ELGES Spherical Plain Bearings in the Tilting System and FAG Gearbox Bearings of the New PENDOLINO

Examples of Application Engineering

WL 07 549 GB-D

New PENDOLINO with Alstom fourth generation tilting system

Photo: Alstom / Massimo Sfreddo

In March 2004, the Italian state railway Trenitalia and Cisalpino – a joint venture of Trenitalia and Swiss Federal Railways (SBB) - ordered a total of 26 PENDOLINOs. The electric high speed trains are the first vehicles with Alstom fourth generation tilting systems by means of which traveling times on conventional lines can be reduced by 15 to 30%.

Starting in November 2006, 12 of the seven-car trains will be added to the fleet of 40 PENDOLINOs and 60 ETR 500 trains that already service the Trenitalia high-speed lines. The 14 train compositions for Cisalpino are intended, among others, for cross-border traffic between Italy and Switzerland. In time for the schedule change in December 2007 and for the opening of the Lötschberg base tunnel, the trains will take up service at Cisalpino as ETR 610.

Schaeffler Group Industrial supplies for all trains ELGES spherical plain bearings for two locations in the tilting systems as well as the complete bearing sets for the gearboxes.

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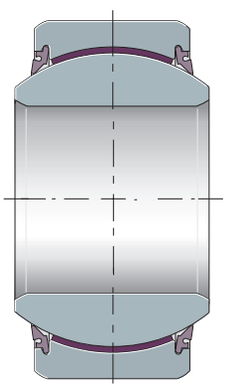
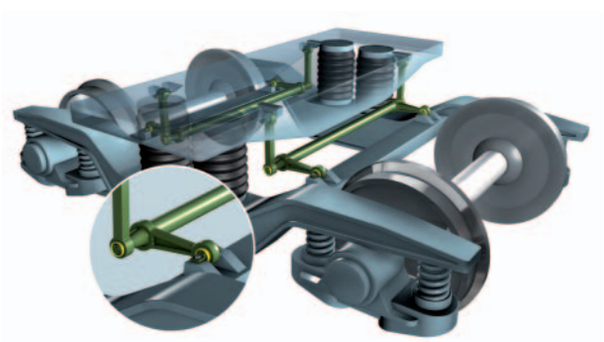
Bearings supporting the bolster in the tilting mechanism

The tilting motion of the superstructure is made possible by a bolster that is integrated into the bogie and onto which the superstructure is mounted. The bolster is connected to the bogie via four connecting rods. Maintenance-free standard ELGES spherical plain bearings **GE60UK-2RS** are used in the connecting rod eyes. This solution, which is already used successfully in the ICE-T fleet of DB, provides a cost-effective and reliable bearing mounting.



Superstructure stabilization

Functional principle
Dynamic forces acting on the trains during the journey cause rolling and sideways motions of the superstructure relative to the longitudinal axis of the train. So-called anti-roll bars are used to reduce these motions. Anti-roll bars function like a torque rod, generating readjustment forces between superstructure and bogie that are opposed to the motions, stabilizing the superstructure.

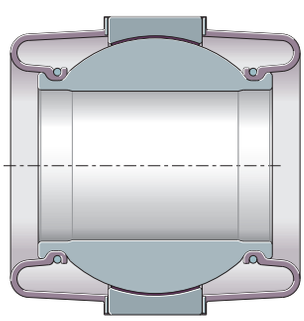


Maintenance-free ELGES radial spherical plain bearings with an ELGOGLIDE® sliding layer are used at the joints of this highly dynamic application. The unprotected position of the radial spherical plain bearings, direct exposure to environmental conditions and the demanded life of more than 2.5 million kilometers require an efficient sealing system.

ELGES special spherical plain bearings with bellows
The special spherical plain bearings that were developed especially for this application is sealed by means of bellows whose geometry was optimized for the necessary large motion angles (slewing angle +/- 20°; tilting angle +/- 19°) by means of FEM analysis.

The bearings' reliability with regard to life, max. joint angle, tightness and resistance to aggressive substances was proved in extensive tests. The bellows material has already been used successfully for ca. 10 years in similar applications in the automotive sector.

The bearing, which is located in the surrounding structure by snap rings and spacer sleeves, is easy to mount and dismount, reducing costs for manufacturer and operator alike.



Gearbox bearings

The gearbox built by ALSTOM Savigliano is a single-stage bevel gearbox which is driven via a universal joint shaft. The pinion shaft is supported in a cylindrical roller bearing that is based on type **NU317-E** and a four point bearing **QJ318-N2**. The ring gear of the output shaft is supported on one side in a cylindrical roller bearing **NU1040-E**. On the other side, support is provided by two tapered roller bearings in X-arrangement.
All bearings are lubricated with oil, supplied by the oil circuit for the gearing. Cage design and bearing clearance were adapted to meet the requirements of this application.
Schaeffler Group Industrial had already supplied the bearings for the gearboxes of the predecessor versions.

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