

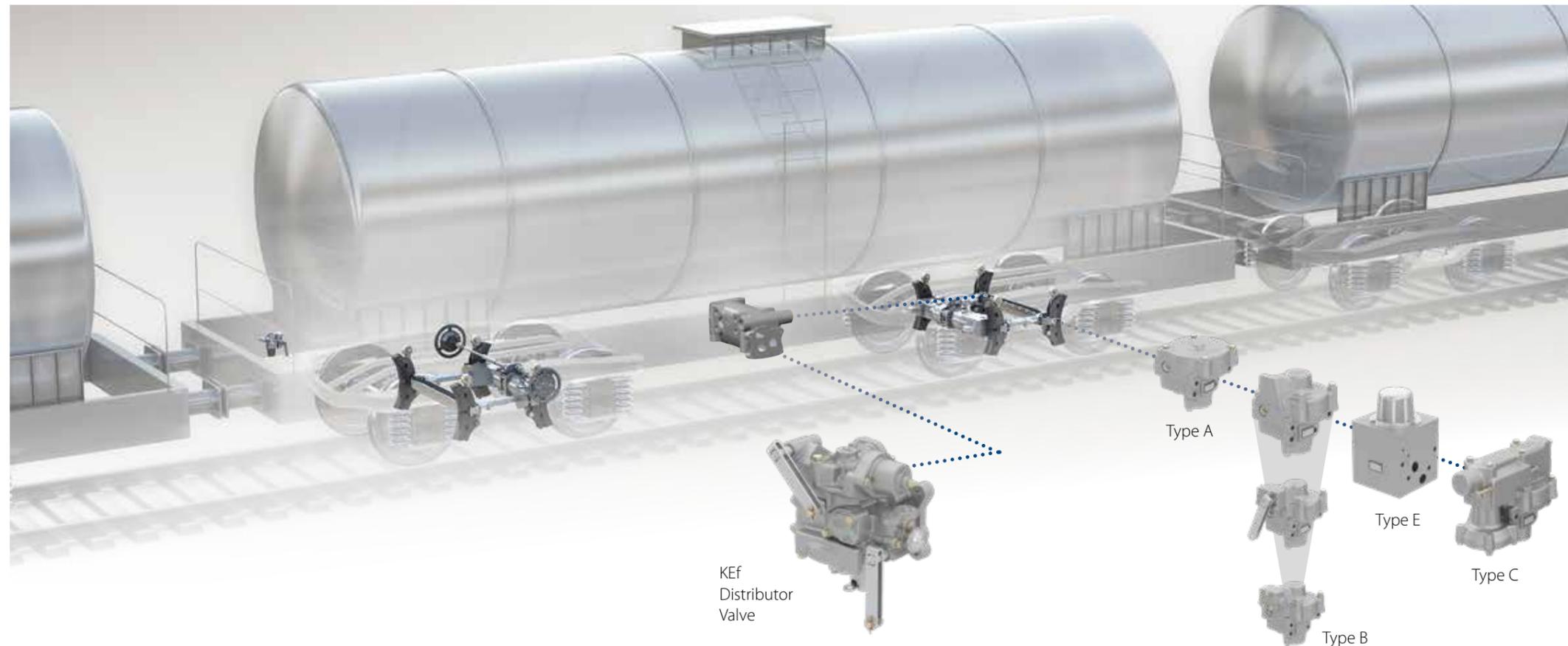
Freight Cars

REALIZING SYSTEM SYNERGIES

KNORR-BREMSE



THE PERFECT COMBINATION OF HIGH-QUALITY SYSTEMS & SERVICES



Knorr-Bremse's expertise in its field has gone into every single component and system. For freight applications Knorr-Bremse uses a synergistic approach to create complete systems which deliver high performance combined with low life-cycle costs. High-quality components operate in harmony to guarantee optimum functionality, high reliability and maximum safety.

For each project, customers are closely consulted at each stage and Knorr-Bremse offers total support from the beginning of the planning process through commissioning and during the entire operational life cycle of the system.

BOGIE EQUIPMENT

Knorr-Bremse offers a wide range of bogie equipment including the compact, lightweight bogie-mounted tread brakes CFCB and CFCB LIGHT. These innovative units focus on maximum durability or minimum weight whilst operating more efficiently than a conventional brake. And LCC and weight-optimized disc brake systems for freight cars are realized by means of Knorr-Bremse's new progressive lightweight disc.

BRAKE CONTROL

Knorr-Bremse has an extensive portfolio of carefully matched components designed for the total coordination of the braking effort along the entire freight train. Load-dependent relay valves ensure multi-level, continuous braking with KE valves finely controlling the system. Various additional modules include the kink-curve valve, which reduces wear, especially during long descents.

TESTING

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 customers' 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.

RAILSERVICES

Global presence. More than 30 service centers all over the world offer customers a comprehensive range of services based on top-quality technologies. Knorr-Bremse's global competence is demonstrated in the form of local service solutions: Knorr-Bremse RailServices makes it possible for repair and maintenance to be carried out rapidly in one location close to the customer. The high-quality working environment in some service centers has already achieved ECM certification – a standard that Knorr-Bremse aims to roll out at all its European sites.

Product expertise. Knorr-Bremse RailServices is familiar with individual types of rail vehicle and develops products and services irrespective of the manufacturer or operator. As a long-term systems partner the company puts together service packages that are tailored to customers' specific requirements. Such ongoing collaboration not only increases vehicle availability but also encourages innovative solutions and cuts life-cycle costs.

Service throughout the entire life cycle. You can choose the particular services you require from our flexible aftermarket program – whether this involves trouble-shooting, kitting or a complete overhaul. To ensure smooth running, regular maintenance, overhaul and repair are essential. Via its global 'Advanced & Project Engineering' network, RailServices offers integrated, customer-specific modernization programs to prepare rail vehicles for the approval process.

BRAKE SYSTEMS



For decades freight car builders and operators from all over the world have trusted braking systems designed, manufactured and supported by Knorr-Bremse. During this time, Knorr-Bremse has combined its experience and expertise in freight braking to develop new systems designed to offer customers even higher levels of performance, reliability and safety while offering lower life-cycle costs.

Based on a modular concept, each of the individual freight braking applications designed by Knorr-Bremse ensures that parameters such as pressure settings, characteristic curves and braking calculations are tailored to exactly suit the customers' specific operational requirements. In addition, Knorr-Bremse can assist the customer at the homologation and commissioning stages. 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.

CUTTING-EDGE TECHNOLOGIES



KE CONTROL VALVE

TRIED AND TESTED, HIGHLY ADAPTABLE

In production and subject to continuous improvement over many years, there are now over 1.5 million KE valves in use throughout the world. The KE valve has established a reputation for delivering fast, controllable, even and safe operation of the braking system, and its proven platform can have many additional features added to it. The latest generation KEf follows the proven modular design, which allows the customer cost benefits combined with the flexibility to customize features and solutions.



KINK-CURVE VALVE

AVOIDS WEAR AND OVERLOAD

The kink-curve valve is an additional valve for braking under load that is simply attached to the KE control valve. In freight trains consisting of cars with differing braking performance, it ensures even braking according to the load and braking requirements and can reduce surface temperatures significantly. The valve comes into its own during long descents, when it effectively protects against excess wear.



PRODUCTS FOR ALL STANDARDS

Knorr-Bremse is the partner of choice for regional train applications – with systems based on more than 110 years of development, production and practical field experience. It provides innovative, TSI-compliant solutions tailored to local requirements, all current global standards (UIC, AAR, GOST, Chinese Standard, ARA) and individual operating scenarios. And its worldwide production and service network meets even the strictest requirements for local content.

SYSTEMS SOLUTIONS – BENEFITS FOR THE CUSTOMER

The more closely braking systems are networked with other rail vehicle sub-systems, the greater the benefit for the operator, as this reduces overall complexity by avoiding redundant infrastructure. For example the braking system's vehicle weight sensors can be used by the HVAC system to adjust output when passenger density drops.

BRAKE SYSTEMS



CUTTING-EDGE TECHNOLOGIES FOR UIC STANDARDS

DERAILMENT DETECTION SYSTEM

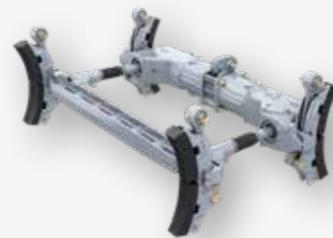
AUTOMATIC EMERGENCY STOP IN CASE OF DERAILMENT

The EDT[®]101 consists of an emergency brake valve, a mounted spring-mass valve and an indicator device. In case of derailment, the vertical acceleration is registered by the spring-mass valve. This immediately activates the emergency brake valve, which opens the main brake pipe and initiates an emergency brake application.



CFCB | COMPACT FREIGHT CAR BRAKE REDUCING OPERATING COSTS AND WEIGHT

Compared to conventional freight car brakes the bogie tread brake CFCB combines extremely durable design with significant weight reduction, making freight cars considerably more economical to operate. Braking force is transferred directly via slack adjusters and the cylinder and transmission rod are fully insulated. All bearings are maintenance-free and the system automatically adjusts for block and wheel wear.



CFCB LIGHT | COMPACT FREIGHT CAR BRAKE BRINGING WEIGHT REDUCTION INTO FOCUS

The CFCB LIGHT is geared towards weight minimization. At least 30% lighter than a fully encapsulated design, it is the preferred solution when weight saving ranks first. Just a single brake cylinder model covers all applications and provides easy conversion to the park brake variant. The slack adjuster integrated in the brake cylinder adjusts the block clearance with one brake application.



FREIGHT CAR DISC BRAKE

WEIGHT AND LCC-OPTIMISED DISC BRAKES BECOME REALITY

Following the requirements of disc-braked freight cars an optimized friction disc/hub interface makes this rugged disc ~45 kg lighter than one usually used for such applications. Latest computer simulation processes like Computational Fluid Dynamics (CFD) yielded an elaborated geometry of the cooling ribs that provides necessary cooling capacity despite a width of only 110 mm.



CUTTING-EDGE TECHNOLOGIES FOR AAR STANDARDS

DB-60 II | WITH BRAKE CYLINDER MAINTAINING (BCM)

DB-60 II with the BCM feature is the safest control valve available for the AAR markets as it makes up for leakage in the brake cylinder circuit. It also improves operational efficiency of railroads and keeps the freight cars in service longer. It is made from the highest-quality materials including cold-temperature rubber compounds. Highly reliable poppet valves used in the valve deliver the longest life since they are free from friction and stiction, while DB-60 II meets all the requirements of AAR S-464. The DB-60 has proven its reliability in service and has been installed on over 500,000 cars in service today throughout North America.



SLOPE SHEET EMPTY/LOAD

The EL-60SS valve provides empty/load control for bulk commodity hopper car applications, using the proven EL-60 upstream proportioning technology in a slope sheet package. In addition to a lightweight all-aluminum design, the EL-60SS includes an innovative test feature, which makes single car testing easy.



TMB-60 | DESIGNED TO LOWER LIFE-CYCLE COSTS

The unique TMB-60 parallelogram design delivers optimum braking performance using extremely rugged but lightweight beams. TMB-60 is recognized for delivering the industry's most uniform shoe and wheel wear. With no "through-bolster rods" the risk of equipment damage is significantly reduced. The integrated compression slack adjuster eliminates trigger failures found on competitors' products. The assembly and set-up process is fast and during car maintenance brake heads can be removed and replaced without de-trucking, providing a major operational advantage. The field-proven highly reliable, rugged and lightweight TMB-60 offers several advantages over the competition.



KLASING HAND BRAKE – THE MOST RELIABLE IN THE INDUSTRY

The product line includes vertical-wheel, geared hand brake designs (Groups N and O) which are AAR approved and qualified. The robust KLASING design provides improved hand brake survival, reducing rail car life-cycle costs. Quick-release levers are available in a short or long handle version, which provides versatility for unobstructed access. The long handle requires less pulling force to activate complete release. Pinion gear and quick-release mechanisms are hardened to provide improved wear resistance. A shelf-type winding drum protects the chain from bending, twisting and overlap. The unique winding drum design provides quick chain take-up and also provides smooth gradual release.



BRAKE SYSTEMS



CUTTING-EDGE TECHNOLOGIES FOR ARA STANDARDS

WF5 TRIPLE VALVE | THE WF5 PNEUMATIC CONTROL VALVE IS A GRADUATED-APPLICATION AND DIRECT-RELEASE BRAKE CONTROL VALVE DESIGNED FOR OPERATION ON LONG FREIGHT TRAINS

It provides long service life with minimum maintenance. It is made of lightweight but sturdy aluminum components for reduced weight and minimized corrosion. It is highly reliable, and system-compatible with railways of Australian specifications. It is inherently fail-safe, and features outstanding performance response and controllability. It delivers high brake signal propagation rates resulting in reduced stopping distances, inter-train forces and shorter brake release response time.



KFS – MULTI-COMPARTMENT RESERVOIR FOR BRAKE CONTROL EQUIPMENT

The KFS Multi-Compartment Reservoir is the next generation reservoir allowing direct connection between pneumatic control valves and their control volumes for braking systems, resulting in improved access for user-friendly system maintenance.



QB13 NARROW GAUGE BOGIE-MOUNTED | SLACK-ADJUSTED BRAKE SYSTEM WITH AUTOMATED PARKLOC PARKING BRAKE

The new QB-13 bogie-mounted brake design offers many additional enhancements for operators running on Australia's narrow-gauge railways. With the introduction of a fully automated slack adjuster, a patented Parkloc™ automatic parking brake solution and replaceable brake heads, the QB-13 bogie-mounted brake system is the industry's leading design for freight cars. Features include: proven brake beam design, single brake cylinder with integrated Parkloc™ automatic park brake, automatic slack adjustment of up to 13" wheel/block combination wear, removable brake heads.



TS 2 TENSION SPRING PARK BRAKE ELEMENATING THE RISK OF A DRAGGING BRAKE

The TS 2 Tension Spring Park Brake is a pneumatically controlled automatic park brake. Utilizing the wagon's brake rigging, the park brake can be applied or released throughout the train, without individual manual operation, resulting in reduced operating time, consistent force application and eliminating brake drag caused by unreleased manual hand brakes.



CUTTING-EDGE TECHNOLOGIES FOR MARKETS WITH 1520 MM TRACK GAUGE

KAB60-01 | DISTRIBUTOR VALVE

DEVELOPED ESPECIALLY FOR CHALLENGING REQUIREMENTS

Knorr-Bremse distributor valves have enjoyed global success over many decades. Following this success there was a demand for a valve to address the special needs of the Russian market with its 1520 mm gauge track and extremely low operating temperatures. Freight trains in Russia are also particularly long and travel at relatively high speeds.

This means that they need distributor valves that guarantee quick and smooth propagation of brake application and release, right down to the final car in the train. They must also be capable of functioning at temperatures ranging between -60 °C and +80 °C. They must be extremely durable, reliable, safe and compatible with existing braking systems. The development of the KAB60 answered all of these challenges as a result of close cooperation between Knorr-Bremse and Russian specialists and the development of state-of-the-art testing facilities and procedures to prove final performance levels.



AKB1 LOAD-DEPENDENT BRAKE VALVE

- Extended maintenance intervals (minimum 6 years)
- Compensates effectively for vibration and jolting
- Enhanced protection against dirt and poor air quality
- High-quality materials and corrosion-resistant steels for prolonged operating life
- Extended working range between empty and loaded
- Simple, rapid maintenance
- Low wear due to use of special bearing materials
- Enhanced protection against mechanical influences (e.g. rock chips)
- Simple, protected pressure setting
- Compact design and low weight



PROBLOCK



LOW-NOISE FRICTION BLOCKS FOR UIC STANDARDS

The broad product portfolio of Knorr-Bremse includes freight car brake blocks with significantly lower noise levels. Extended lifetimes and stable friction levels are among the benefits of our products.

LOW NOISE

LL-BLOCK IB116*

The new organic LL-Block IB116* improves the wheel surface. The environment benefits from significant reduction of noise emissions.

Problock Type LL

- Low friction to replace GCI blocks, noise reduced by 50%
- UIC homologation
- Direct substitution of cast iron blocks
- Experience at Icer Rail in Spain for more than 15 years

2ND GENERATION

K-BLOCK

With high thermal stability and excellent wear characteristics on wheel and block, K-Blocks stands for lowest operating costs and reduced running noise.

Problock Type K

- High friction for modern cars, noise reduced by 50%
- UIC homologation
- For new freight cars
- 2nd generation of K-blocks with improved LCC

BRAKE SHOES FOR AAR STANDARDS

AAR

Anchor Brake Shoe has been manufacturing a full range of AAR-compliant composition and semimetallic freight car brake shoes for over 35 years.

Highest quality is combined with "real world" experience to deliver superior performance and value in all applications and service environments.



TECHNOLOGY INTO THE FUTURE

The high loads and extreme operating conditions to which modern freight trains are subjected demand technologically advanced, reliable and safe braking systems. Knorr-Bremse designs every braking system to address the specific operating conditions of the freight train and to deliver performance, reliability and safety. Wearing parts are minimized to deliver high levels of economy and vehicle availability.

As a manufacturer of braking systems with more than 110 years of 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 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 freight braking and on-board systems.

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