









**Knorr-Bremse Systeme für
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-  **KNORR-BREMSE**
-  **NEW YORK AIR BRAKE**
-  **IFE**
-  **MERAK**
-  **MICROELETTRICA**
-  **SELECTRON**
-  **KIEPE ELECTRIC**
-  **EVAC**
-  **ZELSKO**
-  **RAILSERVICES**

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FRICTION TECHNOLOGIES

**BRAKE PAD AND BRAKE BLOCK EXCELLENCE
FOR ALL TRAIN APPLICATIONS**



KNORR-BREMSE



With the system competence and global know-how of Knorr-Bremse, Friction Technologies provide the most comprehensive, individual and suitable offer of friction products for all train applications.



Optimum friction pairing for maximizing performance and operating life, and for minimizing costs, can only be achieved in a perfectly balanced braking system. As a supplier of brakes and a full range of friction products, Knorr-Bremse is in an ideal position to design the best system.

FRICION TECHNOLOGIES

PROPAD PROBLOCK ULTRAPAD ULTRABLOCK

Knorr-Bremse Friction Technologies offers a full range of sinter and organic brake pads and blocks. Our customers can rely on unique system expertise based on integrated engineering to achieve best brake performance.

ULTRAPAD

Sinter pads both in flexible and rigid designs are composed mainly of sinter material elements in different forms and sizes. High technology degree for the most demanding applications.



ULTRABLOCK

Sinter material blocks for thermally highly demanding applications. Knorr-Bremse is actively working towards introducing this product family in its portfolio.



PROPAD

Produced with a variety of organic friction materials, organic pads cover the demands of a wide range of applications. Available both in standardized forms like UIC/KRS or specific design for hydraulic applications.



PROBLOCK

Wide range of organic material blocks both in UIC and AAR forms to cover a wide range of applications. Developing technologies towards wear- and noise-optimized products.

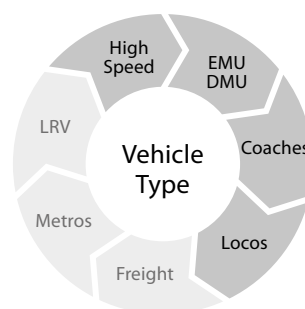






UltraPad



PROPAD PROBLOK ULTRAPAD ULTRABLOCK

- Knorr-Bremse offers a full range of flexible sinter brake pad designs for high-energy application
- High friction stability at high temperatures and reduced hot spots on brake disc
- High mechanical resistance
- Supply chain which supports unique overhaul concept, elements produced at Knorr-Bremse site



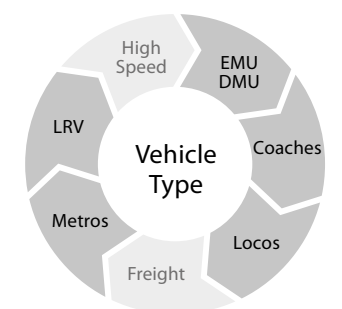
UltraPad Flex			UltraPad Extreme
UIC	KRS	Tetra / Penta	
Speed application up to 250 km/h	Speed application up to 250 km/h, 15% increased life time	Speed application up to 250 km/h, significantly increased wear volume	Highest speed application > 250 km/h
			




ProPad



PROPAD PROBLOK ULTRAPAD ULTRABLOCK

- Organic friction materials
- Large product portfolio covering the specific demands of each application
- Noise-optimized design to avoid squealing
- Standard UIC dovetail designs or specific application-related hydraulic designs



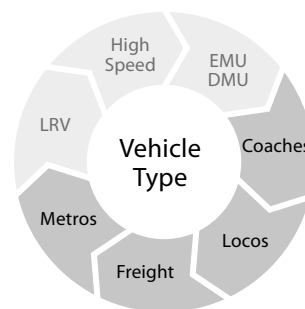
ProPad		
Hydraulic	UIC	KRS
Specific designs fitting into all hydraulic interfaces	Extensive portfolio with global certifications (UIC, GOST, ...)	15% increased lifetime in friction pairing
 Hydraulic specialized	 UIC standard	 KRS optimized

ProBlock – UIC



PROPAD **PROBLOCK** ULTRAPAD ULTRABLOCK

- Organic blocks covering demands of all UIC application types
- High and low friction levels optimized for each application
- Low wear levels, compared to gray cast iron blocks, 3 times longer lifetimes
- Standardized forms and wide range of friction material available, providing a large range of products

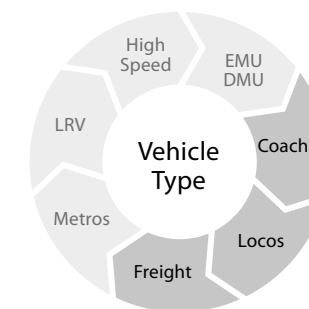








LL Blocks – L Blocks	K Block	Metro Blocks
Low friction to replace gray cast iron blocks, reduction of noticeable noise level by 50%	High friction level for modern freight cars	High friction level, stable for all applications (e.g.: ATO, emergency, ...)
		

ProBlock – AAR

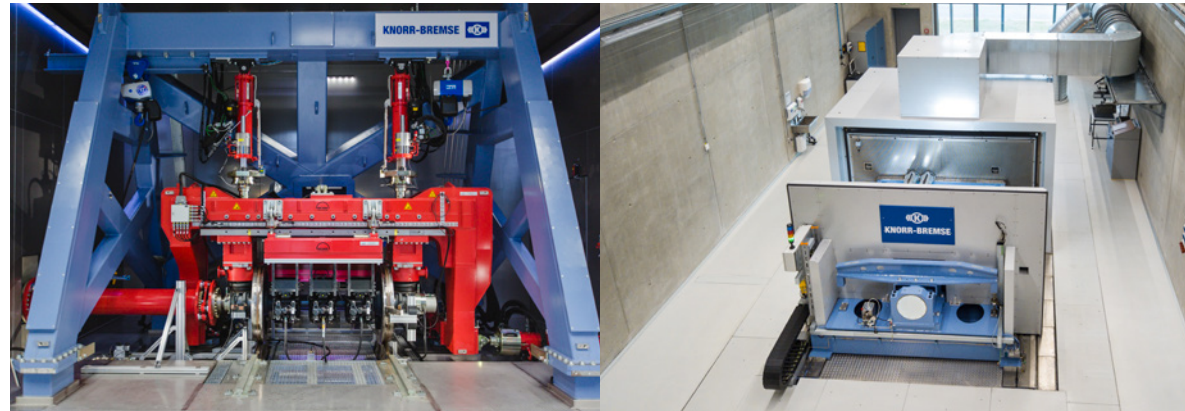
PROPAD **PROBLOCK** ULTRAPAD ULTRABLOCK

- Applications for all AAR markets
- Product lines with differentiated value proposition for the customer
- Standardized forms and wide range of friction material available, providing a big range of products
- Wheel Saver tread conditioning brake shoes repair wheel tread defects keeping wheels in service longer

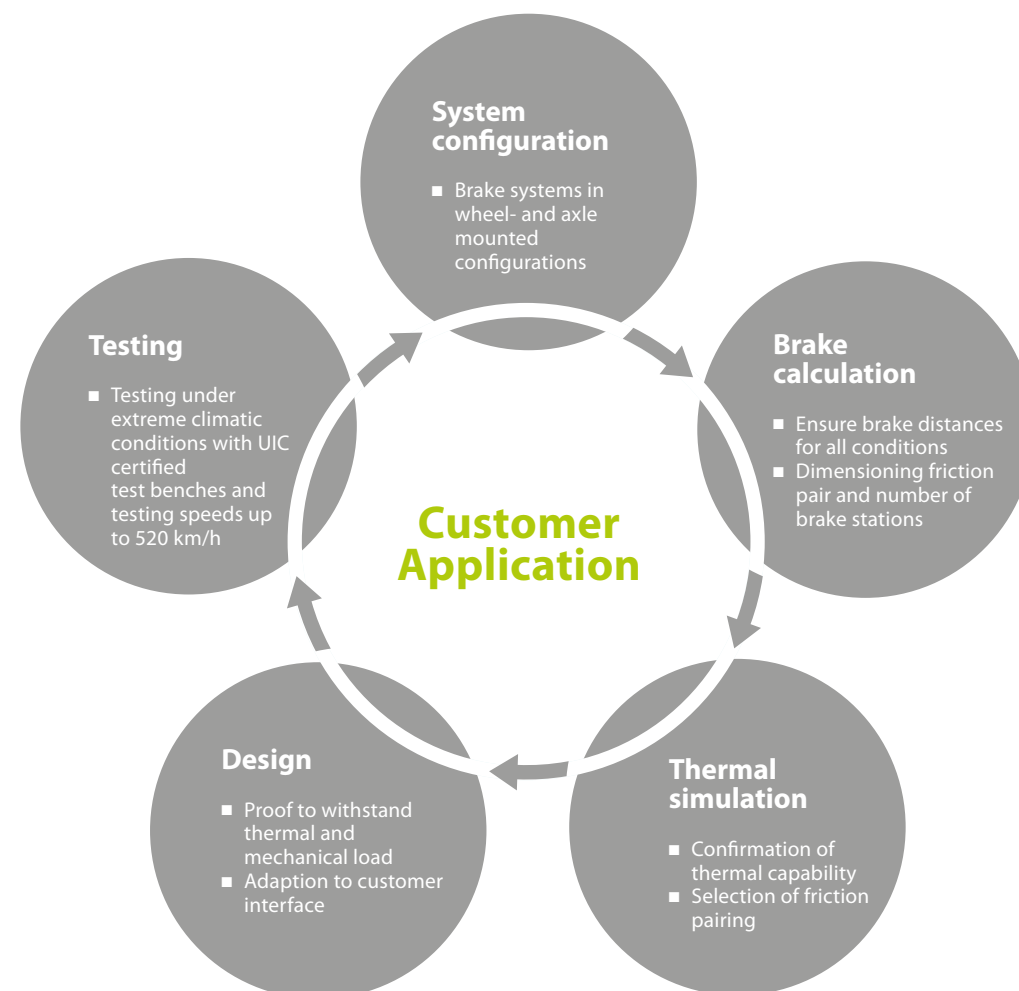


Freight Shoes			Locomotive Shoes		Coaches
CHANGESAVER	VALUESAVER	WHEELSAVER	PROSHOE High Friction	PROSHOE Low Friction	PROSHOE High Friction
Provides 45% more friction material than all other AAR-certified products	Optimized friction performance, competitive price design	Tread conditioning and low fade friction performance	Different mixes and forms produce proven durability and life-cycle value	Low friction formulas designed for today's service environments are replacements for cast iron shoes	Formulas and forms specifically designed for commuter rail service environments
					

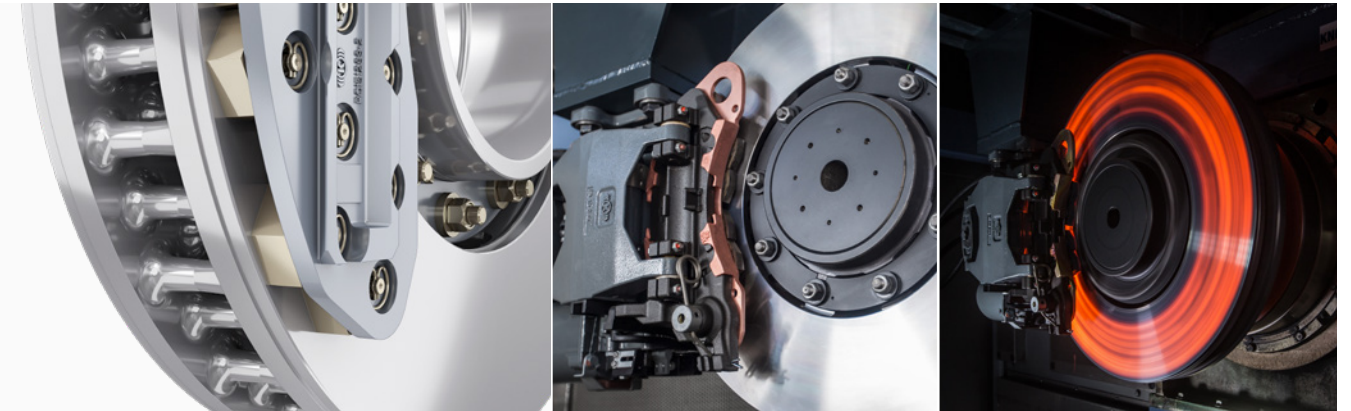
System & Testing Excellence



One of the most advanced testing facilities worldwide allows Knorr-Bremse to close up the cycle for every customer application with the assurance that the most reliable system has been designed for our customers. Knorr-Bremse's holistic approach as a system supplier puts the customer specific applications into the focus.



Friction Pairing Excellence

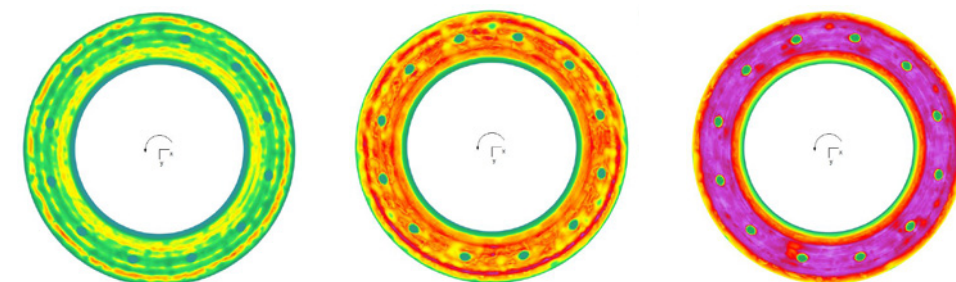


Knorr-Bremse has the expertise to optimize life-cycle costs of friction pairs. Value-add for customers by:

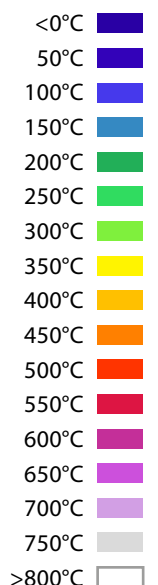
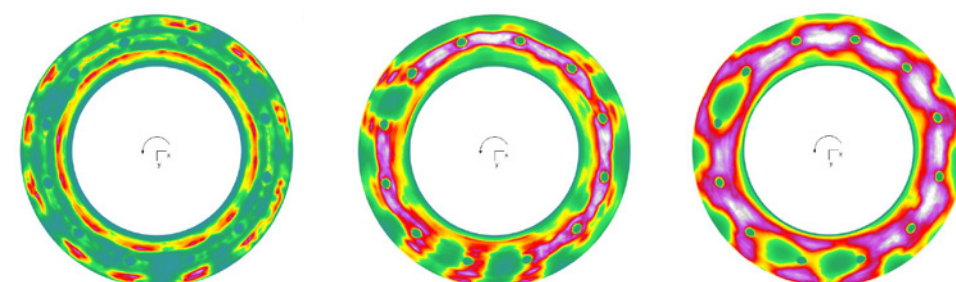
- Optimizing pad design (flexible vs. rigid design) and wear volume (KRS shape)
- Optimizing heat flow and heat distribution on friction surface of disc and pad
- Optimizing cooling performance of brake disc and brake pad
- Avoiding hot spots on friction surfaces

Thermographic investigation of friction pair with state-of-the-art testing equipment in the Knorr-Bremse technology center:

Flexible sinter pad



Rigid sinter pad



speed →

Production Excellence

With one of the world's broadest portfolios, Knorr-Bremse assures high-quality production and supply chain excellence. Knorr-Bremse's leading rail friction factories focus on the product portfolio of the world's largest markets: UIC and AAR. Our facilities are equipped with the latest production technology to ensure high-quality, reliable products.



- Manufacturing in Pamplona, Spain, since 1961
- **Products:** UIC organic friction material
 - Organic brake pads and blocks
 - Sinter friction elements



- Manufacturing in West Chicago since 1977
- **Products:** AAR brake shoes
 - Organic brake blocks (= shoes)
 - Semi-metallic wheel-conditioning shoes

- Manufacturing in Manchester since 1879, owned by Knorr-Bremse since February 2016
- **Products:** Organic metro blocks and organic freight blocks (no UIC blocks)

References (extract)

Knorr-Bremse delivers friction products all over the world with local sales teams

