Why do more and more metro manufacturers and operators put their trust in Knorr-Bremse systems?
We simply find the right answers to complex challenges

With major conurbations growing worldwide, public transport systems are becoming increasingly important. Major cities are depending on attractive metro systems to take the pressure off overcrowded streets. Especially in Asia, massive investment is currently taking place to develop the necessary infrastructure and purchase new, improved vehicles. Knorr-Bremse is a leading player in this growth market. On the basis of tried and tested 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 top marks in terms of environmental friendliness. Customers enjoy full support from a single source – from the initial planning stage and commissioning right down to aftermarket services. Worldwide operator and customer audits regularly single out the consistent quality of our products and services for praise – and this is confirmed by our EN 50126 (RAMS and LCC) certification.
What is Knorr-Bremse’s complete “one-stop solution” for metros?
A perfect balance of high-quality systems and services
Knorr-Bremse’s expertise in the field has gone into every single component and system. Top-quality components operate smoothly together to guarantee optimum functionality, high reliability, and maximum safety. Complex electronic control systems such as blending and brake management reduce wear to a minimum by ensuring the balanced operation of all systems. Customers are closely consulted when the overall system is being designed. It goes without saying that Knorr-Bremse also offers support during the homologation process as well as all the necessary on-site services across the entire product life-cycle.
**Cutting-Edge Technologies**

<table>
<thead>
<tr>
<th>Distributed Brake Control</th>
<th>Central Brake Control</th>
<th>Air Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EP 2002 Cube</strong></td>
<td><strong>EP Compact lite</strong></td>
<td><strong>Oil-free compressor</strong></td>
</tr>
</tbody>
</table>

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 includes a wide range of additional functions in a single cube-shaped unit with integrated piping.

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: control of parking brakes, wheel slide protection, air suspension, sanding, indirect brakes, brake management, BUS coupling, and further functions.

Knorr-Bremse was the first company in the rail vehicle industry to develop a compressor that operates without any oil. Lubrication is replaced 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. Expenses for oil changes, oil separation, and condensate disposal are avoided, and energy consumption, weight, and installation space are significantly reduced.

---

**Innovations that pay their way**

*Reducing wear and tear and maintenance costs is a good way of saving money.* 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 electro-dynamic braking cannot cope on its own. Even then, patented braking 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.

---

**rail services**

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.
Is it true that Knorr-Bremse’s metro solutions are also the best in the world in terms of economy?
Wherever top quality is crucial for competitiveness

Knorr-Bremse’s rail vehicle systems are not only cutting-edge technology – they are also market leaders. All over the world, when manufacturers and operators make purchasing decisions, they take a wide range of factors relating to safety and economics into consideration. They find that the best results are offered by Knorr-Bremse’s unique combination of experience and innovation. Many customers opt for the full range of Knorr-Bremse systems and components for their metros.

Examples for equipped metros worldwide:

1. Munich
2. Algiers
3. Santiago de Chile
4. Guangzhou
5. Nanjing
6. London
### 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 LCC

**Screw compressor**
- Special design, related to tough railway operation conditions
- Low compressor noise level
- Virtually pulsation-free, delivery of compressed air

---

### Brake Control

**EP 2002 Cube**
- Distributed control
- Compact design

**EP Compact lite**
- Central control
- Compact design
- Modular and suitable to various customer requirements
- Optional electronics underfloor

---

### Bogie Equipment

**Wheel- and axle-mounted brake disc**
- Standardized interface and fixation on wheel
- Resistant against thermal cracks due to movable friction disc
- Robust design with high safety against external shock and vibration
- Aluminum friction rings

**Compact brake caliper**
- Only one interface to bogie
- Highly modular design
- Optimized design regarding weight, assembly, and costs
- Reduced maintenance

---

*Source: ALSTOM Transport / R. Pavez*
## Capsuled units
- Compact, light, reliable
- Protected: developed especially for very low noise level
- All components to be maintained can be reached 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
- Reducing life-cycle costs
- Fulfillment of TSI requirements

### Modular motion controller kit
- Brake, traction, and master controller
- Compatible with UIC standard
- Small, flexible installation space
- Robust design, application proven

### 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
Where have Knorr-Bremse solutions already been tried and tested?
What prospects for the future can Knorr-Bremse offer in the metro segment?
Technologies of the future
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 attractive metro systems. What is required are compact, lightweight technologies offering greater economy. We offer to adapt every system to the specific operating conditions involved, thereby minimizing wear and tear and achieving top 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 R & D investment ensure that our systems remain cutting-edge around the world. With railservices Knorr-Bremse offers a high-quality portfolio of maintenance and aftermarket services ranging from original spare parts and maintenance agreements right down 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.