

2|13

Focus on  
the rail industry  
special issue

# ffwd



## Boosting energy efficiency

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## ABB Railways

ABB manufactures and services systems, subsystems and components used in modern urban, conventional and high-speed rail applications. These include rail infrastructure and rolling stock, as well as FACTS (flexible alternating current transmission systems) and network management solutions like SCADA (supervisory control and data acquisition).



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Rail industry special issue



Stephen Trotter

### Dear Reader,

It's timely for me to consider the exciting times we're living through in the rail industry and how ABB's suite of products and services can support the industry.

Rail transport remains as high as ever on the UK's national agenda and ABB is keen to support the ultimate goal of building a more resilient railway (meeting the needs of both travellers and business in a cost effective manner as part of a low carbon economy). Over the past few years, we have been driving innovation in our products to meet the UK's demands and help make railway infrastructure more efficient and sustainable.

As well as an interview with Jeremy Candfield, Director General of the Railway Industry Association, including his views on what the next few years will bring, this newsletter includes an overview of what ABB offers the rail industry.

It also includes details about specific ABB product and project successes. Turn to page 21 to read about low voltage products from recent acquisition to ABB, Thomas & Betts, and learn about ABB's new family of products for traction energy efficiency on page 8.

**Stephen Trotter** – Division Head of ABB Power Systems UK

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To view more information and downloads, install a QR code reader on your mobile device and scan the code.



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# Delivering the railway of the future

Jeremy Candfield, Director General of the Railway Industry Association (RIA), shares his views on how the industry is shaping up to deliver the Government's vision of a more resilient railway as well as the areas that need to be addressed to ensure that projects are delivered smoothly.



Jeremy Candfield – Director General of the Railway Industry Association (RIA)

**W**e are currently in one of the biggest investment periods that the UK railway network has known, with a whole series of major projects under way or starting. Major examples include Thameslink, Crossrail, the Northern Hub, and massive rebuilding works at Reading and Birmingham New Street. Substantial rolling stock fleets are on order or anticipated, while the industry is preparing to introduce major changes in control command technology and systems. Thus the Industry Strategic Business Plan recently published in response to the Government's High Level Output Specification details £37bn of investment in Britain's railway over the 5 years 2014-2019.

## **Electrification**

This includes the most important electrification schemes for decades, covering the last non-electrified inter-city routes from London – the Great Western main line to Bristol and South Wales, and the Midland main line to Sheffield – as well as significant parts of the north-south cross-country route, the trans-Pennine route and local commuter routes. The committed schemes will already increase the total of electrified railway from 40% to 50% of the network; potentially with other schemes the industry has been asked to evaluate, the proportion could rise to 60%. It is vital that these major works are implemented as a planned rolling programme to maximise efficiency and encourage investment in



the resources required. The programme will also drive further investment in rolling stock, with the proportion of electric trains in the fleet rising from 60% today to around 80% by 2019. As well as improving rail's green credentials further, electrification can enable faster, more frequent services while reducing train operating costs.

So electrification is part of the solution to one of the biggest issues that we face – finding capacity for the continuing growth in demand for rail travel. There is still a lot of capacity in many parts of the system, but it needs investment to release it, by electrification, and by resignalling and eliminating bottlenecks and constraints. The growth in traffic is helping justify the investment in schemes such as the complete remodelling at Reading, and flyovers to eliminate conflicting moves at Hitchin and Doncaster, with positive business cases being generated by the increase in carrying capacity. But some parts of the system are simply full, or will be so very soon, which is why we also need longer-

term schemes, especially High Speed 2, which has enormous potential to transform travel between our great cities.

#### **Investing in skills**

It is vitally important that we find the resources that we need to deliver the investments, particularly staff. There is much activity in this area, primarily focused through the National Skills Academy for Railway Engineering, in identifying and addressing potential skills gaps, accreditation of training schemes, facilitating transferable skills and other actions. This need is especially true of the electrification projects and a cross-industry initiative – the Rail Electrification Delivery Programme – is being launched to help meet it.

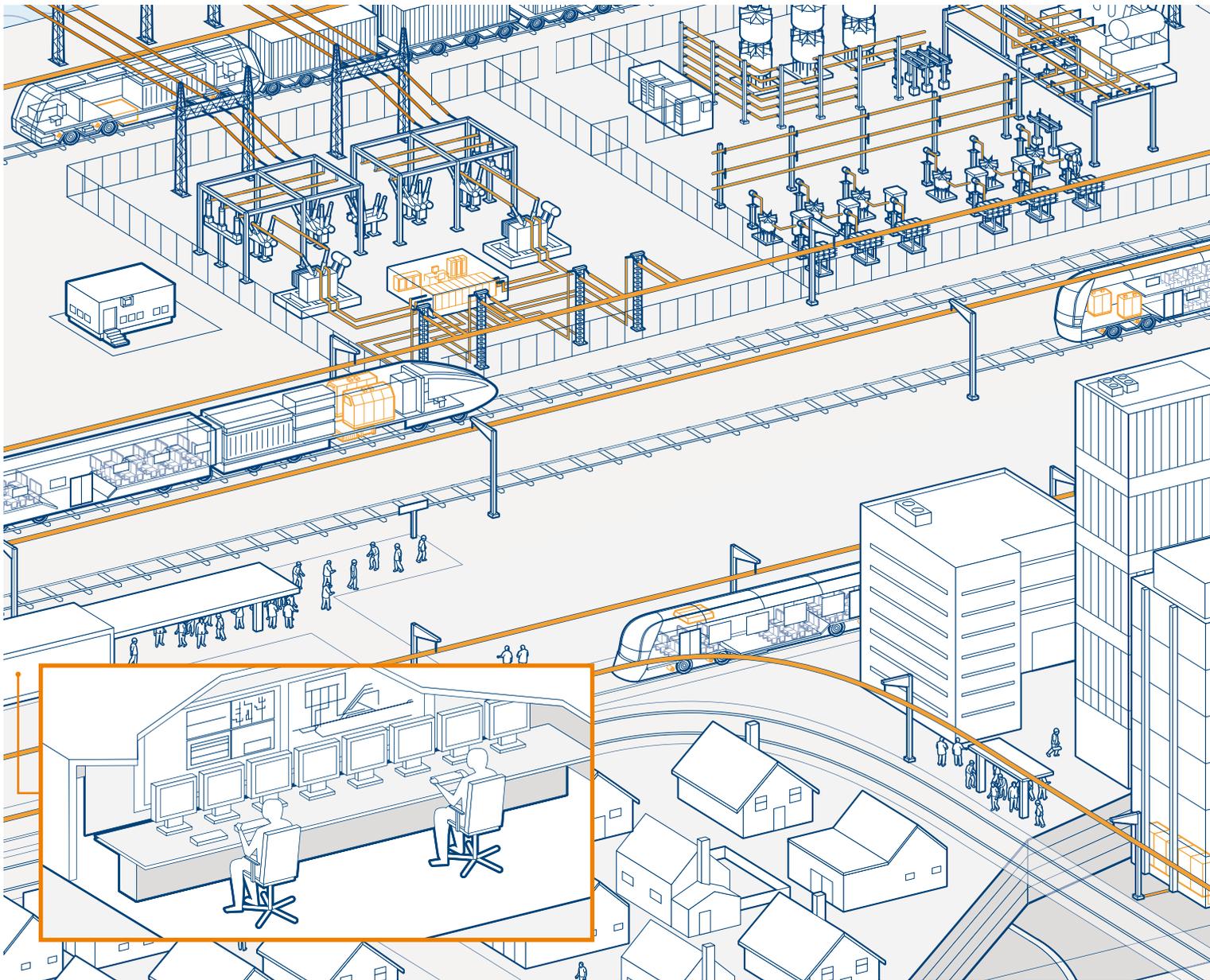
Overall, work is progressing well, but there will be an increasing need for companies to help, by joining relevant working groups for example, bringing their own expertise, and especially in sharing knowledge from other sectors. And they can also help by supporting the initiatives to

encourage young people to seek a career in railway engineering; all the disciplines are going to need skilled professionals at all levels if we are to deliver the comprehensive programme of improvements now being planned.

#### **Seeking innovation**

The overall outlook for the railways is strong. But there are many challenges, not least in financing. All parts of the industry have been collaborating to bring down the costs of operating and maintaining the network and to find better, more efficient ways of delivering enhancement projects. It is especially vital that we continue to seek and deliver innovation, in products and processes, and bring in lessons and technologies from other sectors. We must continue achieving real improvements in performance if we are to continue to attract funding for investments in Britain's railway system that are essential to its long-term future.

# Overview of ABB's railway capability



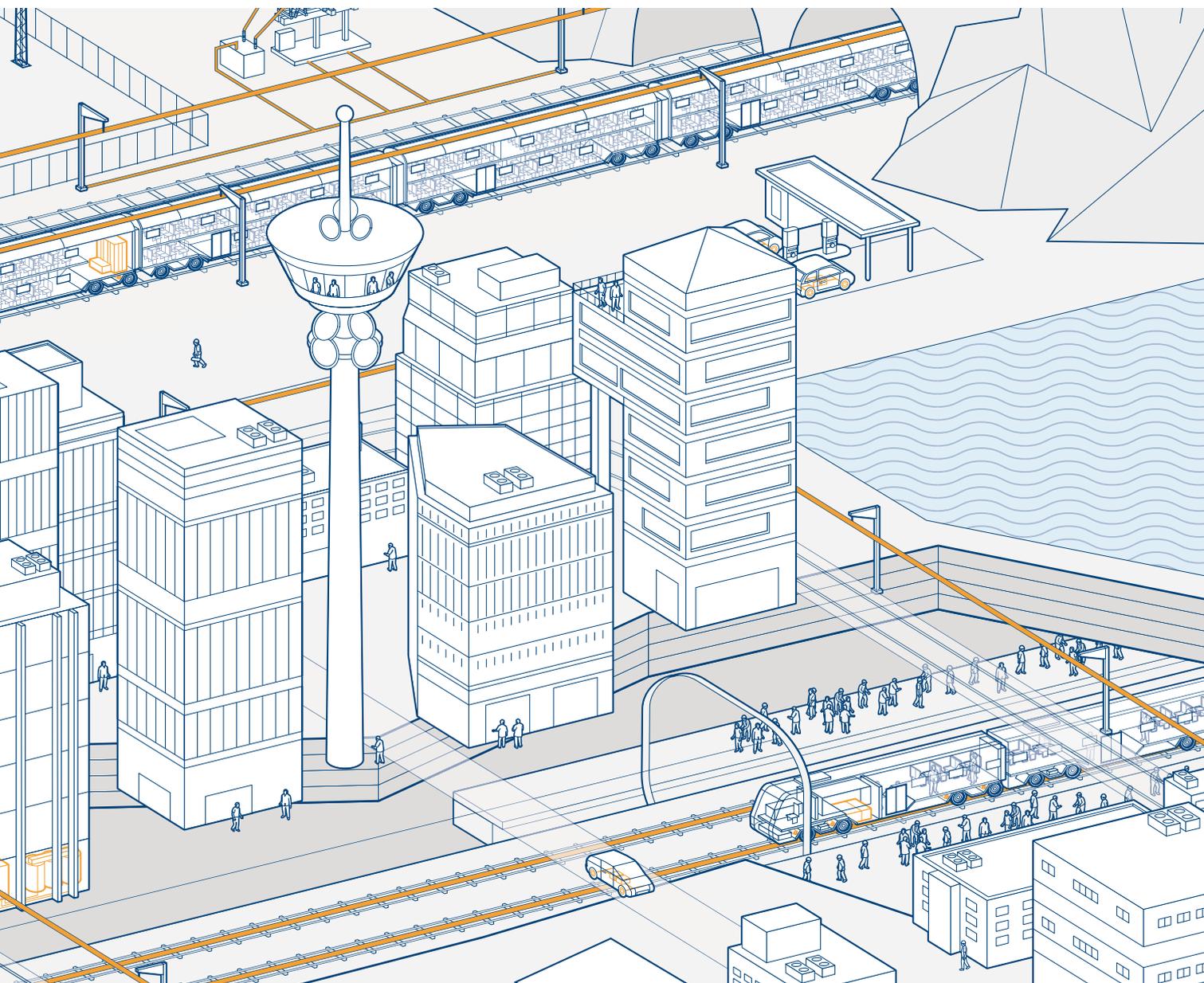
**A**BB is a world leading independent supplier of innovative and reliable technologies for infrastructure and rolling stock projects. ABB also provides service support, including maintenance and retrofit.

We aim to keep the world moving by developing new sustainable approaches that help our customers to use energy effectively and efficiently, to create a low-carbon railway industry, while also increasing industrial productivity.

## Power to the line

- AC & DC power systems studies and analysis
- Public frequency AC railway electrification substations
- HV and MV substation switchgear
- Static frequency converter substations
- FACTS (Flexible AC Transmission Systems)
- Power supply for DC traction systems
- Secondary substations for auxiliary power supply
- SCADA and network management
- Load balancers and filters
- Traction transformers
- Compact autotransformer modules
- Power and control termination
- Surge protection units
- Enclosed switch fuses
- MCBs (miniature circuit breakers)
- Switches for signalling applications
- Slimline switch fuses for station upgrades
- Service

ABB is a world leading independent supplier of innovative and reliable technologies to train manufacturers and railway operators. This includes rolling stock and infrastructure as well as FACTS, network management solutions and SCADA systems. ABB also provides service support, including maintenance and retrofit.



#### Power in the vehicle

- Traction transformers
- Traction converters
- Turbochargers for diesel locomotives
- Low-voltage components
- Motors and generators
- Semiconductors
- Surge arrestors
- Cabin equipment
- Power and communication connections
- Terminals and switches
- Contactors
- MCBs

- Two-part connectors
- Enclosed terminal assemblies.

#### Heating and ventilation

- Cooling systems for underground metros
- Tunnel ventilation

#### Robotics

- Materials handling
- Welding
- Inspection

#### Low voltage products from Thomas & Betts:

- Conduits and cable protection
- Cable management
- Safety technology
- Earthing and lightning protection

#### All rail applications

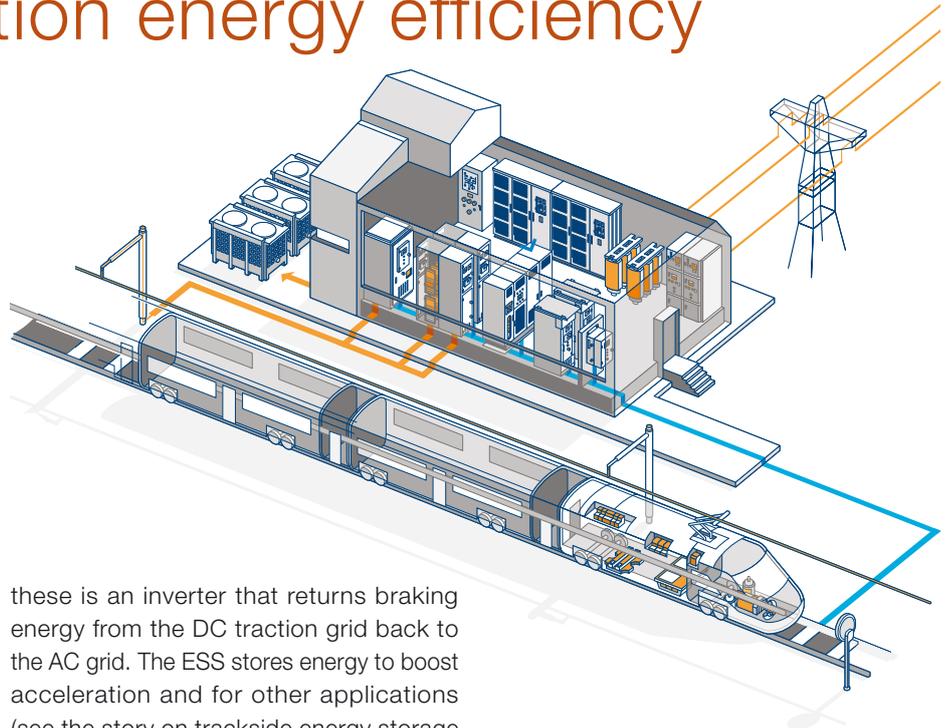
- Freight
- High-speed
- Suburban railways
- Metros
- Tramways
- Electric vehicle charging

# Boosting traction energy efficiency

**A**BB has launched a new family of products to improve railway energy efficiency, reduce energy costs, improve power quality of AC networks and provide the quickest payback at low total cost of ownership (TCO) for returning energy to an AC network.

The Enviline™ is a complete suite of energy-efficient products that offers the ideal solution for each network environment. The family of products starts with the standard power supply components, such as transformers and rectifiers, continues with ABB's latest innovations for energy recovery in traction, and is completed by assured receptivity units and protection devices.

Of particular note are the Enviline™ Energy Recovery System (ERS), Energy Storage System (ESS) and Energy Dissipation System (EDS). The first of



these is an inverter that returns braking energy from the DC traction grid back to the AC grid. The ESS stores energy to boost acceleration and for other applications (see the story on trackside energy storage below) and the EDS provides assured receptivity in a wayside setting.

The Enviline™ family of products improves energy efficiency

# Trackside energy storage

**A**BB was part of a consortium that has installed a world first pilot system to capture the excess energy produced during train braking. The solution allows the train operating company SEPTA (South East Pennsylvania Transit Authority) to store the captured energy and sell it back to the grid at times of high demand, turning trains into power generators and saving 10 per cent on the overall energy bill.

The scheme, installed in the city of Philadelphia for train operator SEPTA uses ABB's Enviline™ Regenerative Energy Storage System, which usually

uses capacitors to capture energy and release it again shortly afterwards to boost train acceleration.

But in SEPTA's case, the capacitors have been replaced with high performance lithium-ion batteries supplied by Saft, a world leader in the design and manufacture of advanced technology batteries for industry.

The energy recovery and storage system is complemented with software that enables SEPTA to monitor energy prices and sell the stored energy back to the grid when energy prices are high, usually during peak hours and in hot weather, so helping

reduce operational costs and creating a new revenue stream.

Braking energy is captured from 400 stopping trains per day at the five stations and has enabled SEPTA to drop its energy consumption by 10 per cent, equivalent to \$190,000 per year and bring in a revenue of between \$75,000 and \$250,000 per year.

It is the ability to sell energy back to the grid at peak times that has made wayside energy storage for mass transit systems commercially viable and it also brings the additional benefit of back-up power in the event of an emergency outage.



A SEPTA train



Lithium-ion battery system

## ZX1.5-R

Network Rail will install ABB's new primary medium voltage gas insulated switchgear (GIS) at 11 sites to upgrade the power supply for the West Coast Main Line (WCML) between Stoke and Warrington.

In 2012, ABB introduced the new version of its ZX GIS especially for railway applications. The ZX1.5-R models are based on the design of well-proven three-phase units and are designed to meet the requirements of two-phase high speed lines and single-phase 25 kV applications.

The new order is the first for the ZX1.5-R outside China, where it is supplying safe and reliable power along the entire length of the 968 kilometre Wuhan-Guangzhou high-speed railway line.

The switchgear is based on a modular and flexible design, with individual gas panels being housed in separate compart-



Panels of ZX1.5-R switchgear

ments for straightforward installation and operation. It features higher mean time between failures and lower mean time to recovery as a panel can be removed and the switchboard re-energised without any SF<sub>6</sub> gas handling as the arc quenching gas is sealed for life into the switchgear units during manufacture.

Looking to the future, ABB anticipates

that once it has proven itself on the WCML, it will receive Full Product Approval from the Network Rail Acceptance Panel.

It is also available as a 'plug and play' option as part of a compact substation package, which includes medium- and low-voltage switchgear, protection equipment and battery back-up systems in a robust steel container.

## Delivering on autotransformer deal

ABB is delivering around 100 of its 25-0-25 kV trackside autotransformers to Network Rail under a three-year framework agreement that will support the UK's programme of railway electrification.

With an established reputation for reliability, earned on Phases 1 and 3A of the WCML, the autotransformers comply with Network Rail's guidelines for 12 kiloamp

(kA) infrastructure and have been modified to reduce no load losses for low traffic areas, a move which is designed to reduce the lifetime energy consumption by around 30 per cent.

The framework covers the whole of the UK, was signed in December 2012 and covers autotransformers rated at 15 megavoltamperes (MVA).

## \$115 million FACTS order to support high speed rail

Last October, the Saudi Electricity Company placed a \$115 million order with ABB for a FACTS (flexible alternating current transmission system) solution to enhance the transmission of Saudi's transmission grid that supplies the country's major railway interconnections.

The turnkey solution will see ABB designing, supplying, installing and commissioning two identical static var compensators (SVCs) at the Haramain High Speed Railways 380 kV (kilo volts) substations.

The installations will support the large-scale railway interconnection between the

pilgrimage cities of Mecca and Medina. Scheduled for completion in 2015, the rail link will cut the journey time from six hours to two, with additional stations at other cities and King Abdulaziz International Airport en route.

The value of the order has made it the largest order received to date by ABB and the static var compensators will work alongside other ABB infrastructure, including 380 kV gas insulated switchgear ordered in 2001 and now in service at substations powering the 444 km railway line.



Typical SVC installation

# New London Underground BSP goes live

**A**BB has successfully delivered a major project to create a new Bulk Supply Point (BSP) for London Underground Ltd (LUL), needed to increase the power on the Circle, District, Hammersmith & City and Metropolitan lines to introduce air-conditioned rolling stock.

With a 120 MW (mega watts) capacity, the new BSP takes electricity from a nearby National Grid 400/132 kV substation and steps it down through transformation (132/22/11 kV) to feed into the LU power supply system. The major challenge for ABB has been in working within the compact site, which is hemmed in on all sides with an operating railway close by, to create a large, modern substation building.

The project started in 2009 with excavation of 11,000 cubic metres of spoil and civil works that included extensive deep piling and construction of a new multi-level reinforced concrete building that includes cable and switchgear basements.

Electrical equipment includes three 22/11 kV 25 MVA coupling transformers, two 132/22 kV 120 MVA grid transformers, a 35 panel 22 kV switchboard featuring ZX2 GIS, a 27 panel 11 kV switchboard featuring UniGear AIS, low voltage switchgear, two 11kV earthing/auxiliary transformers, ventilation system and associated mechanical systems, 110 V batteries and charger.

Control elements include SCADA RTU (remote terminal units) for the 11 kV and 22 kV switchgear plus extensive fibre optic

cabling. As part of the project, ABB is also laying around 55 km of 22 and 11 kV XPLE (cross-linked polyethylene) cable associated with the BSP.

A major challenge was overcome in the successful installation of the two grid transformers, each weighing 97 tonnes. Delivering the transformers to the central London site was a highly complex logistical exercise requiring months of planning and stakeholder engagement to identify the best route and arrange the necessary traffic management to enable the two massive loads to reach the site with minimum disruption.

The two BSP grid transformers in place



# High Speed 1 power quality

**A**BB has successfully delivered a major project to design, manufacture, install and commission reactive power compensation solutions on the High Speed 1 route from St Pancras International to the Channel Tunnel at Dover.

While High Speed 1's nominal line voltage is 25 kV, there were some areas where it dropped. This was found to be due to the level of inductive reactive power demand as a result of the inherent design of the system's isolation transformers.

Over a period of 26 months, ABB designed and installed 17 units at nine AC/DC compounds along the 68-mile track, each consisting of a capacitor bank rated at 6.4 MVar (mega volt amperes

reactive) and a reactor rated at 27.5 kV and 303.134 mH (milliHenry). The units' bespoke design was jointly developed at ABB's centre of expertise in Ludvika, Sweden and Transmission & Distribution (T&D) Infrastructure business unit based in London. The installation has effectively cancelled out the inductive power demand of the transformers, reducing the voltage drop.

During the project, the team designed a terminal cap that fits on the bushing of each capacitor unit. This cap prevents the electrocution of birds landing on the terminals, an approach that is now being rolled out globally on ABB capacitor unit products.

ABB's Operations Manager for T&D Infrastructure Seamus O'Neill said:

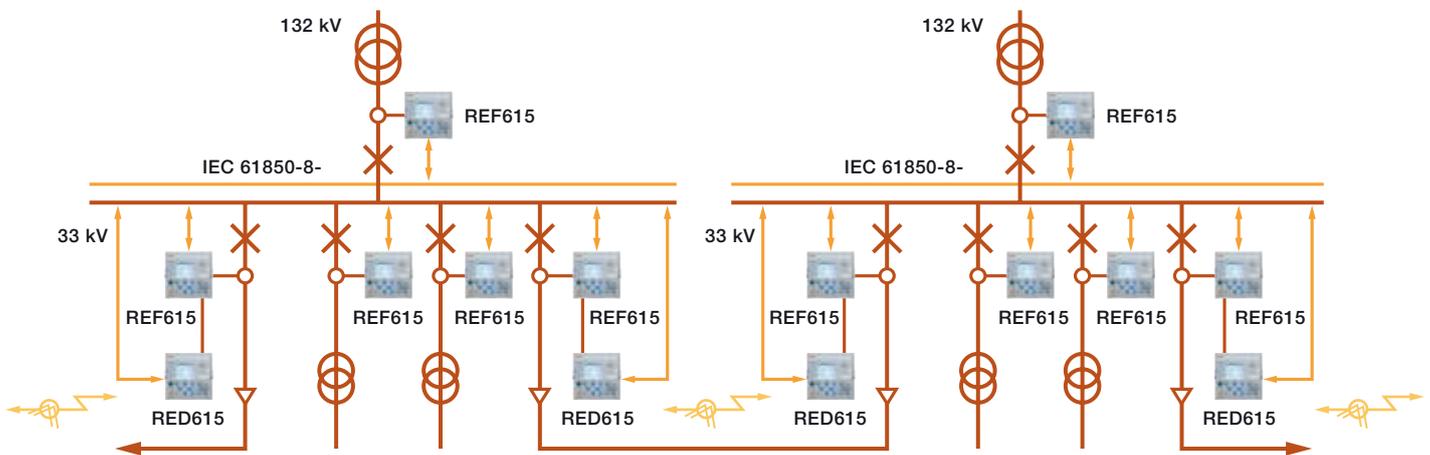
**"We were very pleased to work together as a single unit with HS1. Their input went a long way to deliver the project in a collaborative and supportive environment."**

ABB has installed reactive power units for HS1



# IEC 61850: Optimising protection and control

The 2003 introduction of the IEC 61850 standard brought about a fundamental change in control and automation. It was now possible for power system protection, control and automation devices and systems to communicate with one another, irrespective of manufacturer.



IEC 61850 provides protection and control for rail applications

IEC 61850's single communications protocol means that it is possible to eliminate protocol converters, which translate signals between different communication protocols. This has speeded up response times, with other benefits being more straightforward design and installation, and a wealth of information to support asset management.

## IEC 61850 implementation

In cases where IEC 61850 is retrofitted on top of a substation's existing relays, top-level data follows the protocol but individual relays often require additional configuration and use of protocol converters.

Genuine IEC 61850 implementation means installing protection and control IEDs (intelligent electronic devices) enabled for the standard, meaning the full benefits

of the standard can be exploited. ABB's Relion® IEDs allow simultaneous use of IEC 61850 and a legacy protocol, enabling users to shift to the new standard in a controlled manner.

It also paves the way for fast and secure peer-to-peer GOOSE (Generic Object Oriented Substation Event) communication, which will create an alarm should communication fail. Because GOOSE enables IEDs to exchange information over an Ethernet-based network, it saves the cost of hard wiring a conventional root and branch communications layout and brings inherent security.

## Building a rail power supply that tolerates faults

Preventing any impact on rail operation is critical and the IEC 61850 standard uses

a structure that supports this function. In common with the smart grids being introduced by power utilities, it offers several options for redundant communication.

HSR (High Availability Seamless Redundancy) offers redundancy by sending messages through both directions in the same network and detecting broken communication links and alarming the user accordingly. With PRP (Parallel Redundancy Protocol), a message from an IED is sent through two identical independent networks thus removing the risk of communication breakdown in case there is a fault in one of the networks.

Both of these redundancy solutions ensure that the breakdown of a single component in the communication network will not impact the system as a whole.

# Delivering the standard for substation communications

As the IEC 61850 standard for substation communications becomes business as usual, Intelligent Electronic Devices (IEDs) designed to implement the core values of the standard are having a significant impact on how railway engineers are designing, testing and commissioning systems.

## The Relion® 615 series

Including devices for the protection and control of feeders, motors, transformers, line differential and voltage and frequency protection, ABB's Relion® 615 series is characterised by its compact plug-in design, ease of use and comprehensive protection functions and feature GOOSE communication over a secure Ethernet network.

The IEDs are adaptable to a variety of applications and the latest models support PRP and HSR, which offer full redundancy in substation communication.

### Retrofitting advanced line differential protection

Part of the Relion® 615 series, the RED615 offers phase-segregated, two-end protection and control and communicates with substations over fibre-optic link or galvanic pilot wire connections.

On trial by London Underground, the IED achieved advanced functionality on legacy copper communication infrastructure over long distances of up to 19 km. With the RED615 replacing numerous traditional style discrete relays, the RED615 offers great potential as a retrofit solution.

### The new Relion® 620 series

Embracing the latest IEC 61850 developments, the 620 series includes IEDs for feeder, motor and transformer protection and control. All members of the 620 series have a compact plug-in design, which contributes to a shortened mean time to repair and speedy installation and commissioning.

Like the 615 series, the 620 models feature PRP and HSR, meaning there will be no communication down-time in case of a single point of failure. In case hard-wired signals are required for communication

with devices that do not use GOOSE communication, the 620 series members' wide casing has enough space to add multiple inputs and outputs.

The 620 series is adaptable, easy to operate locally and arc protection is optional to ensure safety of both personnel and equipment. Security is another important feature of the series, with four password protected access levels preventing unauthorised access.

- The feeder protection device, the REF620 protects cable or overhead line feeders
- Protection to transformers is available from the RET620, which is for power, unit and step-up transformers in distribution systems
- REM620 is a dedicated motor protection and control IED for medium and large asynchronous motors in medium-voltage applications.

Members of the Relion family of IEDs





# Effective rail industry asset management

Growing service and regulatory demands coupled with an ageing inventory mean that rail organisations face unique asset management challenges. They must not only maintain assets such as rolling stock and yards but also the rails themselves, while simultaneously keeping networks operating safely, efficiently and on schedule.

Helping managers tread the line between financial and operational performance, software solutions such as enterprise asset management (EAM) and enterprise resource planning (ERP) ensure uptime, safety and customer satisfaction. However, many solutions on the market were designed for manufacturing or business services and don't take into account the challenges presented by the long linear assets found in the rail industry.

This has led to many rail business making do with disparate systems and processes to store and report data on performance, cost, scheduling and tracking. While each system might have its own strengths and weaknesses, the system as a whole can't give rail managers the overview offered by a single solution.

Acquired by ABB in 2010, Ventyx is a world-leading supplier of industrial enter-

prise software designed for customers such as rail, road and pipeline operators. Ventyx software solutions help its customers make faster and better-informed decisions on daily operations as well as long-term planning strategies.

Ventyx solutions for the railway industry include:

- **Enterprise asset management**, which helps to maximise the performance of physical assets over their entire lifecycle, ensuring availability and reliability
- **Mobile work management**, to improve workforce safety and productivity by delivering critical information to technicians. This improves reporting and reduces paperwork
- **Parts management**, with the aim of optimising stock holding of parts based on usage patterns and criticality

- **Asset-intensive enterprise resource planning (ERP)**, a specialised ERP system for industries such as rail, which are asset-intensive and operate in an environment where safety and environmental considerations are important
- **Business analytics**, an analytical tool to help managers make better decisions by capturing and aggregating the rich data held within software systems and presenting it in rail-specific dashboards

Ventyx has a customer list that includes many leading firms in the railway industry, including Network Rail, London Underground and GNER in the UK, plus national and regional rail operators in the USA, Finland and Australia.

# Advances in Train Control and Monitoring Systems

In October 2012, ABB announced a research and development facility for Train Control and Monitoring Systems (TCMS) in China. TCMS is critical to traction systems and is core technology in Urban Mass Transit (UMT) vehicles. The new laboratory is based at ABB Microunion Traction Equipment.

The TCMS R&D team consists of experienced system and electrical engineers and the lab is currently focused on building platforms for multiple vehicle types and developing TCMS software under different communication codes. The lab's first TCMS system solution is due to be launched in 2013.

TCMS manages information from key equipment and components on rail transit vehicles, including data collection, exchange, monitoring and recording. It is recognised as core technology of on-board systems. Based on market demands for stronger data exchange capabilities and greater safety, ABB has developed a highly efficient TCMS system with a flexible network structure. The system perfectly complements ABB's traction equipment,

enhancing the availability and reliability of the complete traction chain, and thereby adding value to ABB solutions.

Dr Chun-yuan Gu, Head of ABB North Asia and China's Discrete Automation and Motion division said: "The new TCMS platform advances ABB's traction system integration and is supported by ABB's leading railway technologies and R&D team. ABB will now be able to offer complete traction solutions, easing the pressure on customers to integrate multiple systems. The new initiative brings ABB's strategic advantages to the railway market."

The growth rate of China's railway construction ranks first in the world and the country's 12<sup>th</sup> five-year development plan has defined the railway equipment industry as an important component of the high-end

equipment manufacturing industry, one of seven emerging industries identified as being of strategic importance.

To respond to the booming market, ABB set up ABB Microunion Traction Equipment in 2010 with a focus on providing railway traction solutions to Chinese customers. ABB's traction equipment is widely used in China's domestic UMT lines, including Changchun's Light Rail Phase 1, Nanjing's Metro Line 1 South Extension Line and Shenzhen Railway's Longhua Line.

ABB already has its 7<sup>th</sup> global R&D centre in Beijing, which has successfully developed ABB's smallest robot, the world's fastest palletising robot, intelligent building technologies and 252 kV GIS breakers.



Wuhan station: China's railway construction ranks first in the world

# Traction transformation

Launched in 2012, ABB has developed a revolutionary power electronic traction transformer (PETT) that uses power electronics to reduce its size and weight while increasing the energy efficiency of the train and reducing noise levels.

Being constructed from iron and copper, transformers are one of the heaviest items on board. Until now, it has not been possible to make significant weight savings, which is one of the rail industry's priority objectives, or to reduce the amount of space used by equipment and free up space for paying passengers.

## How ABB has made the breakthrough

Frequency dictates the size of a transformer's iron core, which in turn influences the radius of the copper windings and therefore the amount of copper used.

As frequency increases, it's possible to reduce the core size. ABB has used insulated gate bipolar transistor (IGBT) power semiconductors to increase the frequency to several thousand Hertz before using a compact medium frequency transformer.

While this sounds like a simple approach, ABB had to overcome significant technical challenges to develop the PETT because many aspects differ from conventional low frequency technology, including using alternative materials for the core and windings, as conventional materials would have led to greater losses at the higher frequency. ABB also had to develop a solution around the limitations of existing semiconductor technology and so the PETT features a series cascade of converter modules so that the unit can be scaled to the required duty. The PETT delivers significant weight and size savings as well as much improved power density and reduced noise levels.

## On trial in Switzerland

As part of ABB's long-term partnership with SBB (the Swiss Federal Railway), a pilot PETT installation is currently under trial

on a shunting locomotive for use on the 15 kV AC and 1.5 kV DC (direct current) lines at Geneva main railway station. In service since February 2012 and weighing in at a total of 4,500 kg, the pilot PETT has 1.2 MW nominal power and can supply 1.8 MW peak for short durations.

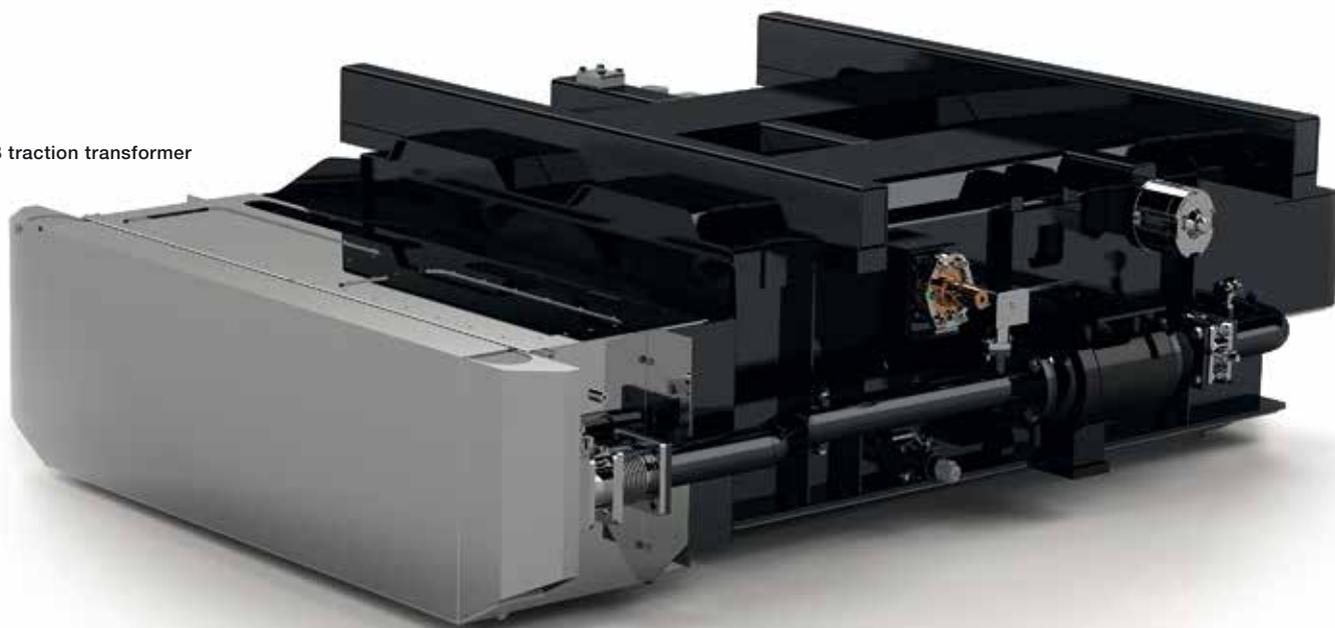
Despite its current service, the PETT's real potential lies in powering multiple unit commuter and high speed trains.

"The innovative use of power semiconductors in a core component such as traction transformers opens up new opportunities for rail markets around the world, and should be extendable across a range of other applications," said Markus Heimbach, head of ABB Power Products' Transformers business.



The PETT trial shunting locomotive in Geneva

ABB traction transformer



# Getting rail passengers to the airport on time

In September, ABB signed a deal to provide a new customised traction transformer and long-term service programme for one of the world's most punctual airport rail links, the Arlanda Express, which runs between Stockholm Central railway station and Stockholm Arlanda Airport.

The aim is to ensure that the fleet of seven four-car electrical multiple units (EMUs) trains continues to operate with almost 100 percent punctuality. The service carries around three million passengers a year with trains running four to six times an hour in both directions at speeds of up to 200 km/h, completing the 39 km non-stop journey in 20 minutes and with a punctuality rate of up to 99 percent.

A-Train, the company that operates Arlanda Express, recently refurbished the fleet to improve passenger comfort and create what it calls 'Trains of the future'.

As part of its efforts to maintain its benchmark levels of punctuality and customer comfort, A-Train selected ABB to design a fleet refurbishment solution for the Arlanda Express traction transformers – a solution that would improve equipment performance, reduce life cycle costs, and

limit the risk of a power outage.

ABB custom-designed a new traction transformer that fits perfectly with the original 13 year-old converters and motor, and retains the existing interfaces with all the traction components and car body.

Not only that, but the new traction transformer retains the same weight and footprint as the original transformer while providing a huge 20 percent boost in reserve power to accommodate any future improvements to the train that require additional energy.

And thirdly, ABB has tailored a full service contract to meet the customer's precise needs and ensure that the new traction transformers perform as specified and at the lowest possible life cycle cost. The contract includes onsite supervision of transformer installation, onsite customer training, and advanced diagnostics – all backed up by a long ABB warranty.

Refurbishing a fleet's traction trans-

formers or converters – while leaving all the other components and interfaces in the traction chain unchanged – is an ABB service differentiator.

A-Train's first three traction transformers are due for delivery this year and A-Train has an option to order five additional transformers, serving seven trains with the eighth functioning as a spare.

# New traction converters recover braking energy

ABB's BORDLINE® family of converters had a new addition in 2012 when the firm launched the new CC750 DE model, a compact traction converter. Designed to convert diesel generator power into propulsion power for the traction motors and auxiliary power for onboard AC, DC and battery consumers, the CC750 DE is suited to regional diesel-electric multiple units (DMUs).



02



01 Vossloh España's EUROLIGHT

02 Bordline auxiliary converter

03 The Bordline compact traction converter installed on Stadler's Rail's FLIRT

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The converter powers two motors and an optional super-capacitor, which stores recovered braking energy. The model enables reduction in the size, power and consumption of the DMU's engine.

Comprising two inverters, an auxiliary converter, a battery charger, a control element and braking and super-capacitor choppers, the converter has a modest 83 x 82 centimetre footprint and a power output for the traction motors which mini-

mises losses, audible noise and mechanical stress.

One example of the CC750DE in service is Stadler Rail's FLIRT trains for operator Elektriraudtee in Estonia, where they meet the demands of the harsh winter climate.

## ABB traction packages for EUROLIGHT

Aiming to develop a versatile and reliable 4-axle diesel-electric locomotive for freight and passenger use with an axle load below 20 tonnes, Vossloh España turned to ABB to supply a suitable traction package to the specifications of the locomotive design.

Vossloh España's aim was to develop a locomotive where all components of the traction package were designed for optimum overall performance and efficiency. With a duty of cross-border freight and passenger operations on Europe's railways, the EUROLIGHT is designed to overcome the differences in Europe's rail network and a range of models is planned with top speeds ranging from 140 to 200 km per hour and power ratings of up to 3,500 kW (kilo watts).

Weight of the EUROLIGHT's components was a key consideration as it will run on Class C and D track and so ABB was challenged to supply a lightweight and compact traction package.

The system is made up of a lightweight Caterpillar diesel engine driving an ABB generator rated at 2.8 MW, which feeds two identical ABB Bordline® Compact Converters connected in parallel, as well as four traction motors.

### Generator

The EUROLIGHT's ABB-supplied generator is directly coupled to the Caterpillar engine and is a self-excited brushless synchronous generator with a single bearing. It is forced air-cooled and weighs in a modest 5.6 tonnes. It is fitted with ABB's UNITROL 1000 voltage regulator.

After testing by ABB, the generator was supplied to Caterpillar USA, where it was subject to rigorous testing with the diesel engine to ensure performance.

### Bordline® Compact Converters

Each of the two Bordline® Compact Converters is fitted with its own drive control, rectifier unit, an auxiliary converter, braking chopper and two independent motor inverters. For the passenger version of the EUROLIGHT, the Compact Converters can be integrated with the Compact Converters.

The model fitted, the Bordline® CC1500 DE, was selected to optimise the overall system for reliability and ease of servicing. It is a heavy duty liquid-cooled unit and for passenger locomotives, an additional power module can be fitted to feed domestic loads.

For the locomotive's self-consumption,

the auxiliary converter is galvanically isolated and integrated into the Compact Converter.

The Compact Converters' drive control is based on ABB's AC800 PEC units, which are used in all ABB traction converters and many industrial applications. For the EUROLIGHT locomotive, the drive control has responsibility for adhesion control as well as power management, optimising energy efficiency and effectiveness of the entire traction chain.

The control unit is mounted on a swing frame, covering the power modules, with all electronic and power semiconductors being contained in a housing with IP54-level protection.

### Traction motors

Again manufactured by ABB, the traction motor is rated at 600 kW and has a top operating speed of 4,400 rpm. Designed for space and weight optimisation, the motor's pinion is machined directly onto its shaft.

# Low voltage products



As a supplier of low voltage products to the rail supply chain, including system providers, solution providers, distributors and OEMs, ABB supplies much of its range of well-proven low voltage products through channel partners, specialist distributors and wholesalers.

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ABB's low voltage products can be found throughout the world in rail and metropolitan infrastructure settings such as station concourses, ticketing halls, escalators, depots, signalling control centres, signalling applications including principle and fixed supply points, heating, third rail heating, lighting projects and rolling stock.

With a broad product range and proven operational performance, ABB's products include air circuit breakers, control and protection equipment, miniature circuit breakers (MCBs) and fuse terminations to name but a few. ABB's range of low voltage products is used in new vehicle builds, rolling stock modification projects and infrastructure applications. It can be configured for Network Rail's new Class 2 signalling equipment, which uses only two wires rather than three, saving tonnes of copper in the process.

## Points and third rail heating

ABB's points heating and third rail (or conductor) heating products power the heating strips that prevent the build up of ice and snow, meaning that operators can ensure safe rail operation during winter months.

An important piece of kit for points heating, ABB's S800 MCB meets the required current rating in a compact form suited to wayside installation. With products passing vibration tests for installation as close as two metres to the track, ABB is prepared to carry out tests on its products for specific installations as required.

## New low energy consumption AC/DC coil contactors

Due to be launched this year, ABB's new range of AF Contactors are low energy, low consumption and low weight, with a traction-specific version for the rail industry. Rated from four to 2,650 A (amps), nine frame sizes are included in the range and with the potential for hundreds of installations, individual contactors' low power consumption will combine to reduce overall power requirements.

## SACE Emax range

Power breakers for the rail network, including ABB's uniformly dimensioned SACE Emax range, which has recently been extended and is available in fixed and withdrawable versions, allowing construction of compact switchgear. Safety measures including protection of up to IP54, safety locks and double insulation ensure maximum safety.

An innovative design guarantees complete insulation between phases, and between the phases and neutral, while ensuring full accessibility for inspection of the arcing chamber and main contacts.

## Switch-disconnectors and switch-fuses

ABB's family of switches is suitable for diverse applications in motor control centres and switchboards, and as main switches in various equipment. They consist of switch-disconnectors rated at 16 to 3150 A, switch fuses (16 to 1250 A), change-over switches (16 to 2500 A), automatic transfer switches (160 to 1600 A), cam switches (10 to 315 A), accessories, manual and motorised switches.

## KNX Intelligent control for concourses

ABB offers intelligent building control with the i-bus® KNX, a single system which enables control of lighting, heating, ventilation, climate, shutter, alarm monitoring, energy management and central automation for concourses.

In the railway realm, the KNX system can include a central LCD control panel for a station, enabling the overview of important building services. Intelligent building control enables optimal, energy-efficient interaction between subsystems, which is almost impossible with conventional technology.

KNX can give a station and concourse operator, buyer or tenant a complete solution that saves energy and provides control of all electrical consumers alongside the best possible safety and security for people and property.



## Thomas & Betts joins ABB's portfolio



In 2012, ABB completed its acquisition of Thomas & Betts (T&B), the leading US manufacturer of low voltage electrical components, whose products complement ABB's portfolio of products.

### Cable protection and management

T&B's cable protection products for the rail sector include the Adaptaflex, PMA and Kopex-Ex brands of conduit systems. Specific ranges protect against corrosion, abrasion and offer EMI protection. Specialist conduits are suitable for: on-roof, inter-carriage and undercarriage applications; air conditioning systems; and trackside applications.

Ty Rap® cable ties are another of T&B's brands, offering superior ties for cable management.

Cable protection systems include wrap-around and braided sleeving from the Shrink-Kon and Bind-it® brands. T&B also offers heat shrink products to protect, identify and repair cables and protect against moisture, corrosion and abrasion.

Shield termination systems from Shield-Kon are another part of the portfolio. Crimped on to shielded cables, Shield-Kon is suitable for harsh environments.

### Safety Technology

Emergency lighting and power systems are another element of T&B's offer through its Emergi-Lite and Kaufel ranges and include escape route lighting, signage, mobile hand lamps and central battery systems.

### Earthing and Lightning Protection

Finally, T&B is a world leader in earthing and lightning protection through its Furse brand, which holds a Network Rail Certificate of Acceptance and is designed to protect trackside equipment.

01 Emax range

02 KNX controls concourse power

03 The Adaptaflex conduit system

04 S800 MCB

# Rail service: installation and maintenance

Spanning the full product ownership life cycle, ABB's experienced multi-disciplinary team of engineers and technicians is qualified and accredited to work on trackside installation, commissioning and maintenance projects.

**A**BB's service offering to the rail industry is a multi-pronged approach, covering installation, commissioning and maintenance elements. Highly skilled, factory-accredited teams carry out installation and commissioning of ABB substation equipment. Planned and reactive maintenance is offered on either a service level agreement (SLA) basis with guarantees for reactive maintenance and repairs or on an ad hoc basis. ABB Service offers maintenance, relay commissioning, surveying, system studies, refurbishment and retrofit of equipment supplied by other OEMs (Original Equipment Manufacturers).

Covering the full range of trackside power applications, ABB has been awarded a Principal Contractor License (PCL) from

Network Rail, meaning that ABB can act as a main contractor to carry out turnkey power supply projects throughout the UK. ABB's installation and maintenance service offer includes all electrical infrastructure applications from low to high voltage AC and DC as well as control systems, and equipment such as circuit breakers, transformers, static var compensators and SCADA systems and is available to the full spectrum of railway infrastructure operators, train operating companies and contractors across the UK on main line, metropolitan, light rail and underground lines.

## A skilled service workforce

ABB has a team of service engineers and technicians with a very high regard for safety who are PTS (Personal Track Safety)

accredited and ready to work trackside, with awareness of the typical hazards and safe working practices of both the rail environment and electrical systems.

With a customer list of blue chip customers in every industry where power is required, ABB's rail specialist service team has more than 20 years experience and is ready to don its orange personal protective equipment whatever the stage of the rail asset life cycle.

## Installation and commissioning

Being listed as an approved contractor to Network Rail and holding a PCL, ABB can deliver complete turnkey design and installation services for rail power projects of all types.

Quality installation and commissioning is just as important as equipment selection at the beginning of a product's life cycle and ABB is ideally placed to carry out the safe and reliable installation and commissioning of its own switchgear and other equipment, as well as protection and SCADA systems supplied by any other manufacturer.

As an OEM with maintenance expertise, ABB's knowledge of installation is second to none. Our technicians carry out installations with a solid understanding of equipment design and manufacture as well as how it experiences wear and tear during its operational life. This knowledge is key to fast and effective fault diagnosis and rectification.

Alongside this, a strong understanding of the constraints of trackside working means that ABB's managers, technicians and engineers work to ensure jobs are





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completed efficiently within the tight time-scales, ways of working and methods employed in the rail industry.

### Maintenance

ABB recognises that each individual operator has its own set of challenges in prolonging the life of equipment and keeping assets operating with maximum efficiency and reliability throughout their life cycle.

To meet operators' specific needs, individual services can be offered on an ad hoc basis or be bundled into a single contract, which can be implemented at any stage of product life cycle and which can include a mix of services including spare part agreements, bonded spares, preventive or corrective maintenance, technical support and training as well as emergency out of hours maintenance.

In addition to scheduled inspection and maintenance regime of the electrical infrastructure, should the asset become beyond economical repair ABB Service is able to offer (in most cases) a retrofit solution to existing equipment including transformers, switchgear, SCADA RTU's, SVC's and protection systems.

ABB can tailor its service level agreement (SLA) to fit the priorities of its customers, agreeing guaranteed response times in advance. In some cases, ABB technicians can be based on-site on a 24/7 basis to form part of a customer's team, carrying out planned inspections and maintenance and resolving emergency issues as and when they arise.

Recognising the value of a timely response in an emergency maintenance

situation, ABB's maintenance service can include a dedicated 24/7 help line for customers, linking through to a manned call centre which will link to an on-call contact.

An escalation process ensures that the customer is not left waiting with the emergency on their hands and a technician with the right skills can be on-site to resolve the incident according to the SLA (service level agreement), following it up with a timely report of action taken.

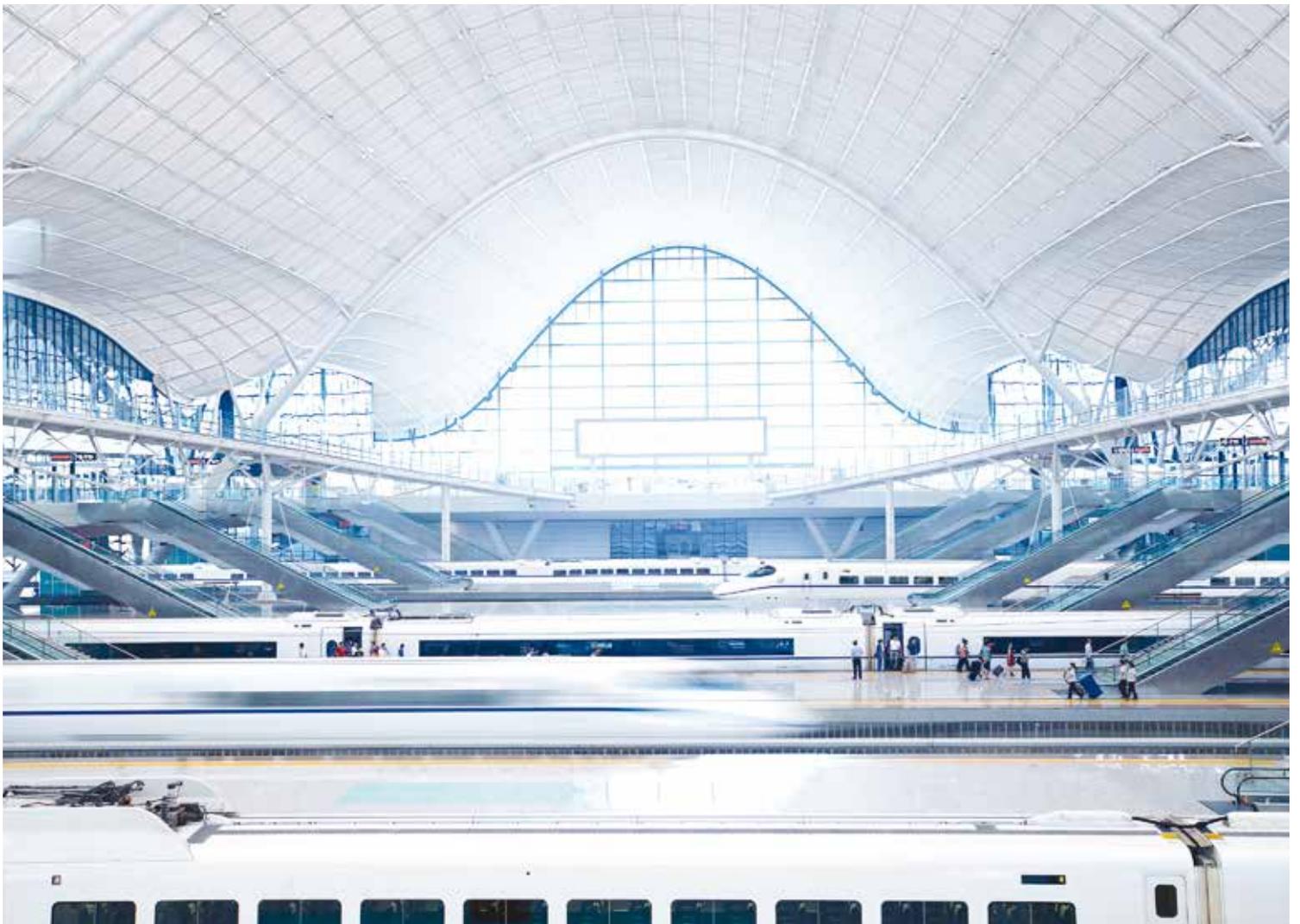


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- 01 Installing a packaged substation
- 02 Switchgear commissioning
- 03 Service
- 04 Transformer service



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Powering the railways. Efficient and reliable solutions for sustainable mobility.

ABB has a wealth of experience as a leading independent supplier of cutting-edge technology for railway power infrastructure and rolling stock projects. We help to keep the world moving with new sustainable approaches that enable customers to use energy effectively, creating a low carbon railway industry that operates with maximum efficiency and reliability. To find out more, visit us on stand D91 at Railtex 2013. [www.abb.com/railway](http://www.abb.com/railway)