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Schienenfahrzeuge GmbH

INFORMATION FOR
KNORR-BREMSE'S CUSTOMERS
AND BUSINESS PARTNERS

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Dear reader,

Some people say rail transportation is inflexible – after all, once a track has been laid, it can't be moved. But of course, although it may seem so at first glance, a closer look reveals that rail transportation can in fact be extremely flexible, fixed routes notwithstanding. Major cities are building new metro networks – no other form of transportation enables such fast and cheap urban travel for so many people. Meanwhile, high-speed rail lines provide an alternative to flying, with passengers welcoming the chance to enjoy stress-free travel that is far less harmful to the environment. Capable of transporting thousands of tonnes at a time, freight trains are essential to the transportation of goods. And while the traffic in our inner cities grinds to a halt, zippy LRVs can simply sail through.

Despite all these different application scenarios, rail transportation is indeed less competitive in situations requiring highly flexible, zero-emission vehicles that are even capable of 24/7 operation. This is where trolleybuses come into their own.

The E-Bus 2020 project in the Dutch city of Arnhem is setting a global benchmark: Self-learning vehicles share their knowledge with the rest of the fleet via the cloud. The vehicles automatically coordinate charging power and charging phases in order to maximize network utilization. In addition, the city is using the buses' overhead lines as a smart grid to which electric vehicle charging stations can also be connected, for example. It is no coincidence that we are reporting in depth on the Arnhem initiative – Knorr-Bremse company Kiepe Electric has a central role in the project.

Needless to say, Knorr-Bremse is also involved in other projects around the world. In the UK, for example, we have developed a process for reusing leftover friction material in new brake blocks for the London Underground. In Switzerland, Knorr-Bremse company Selectron Systems has developed the TCMS for a new snow blower. And in India, our RailServices and IFE engineers are trialing electric drives on EMU doors.

We are also giving you a look at our new EP2002 3.0 brake control system. As well as offering an attractive range of innovative new features, the EP2002 3.0 provides a single control system solution for several different vehicle applications. This is yet another example of the flexibility referred to at the start of this editorial.

But why not read about it all yourself?

Yours sincerely

Dr. Nicolas Lange

news

Building bridges

Eurasia Rail and Railtex were two of this year's largest rail transportation fairs – and Knorr-Bremse featured prominently at both.

As the bridge between Asia and Europe, Turkey is the ideal venue for the Eurasia Rail exhibition, which brings together rail market players from both continents every two years. This year's event was held from April 10-12 in Izmir.

The exhibition provided Knorr-Bremse – which has its own local facility in Turkey – with an opportunity to present some of the key systems in its portfolio. These included the new Knorr-Bremse Standard Valve (KEf), a fundamentally redesigned version of its leading control valve. Based on an ingenious modular system, even the standard model can be accommodated in tight low-floor vehicle installation envelopes with no need for special modifications. Knorr-Bremse also showcased a cross section of its recently expanded friction material portfolio in Izmir. The Company will soon be able to offer the appropriate friction material for almost any type of train. Meanwhile, IFE presented an entrance system with a new sealing system for sliding doors that improves acoustic insulation and significantly reduces passengers' exposure to noise.

The Company's new EP2002 3.0 brake control system was a highlight, not only in Izmir but also at Railtex 2019, the UK's largest rail exhibition, which took place in Birmingham from May 14-16. This product can also claim to be building bridges, since it now spans different vehicle types. Building on the success of its predecessor, which was designed for metro applications, the new control system is now also available for regional and high-speed trains. It also adds a host of innovative new features (see page 22). At both trade fairs, RailServices provided a comprehensive overview of its modernization expertise and service portfolio across the entire rail vehicle life cycle.

Impressions of this year's Railtex trade fair. The right-hand picture shows Andrew Jones, Parliamentary Secretary of State for Transport with Mark Cleobury, member of the Management Board, Systeme für Schienenfahrzeuge GmbH.

news

Kiepe Electric electrifies Dortmund and Erfurt

Energy efficiency is at the heart of smart LRV systems, for new vehicles and modernization projects alike.

The City of Dortmund's public utilities company DSW21 is modernizing 64 LRVs and has ordered a further 24 new vehicles. While the mechanical side and the design of the vehicles will be handled by Leipzig-based LRV manufacturers HeiterBlick, Kiepe Electric will be responsible for all the electrical systems.

The new high-floor, bidirectional light rail vehicles will be powered by energy-efficient three-phase drives, while the driver's cabs will be equipped with ergonomic multifunction displays and modern HVAC systems. The vehicle control system connects the entire drivetrain, the on-board power converters and the HVAC system. With the exception of the drive system, the same electrical systems will be used for both the modernization of the current fleet and the newly built vehicles.

Demand-controlled HVAC using a CO_2-Sensor.
For the expansion of its LRV fleet, the Thuringian state capital of Erfurt has also chosen a range of Kiepe Electric products. "Our systems make up a comprehensive package for the Tramlink fleet," explains Dr. Heiko Asum, Managing Director of Kiepe Electric. "In addition to the complete traction system and on-board power supply, we are also supplying the vehicle control system including the hardware and software, HVAC units for the passenger compartment and driver's cab, on-board and external displays, and a video monitoring system. The control panels and operating and display systems are also coming from Düsseldorf." In other words, a wide range of systems and functions that are perfectly matched not only to each other but also to the Tramlink platform are being supplied from a single source.

Energy efficiency is at the heart of all these systems. The waste heat from the water-cooled 100-kW traction motors is transferred to the passenger compartment via a heat exchanger. In addition, demand-controlled air recirculation reduces the HVAC system's power consumption. A CO_2 sensor continuously measures the air quality, ensuring that only the volume of air that corresponds to the number of passengers on board is heated or cooled. Recuperated braking energy is either used by the vehicle itself or fed back into the overhead lines.

▲ Low-floor high-speed multiple unit train

© Stadler

▲ LRV in Erfurt by night

SMILE test runs underway

It is just under two years since Stadler's SMILE was first presented to the general public. Swiss Federal Railways (SBB) has become the first rail operator to place an order for these trains and has decided that the 29 units in question should go by the name of "Giruno". Test runs for the world's first series-production low-floor high-speed multiple unit train are currently underway in Italy. For these trials, SMILE has been given a modern livery featuring the logos of the suppliers involved in the train.

These include Selectron Systems, which developed the TCMS: The central vehicle control system is in constant communication via Ethernet and CAN networks with the decentralized I/O islands (RIOMs) throughout the train, integrating all the vehicle sub-systems into an optimally coordinated overall system based on the modular Selectron MAS 83x/73x control systems and MAS 3xx Smartio®.

news

Snow blower control system

Last December, a new snow blower entered service on Switzerland's Gornergrat Railway, helping to keep the tracks clear of snow over the winter months. Its control system was supplied by Selectron.

„Xrote 3933," the Gornergrat Bahn snow blower

It's an unusual name for an unusual vehicle. The Gornergrat Railway's new snow blower is known as the "Xrote 3933" – but this designation is far from random. The "X" stands for utility vehicle, "rot" identifies it as a snow blower, the "e" is for "electric", and 3933 is the vehicle number. Knorr-Bremse subsidiary Selectron supplied the complete control system, which is based on MAS83x/73x and MAS 3xx Smartio® components and a CAN-based network architecture.

Clearing 3,000 tonnes of snow an hour off the tracks

The new ZAUGG AG EGGIWIL vehicle replaces an old snow blower dating back to 1943 that had come to the end of its service life. Unlike its predecessor and other conventional blowers, the new vehicle uses a combined cutter/blower.

The snow is removed by a rotating cutter wheel and conveyed to the center of the unit, where the faster-rotating impeller then clears it from the track through a rotating ejection chute. 3,000 tonnes of snow can be cleared from the line in one hour. The 19-tonne blower is pushed along the track by a turbo vehicle that can be remotely controlled from the blower's built-in cab.

Siemens and Knorr-Bremse cooperate in Railigent and iCOM deal

Siemens and Knorr-Bremse are combining their expertise in rail vehicle digitalization. The deal, which was signed at the end of 2018, applies to vehicles covered by Siemens service contracts. On these vehicles, Knorr-Bremse will augment the Siemens Mobility application suite Railigent® with apps from its iCOM platform.

The first joint project involves a service application in the UK for the Siemens Desiro platform. The aim is to deliver further efficiency and performance improvements in the trains' HVAC systems by combining Knorr-Bremse's comprehensive HVAC know-how with Siemens' exceptional maintenance expertise.

▼ Framework cooperation agreement with Herr Emmelheinz of Siemens

Full service contract with HLB

Regional transportation company Hessische Landesbahn has chosen the experts at Knorr-Bremse RailServices to provide it with a comprehensive service package. The service specialists have been entrusted with the supply and organization of consignment stock for the Knorr-Bremse braking components of HLB's 35 class 1440 Coradia Continental XCC vehicles. The ten-year service and materials supply deal commenced in December 2018.

Located on the operator's premises, the consignment warehouse is stocked with spare components such as valves, compressors and brake calipers. In addition, regular checking of wear part requirements enables forward planning for their supply. RailServices also makes sure that an appropriate set of spare parts is provided in good time whenever a vehicle is due for inspection. Other components of the package include an express shipping solution and standard or customized training.

Hessische Landesbahn, Source: Sascha Erdmann ▶

spotlight

Source: Klaus P. Canavan

SMART FLEETS

Self-learning vehicles that share their knowledge with the rest of the fleet via the cloud? You might take this for a vision of the distant future. But you would be wrong – Kiepe Electric's Smart Fleet Management system is already in use in the city of Arnhem.

The hardware controller that makes it all possible is just a couple of square centimeters in size. It consists of a processor soldered to a printed circuit board, a combination found installed in hundreds of thousands of vehicles. But the purpose of this piece of hardware is anything but commonplace. In conjunction with a cloud, it creates a groundbreaking energy management system for electric trolleybus networks.

"The system enables smart energy management, both on board the bus itself and when transferring energy from the charging road sections to the bus," explains Dr. Marcel Manheller, Project Manager Bus & E-Mobility at Kiepe Electric. Rather than simply going through the motions of driving along their particular routes, the idea is for buses to keep an eye on the bigger picture at the same time.

Smart networking of vehicle operating data
"Until now, each individual trolleybus was only concerned with fully recharging its own batteries as quickly as possible," says Manheller. "In the future, we want vehicles to see themselves as part of a fleet that has to be operated as seamlessly and resource-efficiently as possible." The key is to enable smart networking of the vehicles' individual operating data with route data acquired through self-learning algorithms.

This concept, known as "Smart Fleet Management," has been a key focus of Manheller's work in recent times. For example, the engineer describes a scenario where the energy management system constantly recalculates the predicted power consumption if the bus gets stuck in a traffic jam while running in battery mode. The Smart Fleet Management system can then take proactive measures to counter the increase in power consumption, for instance by reducing power to the traction system and auxiliary equipment.

If, in the event of a traffic jam, the bus was on a charging road section ahead of the traffic jam, it would report this to the cloud. As well as "knowing" that it should try to avoid any additional delays, the bus behind would also be aware that it was likely to be spending more time on the charging road section. This would allow the latter bus to switch to a slower, but more constant, charging rate, which is easier on the batteries.

It would also mean that another bus whose battery was approaching a critical level could now draw additional current from the overhead lines. In other words, it is all about smart prioritization. On-board auxiliary equipment such as the HVAC system also comes into the equation. The key is that the Smart Fleet Management system stores its knowledge in the cloud. This means that the same information is available at all times both to the entire vehicle fleet and to the controller in his office.

More buses on the road can use the same infrastructure
The Smart Fleet Management system's automatic coordination of charging rates and charging phases is a crucial feature. "Lower charging rates reduce the demands on the network's infrastructure," explains Manheller. To put it another way: "If all the buses in a network recharge their batteries at the optimal charging rate, the operator can increase passenger capacity by running additional buses without needing to upgrade the infrastructure."

This spring, the concept made it off the drawing board – it is being piloted as part of the E-Bus 2020 project in the Dutch city of Arnhem. In addition, the overhead lines used for the buses will form the backbone of a smart grid to which electric vehicle charging stations will also be connected, for example. According to Manheller, it is no exaggeration to say that "the city has become a European testing ground for multimodal electric transportation and smart energy distribution."

Power for electric bus networks

Kiepe Electric's IMC 500 In Motion Charging technology brings zero-emission mass transit to almost any road. Even gradients of 24 percent are no longer a problem, while full charging is possible on gradients of up to 12.5 percent.

Verona, Pescara, Rimini, Dayton, Solingen and Arnhem – the number of electric bus networks using IMC technology is growing all over the world. Firstly, because the power supply system is based on an established international overhead line standard that is now used in over 300 towns and cities. And secondly, because the IMC 500 is currently the most powerful in-motion charging system on the market, offering bus networks significantly greater route planning flexibility.

IMC buses draw electricity from the overhead lines on the sections of the route where they are present, powering the traction system and recharging the batteries at the same time. On the sections without overhead lines, they run entirely on battery power. "The breakthrough for this technology came when we were able to increase the charging power," explains Dirk Zuther, Director of Buses & E-mobility at Kiepe Electric.

24-hour operation with no interruptions for charging
The technology greatly increases electric buses' operating radius. It allows the buses to serve outlying parts of a city without additional overhead lines having to be installed. With the "charging road" providing an electrified trunk route, opening a completely new route costs no more than it would for diesel buses.

"A 12-meter IMC 500 bus only needs overhead lines on 15 percent of its route," explains Zuther. "It can cover the rest entirely on its own battery power." Operators can run the buses round the clock without any interruptions for charging either at the depot or at the terminus. And they can even do so with the heating or HVAC system running. Flexibility is also key for the "charging roads" themselves. "In Esslingen, the buses even charge while climbing gradients of 12.5 percent," says Zuther.

Electric bus in Arnhem

A HISTORY OF ECO-FRIENDLY MASS TRANSIT

Final assembly of an IMC battery-powered bus at Kiepe Electric, Source: Klaus P. Canavan

The US city of Dayton, Ohio, has a 130-year history of zero-emission mass transit in which Kiepe Electric has also played a part.

Mark Donaghy, CEO of the Greater Dayton Regional Transit Authority (RTA), explains the two compelling commercial reasons behind the authority's latest major order: "Electric buses have a longer life cycle and lower operating costs than conventional buses, as well as being quieter and better for the environment." When the RTA decided to expand its electric bus fleet by 15 vehicles to a total of 45, it chose Kiepe Electric as its partner.

Electric buses a feature of Dayton's streets since 1933

This order consolidates Kiepe Electric's leadership in electric traction systems for buses in the US, as the company helps to write the next chapter in the story of eco-friendly mass transit in Dayton and other cities such as San Francisco, Seattle, Philadelphia and Vancouver. Electric buses first appeared on Dayton's streets in 1933 and have been a familiar feature of the city for many years. Having first introduced electric passenger transportation as long ago as 1888, Dayton has the longest uninterrupted history of electric vehicle operation of any city in the United States.

Final assembly of the IMC trolleybuses takes place at the Kiepe Electric facility in Alpharetta, Georgia. This is also where the Knorr-Bremse subsidiary manufactures the traction system components, ensuring that it complies with the high local content requirements of the US vehicle market.

customers + partners

Speeding up the ordering process

Knorr-Bremse and Deutsche Bahn are implementing a new electronic interface for processing orders placed by workshops. They are not introducing this digital system just for the sake of it – it will deliver huge improvements in response times to incoming orders.

For decades, the individual steps involved in processing orders from workshops meant one thing – paperwork. For the workshop, the process might start with a quick fax or e-mail, sometimes a letter, or perhaps even a short phone call. Then it would be back to work – but the order process didn't stop there. On the supplier side, the order would be forwarded to the relevant department, where it would be assigned to an account by Technical Sales before being entered by Order Management. An order confirmation would then be generated and sent back to the operator for checking. Only once this process had been completed would the components actually be dispatched.

"The underlying processes are well established," says Mehdi Ruppert, head of Order Management Germany at Knorr-Bremse RailServices. "They have always been good." But in today's world, just being "good" is no longer enough.

Automated workflow for order confirmations

To reach the next level – i.e. "very good" – it would be necessary to "link the order processes directly to the supplier's IT system via an Electronic Data Interchange (EDI)," explains Ruppert. Team leader Ruppert then goes into more technical detail: "Data sets known as IDOCs are sent back and forth between DB and RailServices – which may be done via a provider." Basically, this means that customers no longer have to print out their orders and send them manually. It also saves the supplier having to input the same data into their system.

In other words, the EDI process provides a shortcut. Deutsche Bahn places the order via the electronic interface. RailServices then checks the order and sends a confirmation straight back to the customer via an automated workflow. The customer order

number is now permanently linked to the Knorr-Bremse order confirmation – and the same applies to the Deutsche Bahn customer material number and the Knorr-Bremse part number. This is possible because the sales team have previously mapped these data 1:1 and stored them in a database.

It means that RailServices can immediately start taking the necessary steps to ensure that the components are dispatched as quickly as possible. No collecting of faxes from fax machines, no opening of envelopes, and no waiting for someone to pick up the phone.

Systematic error traceability

Deutsche Bahn and RailServices recently started using the EDI interface to process some 7,500 part numbers, encompassing everything from the humble screw to brake control units and accounting for approximately 80 percent of the total volume. "Obviously, it was a massive change for everyone involved," says Ruppert. But the new process delivers huge improvements in response times to incoming orders, as well as preventing the errors that occur during manual processing. "The IDOC error messages also provide us with a systematic means of tracing price, item or delivery time errors."

customers + partners

Low-floor Stadtbahn cars for Vienna's transport operator Wiener Linien. Source: Manfred Helmer

HVAC replaces ventilation

In a major modernization project that began in mid-2017, Kiepe Electric has been refurbishing low-floor Stadtbahn cars for Vienna's transport operator Wiener Linien. This includes retrofitting new vehicle control systems and converters. Although this project is not quite finished, the next already beckons: The old heating/ventilation units are to be replaced with modern HVAC systems.

This project began with the refurbishment of a test vehicle on which Kiepe Electric replaced the existing heating/ventilation units with new HVAC systems that had the same interface. The test vehicle was successfully trialed in regular passenger service throughout last summer. As a result, the operator decided to refurbish the rest of the fleet. The work will begin in July and is scheduled to be completed by the end of 2020.

Passengers report significantly improved comfort

Wiener Linien monitored the test vehicle trial very closely. Vienna's U6 line is known for its packed cars and high on-board temperatures, particularly during the summer. The challenge for Kiepe was to design an HVAC system that is as powerful as possible, but still fits in the same installation space as a substantially smaller heating/ventilation unit.

"Our efficient design allowed us to achieve significant cooling of the Type T car's interior," says Peter Pichler, Managing Director of Kiepe Electric in Vienna. "Even the new fully air-conditioned vehicles on the U6 line are only marginally superior." Customer feedback also showed significantly improved comfort.

▲ Modern HVAC systems

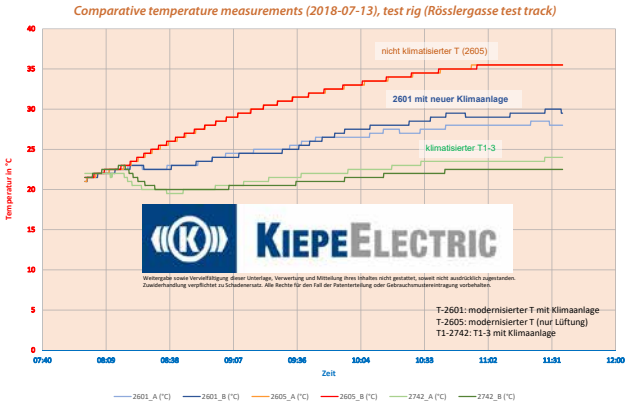
▲ Vehicles with nostalgic charm still operate on the network.

Efficient solution without major reconstruction

"There is a clear trend for people to demand more comfort," says Peter Pichler. Air-conditioning has become standard almost everywhere you go, be it in shopping malls and offices or people's own homes and cars. These expectations are also becoming increasingly apparent in the mass transit market. As well as modern HVAC systems for new vehicles, operators are also demanding efficient solutions that can be installed on existing vehicles without major reconstruction.

Summing up, Peter Pichler states: "The U6 modernization project demonstrates the technological achievements our engineers are capable of delivering – especially in refurbishment projects that require integrated converter, control, on-board power and HVAC solutions from a single source." The modernization project is expected to extend the service life of Wiener Linien's Type T cars by 15 years. Kiepe Electric is now using the solution developed for Vienna in other refurbishment projects for mass transit operators. The company sees significant growth potential in this area over the coming years.

▼ Temperature evaluation Kiepe Electric



customers + partners

Keeping an eye on other trains

Knorr-Bremse RailServices and DB Cargo are incorporating network and infrastructure data from DB Netz AG into the LEADER (iCOM Assist) driver assistance system. The integration of "green functions" will promote acceptance of the system among locomotive drivers – after all, energy savings cannot be delivered without the driver's support.

After entering the cab, the driver starts up the locomotive and checks in with the responsible dispatcher. He enters the freight train's number, total length and weight, plus the number of operational traction units on the display to his right – the interface with LEADER (iCOM Assist). Once he has finished, he sets off at a significantly higher speed than recommended by the system. Although this uses more power than necessary, the driver has a good reason for doing so. If he can get a couple of minutes ahead right at the start of his journey, he will lose less time later on – he is bound to have to stop at some point in order to let a passenger train past. "That always happens."

This has become a familiar scenario to Eva Lohmeier, project manager responsible for introducing driver assistance systems. "You

can't blame the drivers," she says. "They are under constant pressure. They are supposed to stick to the timetable, but from their point of view there is always something stopping them from doing so." As often as not, it will be a red signal requiring the freight train to let a faster Intercity-Express train past. RailServices Knorr-Bremse, DB Cargo and DB Netz AG are currently working on a solution to this conflict.

Driver recommendations to take account of other nearby trains

A key enabler of this solution is the integration into the driver assistance system of the network and infrastructure data now available in the form of DB Netz AG's "green functions of train movement control." Information on the current operating situation can now also be used to generate driver recommendations aimed either at preventing the train from arriving ahead of schedule ("running to schedule" scenario) or avoiding unnecessary stops or braking when the train has other trains behind it ("follow train" scenario). "This means that we can often avoid having to bring a 4,000-tonne freight train back up to full speed after an unplanned stop," says Lohmeier.

Field testing of the integration of the "follow train" scenario into LEADER (iCOM Assist) has been successfully concluded. The integrated solution will shortly be rolled out, initially in over 500 locomotives equipped with the system (BR145, BR152, BR185). A further 150 locomotives will follow during 2019.

The next steps: timetable updates several times a day, real-time data and inclusion of cross-border transportation

Lohmeier is confident that the overview of other nearby trains will lead to significantly higher acceptance of LEADER (iCOM Assist). We know from experience that locomotive drivers are much more likely to buy into assistance systems that add value rather than simply adding to their workload. Lohmeier quotes Michael Bublis of German locomotive drivers' union GDL: "They will be accepted if they make your job easier and/or offer additional benefits. For instance, if they genuinely support stress-free punctuality." The integration of the "green functions" should be an important step towards achieving this goal.

Meanwhile, firm plans are already in place for the next steps. The system will soon be able to provide timetable updates several times a day. The first cross-border routes are also set to be studied and evaluated in terms of potential savings. In addition, DB Netz wants to provide continuous real-time information about the line ahead and the line behind. For example, if a faster train is approaching on the line behind, the panel PC might display the following detailed message to the driver: Accelerate to the following speed; maintain this speed until the following location; then coast until after the next junction, where the faster train behind you will be turning off anyway.

LEADER (iCOM Assist) shows a driver recommendation for DB Cargo.

DB Cargo, Locomotive 185

products + services

RECYCLED BRAKE BLOCKS

Wouldn't it be great if leftover friction material could simply be reused to produce new brake blocks? Knorr-Bremse and the London Underground are already carrying out practical tests on a solution that could save the operator from having to dispose of between 70 and 80 tonnes of raw material a year.

(left) Markus Seidl, , head of friction material development at Knorr-Bremse's Munich headquarters with a brake block

(right) Paul Eeles, Friction Products Business Development Manager at Knorr-Bremse's Manchester facility, where the brake blocks are produced.

All of London Underground's brake blocks bear a small mark. "The marks indicate the point at which 30 percent of the original friction material is left on the backing plate," explains Paul Eeles, Friction Products Business Development Manager at Knorr-Bremse's Manchester facility. "Once the friction material has worn down to this buffer level, the operator has the blocks replaced throughout the entire metro train." Until now, the old brake blocks, including the remaining friction material, were sent to landfill. Now, however, the plan is to send them to the shredder instead.

First, the shredder's rollers would strip the metal backing plate from the rest of the brake block. In a second step, the coarsely shredded friction material would be milled into granulate and returned to the plant. There, it would be added to the mixer with the other raw materials used to make new brake blocks, before being pressed onto a new backing plate at a pressure of up to 600 tonnes to produce a brand-new brake block.

Braking performance must be as good as with original equipment blocks

It sounds simple, but in reality, it is much more complicated. "The recyclate is actually a unique raw material in its own right," explains Markus Seidl, head of friction material development at Knorr-Bremse's Munich headquarters. The challenge is to flawlessly incorporate material that has already been used into a new mix. "In the engineering and compounding processes, we naturally have to ensure that brake blocks containing recycled material deliver the same friction performance as original equipment."

The engineers developed numerous test blocks to get to this point. They made minor modifications to the manufacturing process and composition in order to test different values in the lab. The slightly modified brake block versions were then subjected to repeated testing on the dynamometer test rig in Manchester. Slowly but surely, they got closer and closer to the key benchmark of delivering the same braking performance as original equipment brake blocks.

Unsurprisingly, this was a very time-consuming process, says Seidl. "But developing these innovations in our friction materials division has given us a clear edge over the competition." The process has now been validated for brake blocks with a recyclate content of up to 30 percent – and the test reports have also been completed.

A strong signal

This solution promises to send out a strong signal to other operators of vehicles with single-material brake blocks. After all, it means that they can save on the often substantial costs associated with disposal of the leftover material. "Our colleagues at London Underground have calculated that it could save them having to dispose of between 70 and 80 tonnes of raw material a year," says Seidl. "Taken across the entire life cycle, brake block recycling probably ends up cost-neutral for us." But as an engineer, that is not the most important thing for him. Rather, the solution demonstrates just how serious both manufacturer and operator are about running a sustainable business.

products + services

EP2002 3.0 – the finished product

EP2002 3.0 during production

One for all

Knorr-Bremse has added a range of innovative new features to its best-selling metro EP2002 Distributed Brake Control (DBC) system, expanding its applications into new global regional and high-speed markets. The new, evolutionary EP2002 3.0 DBC product is based on the lightweight and robust architecture of its predecessor and can be accommodated in the same compact installation space on the train. Significantly, EP2002 3.0's designed-in, longer maintenance intervals can deliver greatly improved life-cycle efficiency for operators.

Over 70,000 EP2002 units are currently in service on some 35,000 rail vehicles across 230-plus projects worldwide. Sanjay Albert, UK Director of Innovation and Engineering and responsible for the development of the new product commented, "Our aim in developing EP2002 3.0 was to create a control system fit for the future. In practice, this meant developing a next-generation distributed brake control system for the global market that offers new functionality, while also delivering a significant reduction in life-cycle costs for customers."

"One for all" approach

EP2002 3.0 is available for a new range of applications including for multiple units in the regional and high-speed segments. "With the '3.0', our focus was very much on a 'one for all' approach that provides operators and vehicle manufacturers with a single control system solution for several different vehicle applications," explains Albert, adding that "the unique feature of EP2002 3.0 is its ability to deliver varied functionality using standardized hardware. This better supports customers in rationalizing the low total cost of ownership and profiting from its improved maintainability."

The new control system of EP2002 3.0 is fully compatible with all current Knorr-Bremse auxiliary modules as well as customers' own modules. This makes it an attractive option, both for new vehicles and for modernization projects.

Enhanced functionality

The '3.0' technology features several industry firsts including the optimized Wheel Slide Protection (WSP) algorithm MGS3 now available for metros and multiple units. This facilitates shorter braking distances in situations with extremely low wheel-to-rail adhesion. The new deceleration control function delivers consistent braking distances through active compensation of friction coefficient tolerances for the brake pads and other components. This reduces braking distance variation by some 12 percent.

Brake disc temperature monitoring is another new feature offered by EP2002 3.0. Thanks to their systems experience, Knorr-Bremse engineers can calculate brake disc temperatures during operation using a real-time model. This increases the braking system's availability and avoids the need for speed restrictions.

Integration of indirect brakes for regional and high-speed trains

For regional and high-speed train applications, indirect brakes can now be incorporated alongside the direct brakes by connecting a distributor valve such as the KEf. EP2002 3.0 also provides Detection of Non-Rotating Axles (DNRA) for high-speed trains.

In addition to the established electro-pneumatic emergency brake, the '3.0' will enable the deployment of an electronically controlled emergency brake. This means that in emergency braking situations, the deceleration control function can be employed. The specific design of the emergency braking function can be tailored to the requirements of different operators and operating conditions.

Benefits of the new EP2002 3.0 at a glance

- Distributed, optimized braking performance across the entire train
- Lightweight, compact, uncomplicated and adaptable braking system for all passenger rail vehicle platforms
- Longer maintenance intervals than for the current EP2002 product
- Approximately 12 percent reduction in braking distance variations with deceleration control function
- Extendable through additional pneumatic modules for various auxiliary functions
- Brake disc temperature monitoring for increased vehicle availability

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