

EFFICIENT. TECHNOLOGY. WORLDWIDE.

Environmental Portfolio



KNORR-BREMSE

ENVIRONMENTAL PORTFOLIO

Our contribution to a more environmentally-compatible and energy-efficient mobility

Climate change and environmental protection have recently become much more important both in the commercial and rail vehicle sector. For years, Knorr-Bremse has given top priority to developing fuel-saving, emission-reducing technologies with solutions tailored to market needs.

Our product portfolio offers solutions that

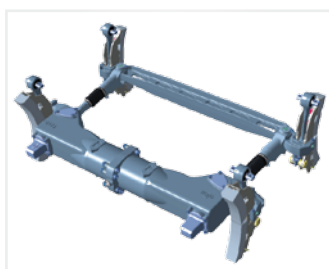
- >> minimize energy consumption and enhance fuel efficiency,
- >> reduce air emissions,
- >> minimize noise emissions,
- >> protect the environment by using more environmentally friendly materials and production processes.

ENERGY		AIR & NOISE EMISSIONS	MATERIALS	RAIL VEHICLE DIVISION
VEHICLE WEIGHT	FUEL EFFICIENCY			
<ul style="list-style-type: none"> • Bogie block brake CFCB • Compact brake caliper • Reduced weight A/C, doors, brake disks 	<ul style="list-style-type: none"> • Driver assistance systems • Driving and training simulators • Energy meters • Air conditioning with heat pump 	<ul style="list-style-type: none"> • Oil-free compressor in sound insulation enclosure • Flexpad Silent brake pad • LL brake blocks • Sanding systems with reduced sand use • Compact brake caliper 	<ul style="list-style-type: none"> • Oil-free compressor • A/C with environmentally-compatible refrigerants • Chrome VI-free surface coatings 	
<ul style="list-style-type: none"> • Pneumatic disk brakes 	<ul style="list-style-type: none"> • Compressor with coupling • Compressor with energy savings system • Pneumatic booster system (PBS) • Electronic air treatment (EAC2) • Tire pressure and temperature monitoring systems • Warning collision and emergency braking assistance systems 	<ul style="list-style-type: none"> • Pneumatic Booster System (PBS) 	<ul style="list-style-type: none"> • Chrome VI-free surface coatings 	
				COMMERCIAL VEHICLE DIVISION

ENVIRONMENTAL PORTFOLIO

OF THE RAIL VEHICLE DIVISION

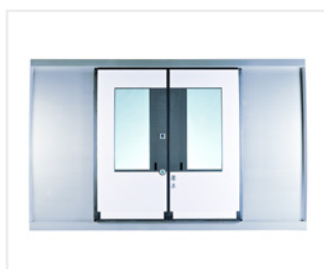
ENERGY



The compact **bogie block brake CFCB** makes it possible to reduce weight by up to 1,000 kg per freight car and is clearly more energy efficient than conventional brake equipment.



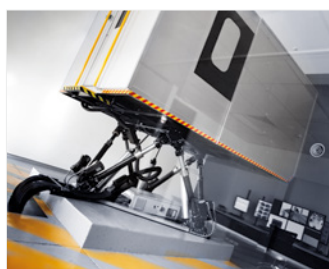
The **compact brake caliper** prevents disruptive noise and saves up to 150 kg per bogie, thus lowering the entire vehicle's noise levels and energy consumption.



Lighter products such as the new models of our **air conditioning units, doors** or **brake disks** contribute significantly to reducing energy consumption during operation.



The **LEADER Driver Assistance System** supports train drivers, enabling them to drive trains as energy-efficiently as possible, minimizing wear, and still arriving safely and punctually. LEADER typically makes it possible to save 10 to 15 percent of energy costs.



Driving and training simulators contribute to driving efficiency and therefore to reducing the environmental burden.



Energy meters measure the power consumption of trains and indicate savings potential, thus ensuring the most efficient operation possible.



Air conditioning units with integrated heat pump save 25 to 50 percent of energy costs compared to units without a heat pump.

ENVIRONMENTAL PORTFOLIO

OF THE RAIL VEHICLE DIVISION

AIR & NOISE EMISSIONS



The **oil-free compressor in a sound-proof capsule** helps keep down noise levels.



The **Flexpad Silent high-performance brake pad** largely prevents typical train brake squeal, thus lowering the noise emissions produced by rail traffic.



The **LL brake block** made of composite significantly lowers the rail noise of freight cars compared to conventional cast iron brake blocks.

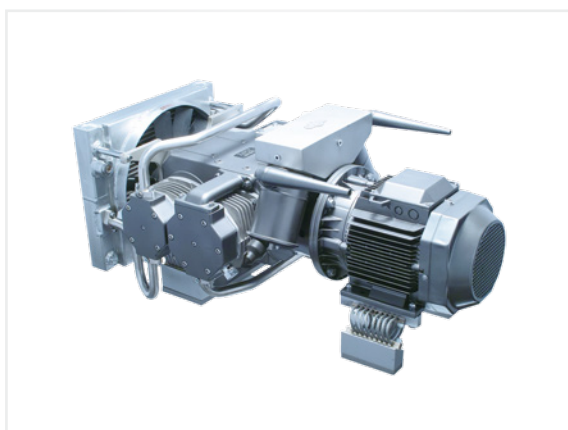


New **sanding systems** reduce to a minimum the fine dust produced when braking rail vehicles and also come with modern diagnostic options.

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OF THE RAIL VEHICLE DIVISION

MATERIALS



The **oil-free compressor** works without oil lubrication which means that no oil reaches the environment. A lot less energy, weight and space are needed, plus installation in a sound-proof capsule significantly reduces noise levels.



Air conditioning units operate with the environmentally-compatible refrigerant HFO1234yf.

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OF THE COMMERCIAL VEHICLE DIVISION

ENERGY



The SL7, SM7, ST7 **pneumatic disk brakes** increase energy efficiency because they weigh a lot less than their predecessors. The environmentally-compatible chrome VI-free surface coatings avoid the use of critical materials.



The **compressor with coupling** automatically uncouples from the engine when the system is adequately supplied with air, thus lowering a truck's CO₂ emissions by about 2.5 metric tons per year.



Compressors equipped with an additional **energy saving system** (ESS) can lower fuel consumption even further.



The **electronic air treatment unit EAC2** treats air according to the driving situation, thus saving fuel.



Tire pressure and temperature monitoring systems warn the driver when tire pressure has fallen below a certain level or the temperature is too high. This not only increases safety but also prevents higher fuel consumption caused by excessively low tire pressure.



Collision warning and emergency braking assistance systems help drivers to control their vehicle more efficiently and with foresight and therefore also to use less fuel.

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OF THE COMMERCIAL VEHICLE DIVISION

AIR & NOISE EMISSIONS



The **pneumatic booster system (PBS)** bypasses turbo lag with compressed air from the storage tanks, reducing fuel consumption while increasing useable power. Particulate emissions can be reduced by up to 25 percent.