

FAG

Everything that moves us



FAG Rolling Bearings for Rail Vehicles

A Complete Delivery Program

BASCO



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FAG Kugelfischer AG & Co. KG

About this Catalog

This product catalog is primarily geared towards manufacturers and operators of rail vehicles who use journal roller bearings, traction motor bearings and transmission bearings.

The following pages contain our product ranges for journal roller bearings, housings, TAROL units and include the FAG equipment for mounting, maintenance and lubrication.

The quality demands we place on our products and services are the result of more than 100 years experience in the production of precision components for rail applications.

Safety, reliability and economic operation are characteristic of FAG products. Innovations in rail traffic have been developed in close co-operation with operators and system suppliers.

The employees of FAG Industrial Bearings and Services will be only too pleased to offer bearing selection advice for your particular application.

Should you have any questions regarding this catalog, please contact your local field service representative or
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Industrial Bearings and Services Division

We are specialists in the field of movement: all over the world machines are working with FAG rolling bearings which function with the highest precision, (precise to one thousandth of a millimeter). "Everything that moves us" is a basic principle for our company management. FAG stands for change, innovation and optimization for both its products and services.

The Industrial Bearings and Services Division develops, produces and supplies ball bearings, roller bearings, bearing units, housings, rolling elements, accessories and the Arcanol brand of rolling bearing greases for almost all machines, plants, vehicles and equipment worldwide.

We offer a comprehensive range of services covering mounting and maintenance for the following industry segments:

- Power Transmission & Mechanical Engineering
- Electrical Machinery & High Volume Industries
- Heavy Industries
- Railway & Transport
- Distribution

Quality and price are not the only deciding factors when choosing products. Services, consulting, individual solutions and branch-specific expertise are also important factors when competing in world markets. Manufacturing facilities are located in Germany, USA, Portugal, Korea, China and India. In addition, there are sales and service offices and distributors in more than 100 countries.



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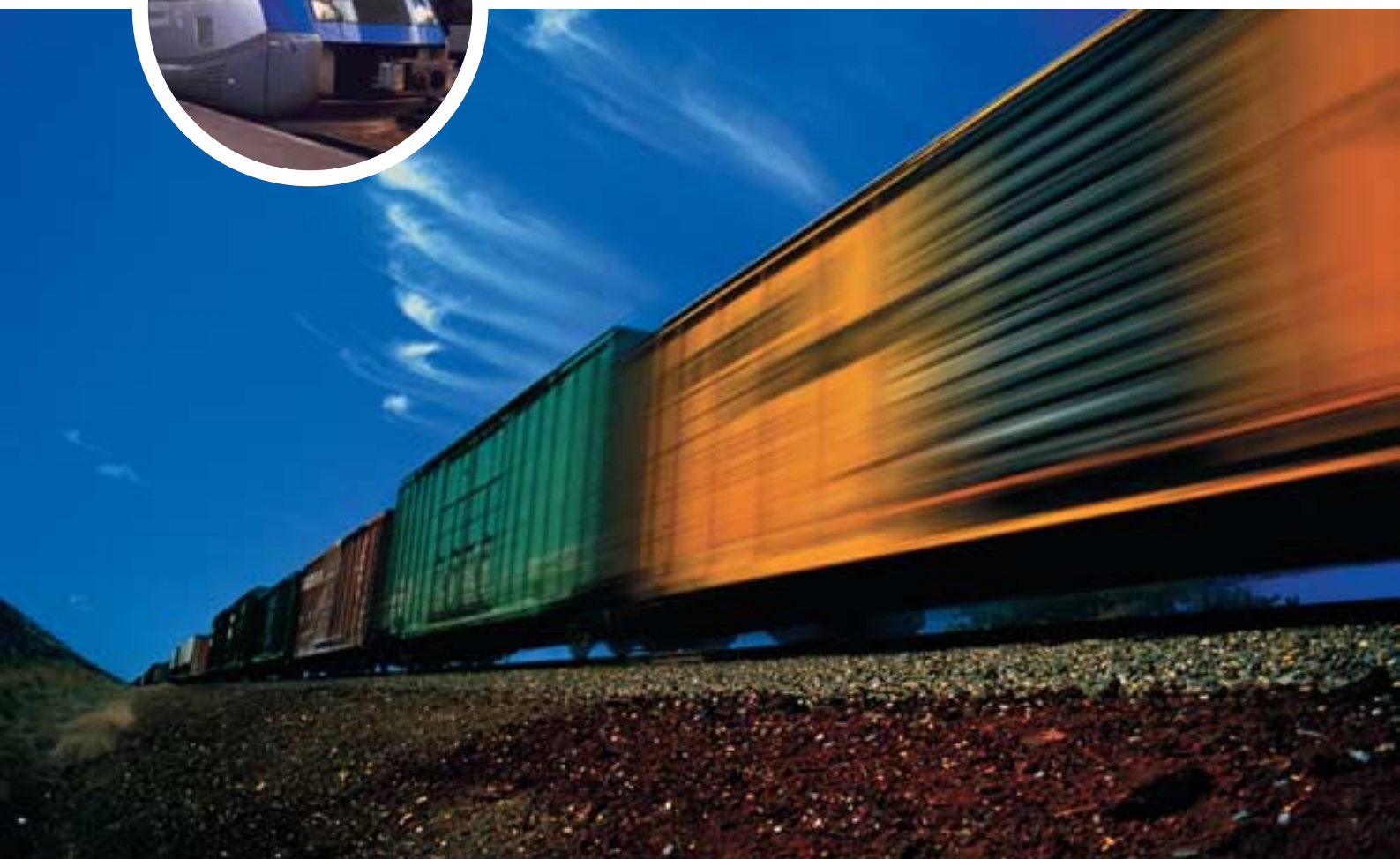


Publications	45
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XTER 73500 for SNCF / Alstom

Cylindrical roller bearings
with polyamide cage



FAG Journal Roller Bearings for Rail Vehicles

Journal Roller Bearings for Extreme Loads

Journal roller bearings are one of the most significant parts ensuring the safety of rail vehicles. They are subject to extreme loads at the interface between journal roller bearing unit and bogie frame and in this case must fulfill a large number of completely different demands. In close co-operation with the manufacturers and operators of rail vehicles FAG develops journal roller bearings precisely for their specific environment. Cylindrical and tapered roller bearings are the primary types used for journal roller bearings.



Cylindrical roller bearings



TAROL tapered roller
bearing units



Spherical roller bearings

FAG Cylindrical Roller Bearings for Journal Roller Bearings

For decades cylindrical roller bearings have proved successful as journal roller bearings of all kinds for both long distance and local rail vehicles. Through research and development, their performance has been adapted to meet the high requirements of modern rail vehicles.

Unlike the other usual types of bearings, for example, TAROL units or spherical roller bearings, using single row cylindrical roller bearings as journal roller bearings offers the advantage of easy dismounting (without tools) of the inner and outer ring with roller cage assembly. Consequently the user is offered a practical advantage as far as mounting, dismounting, maintenance and inspection are concerned. This has a positive impact on life cycle costs.

Cylindrical roller bearings in journal roller bearings are used in two configurations:

- Double row cylindrical roller bearings adjacent to each other (for example WJ + WJP or NJ + NJP)
- One double row cylindrical roller bearing unit installed adjacent to each other on one axle journal

Cylindrical roller bearings with polyamide cage
Munich Underground Train



Cylindrical roller bearings with polyamide cage
Axle box bearings
Tramway



Dresden tramway
Siemens



Munich underground train
Bombardier Transportation

**Cylindrical roller bearings
with polyamide cage
XTER 73500
Diesel multiple unit (DMU)**



**Cylindrical roller bearings
with polyamide cage
ET423
Metro train**



**Cylindrical roller bearings
with polyamide cage
Taurus
Locomotive**



**ET 423 / DB
Metro Train
Bombardier / Alstom**



**XTER 73500 / SNCF
Alstom**



**Taurus / ÖBB
Siemens**

**Cylindrical roller bearings
with polyamide cage**



**Cylindrical roller bearings
with brass cage,
Internal axle bearing arrangement**



**Cylindrical roller bearings
with polyamide cage,
LINT series**



**145 / DB
Bombardier**



**Taurus / Hungary
Siemens**



**Heavy load locomotive
EL2000
Rheinbraun AG
Bombardier**

**Cylindrical roller bearings
with polyamide cage
Y25 bogie up to 25 t axle load
Freight car**



**Cylindrical roller bearings
with polyamide cage
Axle box bearing UIC
Freight car**



**Freight car
AAE Switzerland**

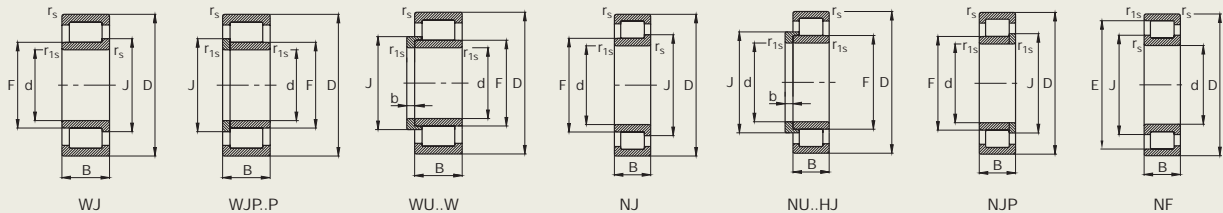


**Freight car
AAE Switzerland**

Single row cylindrical roller bearings

Typical bearing designs for axle journals ranging from 80 to 180 mm.

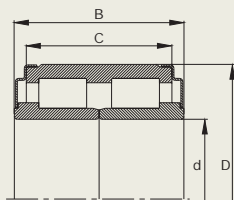
Further designs and dimensions are available on request.

													
Shaft	Dimension							Load rating		FAG code	Type/ Cage	Weight	
	d	D	B	r _s min	r _{1s} min	J	F	b	E				Dyn C
	mm	mm	mm	mm	mm	mm	mm	mm	mm	kN		kg	
80	80	140	42	2	2	101.5	95.3			186	WJ80x140TVP	WJ/TVP	2.37
	80	140	42	2	2	101.5	95.3			186	WJP80x140P.TVP	WJP/TVP	2.48
	80	170	58	2.1	2.1	110.6	101			355	NJ2316E.TVP2.C3.F2.H25	NJ/TVP	5.89
	80	170	58	2.1	2.1	110.6	101			355	NJP2316ED.TVP2.C3.F2.H25	NJP/TVP	5.89
90	90	160	48	2	2	114.25	107			240	574332	NJ/TVP	3.63
	90	160	48	2	2	114.25	107			240	574333	NJP/TVP	3.76
	90	160	52.4	2	2	114.25	107			240	WJ90x160TVP	WJ/TVP	3.84
	90	160	52.4	2	2	114.25	107			240	WJP90x160P.TVP	WJP/TVP	3.96
	90	190	64	3	3	124	113.5			430	NJ2318E.TVP2.C3.F2.H25	NJ/TVP	8.01
	90	190	64	3	3	124	113.5			430	NJP2318ED.TVP2.C3.F2.H25	NJP/TVP	8.01
	100	180	46	2.1	2.1	127.3			163	335	NF2220E.M1.C4.F2	NF/M1	4.77
	100	180	55	2.1	2.1	127.3	119			335	574334	NJ/TVP	5.4
100	100	180	55	2.1	2.1	127.3	119			335	574335	NJP/TVP	5.59
	100	180	60.3	2.1	2.1	127.3	119			335	WJ100x180TVP	WJ/TVP	5.73
	100	180	60.3	2.1	2.1	127.3	119			335	WJP100x180P.TVP	WJP/TVP	5.9
	100	200	67	4	4	132	121.5			390	WJ100x200M	WJ/M	10.3
	100	200	67	4	4	132	121.5			390	WJP100x200P.M	WJP/M	10.3
	100	200	67	4	4	132	121.5	13		390	WU100x200W.M	WU/M	10.78
	100	215	73	3	3	139.6	127.5			570	NJ2320E.TVP2.C4.F2.H25	NJ/TVP	12
	100	215	73	3	3	139.6	127.5			570	NJP2320ED.TVP2.C4.F2.H25	NJP/TVP	12
	110	180	55	2	2	132.9			165	280	577935	NF/M1	4.95
	110	200	53	2.1	2.1	141.6			180.5	380	NF2222E.M1.C4.F2	NF/M1	6.68
	110	215	73	4	4	147	135.5			455	WJ110x215M1	WJ/M1	12.5
	110	215	73	4	4	147	135.5			455	WJP110x215P.M1	WJP/M1	12.5
110	215	73	4	4	147	135.5	13		455	WU110x215W.M1	WU/M1	12.5	
120	120	180	44	2	1.1	140.4	134		166	245	804970	NF/M1	3.9
	120	215	58	2.1	2.1	153.5			195.5	450	NF2224E.M1.C4.F2	NF/M1	8.29
	120	215	73	3	3	150.8	140.5			520	WJ120x215TVP	WJ/TVP	10.4
	120	215	73	3	3	150.8	140.5			520	WJP120x215P.TVP	WJP/TVP	10.4
	120	240	80	4	4	161	150			560	WJ120x240M1	WJ/ M1 o. TVP	17.9
	120	240	80	4	4	161	150			560	WJP120x240P.M1	WJP/M1 o. TVP	17.9
	120	240	80	4	4	161	150	14		560	WU120x240W.M1	WU/M1	18.63
	130	220	62	4	4	160.15	150			465	579021	NJP/TVP	8.85
130	130	220	62	4	4	160.15	150			465	579020	NJ/TVP	8.85
	130	220	73	3	3	160.35	151			500	514494*	NJP/TVP o. M1	10.7
	130	220	73	3	3	160.35	151			500	514493*	NJ/TVP o. M1	10.7
	130	240	80	4	4	167.5	157			540	WJ130x240*	WJ/TVP o. M1	16.8
	130	240	80	4	4	167.5	157			540	WJP130x240P.*	WJP/TVP o. M1	16.8
	130	250	80	2	1.1	170.4	158			600	581171A	NJ/TVP	16.6
	130	250	80	2	1.1	170.4	158			600	581172A	NJP/TVP	16.6
	130	260	86	4/10	4	178	164			695	WJ130x260M1	WJ/M1	22.6
	130	260	86	4	4	178	164			695	WJP130x260P.M1	WJP/M1	22.6
	130	260	86	4	4	178	164	14		695	WU130x260W.M1	WU/M1	23.53
	150	250	60	2	1.5	184.7	174			520	801086	NJ/M1	12.5
	150	250	60	2	1.5	184.7	174			520	801087	NJP/M1	12.5
150	150	270	73	3	3	193.7	182			655	NJ2230E.M1.C4.F2	NJ/M1	19.2
	150	270	73	3	3	193.7	182	12		655	NU2230E.M1.C4.F2 + HJ2230E.F2	NU/M1	19.2
	150	300	102	5/10	5	203	188			865	WJ150x300M1	WJ/M1	35.8
	150	300	102	5	5	203	188			865	WJP150x300P.M1	WJP/M1	35.8
160	160	290	80	3	3		193			800	NU2232E.M1.C4.F2	NU / M1	23.5
	160	290	80	3	3	206.8	193			800	NJ2232E.M1.C4.F2	NJ / M1	23.5
180	180	320	86	4	4		215			1000	NU2236E.M1.C4.F2	NU / M1	30.9
	180	320	86	4	4	228.9	215			1000	NJ2236E.M1.C4.F2	NJ / M1	30.9
	180	340	100	4	4		220			1000	WU180x340M1	WU / M1	42.8
	180	340	100	4	4		220	15		1000	WU180x340W.M1	WU...W / M1	45.7
	180	340	100	4	4	235.35	222			1000	WJ180x340M1	WJ / M1	43.7

Double row cylindrical roller bearing units

Double row cylindrical roller bearing units have an integrated seal, are pre-greased and supplied as a ready-to-fit cartridge.

The dismantling of the cartridge is only possible by removing the seals. Other designs and dimensions available on request.



Shaft	Size		B mm	C mm	Load rating Dyn. C kN	FAG code	Cage	Seal	Weight kg
	d mm	D mm							
100	100	180	120.6	124.6	575	804630	TVP	Sheet cap	12.1
120	120	215	146	146	520	807081	TVP	Sheet cap	21.5
130	130	220	160	160	800	803419	TVP	Sheet cap	22
	130	220	160	160	1000	803417A	TVP	Sheet cap	24
	130	240	160	164	925	804315	TVP	Sheet cap	15.1
160	160	270	170	150	1080	801804	TVP	Sheet cap	37
180	180	280	145	145	750	803870	TVP	Sheet cap	28
+ rubber lip									

Cage versions

*	Versions available with TVP or M1
TVP	polyamide cage
M	solid brass cage (steel riveted)
M1	solid brass cage (cross piece riveted)

Prefixes

W...	with special bearing cross section, deviating from standard bearing
N...	further specified standard bearing for rail vehicle applications
NF	special design for internal axle bearing arrangement, only one shoulder on the outer ring to allow bearing inspection without dismantling the wheel

FAG TAROL Tapered Roller Bearing Units

TAROL tapered roller bearing units are double row tapered roller bearings that are clearance adjusted, greased and sealed in the factory. Thus TAROL units are ready for mounting and “cold”-fitted onto the shaft journal by a hydraulic press. Individual parts, spare parts and housing adapters are available on request.

TAROL units are used for journal roller bearings for freight cars, passenger cars, locomotives, drive cars, suburban trains and underground trains. They can be installed quickly and without any difficulty: the bearing is press-fitted onto the axle journal in a single operation and the end cap is fastened by a locking plate. The necessary axial clearance is provided by press-fitting the unit onto an axle journal with a diameter within the stipulated tolerances.

As standard TAROL units are lubricated with grease tested in service, provisions can be made for re-greasing. FAG supplies TAROL units to order with re-greasing holes in the end cap or in the outer ring. The re-greasing holes in the end caps are provided with a plug screw or grease nipple. Re-greasing intervals are determined according to the respective application.

FAG delivers TAROL units in inch and metric sizes for all standardised rail vehicle shaft journal diameters.



Cap screw

End cap

Locking plate

Backing ring with lamellar rings

Rolling highway

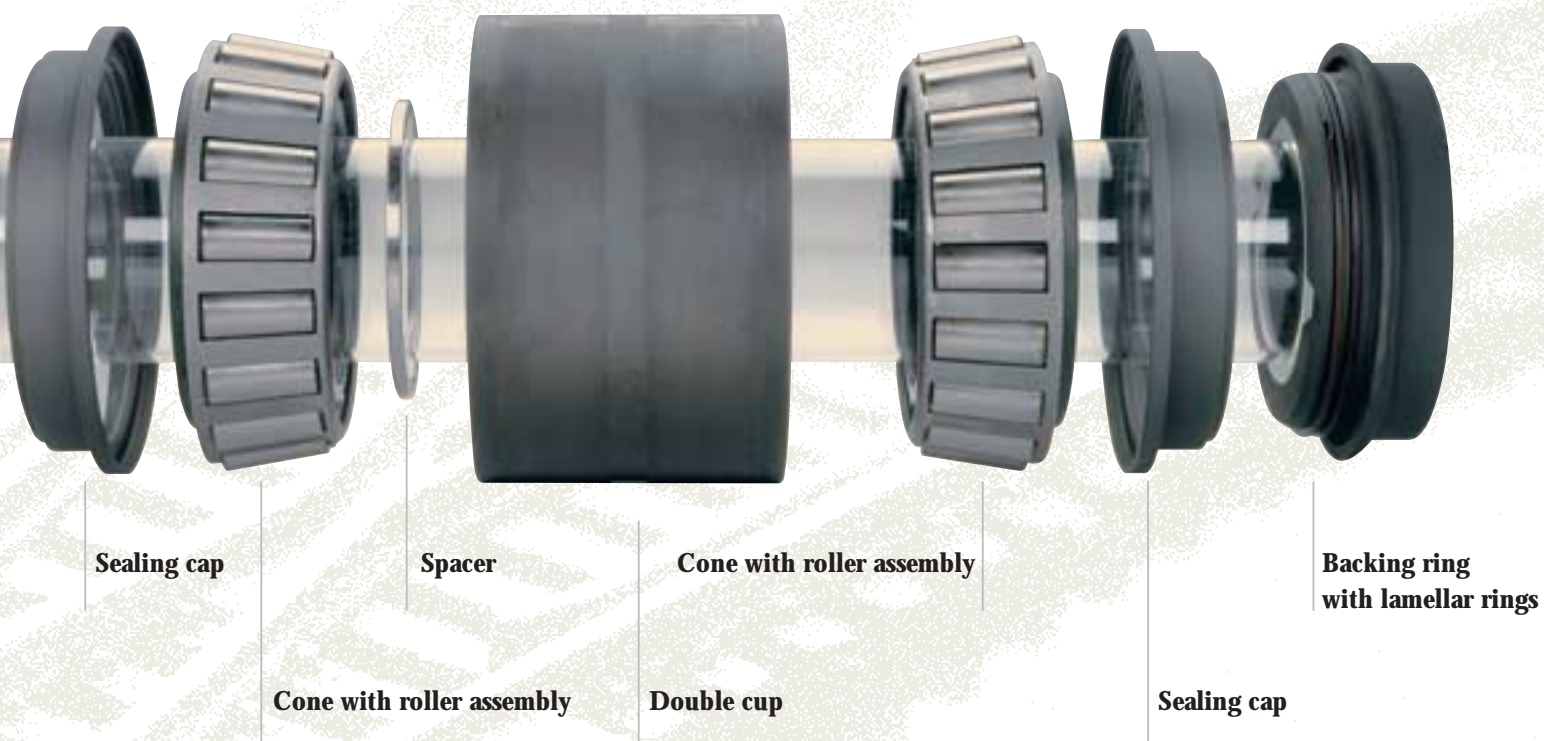


Hamersley Iron
GE, Australia



New Jersey Transit
City Rail, USA

Various parts of a TAROL unit with lamellar rings



**Acela
Bombardier and
Alstom, U.S.A.**



**Tapered roller bearing units
Passenger car**

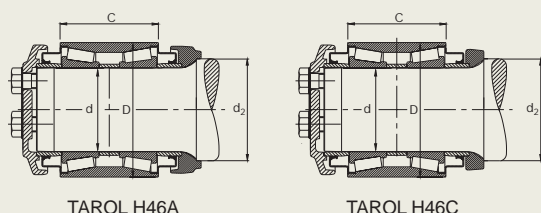


**TAROL unit
High speed trains**



**Type according to AAR Specification
(Association of American Railroads)
in inch dimensions**

Design D, E, F, G in accordance with
AAR Standard, M -934-01/AAR Approval
26. The bearings below are continually
modified to AAR specifications. An AAR
approved grease is used for lubrication.



Version / size	Dimension bearing d	D	B	Shaft d	d ₂	Load rating ABEC/RBEC C1	Load rating DIN ISO 281 C	Max. load shaft	Weight TAROL- unit	Cage design
	inch mm	inch mm	inch mm	inch mm	inch mm	kN	kN	lbs kN	lbs kg	
B 4 1/4 x 8	4	6.5	4.5	4.004	5	106000	415	24000	40	JP
	101.6	165.1	114.3	101.702	127	475		107	18.1	JP
C 5 x 9	4.6875	7.6875	5.63	4.6915	5.875	146000	560	33500	67	JP
	119.063	195.263	142.9	119.164	149.22	655		149	30.4	JP
D 5 1/2 x 10	5.187	8.1875	6	5.1915	6.375	160000	620	42000	60.4	JP
	131.75	207.963	152.4	131.864	162	720		187	27.4	JP
E 6 x 11	5.687	8.6875	6.44	5.6915	7.030/ 7.032	170000	655	52500	74.3	JP
	144.45	220.663	163.5	144.564	178.562/ 178.613	750		234	33.7	JP
F 6 1/2 x 12	6.187	9.9375	7.25	6.1915	7.530/ 7.532	232000	900	63000	111.9	JP
	157.143	252.413	184.2	157.264	191.262/ 191.313	1040		280	50.7	JP
G 7 x 12	6.9995	10.875	7.31	7.004	8.000/ 8.002	265000	1020	76000	137.8	JP
	177.787	276.23	185.7	177.902	203.200/ 203.251	1180		338	62.5	JP
GG 6 1/2	6.4995	11.878	7.75	6.504	7.905/ 7.906	300000	1320		172	JP
	165.087	301.7	196.9	165.201	200.79/ 200.81	1530			78	JP
GG 6 7/8	6.8745	11.878	7.75	6.879	7.870/ 7.873	300000	1320		163.2	JP
	174.612	301.7	196.9	174.727	199.90/ 199.974	1530			74	JP

Version

Order designation

Suffixes stand for:

B 4 1/4 x 8
C 5 x 9
D 5 1/2 x 10
E 6 x 11
F 6 1/2 x 12
G 7 x 12
GG 6 1/2
GG 6 7/8

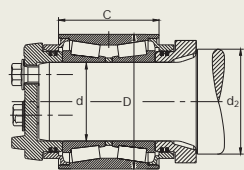
TAROL.4.1/4x8.U.E34*.H46C
TAROL.5x9.U.E34*.H46C
TAROL.5.1/2x10.U.E34*.H46C
TAROL.6x11.U.E34*.H46A
TAROL.6.1/2x12.U.E34*.H46A
TAROL.7x12.U.E34*.H46A
TAROL.GG.6.1/2.U.581100.E34*
TAROL.GG.6.7/8.U.581101.E34*

U complete unit
E34 type of packaging
* A = individual packaging
D = pallet packaging (US Standard)
H46C end cap (NFL) without relubrication facility with collar, supporting ring without collar
H46A end cap (NFL) without relubrication facility with collar, supporting ring with collar and centered on axle journal collar

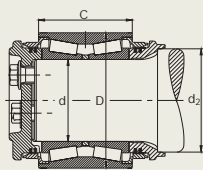
Types for the UIC area (Union Internationale des Chemins de Fer, Paris), in metric dimensions

These are, to some extent, inch designs which have been adapted to meet the requirements in the European area as well as new designs which are largely based on UIC standards. FAG Arcanol L42 grease is used as standard.

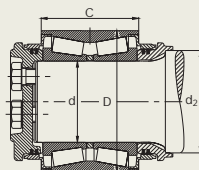
The bearings shown below are only a small representation of the range of products as far as connection parts are concerned. Connecting parts and seals can be tailored to meet customer-specific requirements.



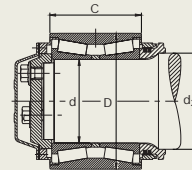
TAROL 90/154



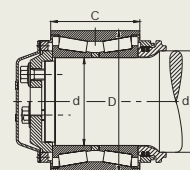
TAROL 100/165



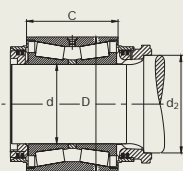
TAROL 100/175



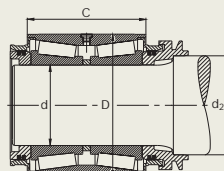
TAROL 120/195



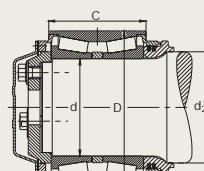
TAROL 130/210



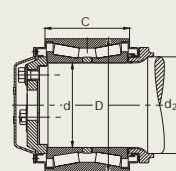
TAROL 130/220



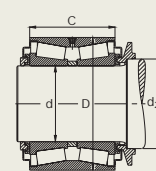
TAROL 130/230



TAROL 140/220



TAROL 150/250



TAROL 160/280

Size and order designation	Dimension bearing			Shaft		Load rating DIN ISO 281 C	Load rating ABEC/RBEC C1	Weight TAROL-unit kg	Cage design
	d	D	B	d	d ₂				
	mm	mm	mm	mm	mm	kN	kN	kg	
TAROL90/154.572103B.E34*	90	154	115	90 n6	120	390	450	15	TVP
TAROL100/165.517874.E34*	100	165	114.3	100 n6 (p6)	126 k8	415	475	13.9	JP
TAROL100/175.578693.E34*	100	175	120	100 n6 (p6)	126 k8	510	585	18.5	TVP
TAROL120/195.517905B.E34*	120	195	131.4	120 p6	138 t7	560	655	19	TVP (JP)
TAROL130/210.517906.E34*	130	210	132	130 p6	150 t7	620	720	22	JP
TAROL130/220.800050.E34*	130	220	150	130 p6	160 t7	780	900	25.6	TVP
TAROL130/230.577997D.E34*	130	230	160	130 p6	160 t7	850	965	33.7	TVP (JP)
TAROL140/220.517907.E34*	140	220	140	140 p6	160 t7	655	750	27	JP
TAROL150/250.803295.E34*	150	250	160	150 p6	170 t7	900	1040	40	TVP (JP)
TAROL160/280.804595.E34*	160	280	180	160 p6	189 k6	1270	1460	50.5	TVP

Cage version:

TVP polyamide cage
JP sheet metal cage
(...) alternative version in brackets

Suffixes stand for:

E34 type of packaging
* A = individually packed
B = FAG standard pallet packaging

FAG Spherical Roller Bearings for Journal Roller Bearings

FAG supplies spherical roller bearings for journal roller bearing arrangements with fixed inner ring shoulder and machined brass or sheet steel cage.

Advantage: When using a spherical roller bearing, the axle bending is compensated for without creating additional forces. Spherical bearings are used as axle box bearings for freight cars, locomotives and other rolling stock.

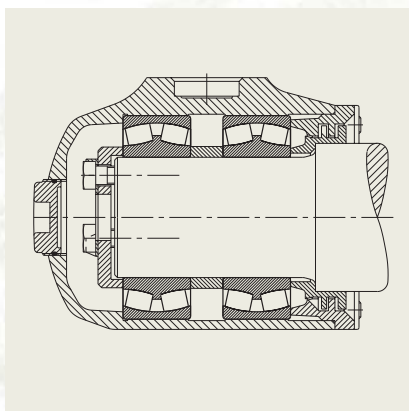
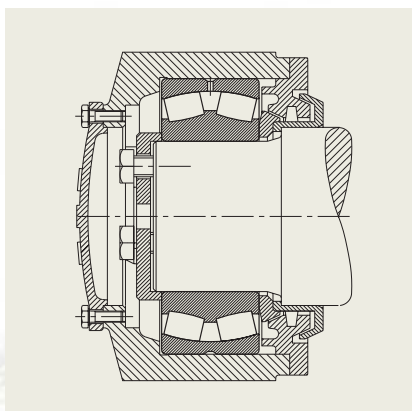
**Spherical roller bearing
Locomotive**



**Spherical roller bearing
Freight car to UIC specifications**



FAG spherical roller bearing 502472AA with $d = 130$ mm, $D = 220$ mm, $B = 73$ mm, $r_s = 3$ mm with a dynamic bearing load $C = 548$ kN and 12.5 kg in weight.




Dresden tram / Siemens

Cylindrical roller bearings for journal roller bearing arrangements


FAG Axle Box Bearings, Adapters and Polyamide Cages
BEM Calculation and Lightweight Construction in Rail Vehicles

FAG journal roller bearing housings and adapters are safety components: Safe construction with respect to operational strength is ensured by using BEM (Boundary Element Method) in designing bearing components. By using aluminium as the housing material the weight of the vehicle is kept low for metropolitan vehicles. The top speed can be reached faster on short line sections, making a significant contribution to energy saving. As an innovator, FAG has been using aluminium as a housing material since the 1950's.



Journal roller bearing housings



Adapters



Polyamide cages



FAG Journal Roller Bearing Housings and Adapters

FAG supplies housings and adapters made of spheroidal cast iron, cast light alloy and, in special cases, cast steel.

The design of the housing is adapted individually to the connecting design and the optimal design is ensured by BEM calculations.

**Journal roller bearing housing
Tram axle boxes**



**Journal roller bearing housing
Passenger car axle boxes**



**Journal roller bearing housing
Freight car axle boxes**



**Closed adapter
(special version)**



**Split adapter
(special version)**



**AAR adapter
(standard adapter)**

FAG Polyamide Cages

FAG also supplies cylindrical and tapered roller bearings with glass-fiber reinforced polyamide cages.

The advantage of these cages are: low weight, increased grease life and very good dry running properties. Another advantage is experienced in the maintenance of the bearings.

A single roller can be removed to check the raceway without destroying the cage. Polyamide cages are also supplied as single parts.

Cylindrical roller bearings with polyamide cage



Tapered roller bearing unit with polyamide cage







**ICE 3rd generation for DB /
Voith and Bombardier**
Transmission bearings



FAG Bearings in Transmissions and Traction Motors

Covering Distances Quickly and Safely

A speed of 330 km/h (205 mph) is reached quickly and safely in every day service by the ICE 3 and other high speed trains. The loads and stresses occurring in such applications place high demands on all components. FAG develops and produces rolling bearings specially for rail vehicle gearboxes and traction motors. All types of ball and roller bearings are fitted in rail vehicle gearboxes to guide the shafts. In traction motors, cylindrical roller bearings are used on the pinion end and cylindrical or deep groove ball bearings on the locating bearing end.

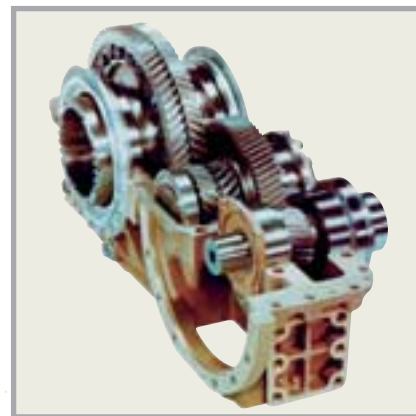
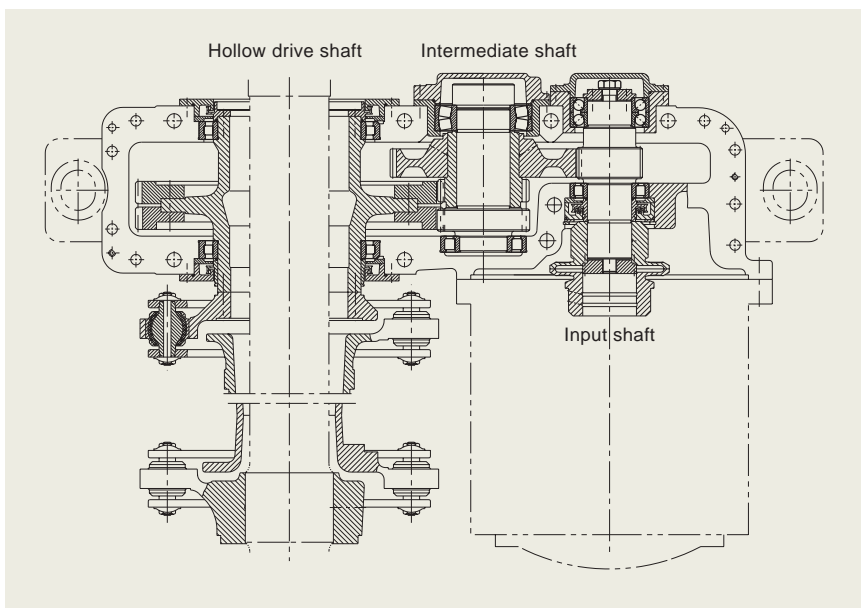
FAG Transmission Bearings

Cylindrical roller bearings, four-point bearings, angular contact ball bearings, deep groove ball bearings, tapered roller

bearings and spherical roller bearings are fitted in mechanical and hydraulic gearboxes to guide the shafts.

You can see the large selection of FAG transmission bearings for shaft diameters ranging from 10 to 400 mm in the table on pages 26-27.

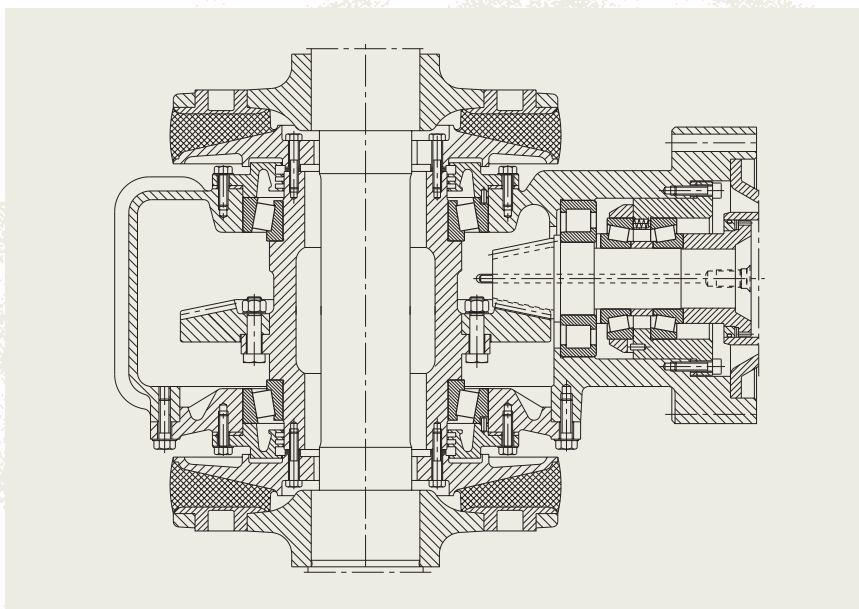
Spur transmission for underground railway



**Spur gear transmission
Hamburger Hochbahn
ZF Bahntechnik**

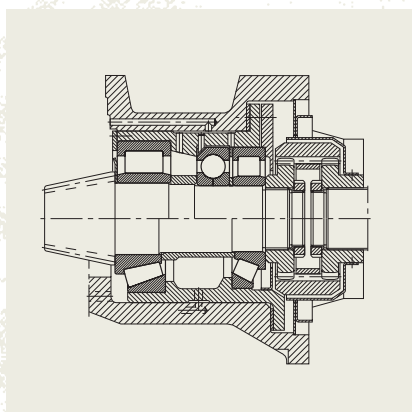
The objective for modern suburban trains is to provide a high degree of travelling comfort, low noise and high efficiency. These requirements are fulfilled by a new compact drive package which is spring supported in the bogie.

In the case of the so-called two axle longitudinal drives for underground and city trains, the traction motor is arranged lengthwise in the bogie. A bevel gearbox is flange-mounted onto both sides of the motor face. The drive unit is fastened to the bogie frame and spring mounted on the axle boxes.

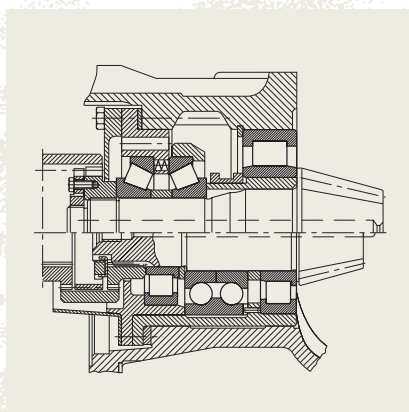


Bevel gear transmission for underground and metro trains

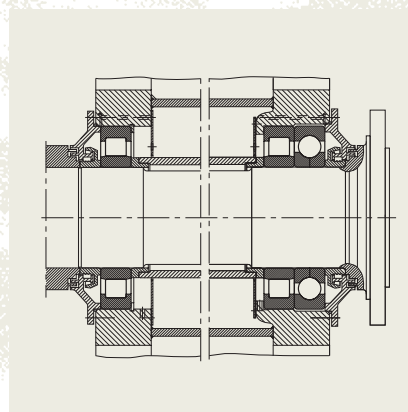
Pinion shaft with two cylindrical roller bearings and one four-point bearing or two tapered roller bearings.



Pinion shaft with tapered roller bearings (O arrangement) and one cylindrical roller bearing or with two cylindrical roller bearings and one double row angular contact ball bearing.



Gearbox shaft with two cylindrical roller bearings and one four-point bearing.



**Hamburger Hochbahn
ZF Bahntechnik**

**Dresden tramway
Flender**



**New Jersey Transit
USA, Metro Train
Voith**



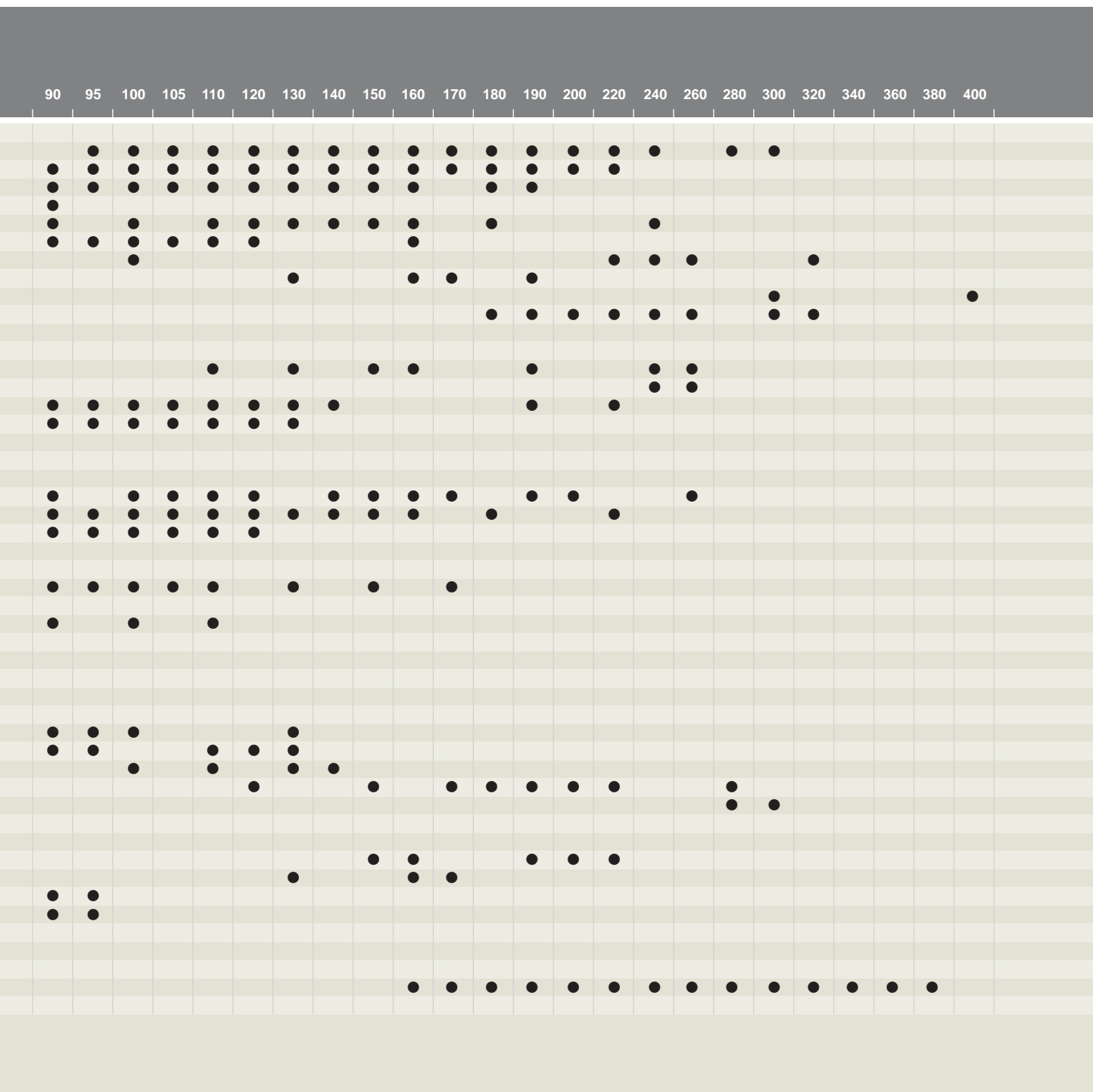
**ICE 3rd generation
Voith / Bombardier**



FAG bearing types and versions for rail vehicle transmissions

Bearing type and design	Bore																		
	d																		
	mm	10	12	15	17	20	25	30	35	40	45	50	55	60	65	70	75	80	85
Cylindrical roller bearings																			
NU,NJ,NJP 10..N/M1,M1A,MPA,HPA/C3,C4/F59																			
NU,NJ 2..E/N/M1,M1A,MPA/C3,C4/F59																			
NU,NJ 3..E/N/M1,M1A,MPA/C3,C4/F59																			
NU 4..MA,M1A/C3/F59																			
NU,NJ 22..E/N/M1A,MPA/C3,C4/F59																			
NU,NJ 23..E/N/M1A,MPA/C3,C4/F59																			
NU,NJ 19..E/M1A,MPA/C3,C4																			
NU 20..E/M1A/C3																			
NU 18..MA,MPA/C3/P63																			
NU,NP 29..A/F,M,MPA/C3,C4/F59																			
Deep groove ball bearings																			
60..N/MA/C3,C4/F59																			
160..MA/C3,C4/F59																			
62..N,N2/MA/C3,C4/F59																			
63..N/MA/C3,C4/F59																			
64..MA/C3,C4/F59																			
Four-point bearings																			
QJ 10..N2/MPA/C3,C4/F59																			
QJ 2..N2,N5/MPA/C3,C4/F59																			
QJ 3..N2,N5/MPA/C3,C4/F59																			
Angular contact ball bearings																			
72..B/MP/F59/UA																			
73..B/MP/F59/UA																			
33..DA/MA/C3																			
Self-aligning ball bearings																			
23..M/C4/F59																			
Spherical roller bearings																			
222..EAS/M/CN,C3,C4/F59																			
223..EAS/M/CN,C3/F59																			
232..EAS/M/C3/P63																			
230..B/MB/C3/A/MB/780164/H40																			
239..MB/C3																			
Tapered roller bearings																			
320..X/M/BL																			
302..A/BL																			
313..F22																			
T7 FC..F22																			
323..B																			
Special bearings, mainly in inch dimensions																			
500000, 800000																			
F59: Special regulations for turbo transmission bearings, 780164: Special regulations for spherical roller bearings in suspension tube bearing arrangements																			

F59: Special regulations for turbo transmission bearings, 780164: Special regulations for spherical roller bearings in suspension tube bearing arrangements



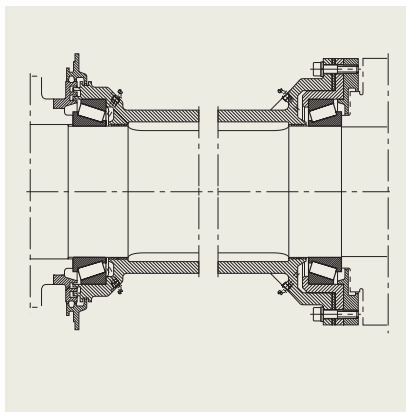
FAG Drive Bearing Arrangements

FAG roller bearings are used in all drive systems of rail vehicles.

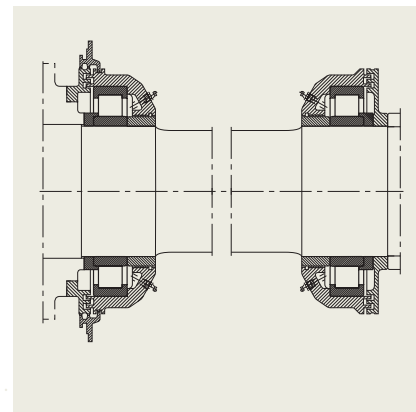
Suspension tube roller bearings are installed in electrical freight train locomotives to support the traction motor arranged transverse to the direction of travel. The motor is mounted directly on the wheel axle on two bearing elements, the so-called suspension points.

FAG roller bearings are also found in hollow cardan shaft drives for 3-phase locomotives and in support and guide rollers, wheels and auxiliary units.

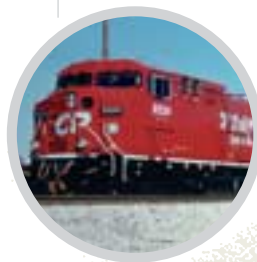
Suspension tube bearing arrangement with two tapered roller bearings



Suspension tube bearing arrangement with two cylindrical roller bearings



**CP Rail
GE Canada**



**Hamersley Iron
GE Australia**



**Dresden tramway
Flender**

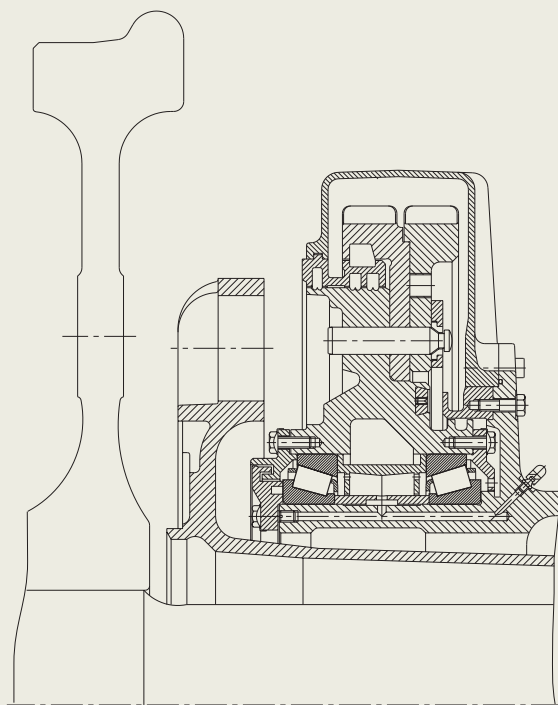
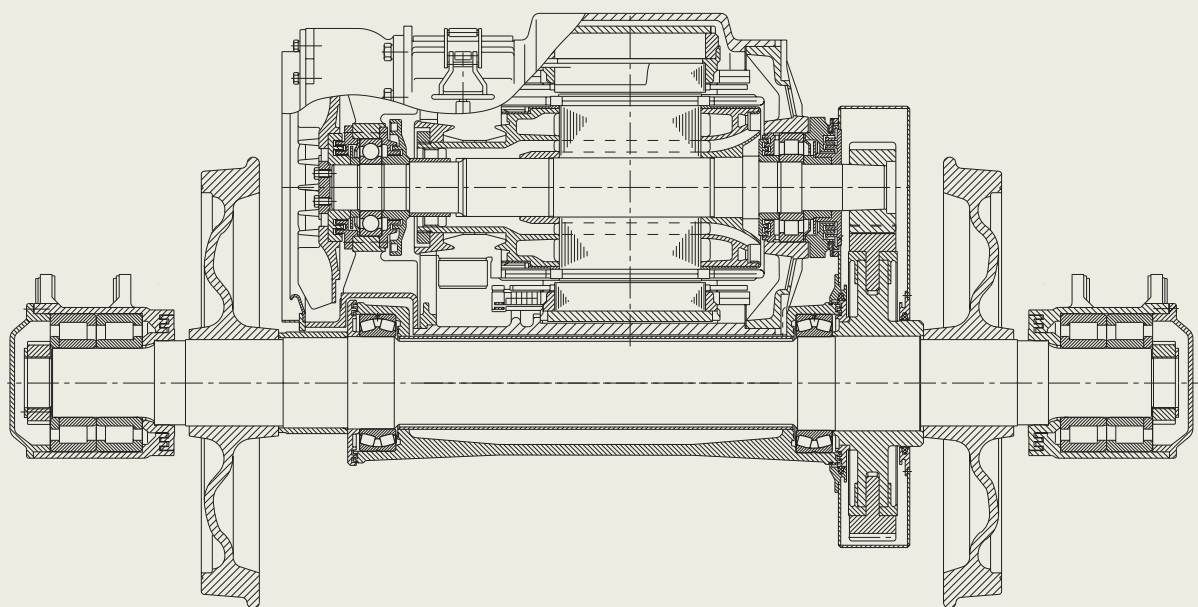


**Hamburger Hochbahn
ZF Bahntechnik**



**Hamburger Hochbahn
ZF Bahntechnik (detail)**

Bogie for electric drive car: cylindrical roller bearing (wheel set, motor), deep groove ball bearing (motor), spherical roller bearing (suspension tube bearing arrangement).



Bull gear bearing of a hollow cardan shaft drive for DB 3-phase locomotive, Series 120.

Bearing unit, comprised of 2 tapered roller bearings joined by spacers.

Suspension tube roller bearings for rail vehicles

High load roller bearings are selected to achieve a long service life for suspension tubes (nominal service life of approx. 2 million km, depending on operational conditions).

High loads and stresses due to vibration and shock are absorbed by special tapered roller bearings with reinforced sheet metal cages.

FAG bearing type	Dimension				Load rating dyn. C kN	Remarks
	d mm	D	T	B		
536326	189.738	279.400	52.388	57.150	455	
536325	190.475	279.400	52.388	57.150	455	
566565	198.298	279.400	46.038	49.212	355	
566566	199.949	282.575	46.038	49.212	355	
548100	200.025	276.225	42.863	46.038	340	
548101	203.987	276.225	42.863	46.038	340	
548101B	203.987	276.225	42.863	46.038	340	case-hardened steel
527100	200.025	292.100	57.945	61.913	480	
547285	200.812	292.100	57.945	61.913	480	
530994	216.408	285.750	46.038	49.213	365	
530995	216.713	285.750	46.038	49.213	365	
801812	220.000	285.000	41.000	40.000	365	case-hardened steel
801813	223.175	300.000	50.000	48.000	455	case-hardened steel
522416	230.188	317.500	47.625	52.388	455	
522417	231.775	317.500	47.625	52.388	455	
525862	231.775	336.550	65.088	69.850	640	
578361	234.950	314.325	49.212	49.212	455	
801376	237.330	336.550	65.088	69.850	640	
578072	240.000	360.000	76.000	76.000	830	
578073	241.000	360.000	76.000	76.000	830	
574019A	254.000	324.925	39.000	41.500	325	
574019B	254.000	324.925	39.000	41.500	325	case-hardened steel
546556	254.000	358.775	71.438	71.438	695	
547734	255.600	342.900	57.150	63.500	510	
547734A	255.600	342.900	57.150	63.500	510	case-hardened steel
547733	257.175	358.775	71.438	76.200	720	
547733A	257.175	358.775	71.438	76.200	720	case-hardened steel
546569	257.175	342.900	57.150	63.500	510	

Listed suspension tube roller bearings of tapered roller bearing type

Special dimensions to order

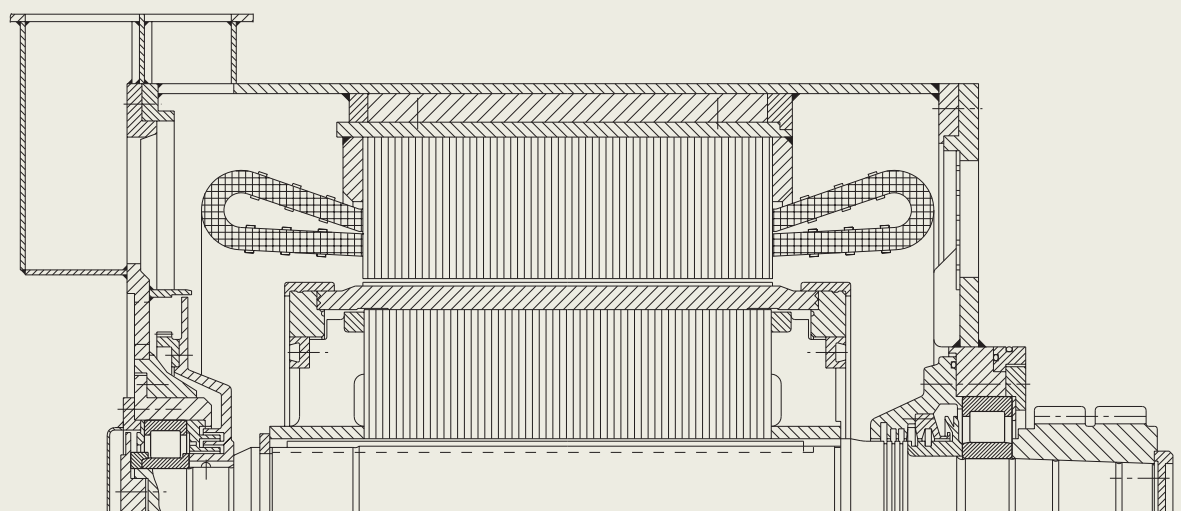
d Bore diameter
D Outer diameter
T Construction height
B Inner ring width

FAG Traction Motor Bearings

In the majority of cases traction motors have the following bearings:

- Pinion end; type NU, narrow series, cylindrical roller bearing
- Locating bearing end; type NJ cylindrical roller bearing with HJ angle ring, type NUP cylindrical roller bearing or deep groove ball bearing

Example of a standard traction motor of the DB Universal Locomotive E120 used for freight and passenger rail cars, which runs at speeds of up to 200 km/h (125 mph).



Common sizes of bearings for traction motors of European manufacturers

Roller bearings in US traction motors

Bore d mm	NU10	NU NJ NUP2	NU NJ NUP3	62..	63..
30					
35					
40			●		
45			●		
50			●		
55			●		
60		●	●		●
65		●	●		●
70		●	●		●
75		●	●	●	●
80		●	●	●	●
85		●	●	●	●
90		●	●	●	●
95		●	●	●	●
100		●	●	●	●
110		●	●	●	●
120		●	●	●	●
130	●	●	●	●	●
140	●	●	●	●	●
150	●	●	●	●	●
160	●	●	●		●
170	●	●	●		●
180	●	●	●		●
190	●	●	●		●
200	●	●			
220	●				
240	●				

Manufacturer	Motor number	Pinion end FAG code	Commutator end
General Electric	GE-716	558826D	NJ318E.M1.F1.T51F
	GE-720	558826D	NJ318E.M1.F1.T51F
	GE-723	NU322E.M1.F1.T51F	NJ317E.M1.F1.T51F
	GE-726	558830C	558320C
	GE-730	558830C	558320C
	GE-731	558826D	NJ318E.M1.F1.T51F
	GE-733	NU412M1.F1.T51F	6212ZR
	GE-741	NU412M1.F1.T51F	6212ZR
	GE-746	558830C	558320C
	GE-748	NU418M1.F1.T51F	6313.C3
	GE-752	558830C	6320.R114.139
	GE-754	558826D	NJ318E.M1.F1.T51F
	GE-755	558830C	558320C
	GE-756	NU322M1.F1.T51F	6316.C3
	GE-761	558826D	6318.R66.84
	GE-792A	NU324E.M1.F1.T51F	6318.R66.84
	GE-793A	558540D	6318.R66.84
	GE-1204	6313ZR.C3	6309ZR.C3
	GE-1213	6313ZR.C3	6310ZR.C3
	GE-1240	NU314E.M1.F1.T51F	6312.C3
	GEB-13	N2236E.807603.R460.490	6418M.R114.139.J20A.T36
	GEB-15	558830AD	6320.R114.139
	HM-833	NU322E.M1.F1.T51F	NJ317E.M1.F1.T51F
	HM-838	NU320E.M1.F1.T51F	NJ316E.M1.F1.T51F
	HM-846	NU316E.M1.F1.T51F	NJ312E.M1.F1.T51F
Westinghouse	WE-362-D	558826D	NJ318E.M1.F1.T51F
	WE-362-DZ	NU328E.M1.F1.T51F	NJ322E.M1.F1.T51F
	WE-370	NU328E.M1.F1.T51F	NJ318E.M1.F1.T51F
	WE-370-DEZ	NU328E.M1.F1.T51F	NJ318E.M1.F1.T51F
	WE-561	NU324E.M1.F1.T51F	NJ314E.M1.F1.T51F
	WE-563	NU322E.M1.F1.T51F	NJ312E.M1.F1.T51F
	WE-776	NU328E.M1.F1.T51F	NJ318E.M1.F1.T51F
	WE-970	NU322E.M1.F1.T51F	NJ314E.M1.F1.T51F
Electro Motive	WE-974	NU322E.M1.F1.T51F	NJ312E.M1.F1.T51F
	D7-77	558540D	558320C

Suffixes:

E = Max. Capacity Design
F1 = Traction motor bearing according to DIN 43283
M = Solid brass cage steel riveted
M1 = Solid brass cage, cross piece riveted
C3/C4 = Larger than normal radial clearance
J20A = Current insulated (thick layer)
J20B = Current insulated (thin layer)
T51F = Bearing for US traction motors

Example for ordering:

Fixed bearing
NJ318E.M1.F1.T51F with
HJ318E.F1

Floating bearing
NU328E.M1.F1.T51F

Hammersley Iron,
General Electric
Traction motor bearings



FAG Mounting, Maintenance and Lubrication

A Complete Program for Maintenance and Servicing

Care and cleanliness during mounting, suitable mounting and dismantling tools, and appropriate maintenance devices are the basis for long service life. The devices include, for example: induction heating devices, special pullers or modern high pressure pumps for hydraulic processes. Specially developed rolling bearing grease keeps our bearings running efficiently over long periods of time.



Tools for mounting
and dismantling



Mounting accessories



Arcanol rolling
bearing greases



FAG Tools for Mounting and Dismounting

Various tools adapted to the requirements are available for mounting, dismounting and maintenance of rolling bearings on railway vehicles.

You will find further equipment and services for the mounting and maintenance of rolling bearings in our complete programme catalogue FAG-Publ. No. WL 80 250.

These products can be obtained through FAG Industrial Services GmbH or your local FAG field representative:
Tel: +49 (0) 24 07 / 91 49 - 0,
Fax: +49 (0) 24 07 / 91 49 - 59,
E-mail support@fis-services.de

Mounting and dismounting of cylindrical roller bearings

Low voltage induction coils are suitable for easy, quick mounting and dismounting of cylindrical roller bearing inner rings.
(See also FAG Publ. No. WL 80 107)

Water-cooled design for serial assembly



Unit as illustrated on the left, but without water cooling



FAG induction heating devices ensure fast, clean, safe mounting. They are particularly suitable for heating of bearing inner rings. The device offers temperature hold, temperature control and time control modes. For bearings with a smaller diameter additional accessories are available.



AWG 13, for workpieces with min. 115 mm bore, width max. 330 mm, weight max. 200 kg
(Order Ref.: AWG13)



AWG 8, for workpieces with min. 100 mm bore, width max. 210 mm, weight max. 100 kg
(Order Ref.: AWG8)

Mounting and dismounting of TAROL units

Mounting and dismounting equipment and tools for FAG TAROL tapered roller bearing units. Suitable also for permanent sealed cylindrical roller bearing units.



Mobile hydraulic unit for TAROL assembly (see also FAG Publ. No. WL 80 250, Order Ref.: MHU.TAROL)



Tool set and tool for mounting and dismounting TAROL units of different sizes (see following table for Order Ref.)

Mounting tools for FAG TAROL units in metric dimensions

TAROL design	Mounting unit (tool set)	Mounting and dismounting tool for sealing caps	Grease cover
TAROL 90/154.572103B	MDE.TAROL.572103B	SCT.TAROL.572103B	GC.TAROL.572103B
TAROL 100/165.517874	MDE.TAROL.517874	SCT.TAROL.517874	GC.TAROL.517874
TAROL 100/175.578693	MDE.TAROL.578693	SCT.TAROL.578693	GC.TAROL.578693
TAROL 120/195.517905B	MDE.TAROL.517905B	SCT.TAROL.517905B	GC.TAROL.517905B
TAROL 130/210.517906	MDE.TAROL.517906	SCT.TAROL.517906	GC.TAROL.517906
TAROL 130/220.800050	MDE.TAROL.800050	SCT.TAROL.800050	GC.TAROL.800050
TAROL 130/230.577997D	MDE.TAROL.577997D	SCT.TAROL.577997D	GC.TAROL.577997D
TAROL 140/220.517907	MDE.TAROL.517907	SCT.TAROL.517907	GC.TAROL.517907
TAROL 150/250.803285	MDE.TAROL.803285	SCT.TAROL.803285	GC.TAROL.803285
TAROL 160/280.804595	MDE.TAROL.804595	SCT.TAROL.804595	GC.TAROL.804595

Tools for other sizes on request.

Mounting tools for FAG TAROL units in inch dimensions

TAROL design	Mounting unit (tool set)	Mounting and dismounting tool for sealing caps	Grease cover
B 4 1/4 x 8	MDE.TAROL.B	SCT.TAROL.B	GC.TAROL.B
C 5 x 9	MDE.TAROL.C	SCT.TAROL.C	GC.TAROL.C
D 5 1/2 x 10	MDE.TAROL.D	SCT.TAROL.D	GC.TAROL.D
E 6 x 11	MDE.TAROL.E	SCT.TAROL.E	GC.TAROL.E
F 6 1/2 x 12	MDE.TAROL.F	SCT.TAROL.F	GC.TAROL.F
G 7 x 12	MDE.TAROL.G	SCT.TAROL.G	GC.TAROL.G

Tools for other sizes on request.

FAG Mounting Accessories

Heating unit for housings

For inductive heating of bearing seats for all suspension unit bearing housings. Individually adapted to the housing design (special design).



Axial clearance gauge

For maintenance and checking of the bearings in installed condition.
(Order Ref.: ACMI:TAROL+...)



Visual inspection device

For the visual inspection of dismounted bearings.
(Order Ref.: BVTD:TAROL)



Plate press

For dismounting and repair of bearing units.
(Order Ref.: PP:TAROL)



Grease dispensing unit

For dispensing measured amounts of grease for lubricating rolling bearings. Measured doses range between 10 and 133 cm³.
(Order Ref.: ARCA:PUMP.25 for 25 kg container or ARCO.PUMP.180 for 180 kg drum)

FAG Arcanol Rolling Bearing Greases

Reliable and economic lubrication for longer bearing service life

Special rolling bearing greases, such as Arcanol products, cost slightly more at first glance but provide higher value in the long run. You also buy safety with Arcanol, as FAG carries out selection tests, implements quality assurance and provides practical greasing recommendations. Premature bearing failure due to the wrong choice of grease with all the undesirable and costly associated problems are becoming more and more a thing of the past.



All greases in the Arcanol range are subjected to a series of tests such as service life, friction and wear with rolling bearings in the lubrication laboratory. The strict FAG quality controls ensure consistent properties.

The greases used by FAG take into consideration the demands of the norms and standards such as UIC, EN, DIN, AAR and others.

A special department is available to help you select suitable rolling bearing greases:
FAG Kugelfischer AG & Co. KG
Railway and Transport Division
Tel: +49 (0) 9721 / 91 39 98
Fax: +49 (0) 9721 / 91 37 88
E-Mail: rail_transport@fag.de





LIREX, regional express train
Alstom / LHB
 Cylindrical roller bearings with polyamide cage

FAG Research, Development and Service

With a View toward the Future

FAG researchers and developers work with application technicians in close conjunction with customers to ensure all demands made during the working life of a bearing are taken into consideration from the beginning. FAG service is much more than just a temporary "extra". It is a range of services which are provided when designing a bearing. FAG test rigs support the development and service process and ensure high quality assurance right from the outset. This makes us a certification partner of the Federal German Railway Office (EBA).



Research and
development



Test rigs



Condition
monitoring,
consultancy
and service



Quality assurance
and certification



The starting point for all activities is to foresee the demands laid down later in practical operations. Researchers and application technicians work closely together with customers in this respect.

Special rolling bearing coatings improve the tribological behaviour, increase the resistance to wear or corrosion and provide insulation against current passage.

We test greases for service life, friction and wear with self-developed, standard grease test rigs and testing methods.

FAG uses their own methods for calculating the service life and failure probability, material, lubrication, load, type of bearing, cleanliness, etc.

Using the Boundary Element Method (BEM) for calculations increases the operational reliability of bearings

FAG Research Center

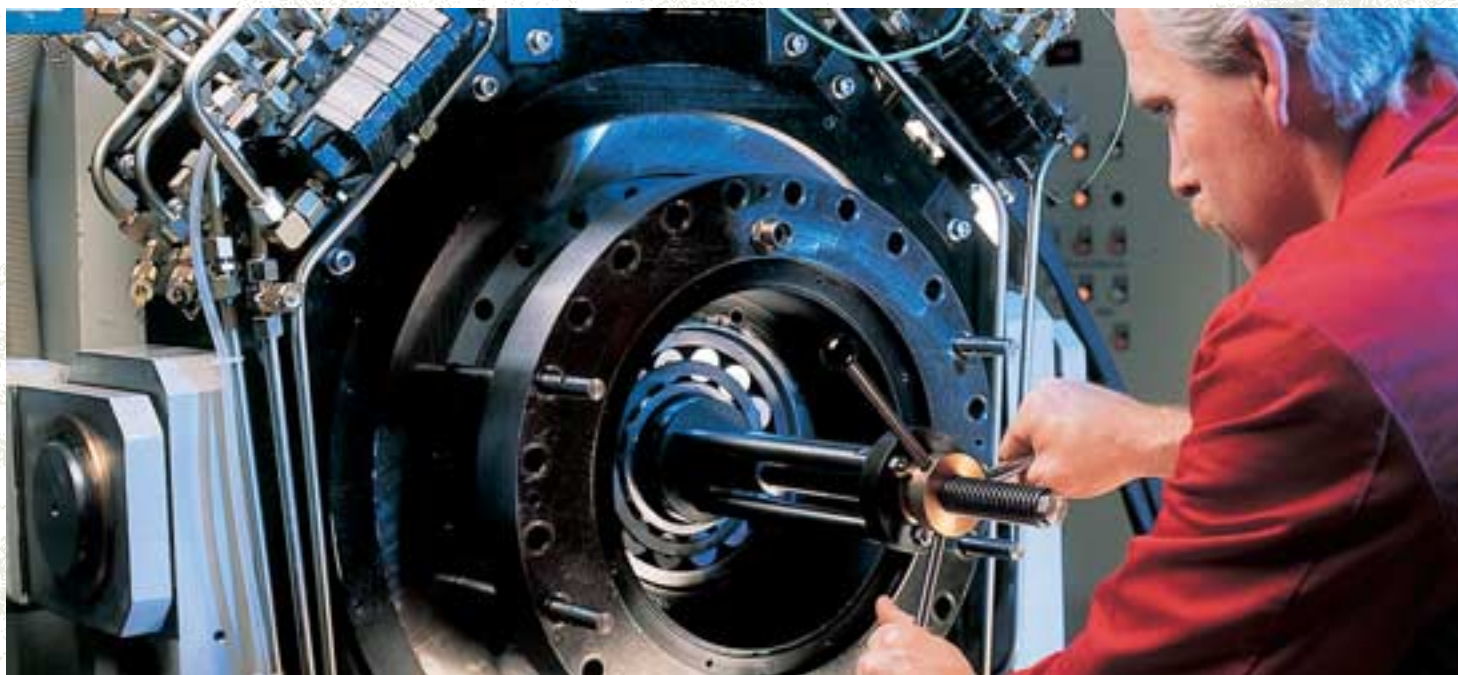


Stress analysis with BEM calculation



Computer-supported service life calculation





Journal roller bearings for high speed vehicles with sensor system

The ready-to-fit FAG journal roller bearing with rail-suitable optimised sensor system are low-cost system solutions and important components in "intelligent" wheel sets. Besides measuring temperature, the speed sensors also measure the acceleration during travel. If necessary, maintenance can be carried out on time on the basis of this data.



Extremely high service life through X-life bearings in wheel sets and traction motors

With the help of the X-life bearing, FAG wants to extend the maintenance intervals for wheel set bearings. The aim is 4 million kilometres (2.5 million miles) instead of the previous approx. 1 million kilometres (approx. 620 000 miles). High-nitrated special steel ensures an extended material fatigue life. The ceramic roller bodies permit higher speeds, allow operation at higher temperatures and are not affected by lack of lubrication.



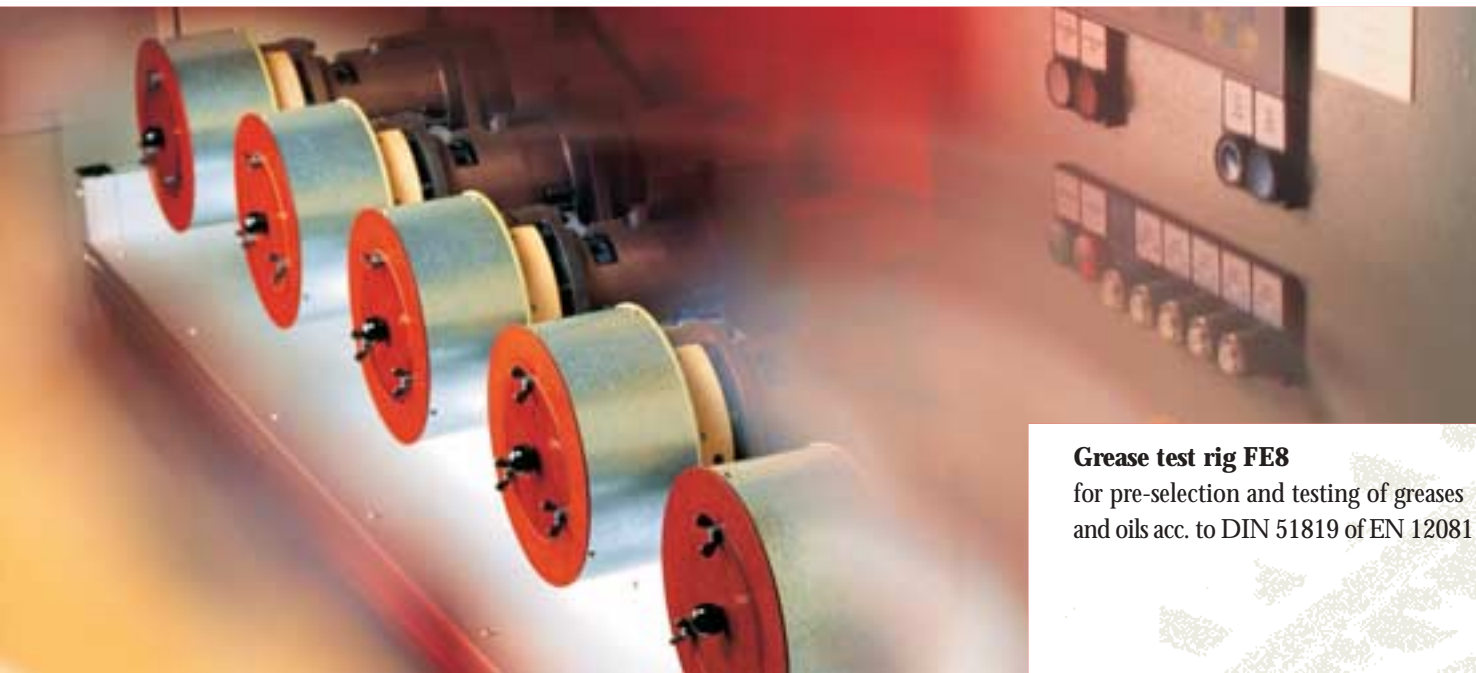
Current from the axle boxes bearing

FAG designed an innovative solution for rail cars without a power supply, for example, freight cars. The FAG generator bearing supplies the sensor system with the current necessary for monitoring the travel status (temperature, speed, acceleration) as well as other systems such as

- Theft protection systems in freight cars
- Monitoring systems for special transport
- GPS receivers
- Power supply for braking and antiskid systems



FAG Test Rigs



Grease test rig FE8
for pre-selection and testing of greases
and oils acc. to DIN 51819 of EN 12081

The reliability of bearings under extreme conditions are tested on FAG owned test rigs. The test rig simulates travel speeds of up to 550 km/h (340 mph) and wind speeds of up to 180 km/h (110 mph).

These tests have contributed considerably to increasing service life and maintenance intervals for roller bearings. Today a running performance of approx. 1.2 million kilometres (745 000 miles) without maintenance, depending on operational conditions, is FAG standard for long distance railway vehicles.

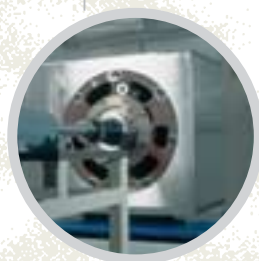
Lubricant test rig



Test rig for traction motors



Test rig (AN 46)
for highly realistic
simulation of route
profiles and influence
of air flow



**AN 55 test rig, a version
of the AN 46. Fulfills the
requirements of EN 12082.**





Trouble shooting, consulting, online monitoring, measuring campaigns, training.

FAG has extensive experience in providing modern maintenance concepts, such as maintenance planning and the introduction of control systems.

Reliable monitoring ensures troublefree, optimised operation of rail vehicles. Condition-monitoring avoids unforeseeable downtime and further damage. This in turn, improves performance and reduces maintenance costs. Vibration diagnosis is a reliable method of detecting damage before failure occurs. Imbalance and alignment faults can be detected by this method in just the same way as bearing damage and gearing defects.

Maintenance consulting



Rolling bearing service

FAG on site mounting service

FAG specialists are on hand to guide you through acceptance controls of mounting and inspection of rolling bearings. We advise you on the choice of suitable tools and introduce you to methods for the mounting and maintenance of rolling bearings. Customers who only need special mounting tools and measuring instruments occasionally, can rent them from FAG on a weekly basis. FAG also offers an extensive training program as well as teaching materials.

These services can be obtained through FAG Industrial Services GmbH or your local FAG field representative:

Tel: +49 (0) 24 07 / 91 49 - 0,
Fax: +49 (0) 24 07 / 91 49 - 59,
E-mail: support@fis-services.de

FAG Quality Assurance and Certification



In the rail vehicle sector FAG is the approved testing organisation of the Federal German Rail Office (EBA). DB, AAR, SNCF and other associations list FAG as a certified partner and supplier.

Quality is achieved in the production process - no FAG product line leaves the plant before it has been subjected to thorough quality control inspections.

All processes and methods are described in the Quality Manual and certified in accordance with DIN EN ISO 9000. However, you can only test something which you have already produced.

This applies especially to the quality of FAG bearings and their components. In other words: quality is generated in the production process and not in a subsequent inspection.

Quality assurance



Material testing

FAG Publications

FAG Journal Roller Bearings for Rail Vehicles

Brochures

Publ WL 07170*	09/2002	FAG Rolling Bearings for Rail Vehicles (D,E)
Publ WL 07161	08/2000	Reference list rolling bearing axle boxes in light rail vehicles (E)
Publ TI WL 40-43	04/1994	Refined life calculation of rolling bearings reveals reserve capacities (D,E)
Publ WL 07154	02/1991	FAG Journal Roller Bearings TAROL (D,E,F)
Publ WL 07137	01/1991	FAG Wheelset Bearings for Sand-Lime Brick Autoclave Trucks (D,E)
Publ WL 07155	1990	Rolling bearings for local traffic rail vehicles "Bahn" (E)
Publ WL 07147	02/1989	Journal Roller Bearings for Rail Vehicles (E)
Publ WL 07140	08/1986	FAG rolling Bearings in the new three phase current locomotive series 120 of the German Federal Railways (E)

Reference sheets

Publ WL 07531*	09/2002	FAG X-life Bearings in Traction Motors for Rail Vehicles (D,E)
Publ WL 07532*	09/2002	FAG Journal Roller Bearings for the Variobahn in the Rhein-Neckar Region (D,E)
Publ WL 07533*	09/2002	FAG Test Rig for Journal Roller Bearings (D,E)
Publ WL 07519*	08/2002	FAG Wheelset Bearing for Y25/25t-type Bogies for Freight Cars (D,E)
Publ WL 07520*	08/2002	FAG Wheelset Bearings in the "Herkules" Diesel Electric Locomotive (D,E)
Publ WL 07521*	08/2002	FAG Sensorized Wheelset Bearings (D,E)
Publ WL 07522*	08/2002	FAG Wheelset Bearing for the "TTINO" Diesel Multiple Unit (D,E)
Publ WL 07523*	08/2002	FAG Bearings for Voith Wheel Set Gearbox SZH 465 for the New Jersey Transit Low-Floor Light Rail Vehicle (D,E)
Publ WL 07526*	08/2002	FAG Wheelset Bearings for Diesel Rail Cars (D,E)
Publ WL 07530*	08/2002	FAG Wheelset and Gearbox Bearings in the Dresden Tramway (D,E)
Publ WL 07527*	08/2002	FAG Wheelset Bearings for the IC4 Diesel Multiple Unit (D,E)
Publ WL 07517*	08/2002	FAG Journal Roller Bearings for Innovative Light Regional Express Train (D,E)
Publ WL 07518*	11/2001	FAG Axle boxes with integrated Generator (D,E)
Publ WL 07515*	01/2001	FAG Journal Roller Bearings in the EG 3100 engine for the DSB Gods (D,E)
Publ WL 07516*	09/2000	FAG Journal Roller Bearings for Trainsets of Munich Underground (D,E)
Publ WL 07513*	08/2000	FAG Journal Roller Bearings in the Berlin underground, Series H (D,E)
Publ WL 07512*	02/2000	FAG Journal Roller Bearings in light Rail Vehicles (D,E)
Publ WL 07509*	01/2000	FAG Rolling Bearings in EL 2000 Heavy-Freight Locomotives (D,E)
Publ WL 07510*	01/2000	FAG Journal Roller Bearings in the High power Locomotive "Taurus" (D,E)
Publ WL 07511*	01/2000	FAG Journal Roller Bearings in Berlin Trams (D,E)
Publ WL 07508	10/1998	FAG Journal Roller Bearings TAROL for the American Flyer (D,E)
Publ WL 07505	01/1998	FAG Rolling Bearings in the ICE High-Speed Train (D,E)
Publ WL 07504	03/1988	FAG axle box roller bearings with light metal housings for suburban rail vehicles (D,E)
Publ WL 07503	04/1987	Viennese underground carriages with FAG current insulated axle box roller bearings (D,E)
Publ WL 07502	08/1985	FAG Tapered Bearing Units (TAROL) in the Wheelsets of Light Locomotives (D,E)
Publ WL 07501	04/1983	FAG Control Wheels and Guiding Wheels with Integral Tapered Roller Bearings in the M-Bahn (D,E)



FAG Journal Roller Bearing Housing and Polyamide Cages

Publ WL 95101	11/1992	Rolling bearing cages made of PA-66-GF meet the highest demands (D,E,F,S)
Publ WL 07148	08/1989	Special reprint - Plastic Cages in Wheelset Bearings of Rail Vehicles (D,E)
Publ WL 07146	03/1987	Special reprint - Light metal housings for axle box roller bearings (E)

FAG Bearing Arrangement of Transmission and Traction Motors

Publ WL 43167*	05/2002	The Trademark of Extreme Performance (D,E,F)
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FAG Monitoring, Maintenance and Lubrication

Publ WL 81116/3*	04/2002	Arcanol Rolling Bearing-tested Grease (3D,3E,2F,2DK)
Publ WL 80250*	03/2002	FAG Mounting and Maintenance Equipment and Services for Rolling Bearings (D,E)
Publ WL 80100/3*	03/2002	Mounting and Dismounting of Rolling Bearings (3D,3E,3ED,3F,3I,3N,3P)
Publ WL 82102/2*	04/2001	Rolling Bearing Damage - Recognition of damage and bearing inspection (2D,2E,2I)
Publ WL 07162	08/2000	Arcanol L300 - 1.5 Million Kilometers without Grease Exchange (D,E,ED)
Publ WL 80151*	06/2000	Repair Service for Large Rolling Bearings (D,E,F,S)
Publ WL 81115/4*	02/2000	Rolling Bearing Lubrication (4D,4E,4EC,4DK)
Publ WL 07160	08/1999	Operating conditions for tunnel traffic and the quality maintenance of the FAG axle box bearing TAROL 120 (D,E)
Publ WL 40206	05/1996	Economy and safety for rolling bearings can be calculated (D,E)
Publ WL 07142	04/1988	Perfected design and lubrication of axle box roller bearings for high cruising speed and long relubrication intervals (D,E)

FAG Research and Development, Services

Publ WL 07525	08/2002	FAG Standard AN 55 Test Rig for Wheelset Bearings (D,E)
Publ WL 07524	08/2002	FAG AN 46 Universal-Test Rig for Wheelset Bearings (D,E)
Publ WL 51133	08/1999	Ten fold service life - rolling bearing made of Cronidur 30 (D,E,F)
Publ WL 51132	07/1999	The Rolling Bearing Steel from The Future - Nitrogen instead of carbon (D,E)
Publ WL 07158	04/1995	Pit stop for rail vehicles - FAG-developments take you on a new track (D,E)

FAG General

Publ WL 41520/3	08/2001	Catalogue FAG Rolling Bearings (3D,3E,3ED,3FI,3S,3P,Sv,2H,3J,2PL)
Publ WL 49260	04/1999	"Everything that keeps us going" (D, E, S)

* Publications are also available as pdf-files in the FAG Internet-library (www.fag.com)

Alternative languages:

D = German, DK = Danish, E = English (GB and english speaking countries), EC = English (Stratford), ED = English (Danbury, USA: loads, load ratings and weights in lbs), F = French, H = Hungarian, I = Italian, J = Japanese, N = Dutch, P = Portuguese, PL = Polish, S = Spanish, Sv = Swedish

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