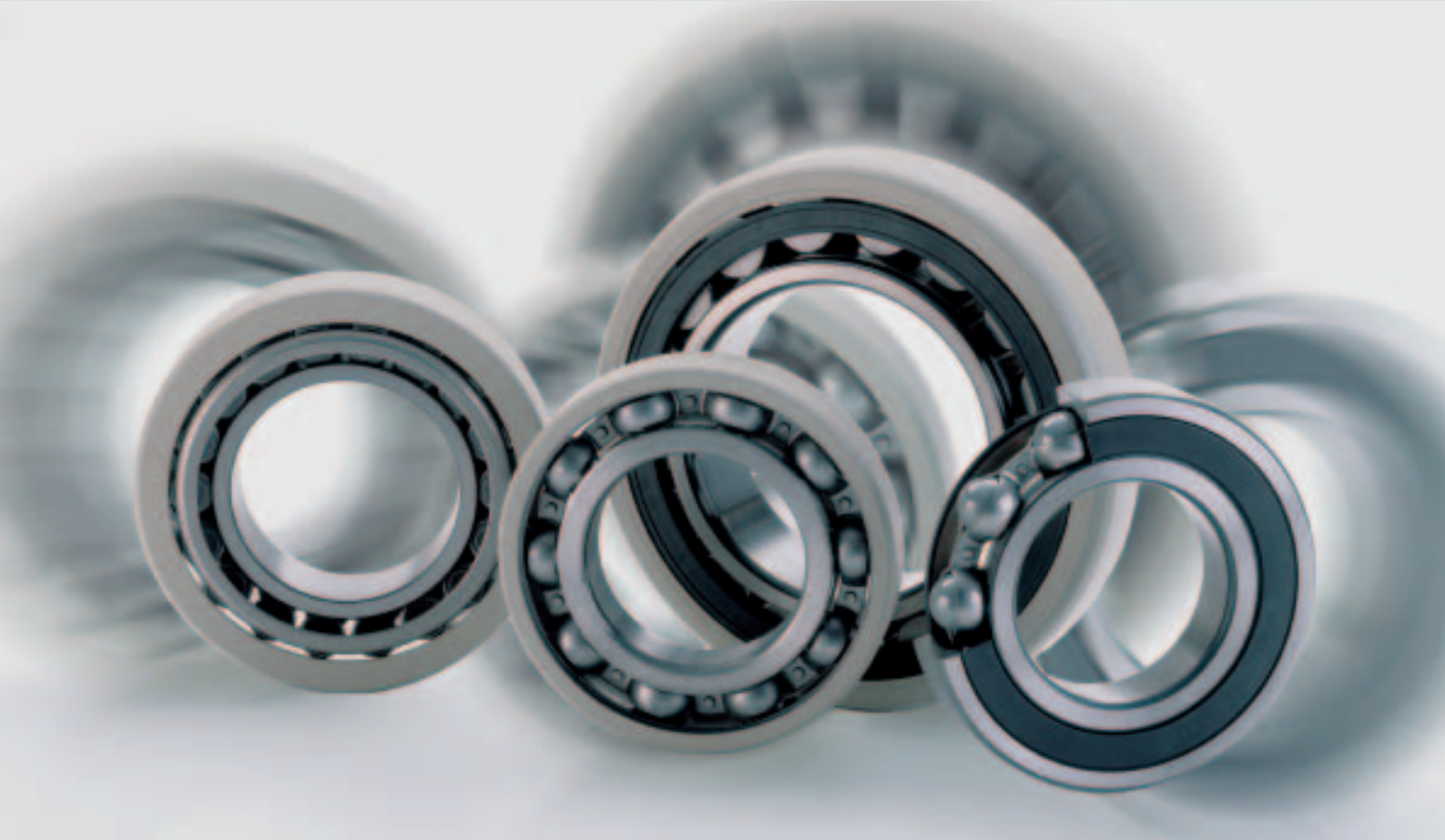


FAG



**Current-Insulated FAG Rolling Bearings
Prevent Damage due to Passage of Electric Current**

Technical Information

A Member of the
Schaeffler Group

Current-Insulated Designs

If conditions are unfavourable in electric motors, bearing damage due to passage of electric current can occur. Magnetic asymmetries, which cannot be completely avoided even if production of electric motors is carried out very carefully, causes a voltage difference between rotor and stator. The circuit is closed through the bearings.

Rolling bearings in electric motors that are operated with a frequency converter are particularly jeopardized. High-frequency harmonics generate ripple voltages that can also cause passage of current through the bearing.

Current passage causes damage to the running areas in the form of:

- craters
- beads
- fluting
- discolourations
- microwear,

which in turn lead to premature bearing failures.

Usually, damage due to the passage of current attracts attention through increased running noise.

If insulation is provided between bearing shield and housing or between shaft and inner ring, such passage of current can be prevented. Another, very simple, method to interrupt the induced current circuit is to use current-insulated rolling bearings.

In some cases, in motors operated with a converter, it is sufficient to insulate only one bearing.

Types of coating for rolling bearings

- FAG offers coatings (suffix J20..) on bearing outer rings. The coating is applied to the ring outside diameter and to the two ring faces:
- **J20B** layer thickness < 0.1 mm
- **J20AA** layer thickness = 0.2 mm

Properties of coated rolling bearings

The layer protecting FAG rolling bearings consists of oxide ceramic. It is applied by plasma spraying and then sealed with synthetic resin.

The disruptive voltage with direct current is:

- 500 V for a J20B coating
- 1 000 V for a J20AA coating

Thanks to a special sealing, bearings with a J20AA layer can be used even in humid environments.

The oxide ceramic layer is very hard. The material is resistant to wear and a good heat conductor.

Dimensions of the coated bearings

The boundary dimensions of FAG current-insulated rolling bearings are in accordance with DIN 616 (ISO 15). They are therefore interchangeable with standard bearings.

Hybrid bearings - an alternative

An interesting alternative to coated rolling bearings are hybrid bearings with steel rings and ceramic (silicon nitride) rolling elements. The rolling elements provide the required current insulation. Hybrid bearings are prefixed **HC**.

In addition, hybrid bearings offer the following advantages:

- higher speed
- reduced friction
- lower temperature

Especially with sealed hybrid bearings, a longer grease life and thus a clearly longer bearing service life can be achieved.

For more information refer to TI WL 43-1210.

Which bearing design for which applications?

Coated bearings to J20B

- Thin layer, insensitive to damage caused during mounting lower-priced.
- Less strict requirements on disruptive strength (at least 500 V).

Coated bearings to J20AA

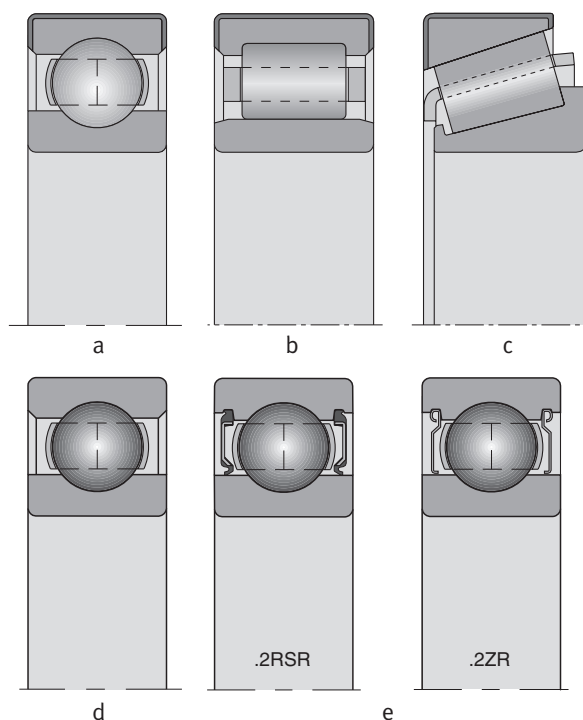
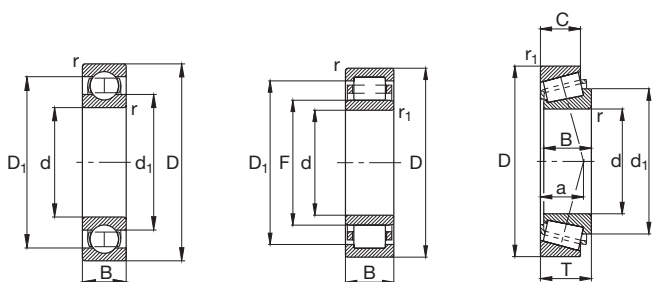
- high resistance to the passage of current (at least 1 000 V), even in a humid environment.

Economic effectiveness

With small rolling bearings, the hybrid designs are more economical. With larger rolling bearings, the coated designs are the more economical choice.

Current-Insulated Designs

Figures a – e show cross sections of current-insulated bearings. (a) coated deep groove ball bearing, (b) cylindrical roller bearing, (c) tapered roller bearing, (d) hybrid deep groove ball bearing (open), (e) hybrid deep groove ball bearing (sealed).



Current-Insulated Design

Shaft	Dimensions							Load rating		Reference Code	Mass ≈	
	d	D	B	r	r ₁	D ₁	d ₁	F	C			C ₀
	mm							kN	min ⁻¹	FAG	kg	
75	75	160	37	2.1		133.2	101.8	114	76.5	7000	6315M.C3.J20AA	3.23
	75	130	25	1.5	1.5	114.4		88.5	132	156	NU215E.TVP2.C3.J20AA	1.27
80	80	140	26	2		121.2	98.9	72	53	6300	6216.C3.J20AA	1.46
	80	170	39	2.1		141.8	108.6	122	86.5	6700	6316M.C4.J20AA	3.82
85	85	180	41	3		151.6	114.4	132	96.5	6300	6317M.C3.J20AA	4.33
90	90	160	30	2		139.4	112.7	96.5	72	6000	6218.C3.J20AA	2.21
	90	190	43	3		157.1	123.8	134	102	6000	6318M.C3.J20AA	5.53
	90	160	30	2	2	139.7		183	216	4500	NU218E.TVP2.C3.J20AA	2.36
95	95	200	45	3		165	129.1	143	112	5600	6319M.C4.J20AA	6.34
100	100	215	47	3		179	138.6	163	134	5000	6320M.C3.J20AA	7.78
	100	180	34	2.1	2.1	156.9		250	305	4000	NU220E.TVP2.C3.J20AA	3.49
110	110	240	50	3		197.4	153.4	190	166	4500	6322M.C3.J20AA	10.5
120	120	260	55	3		214.8	165.1	212	190	4000	6324M.C3.J20AA	13.0
	120	215	40	2.1	2.1	187.8		335	415	3200	NU224E.TVP2.C3.J20AA	5.8
130	130	280	58	4		231.2	178.9	228	216	3800	6326M.C3.J20AA	18.3

Availability of other types and sizes of current-insulated rolling bearings will be indicated on request.

Mounting Examples

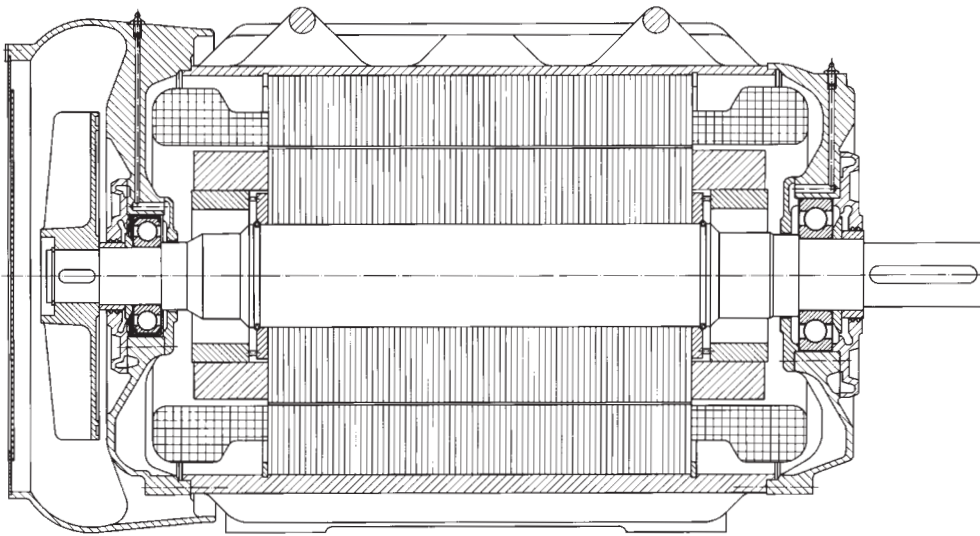
1. Three-phase motor

Deep groove ball bearing with a J20AA layer

Technical data:

Three-phase motor, converter-fed
Power 375 kW
Design four-pole

A current-insulated deep groove ball bearing **FAG 6316.C3.J20AA** is installed at the ventilation end, and a deep groove ball bearing **FAG 6320.C3** is installed at the drive end. Both bearings are lubricated with grease. A relubrication device is provided.



2. Axle box roller bearing

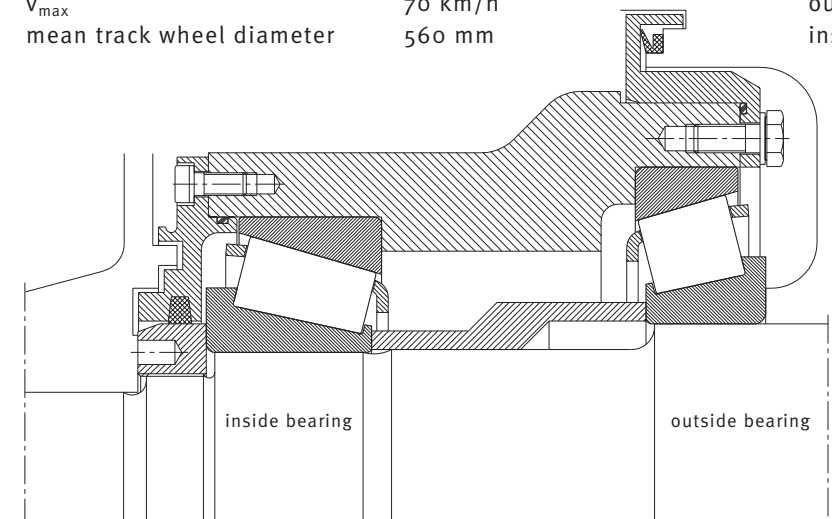
Tapered roller bearings with a J20B layer

Idler mounting in Combino low-floor articulated tramcar, one-meter gauge / Freiburg (Germany)

Technical data:

v_{max} 70 km/h
mean track wheel diameter 560 mm

Tapered roller bearings (O arrangement):
outside **FAG 30228A.580065.J20B**
inside **FAG 32224A.803889.J20B**



Mounting Examples

3. Traction motor bearing mounting in an electric tramcar

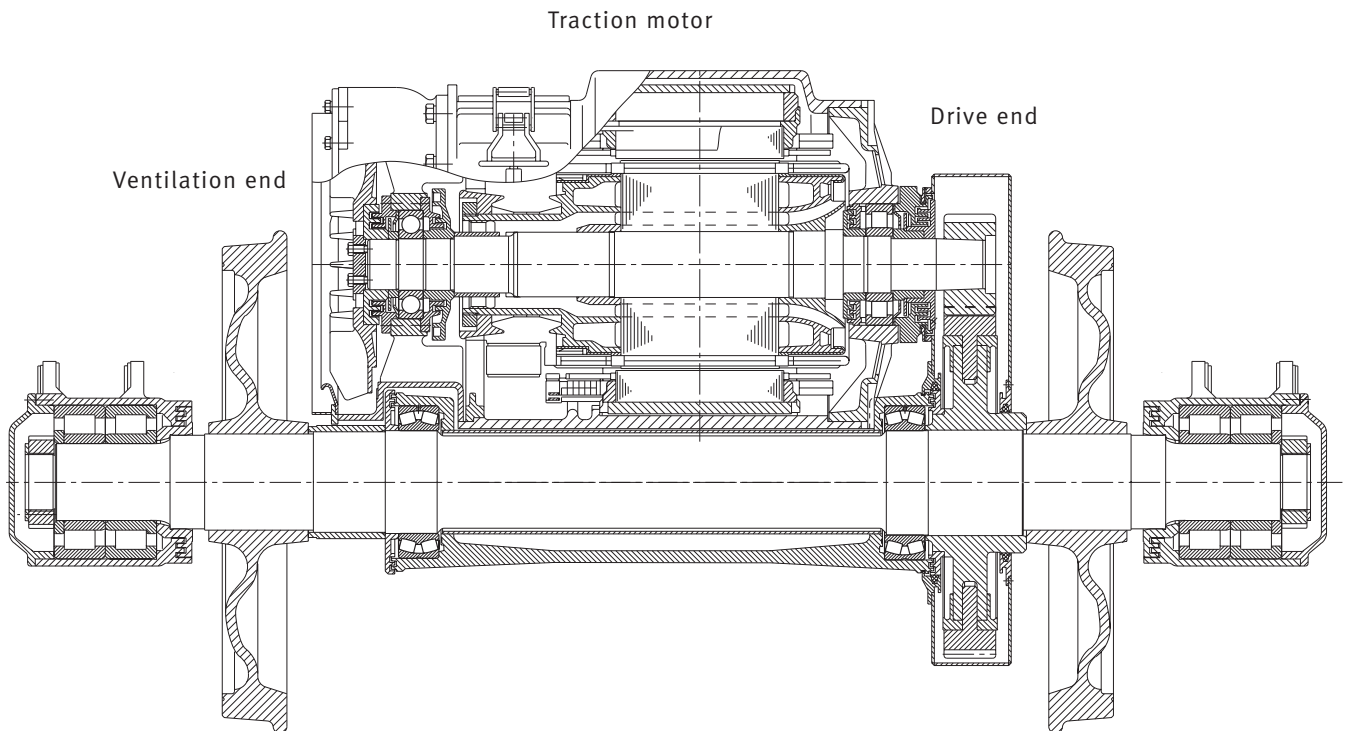
Deep groove ball bearing and cylindrical roller bearing (both with J20AA coating)

500 kW three-phase motor

A deep groove ball bearing **FAG 6318M.C3.J20AA** is installed at the ventilation end, and a cylindrical roller bearing **FAG NU320E.M1.C4.F1.J20AA** is installed at the drive end of the rotor shaft.

Both bearings are lubricated with grease and protected from dirt and environmental influences by labyrinth seals.

A relubrication facility was provided.



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