



Metros



REALIZING SYSTEM SYNERGIES

KNORR-BREMSE



AIR SUPPLY
BRAKE CONTROL
BOGIE EQUIPMENT
RAIL SERVICES
ON-BOARD

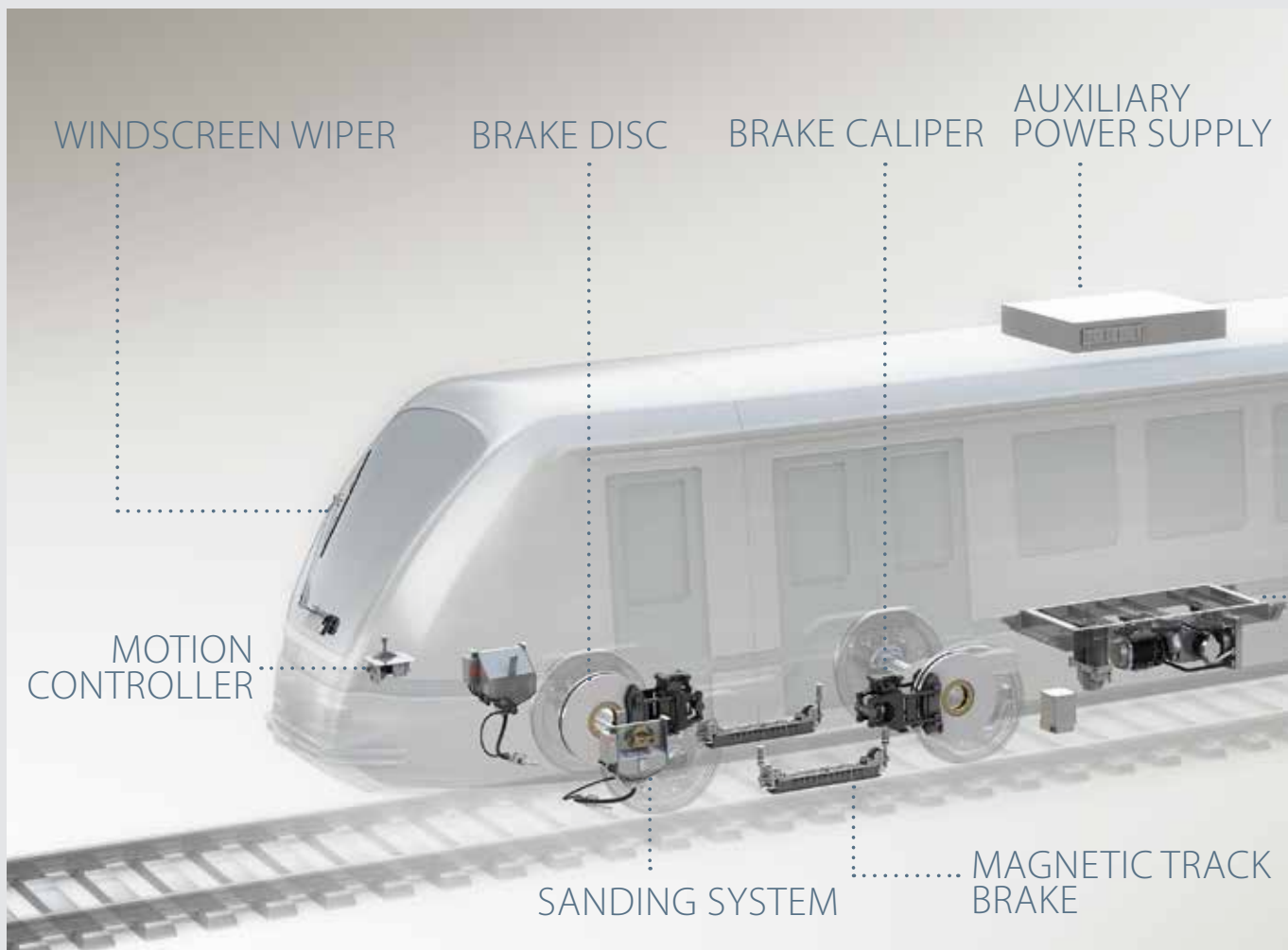


BECAUSE WE
SIMPLY FIND THE RIGHT
ANSWERS TO COMPLEX
CHALLENGES



WITH URBAN CONURBATIONS GROWING WORLDWIDE, PUBLIC TRANSPORT SYSTEMS ARE BECOMING INCREASINGLY

IMPORTANT. Major cities are depending on attractive mass transit systems to take the pressure off overcrowded streets. Especially in Asia, the Middle East and South America massive investment is currently taking place to develop the necessary infrastructure and to purchase new, improved vehicles. Knorr-Bremse is a leading player in this growth market. From a base of proven technologies we develop innovative solutions offering top levels of safety, reliability and economy. The systems we have developed are so efficient that they also score highly in terms of environmental friendliness. Customers enjoy full support from a single source – from the initial planning stage and commissioning right through the life cycle with support from our RailServices team. Operator and customer audits worldwide regularly single out the consistent quality of our products and services for praise and this is confirmed by our International Railway Industry Standard (IRIS) certification.

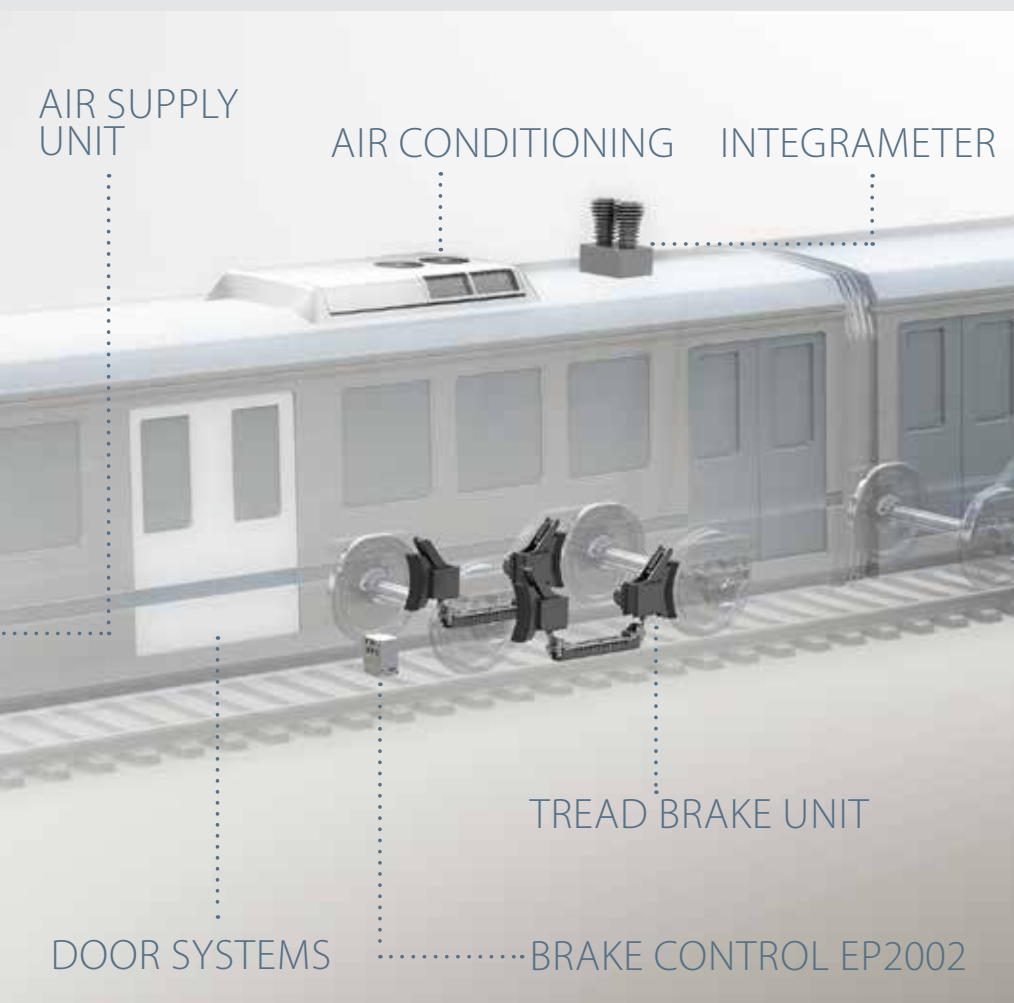


KNORR-BREMSE EXPERTISE IN ITS FIELD HAS GONE INTO EVERY SINGLE COMPONENT AND SYSTEM.

Highest quality components operate in harmony to guarantee optimum functionality, high reliability and safety. Complex electronic control systems such as blending and brake management reduce wear to a minimum by ensuring balanced operation. The system can be configured either to use the vehicle bus system or a separate bus exclusive to the braking system. For each project, customers are closely consulted at the design stage. Knorr-Bremse offers support during the homologation process as well as all the necessary on-site services through the entire product life cycle.

THE PERFECT COMBINATION OF HIGH-QUALITY SYSTEMS AND SERVICES

RAIL
VEHICLE
SYSTEMS
METROS



»AIR SUPPLY | COMBINED COMPRESSOR AND AIR TREATMENT SYSTEM

The space available in modern metro vehicle platforms is increasingly limited and installation is becoming more and more complex. When it comes to air supply, the trend is towards distributed systems using increasingly lightweight, compact units. Knorr-Bremse high-performance systems have been designed to meet these requirements. Intelligent compressor management is key to improve LCC. In addition, reduced installation and maintenance times increase vehicle availability.

»BOGIE EQUIPMENT | INNOVATIVE DESIGN MINIMIZES ASSEMBLY AND MAINTENANCE REQUIREMENTS

Knorr-Bremse offers a wide range of compact, lightweight bogie equipment including tread-brake units, low-wear brake discs and innovative high-performance brake pads. For individual projects, precise calculations are made and testing is carried out on the basis of the customer's data. New systems are subjected to extreme loads on the test bench before they are put into operation.

»BRAKE CONTROL | KNORR-BREMSE BRAKE CONTROL SYSTEMS ENSURE EFFICIENT AND SAFE BRAKING ALL OVER THE WORLD

Knorr-Bremse offers both centralized and distributed systems that are compatible with all types of vehicle bus systems. Combined with the ESRA electronic platform, brake control systems such as EP Compact lite ensure optimum interaction of all braking functions. The EP2002® intelligent brake control system combines mechatronic and electronic elements in a single, extremely compact unit.

»ON-BOARD SYSTEMS | DOORS, AIR CONDITIONING UNITS, WINDSCREEN WIPER AND WASH SYSTEMS AND MORE

It is not just Knorr-Bremse braking systems that ensure greater safety and comfort in rail vehicles. Our on-board product portfolio covers a wide range of efficient and innovative products and solutions including entrance systems and platform screen systems, air conditioning units, windscreen wiper and wash systems and state-of-the-art electronic diagnostic systems.

»RAILSERVICES | A PARTNER FOR ALL REQUIREMENTS THROUGHOUT THE ENTIRE PRODUCT LIFE CYCLE

Knorr-Bremse offers a wide range of rail services ranging from individual consultancy and collaborative product development to homologation, commissioning, training, maintenance, repair, upgrading and overhaul of all components – as well as a reliable supply of genuine parts. Whether you opt for individual services or the full package, everything is provided locally, either on-site or in one of our service centers.

»TESTING | TEST BENCHES FOR ALL PRODUCTS – WORLDWIDE

Knorr-Bremse can supply test benches for all of the company's products and systems. The test equipment can be customized and the necessary tools can be provided to exactly suit the customer's specific test requirements. Hundreds of Knorr-Bremse test benches and test installations are in successful operational service with customers worldwide. Examples of the type of testing covered include: train brake systems, brake control products, compressors, air dryers, tread brakes, brake calipers and there are many more available.

CUTTING-EDGE TECHNOLOGIES



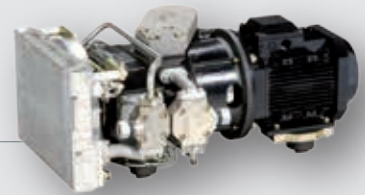
DISTRIBUTED BRAKE CONTROL | EP 2002® CUBE

Growing passenger numbers call for greater availability of trains and shorter operating intervals on metro networks – which puts greater demands on brake reaction times. The EP2002® intelligent brake control system combines mechatronic and electronic elements in a single, extremely compact system with distributed control modules installed close to the bogie. The entire compressed air system has become even more compact with the latest development – the EP2002® Cube – which adds a wide range of additional functions in a single cube-shaped unit with integrated piping.



CENTRAL BRAKE CONTROL | EP COMPACT LITE

With EP Compact lite, Knorr-Bremse has developed a flexible and powerful brake control system with central control. The core functions can be expanded by the addition of a wide range of optional functions offered by the various different modules of the EP Compact product family. EP Compact lite offers electronic load correction and pneumatic load limitation and can also be installed beneath the floor, including electronics. Additional functions include: control of parking brakes, wheel slide protection, air suspension, sanding, indirect braking, independent brake.



AIR SUPPLY | OIL-FREE COMPRESSOR

Knorr-Bremse was the first company in the rail vehicle industry to develop a compressor that operates without any lubricating oil. The use of oil is negated by a special coating and the unit is cooled by air taken in via the crankcase. This innovative product is a winner in both environmental and economic terms. The expenses of oil changes, oil separation and condensate disposal are avoided and energy consumption, weight and installation space are significantly reduced.

BOGIE EQUIPMENT | TREAD-BRAKE UNIT – PEC7

The compact, space-saving design of the PEC7 tread-brake unit makes it ideally suited for vertical or horizontal installation in bogies with restricted space. Depending on operating requirements a number of different variants are available with or without spring parking brake. The robust design has been installed and tested on metro trains all over the world.



INNOVATIONS THAT REDUCE LIFE-CYCLE COSTS

METROS[®] RAIL
VEHICLE
SYSTEMS

"In today's competitive global market, we need more than a worldwide presence – we must understand our customer's expectations independently of language and culture. It is not unusual to have to design a brake system with a traction and bogie manufacturer located in Europe and a vehicle builder located in Asia delivering vehicles to South America. We manage the complexity to the advantage of our customers."

RICARDO FORTES
MANAGER PROJECT ENGINEERING
METRO

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REDUCING UNNECESSARY WEAR AND MAINTENANCE IS A GOOD WAY OF REDUCING LIFE-CYCLE COSTS.

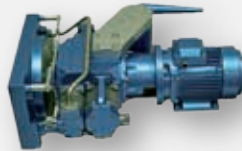
More than any other manufacturer, Knorr-Bremse has succeeded in finely coordinating the complex interplay of different braking systems. Brake components that are prone to wear are only used when the wear-free electrodynamic braking cannot cope on its own. Even then, patented brake pads have proven longevity against conventional materials. Brake pads and discs require replacement less frequently and their design enables them to be serviced rapidly. The brake calipers themselves are low maintenance. These examples demonstrate that if all the relevant factors are included in the calculation, the bottom line is savings for the customer.



Customized service packages ensure that all Knorr-Bremse systems function smoothly for up to 30 years – anywhere in the world. The secret is our combination of OEM expertise and a highly efficient service infrastructure.

PRODUCT RANGE

AIR SUPPLY



OIL-FREE COMPRESSOR

- » Oil-free air (environmentally friendly, no downstream contamination)
- » Less complex system / fewer interfaces (no oil filter, no condensate collector)
- » Almost maintenance-free, very low life-cycle costs



SCREW COMPRESSOR

- » Special design, to cope with tough railway operation conditions
- » Low noise level
- » Low vibration

BRAKE CONTROL



EP2002® CUBE

- » Distributed control
- » Compact design



EP COMPACT LITE

- » Central control
- » Compact design
- » Modular and suitable to various customer requirements
- » Optional electronics underfloor

BOGIE EQUIPMENT



BRAKE DISCS

- » Standardized interface and mounting
- » Resistant against thermal cracks due to movable friction disc
- » Robust design with high protection against external shock and vibration
- » Aluminum friction rings
- » Wheel and axle mounted discs



COMPACT BRAKE CALIPER

- » Only one interface to bogie
- » Highly modular design
- » Optimized design regarding weight, assembly and costs
- » Reduced maintenance

AUXILIARIES

WINDSCREEN WIPER AND WASH SYSTEMS

- » Customized systems for every vehicle type
- » Wide variety of functionalities and options
- » High system availability
- » Long life components



SANDING SYSTEMS

- » Modular design delivers a wide range of systems
- » Optimal performance with low weight and installation space
- » Low life-cycle costs



CAPSULED UNITS

- » Compact, light, reliable
- » Developed especially to deliver very low noise levels
- » All components to be maintained can be accessed through a maintenance port



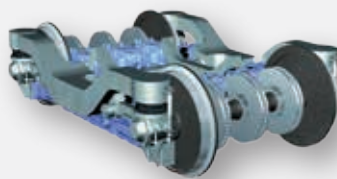
AIR DRYER

- » Dual-chamber regeneration dryer
- » Lightweight aluminum design
- » Integrated pre-filtration elements



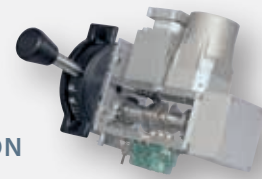
COMORAN® – CONDITION MONITORING FOR RAILWAY APPLICATIONS

- » Condition monitoring and diagnosis
- » Derailment detection (E-EDT® second generation)
- » Reduces life-cycle costs



MODULAR MOTION CONTROLLER KIT

- » Brake, traction and master controller
- » Compatible with UIC standard
- » Small, flexible installation space
- » Robust design, proven application



TREAD-BRAKE UNIT

- » Modular design
- » Flexible mounting
- » High output forces



CLEANING-BLOCK UNIT

- » Wheel surface conditioning to improve friction
- » Flexible mounting in bogie
- » Robust and service-proven design



GLOBAL APPLICATIONS



Delhi



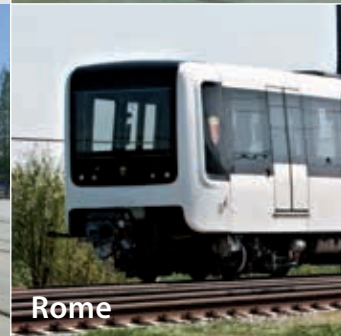
Santo Domingo



Bochum



Hangzhou



Rome



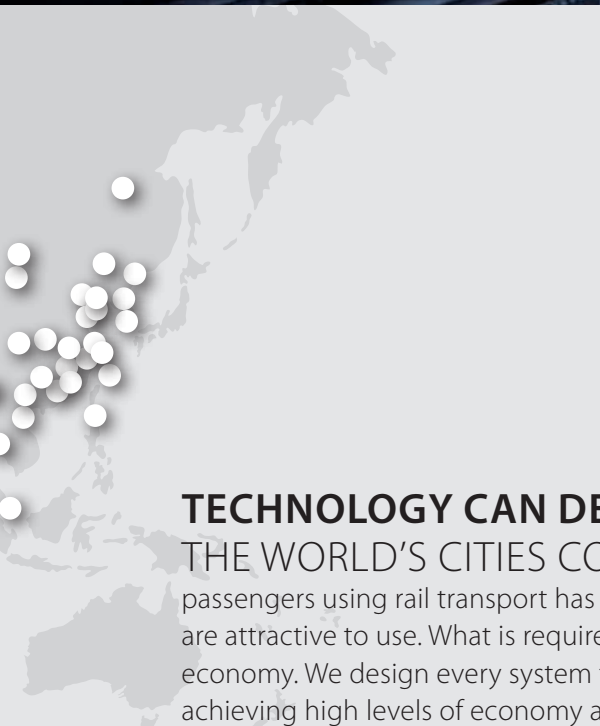
Shenzhen



WHEREVER TOP QUALITY IS CRUCIAL FOR COMPETITIVENESS, KNORR-BREMSE RAIL VEHICLE SYSTEMS OFFER CUTTING-EDGE TECHNOLOGY

TECHNOLOGY INTO THE FUTURE

METROS[®]
RAIL
VEHICLE
SYSTEMS



TECHNOLOGY CAN DELIVER SOLUTIONS AS TRAFFIC LEVELS IN THE WORLD'S CITIES CONTINUE TO RISE.

To avoid gridlock, the proportion of passengers using rail transport has to be increased by developing efficient metro systems which are attractive to use. What is required are compact, lightweight technologies offering greater economy. We design every system to address specific operating conditions, minimizing wear and achieving high levels of economy and vehicle availability. As a manufacturer of braking systems with more than 100 years' experience, Knorr-Bremse has the necessary expertise to achieve this. High levels of research and development investment ensure that our systems remain cutting-edge. With RailServices Knorr-Bremse offers a high-quality portfolio of maintenance and aftermarket services ranging from original parts and maintenance agreements through to responsibility for complete systems during the entire life cycle. Customers also benefit from a comprehensive network of service centers for all braking and on-board systems.

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