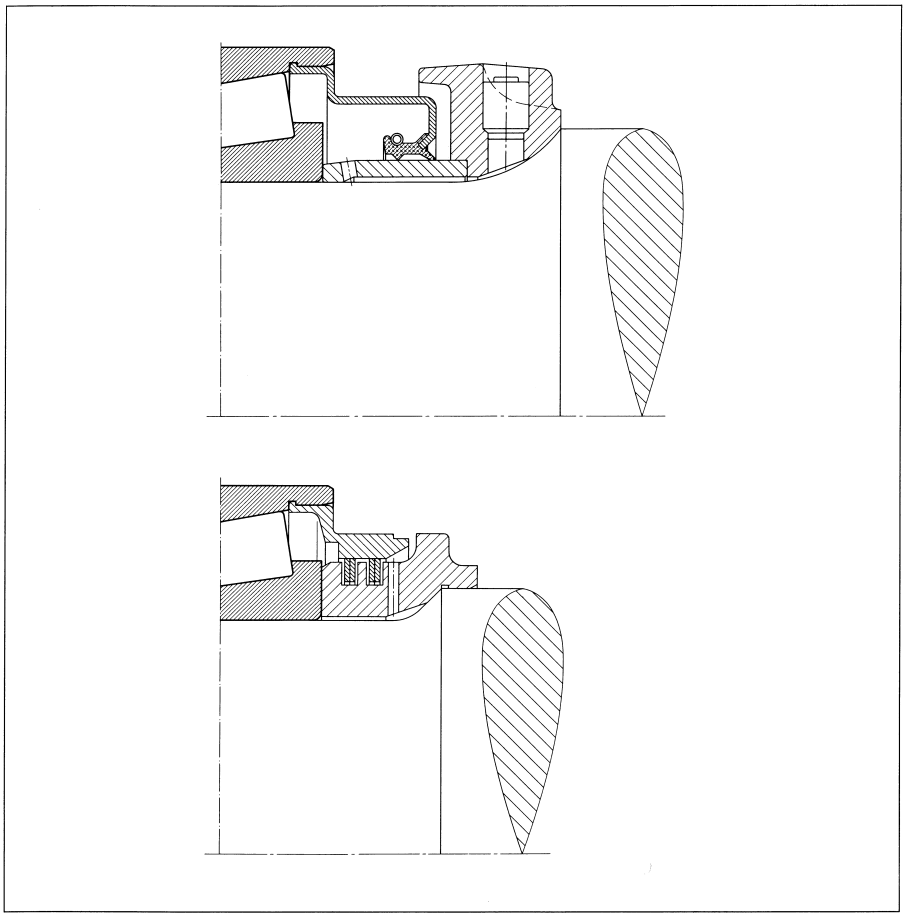
Tightening torque for the plug of the relubricating hole of TAROL units in inch dimensions

TAROL unit Grade/Size	Tightening torque N m	ft lbs
B 4 1/4x8	40...55	30...40
C 5x9	40...55	30...40
D 5 1/2x10	55...70	40...50
E 6x11	55...70	40...50
F 6 1/2x12	55...70	40...50
G 7x12	55...70	40...50

Tightening torque for the plug of the relubricating hole of TAROL units in metric dimensions

TAROL unit Size	Tightening torque N m
90	40...55
100	40...55
120	40...55
130x210	55...70
130x220	55...70
130x230	55...70
140x220	55...70
150x250	55...70

It is possible that grease will escape from bearings with relief holes. In this way the bearing is prevented from being heated by grease working. When the bearing is relubricated, it has to be ensured that the relief holes are not blocked.



Inspecting the adapters

Inspecting the mounted adapters

Maintenance also includes inspecting the adapters (the seatings between bearing unit and bogie). The adapters have to be well supported by the bearing and in the frame opening. Clamped or jammed adapters cause load concentrations and bearing damage. Gauges are used to check whether the wear limits are exceeded. The distance between the axial flange of the adapter and the seal cap of the bearing (A) is measured.

Checking the adapter wear

If the bearings are in a bogie, a gauge is used (see drawing).

A is the minimum distance between the axial shoulder of the adapter and the seal cap. B is the design dimension for the gauge.

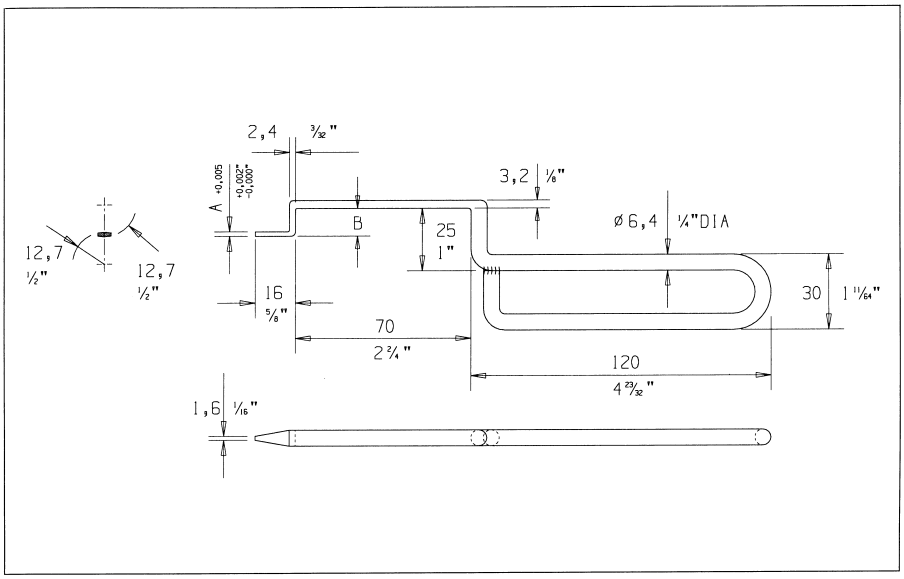
The gauge is applied at the adapter foot and guided around to the opposite foot. If the gauge cannot be guided through the gap, the adapter has to be removed for inspection. For more details on adapter wear see pages 27.

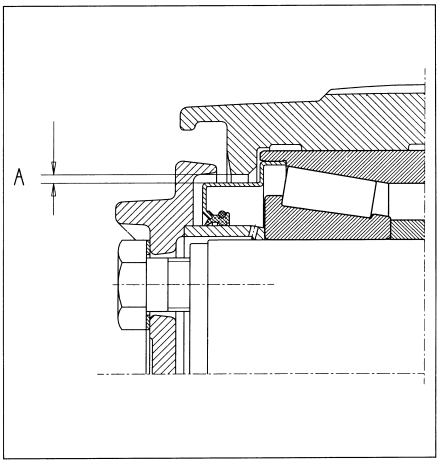
If the bearing cup displays a shining band of wear, the adapter has to be removed, too. Any deformed or otherwise damaged adapters have to be replaced immediately.

Dimensions of the gauge for checking the adapter wear of TAROL units in inch dimensions

TAROL unit	Dimensions			
	A		B	
Grade/Size	mm	inch	mm	inch
B 4 1/4x8	0,6	0,025	9,5	3/8
C 5x9	1,8	0,072	11,1	7/16
D 5 1/2x10	1,8	0,072	11,1	7/16
E 6x11	2,7	0,107	15,1	19/32
F 6 1/2x12	2,7	0,107	15,1	19/32
G 7x12	2,7	0,107	15,1	19/32

Gauge for checking the adapter wear of a journal roller bearing which is built into a bogie





Special cases of journal roller bearing maintenance

In collisions and derailings of rail vehicles, bearings, axles or bogies can be damaged or the bearing units loosened from their seats.

The following measures have to be taken:

- Remove journal roller bearing units, disassemble, clean, examine and repair or replace them if necessary.
- Check the radial runout of the shafts on the shaft-turning lathe. According to AAR regulation M 101, the radial runout must not exceed 0.2 mm.
- Check bogie frame for deformation. Load concentrations lead to bearing damage.

If any electric welding works are carried out on the car or bogie, the ground wire has to be fastened near the welding spot so that the bearing is protected from the passage of current.

If the rail vehicles are cleaned with water, the water jet shall not be directed on the sealing area. Prior to sand blasting or shot peening, the bearings are covered with guard plates.

If journal roller bearings are dismounted in order to enable the wheels to be re-turned or reground, the journal roller bearings are protected from chips by fastening pressed caps over the end caps (see drawing).

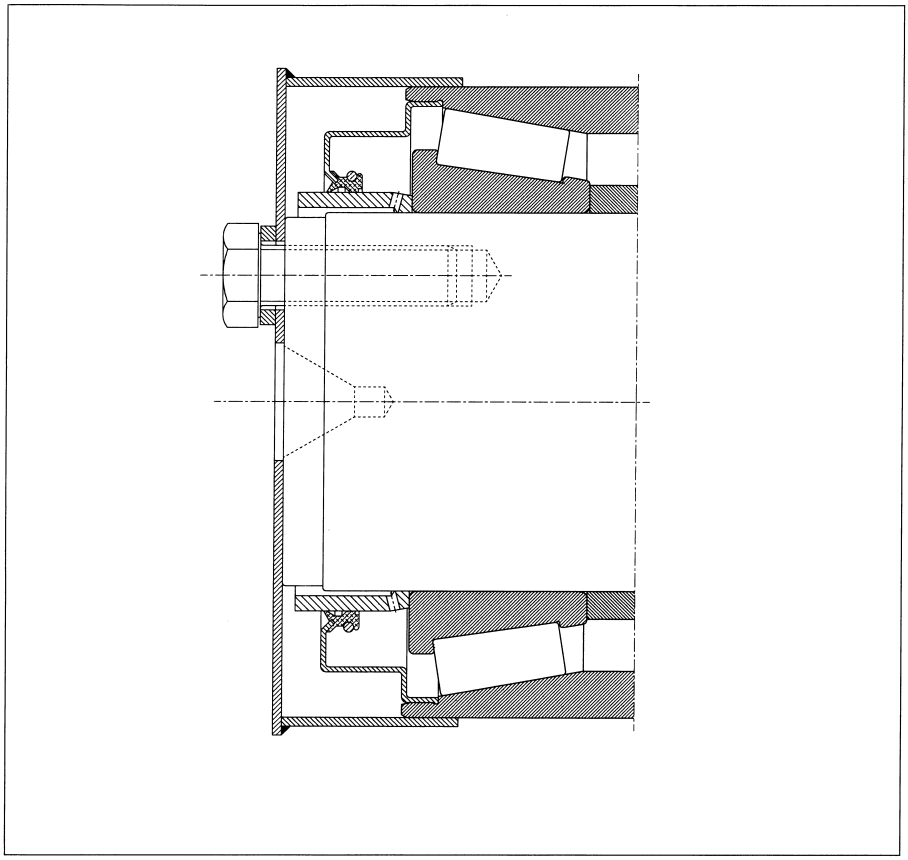
The seal at the other end of the bearing is wrapped with a strip of cloth when the wheels are reworked and is thus protected from the penetration of chips.

Then the entire wheel set is thoroughly cleaned. The end caps are screwed on again and the locking plates replaced.

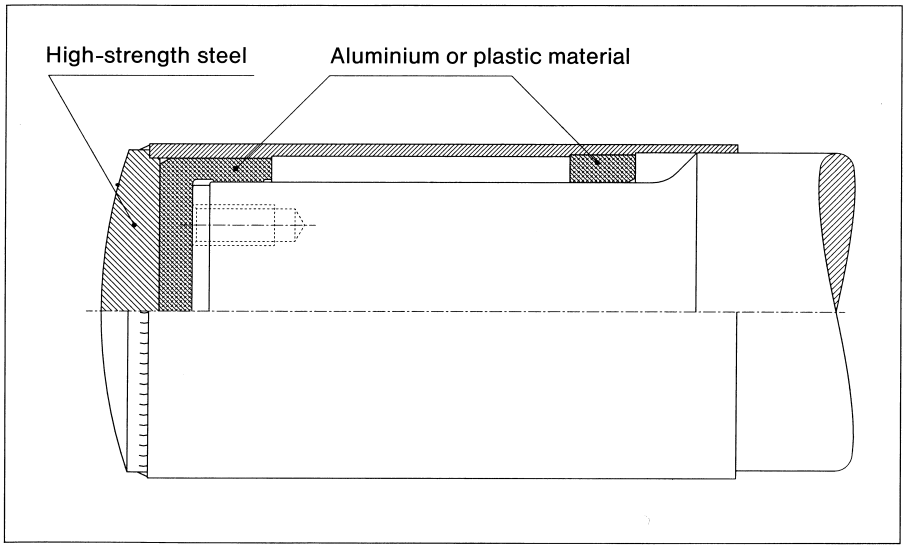
If there is water in the bearing, the bearing unit has to be removed, completely broken down and overhauled.

During the mounting and dismounting of the wheel the axle journals are protected from damage by steel caps (drawing).

Steel cap for protecting the axle journals during mounting and dismounting the wheels



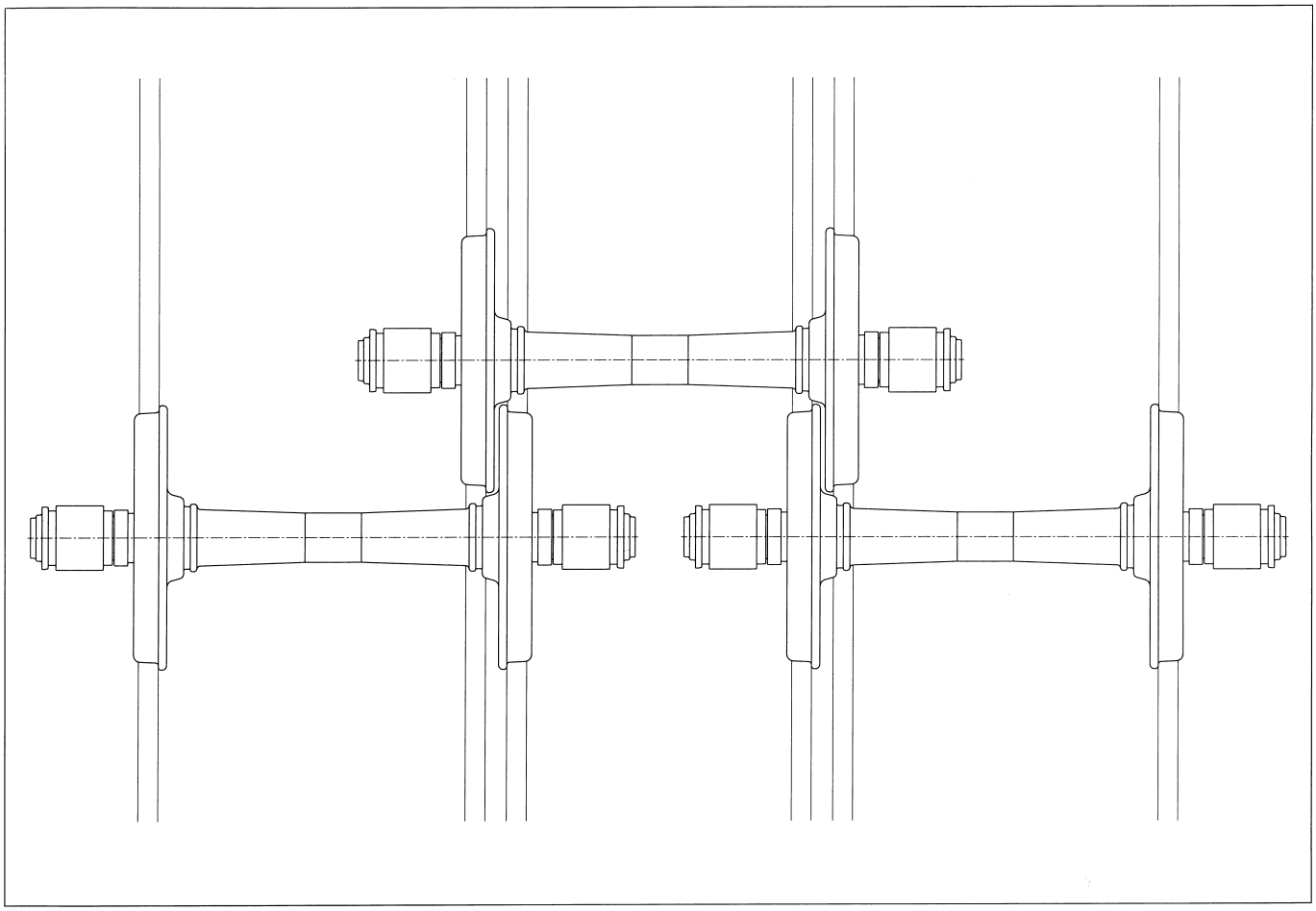
Journal roller bearing with protection cap which is installed when the wheels are reworked.



Special maintenance cases

Storage rails for wheel sets have to be arranged in such a way that the wheel flanges of the wheels can touch and damage neither the journal roller bearing nor the axle of the next wheel set. (See sketch!)

Arrangement of the rails on which the wheel sets are stored.



Dismounting and repair of TAROL units

For inspection, repair and lubrication, the TAROL unit is removed from the axle journal. The procedure is effected in the reverse order of mounting.

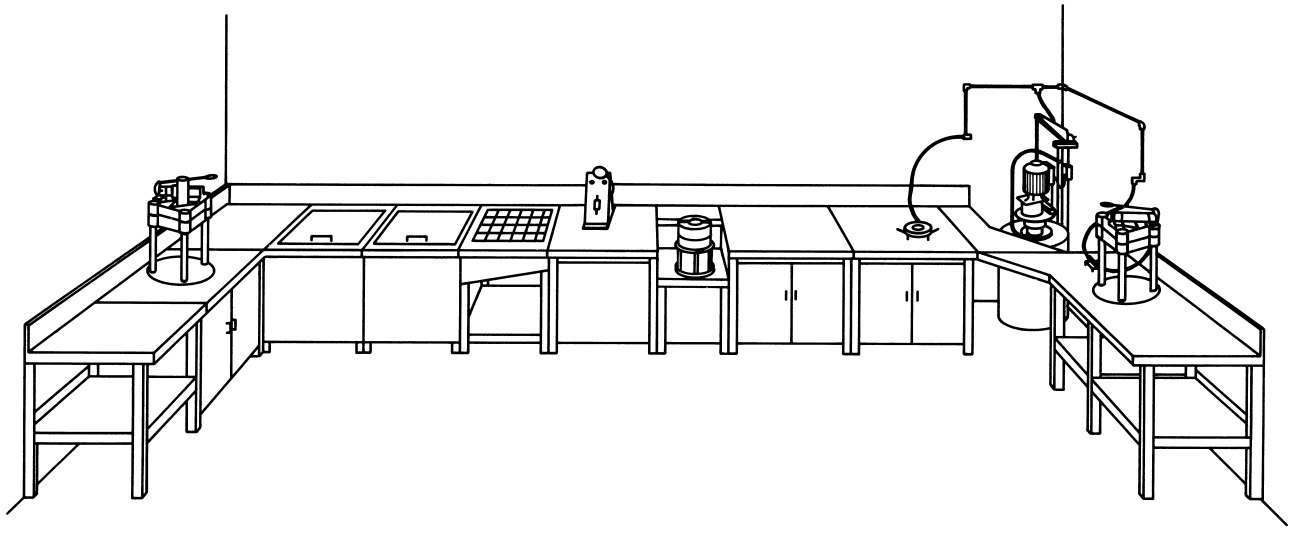
The work area where the TAROL units are repaired must be spacious and free from dust. It is recommended to furnish the workshop with work stations arranged according to the logical order of repair as is shown in the picture.

First, the seals are removed, then all the bearing parts are cleaned and checked for damage one by one. Then the parts, and the axial clearance of the bearing, are measured.

Now the unit is re-assembled from the examined or new parts, lubricated and sealed.

All tools which are needed for assembling, disassembling and repairing TAROL units can be purchased from FAG. Intact and suitable tools are one precondition for ensuring that the bearings and seals do not get damaged.

Repair shop for tapered roller bearing units



Removing the seals | Cleaning the bearing parts | Examining the bearing parts | Measuring the axial clearance | Lubricating the bearing parts | Installing the seals

Removing the end cap · Removing the unit · Removing the seals

Removing the end cap

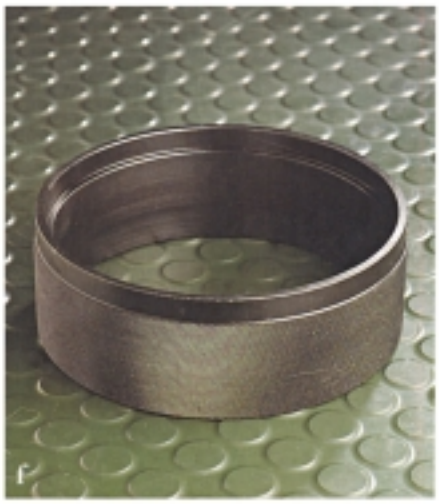
– Clean bearing parts and mating parts.
– Remove cover plate, if there is any.
– Bend lock washer away from the side faces of the bolt heads.
– Unscrew bolts by means of impact screw driver.
– Remove end cap without removing the sealing ring.

Removing the unit

– Screw on guiding sleeve
– Insert spindle through the tubular piston press without counternut (a).
– Height-adjust and align press (b).
– Screw spindle into the guiding sleeve (c).
– Position pulling frame with a withdrawal shoe insert which is suitable for the bearing size.
– The withdrawal shoe has to be supported by the shaft behind the axle shoulder (d).
– Switch on pump motor.
– Turn switch lever.

Removing the seals

– Remove front sealing ring.
– Remove supporting ring with sealing ring at the axle end.
– Place ready ram and supporting plate and counternut, removal jaws and support ring (e,f).



– Insert removal jaws between cone and sealing lip (g).
– Guide ram through the bearing bore until the pins of the jaws grip into the holes of the supporting plate (h).
– Screw counternut onto the ram, axially clamp jam and jaws (i).
– Insert bearing into the support ring (j).
– Insert bearing and support ring into the press and align them (k).
– Remove the sealing (sealing cap).
– Remove cone and spacer, which are now loose, and unscrew counternut.
– Remove seal at the opposite end of the cup by repeating the steps just described.


g


i

Removing the lamellar rings

The lamellar rings are removed from the unit, without a special device, together with the ring carriers, the end cap and the supporting ring.

The lamellar rings are lifted by means of a narrow screw driver, slightly expanded by hand and screwed out of the groove (l).


h


k


j

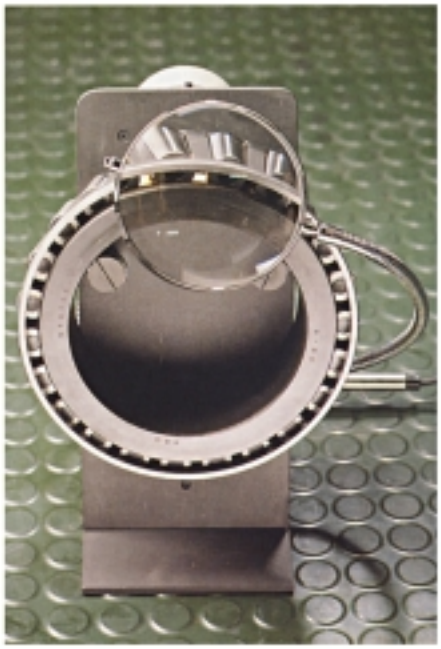

l

Cleaning the bearing parts

Cleaning the bearing parts

- Remove any grease residues from the parts; this is done by means of a centrifuge, a wooden spattle or a cloth which is free of fluff.
- Washing machines are used in series maintenance. The manual cleaning is done in washing containers.
- Cones, rolling element and cage assemblies, cups and spacer rings are cleaned, in a special washing plant, either with kerosene or with cold cleaning agents.
- If the parts are cleaned with soda solutions (0.5 to 1%) or with caustic soda (10%), the bearing parts have to be flushed with a neutral oil or with some other water displacing agent afterwards. In this way any oxidation precipitations are ruled out and residues of metallic soaps are dissolved.
- The cleaned bearing parts are then sprayed with a light machine oil.
- The adapters, end caps, supporting rings and fastening bolts are cleaned in a plant which is provided especially for this purpose.
- The seals with the vulcanized rubber parts are replaced as a rule with new ones during every repair of tapered roller bearing units.
- Lamellar rings which are no longer elastic and therefore not in tight contact with the seal cap have to be replaced with new ones.

Inspecting the bearing parts



The condition of the cup and the roller rows of TAROL units with pressed cages can be checked in a dismantled condition. A device with a lamp and magnifying glass (as shown in the figure) also allows the raceway of the cone to be inspected. In the case of bearings with cages of glass-fibre reinforced polyamide it is also possible to remove one tapered roller, the cage pocket of which is marked with an X, and to install it again after examination. The raceways are checked for wear traces and foreign particle indentations.

If faulty or damaged parts are found, it has to be decided whether they can remain in service or whether they have to be repaired or replaced with new ones. Some examples from the AAR field:

Surface corrosion

- Surface corrosion on bearing rings and rollers occurs in the form of rusty discolouration, etching and pitting formation.
- If the discolourations and stains can be removed by means of a fine abrasive cloth, the parts do not have to be rejected. Any rubbed-off abrasive parts have to be washed out completely.
- Parts which display etching marks from water or acids, which can be polished away without leaving any major indentations, can be used again.

The corrosion marks can be treated with polishing wheels and pastes. In this way stains can sometimes be removed.

- If rust and corrosion have led to the generation of pitting, the rings and rollers cannot be used anymore.
- Bearing parts which display heat discolourations have to be singled out and rejected.

Brinelling

Brinelling (rolling element indentations) in the raceways is caused by high shock loads. In order to be able to carry out a correct assessment it is vital that the components of a disassembled and cleaned bearing do not get mixed up with components of other bearings.

According to the AAR Roller Bearing Manual, cups with brinelling can be used again provided that

- the length of the indentation is less than half the raceway width and is not wider than 4 mm (5/32");
- the brinelling is very slight, extends beyond the raceway middle and is not wider than 2.4 mm (3/32"). The number of indentations is irrelevant.

If the cup proves to be still usable, then the same also holds for the cone and the roller and cage assembly; any damage of the cone also shows on the rollers and the cup.

If one rolling element identation exceeds as much as one of the specified limiting values for length or width, the part in question cannot be used anymore.

Fatigue damage

Fatigue damage on the raceways is indicated by pitting.

Bearing with fatigue damage should be rejected as a rule. AAR allows to repair pitting in the raceways of the bearings. After regrinding, however, these sections must not be longer than 9.5 mm (3/8") and deeper than 3.2 mm (1/8").

Heavily stressed bearings, such as bearings in high speed trains, must be free of fatigue damage.

The AAR instructions (Roller Bearing Manual, Section 1) restrict the repair to a maximum of two fatigue-damaged sections on a 50 mm (2") wide section over the circumference of the raceway (with a maximum length of 9.5 mm (3/8") and depth of 3.2 mm (1/8")) or a maximum of four fatigue-damaged sections of 1.6 x 1.6 mm (1/16" x 1/16"). There must be an undamaged area with a width of at least 5 mm (3/16") between two repaired fatigue-damage sections.

If there is one uninterrupted repaired area, it must not exceed a length of 9.5 mm (3/8") and a depth of 3.2 mm (1/8"). Only 12 cases of repaired fatigue damage are allowed per raceway.

Inspecting the bearing parts

Raceway indentations as a result of contamination

Contaminants in the lubricant can also lead to the generation of indentations in the raceway. According to AAR, the parts can continue to be used as long as such raceway indentations are felt as rough spots when the bearings are rotated by hand.

Any surface indentations which are caused by lubricant contaminations, and which do not rule out further usage, can be removed by polishing.

Current passage damage

Bearings with grooves and craters which were caused by the passage of electric current cannot continue to be used.

If the cones can be examined separately during the inspection of the bearing condition, then the same criteria for rejection or further use apply as for the cup.

Cages must not display any cracks or deformations either as these would rule out any further use.

If the spacer ring displays any cracks, notches or burning marks it has to be replaced.

Seat of the seal and seal cap

Prior to assembling the bearing, a measurement is carried out to ascertain whether the seat for the seal/seal cap still has the required dimensions. The diameter is measured by means of an inside micrometer and must be within the specified tolerances as listed in the tables.

Bearing accessories

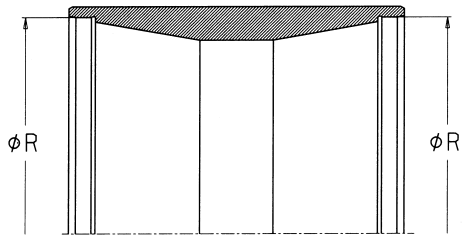
- The end cap is checked for cracks, fractures and deformations.
- The sealing rings must not be broken, cracked or deformed. The surfaces in the contact area of the sealing lips have to be smooth and must not display any wear. For mounting-related reasons, the inner sealing ring must be positioned in the supporting ring with an interference fit (interference 0.05 to 0.175 mm).
- The supporting ring must not be damaged. The supporting radius is checked by means of a gauge. The gauge must touch the ring on both sides.

The ventilation nipple must be neither clogged nor damaged. It has to be covered carefully prior to painting.

As a rule the seals with the vulcanized rubber part are replaced with new ones when the unit is repaired.

Lamellar rings which have lost their elasticity, and are therefore no longer in tight contact with the seal cap, have to be replaced with new ones.

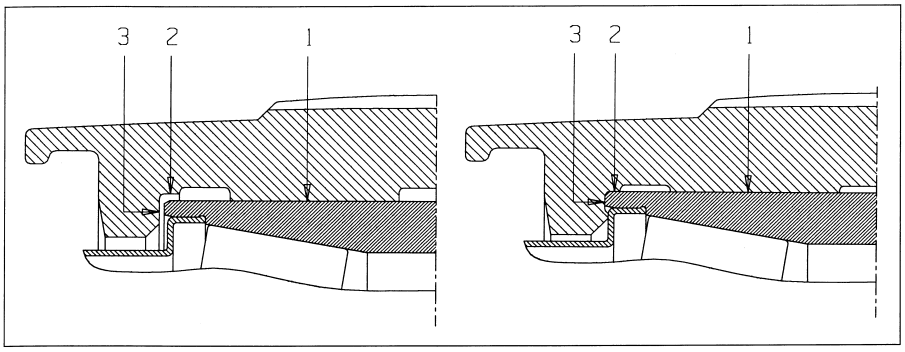
TAROL unit in inch dimensions
Dimensions for the seal seat in the outer ring

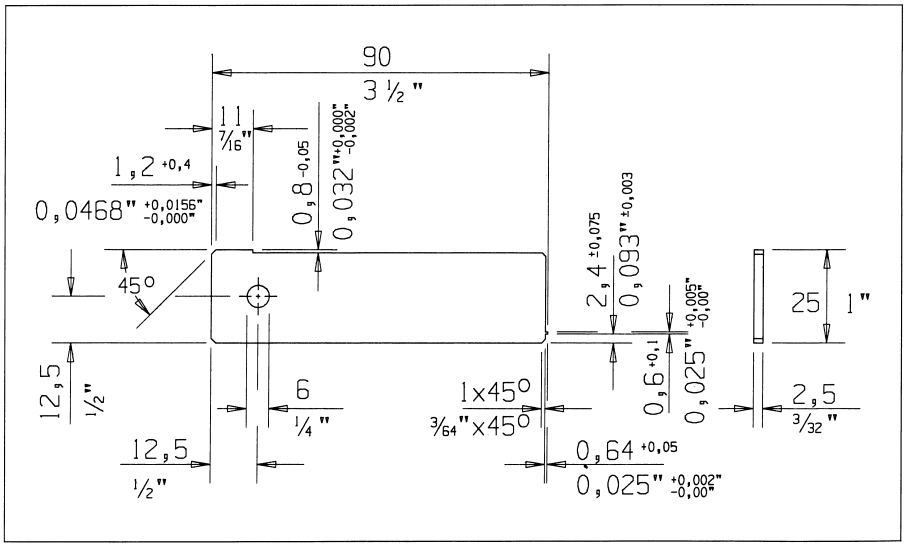


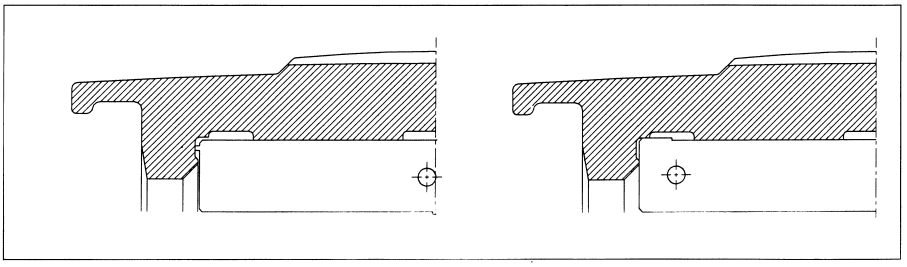
TAROL unit Grade/Size	Diameter R min. mm	max. mm	min. inch	max. inch
B 4 1/4x8	153,95	154,02	6,061	6,064
C 5x9	182,56	182,63	7,187	7,190
D 5 1/2x10	196,85	196,92	7,750	7,753
E 6x11	209,55	209,62	8,250	8,253
F 6 1/2x12	238,125	238,195	9,375	9,378
G 7x12	260,985	261,055	10,275	10,278

TAROL unit in metric dimensions
Dimensions for the seal cap seat in the cup

TAROL unit Size		Diameter R min. mm	max. mm
90	90 SK	144,475	144,525
100SK		153,97	154,02
MK120	MK120C	182,56	182,63
MK130	MK130C	196,85	196,92
UIC130C		218,3	218,37
MK140	MK140C	209,55	209,62
MK150	MK150C	238,125	238,195







The hexagon head bolts must have an intact thread. It has to be checked if the bolts were stretched in any way.

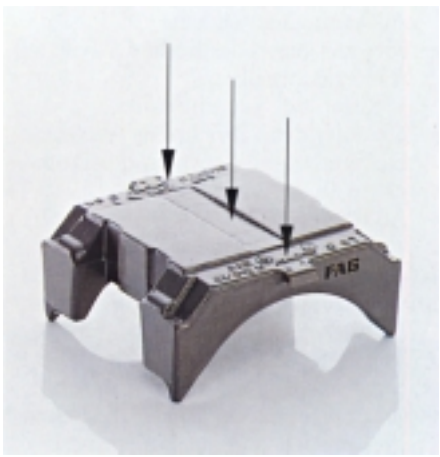
The lock washers are replaced with new ones every time.

Normally, the adapters display only little wear. It has to be checked, however, every time the bearing is dismounted whether the adapter is damaged or excessively worn.

With a worn bearing seat (1) it can happen, as is shown in the drawing, that the recess (2) touches the cup end and that the face of the cup touches the axial shoulder of the adapter (3).

By means of a gauge it is checked if the adapter exceeds a certain wear limit (distance not shorter than the tab of 0.64 mm or 0.025" and not less than the projection of 0.8 mm or 0.032").

When the supporting, crowned surface areas of the adapter are worn and the frames lie on the recessed areas (arrows), the adapter is no longer fit for use.



Measuring the axial clearance

Measuring the axial clearance

Maintenance also includes checking the axial clearance of the dismounted bearing. This measure ensures that the spacer ring has the width which is required for the appropriate axial clearance of the bearing when mounted.

The cleaned bearing parts are immersed in a machine oil or anti-corrosion oil. The axial clearance of the bearing must never be measured on the dry bearing.

The axial clearance is measured by means of an axial clearance measuring instrument. The procedure is as follows:

- Select the suitable bearing sleeve.
- Place the bearing sleeve on the supporting plate. Tighten fastening bolt. (For the bearings 6 1/2 x 12 and 7 x 12 the specially wide sleeve adapters must be used.) (a)
- Push one cone with roller and cage assembly plus spacer ring onto the bearing sleeve until it reaches the supporting plate (b).
- Push the cup over the cone; rotate it while doing so.
- Insert second cone with roller and cage assembly; rotate it while doing so.
- Place clamping plate onto the top cone (one single clamping plate suffices for all sizes).
- Securely tighten locking screw (c).
- Make sure that the clamping plate does not touch the cup.
- Put down bearing and rotate top cone approx. 12 times (d).
- Attach dial gauge with magnet support to the cup outside diameter.
- Adjust dial gauge so that it touches the top of the locking screw.
- Zero set dial gauge.
- Operate excenter of the device. The cup is lifted on the rim of the two-piece supporting plate (e), the center washer of which remains in place.
- Rotate cup back and forth (f).

Now the axial clearance of the dismounted bearing can be read off the gauge (workbench axial clearance).

- Repeat measurement.
- Put down the bearing with the

excenter. Rotate top cone several times. The values on the dial fall to zero.

– Lift bearing with the excenter. Rotate cup back and forth. Read axial clearance again and compare the value with those listed in the tables.

If the axial clearance is excessively large, the spacer ring must be ground down to a smaller width. If the axial clearance is too small, a wider spacer ring is selected. The suitable spacer ring and the other bearing parts form a unit and have to stay together until mounting.

Axial clearance values for the dismounted TAROL units in inch dimensions (workbench axial clearance of the bearings)

TAROL unit	Axial clearance			
	min.		max.	
Grade/Size	mm	inch	mm	inch
B 4 1/2x8	0,46	0,018	0,61	0,024
C 5x9	0,46	0,018	0,61	0,024
D 5 1/2x10	0,51	0,020	0,66	0,026
E 6x11	0,51	0,020	0,66	0,026
F 6 1/2x12	0,51	0,020	0,66	0,026
G 7x12	0,51	0,020	0,66	0,026

Axial clearance values for the dismounted TAROL units in metric dimensions (workbench axial clearance of the bearings)

TAROL unit		Axial clearance	
		min.	max.
Grade/Size		mm	mm
90	90SK	0,530	0,630
100		0,530	0,680
MK120	MK120C	0,533	0,685
MK130		0,533	0,685
MK130C	UIC130C	0,510	0,660
MK140	MK140C	0,533	0,685
MK150	MK150C	0,533	0,685

Lubrication

Only AAR approved greases shall be used for AAR applications.

Use high-quality, non-corrosive greases which are resistant to oxidation and aging.

Metal soap base greases with an anti-corrosion additive are preferably used.

Store greases in their closed original packing, and protect them from heat.

Feed the specified grease quantity into the disassembled bearing only. It is not admissible to press the grease into bearings which are mounted on the axle.

The lubrication nipple provided in the end cap is for relubrication only. The end caps of TAROL units of NFL design (no field lubrication) have neither lubrication nipples nor plugs. The bearing unit is packed with a sufficient quantity of grease for the entire mileage until the next main inspection.

When the bearing is lubricated, no contaminants (dust, sand, chips, ashes, fibres, fluff etc.) must be allowed to penetrate into the grease or reach the bearing parts.

The faces of all bearing parts which get into contact with the axle after the unit is mounted must be free from grease.

The grease quantity specified for a cone with roller and cage assembly is fed in by means of the following device (a):

- Place the cone onto the base plate of the device.
- Position grease distributor of the lubricating device and feed in grease according to specification (b). The cone faces must be free from grease.
- Insert cone with roller and cage assembly into the cup from the top.
- Grease outer roller faces.
- Remove any grease from the inner ring face.
- Put on seal cap.
- Place cup onto the support ring.
- Lay adapter ring onto the seal cap (c).
- Insert parts into the press, align them and press in seal cap (d).

Lubrication of TAROL units in inch dimensions.
Grease quantity and distribution for the first or repeated packing.
Lubricants according to AAR specification M942-81 have to be used.

TAROL unit	Grease quantity and distribution within the bearing unit							
	Outer roller faces		Cone with roller and cage assembly		Space between the roller rows		Total grease quantity	
	Per row		Per roller and cage assembly					
Grade/Size			g	ounce	g	ounce	g	ounce
B 4 1/4x8			55	2,0	115	4,0	225	8,0
C 5x9			85	3,0	170	6,0	340	12,0
D 5 1/2x10	grease		115	4,0	225	8,0	455	16,0
E 6x11	slightly		115	4,0	225	8,0	455	16,0
F 6 1/2x12			170	6,0	340	12,0	680	24,0
G 7x12			225	8,0	450	16,0	900	32,0

– Remove bearing from support ring, turn it around and place it onto the support ring again with the already inserted seal cap.
– Insert spacer ring.
– Distribute grease over the inside wall of the cup according to specification (e).
– Insert second, greased cone with roller and cage assembly.
– Grease outer roller faces.
– The cone face must not be greased.
– Position second seal cap and adapter ring and press bearing together in the press until the seal cap snaps into the cup.

Lubrication of TAROL units in metric dimensions.
Grease quantity and distribution for initial or subsequent filling.
Use grease specified in the FAG drawing.

TAROL unit	Grease quantity and distribution within the bearing unit			
	Outer roller faces	Cone with roller and cage assembly	Space between the roller rows	Total grease quantity
	Per row	Per roller and cage assembly		
Size	g	g	g	g
90	15	45	40	160
100	20	55	50	200
120	20	65	60	230
130x210	25	70	60	250
130x220	25	80	70	280
130x230	30	90	80	320
140	35	100	90	360
150	50	150	120	520

Installation of the seal contact rings

Installation of the supporting ring

Units with rubber seals

The installation is done partly without tools. The outside seal contact ring is cautiously inserted into the seal until it touches the cone (f).

The seal contact ring on the bearing side facing the wheel is pressed into the supporting ring by means of a device (g).

The two parts are cautiously pushed into the seal until they touch the cone. All faces of the parts must be free from grease.

Do not bend or damage the lips of the rubber seal.

Units with lamellar rings

The lamellar rings are slightly expanded and slipped into the grooves of the ring carriers with a rotating motion. Only small quantities of grease are distributed over the rings.

The ring carriers with the lamellar rings can be manually installed into the seal caps without problems. The seal caps have suitable chamfers. The faces of the ring carriers must be free from grease.

The two double lamellar rings are in tight contact with the stationary seal cap and form an effective labyrinth seal with the grooves.

Prior to installing the end cap

A new lock washer and three hexagon head bolts must be readily available together with the clean end cap.

Packaging and storage

If the repaired TAROL unit is not mounted immediately, it is packed and stored like a new bearing unit.

The complete FAG delivery programme

FAG has branch offices and agencies all over the world. Being a rolling bearing universalist, FAG also has a complete delivery programme for rail vehicles (FAG Publ. No. WL 07 150 EA). The service offered by FAG also includes the technical advisory service for solving bearing problems in rail vehicles and carrying out specific research projects.

FAG Journal Roller Bearings TAROL

Mounting, maintenance, repair

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