

**Soft suspension – that always stays connected** In order to adapt climatic conditions to the passenger's comfort, trains carry state-of-the-art air conditioning systems. In this dynamic application soft suspension is called for. Angst+Pfister has developed tear-proof suspension elements for Liebherr-Transportation Systems GmbH & Co KG. Soft and at the same time completely secure – it doesn't have to be a contradiction.



For the comfort of passengers, the air conditioning units are mounted on elastomeric and metal components. Liebherr Transportation Systems expects a lot from these components.

Anyone hearing the name Liebherr is likely to first think of cranes, construction machinery and refrigerators. But Liebherr Transportation Systems is another important company within the Liebherr Group, internationally active with manufacturing sites in Korneuburg near Vienna, in Marica, Bulgaria, and in a joint venture in Zhuji, China. The company is a leader in the development, production and maintenance of air conditioning technology and hydraulic activation systems for the railway industry.

The air conditioning units are installed either inside the carriages, on their underside, or on the roof. In order to avoid transmitting the unavoidable vibrations emanating from the compressors to the carriage structure, the compressors must always be suspended inside the unit in complete vibration isolation. The equipment therefore is mounted on elastomeric and metal compo-

**Stability a top priority**

	EPDM	NR
Rebound elasticity	6	5
Acid resistance	6	3
Alkali resistance	6	5
Oil resistance	2	1
Fuel resistance	2	1
Temperature of use min./max. [°C]	-40/+130	-30/+70
Steam resistance	6	4
Resistance to weather conditions	6	3
Hot water	6	4

On a scale of 1 (= poor) to 6 (= excellent), EPDM generally scores very much better than natural rubber in all respects.



Angst+Pfister's solution: An additional metal plate makes the standard bearing into a bearing that is not going to tear loose.

nents, designed specifically for this application. These components need to be capable of withstanding environmental stresses like extreme cold and heat, rain, snow and ultraviolet radiation, as well as the cleaning agents that are in standard use. The high levels of ozone which can result from the running of large electrical engines also put the elastomer and metal components under strain.

**Maximum stability essential** Liebherr has just developed an innovative new type of compact air conditioning unit for installation on the carriage roof. This project of the rail operating company makes exceptional demands on the bearing elements. Not only do they have to be specially designed for use in rail vehicles; an important additional feature is that they cannot be torn away from the roof.

High resistance to corrosion is critical, as these components will be heavily exposed to extreme environmental influences and railway-specific cleaning agents. With a view to meeting all these requirements, Liebherr decided to use stainless steel for the metal components. Additionally, EPDM has been selected instead of natural rubber, so that the elastomeric components can measure up to this application's rigorous requirements. EPDM is significantly more durable in comparison with natural rubber – as shown by the table on this page.

**Keeping the unit in the mount** A special system ensures that the unit remains in the mount even if the rubber and metal bonding gives

way. With the use of standard elements, the Angst+Pfister engineers created a design that ensures that the air conditioning unit can never be accidentally uncoupled from the train. The basis for their solution was the APK tool bearing from Angst+Pfister's standard range. With its compact size and equally modest cost, it is highly efficient in isolating vibrations. The technicians developed a new kind of bearing to go with this standard component by adding a specially designed metal plate. Together with a modified bushing at the centre, this constitutes the tear prevention safety system.

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**The new APK bearing is the same – and yet different** The bearing for the air conditioning systems of Liebherr-Transportation Systems

GmbH & Co KG has the same suspension properties as a standard bearing. In addition it is rust-proof, the rubber mixture is highly resistant to environmental influences and the suspension travel is restricted in all directions. But above all, it is not going to tear loose. The basic principle of this tear prevention safety system can be transferred with relative ease to most standard bearing systems.

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