

# Railvolution

The Professional Two-Monthly Magazine Of Rail Transport Worldwide

Volume 13

No. 1/13

€ 10.00



**A Visit To Newag  
Granit Locomotives  
InnoTrans Megareport III  
Stadler's 1,520mm-Gauge Designs  
Eversholt's Proposal For ECML Trains**







## Stadler's 1,520 mm-Gauge Activities

**On 24 January 2013 in Tallinn, Stadler organised a conference presenting the company's successes and future plans relating to trains for the 1,520 mm gauge networks in Europe, the Baltic and CIS states, and Russia.**

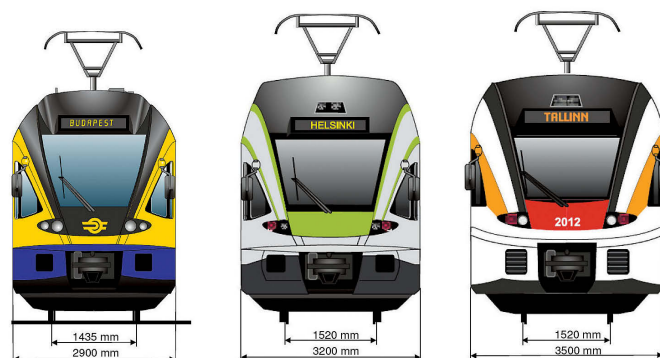
### Helsinki FLIRT EMUs - The First Venture

Stadler, whose rail vehicles are popular not only in Switzerland, Europe and several other countries, notably Algeria and the USA, is building trains mainly for 1,435 mm gauge networks and lines of narrower gauges. However the Helsinki FLIRT EMU project required trains of 1,524 mm gauge, the order for these being placed in October 2006. This provided an opportune „foundation stone“ for the manufacturer to consider building trains for the 1,520 mm gauge market in general, and to participate more widely in tenders for trains of this gauge.

The Helsinki FLIRTS were designated **Class Sm5**. Initially 32 four-car trains were ordered, and an option for

a further nine was confirmed in December 2011. The first train arrived in Finland in November 2008, entering passenger service a year later, and the aim is to have 41 FLIRTS in service by 2014, when the Ring Rail Line is inaugurated, connecting Helsinki-Vantaa Airport with the city centre. By 31 December 2012 21 FLIRTs had been delivered, and these had already clocked up over 4 million km in service. Ten more trains are scheduled for delivery in 2013, and ten in 2014. The 2014 deliveries will comprise the last of the initial batch of 32 and the nine forming the option. When all are delivered, they would, if all coupled end to end, form a trainset 3,075 m long!

The FLIRTs are shouldering an ever greater share of the intensive suburban



**Here we see the considerable difference in appearance between a 2,900 mm wide FLIRT built for European 1,435 mm gauge track, a 3,200 mm wide Finnish 1,524 mm gauge FLIRT and a 3,500 mm wide, 1,520 mm gauge Estonian FLIRT.**



New-generation passenger trains are transforming the Estonian railway scene. This photo taken on 24 January 2013 at Pääsküla depot, to the southwest of Tallinn, shows FLIRT 1401 EMU together with two ageing RVR-built EMUs, ER2-2204 and ER2T-2208, the latter forming regional service 593 from Tallinn to Paldiski.



**services** operating out of Helsinki, as we can see from the following anticipated data for future years:

- in 2012 40 % km services operated by FLIRTs and 60 % of all departures,
- in 2013 64 % km services operated by FLIRTs and 75 % of all departures,
- in 2014 80 % km services operated by FLIRTs and 87 % of all departures,
- in 2015 87 % km services operated by FLIRTs and 90 % of all departures.

Starting at the end of 2013, it is envisaged to have the class Sm5s operating all weekend services. The Helsinki suburban rail **network** is 81 km long, on weekdays 753 services are operated. There are four route groups:

- Helsinki to Karjaa, with short workings to Kirkkonummi and Kauklahti,
- Helsinki to Vantaankoski,
- Helsinki to Riihimäki, with short workings to Tikkurila and Kerava,
- Helsinki to Lahti.

Between Helsinki and the first junction at Pasila, all trains share the same route, with departures from Helsinki at peak periods every four to six minutes! Every day around 176,000 passengers use the suburban services, average trip length is 9.6 km, and average journey

time 12.4 minutes. The trains average between 40 and 60 km/h.

### Into Belarus...

The Sm5s served as a springboard for Stadler into genuine 1,520 mm gauge territory - in other words, the former Soviet countries. In March 2010 BCh ordered ten four-car FLIRTs, six Class **EP<sup>G</sup>** EMUs for suburban services and four Class **EP<sup>R</sup>** EMUs for inter-regional services (see R 4/11, pp. 60 - 67). To enable speedy deliveries, the Belarus FLIRTs were almost identical to the Finnish Class Sm5s, and in February 2011 EP<sup>G</sup>-001 arrived in Belarus. The first three trains were able to enter test commercial service in July 2011. EP<sup>R</sup>-001 arrived in Belarus in September 2011 and in November that year entered commercial service. EP<sup>R</sup>-004 was put into commercial service in March 2012.

The second chapter in Stadler's involvement in the Belarus market was written on 4 October 2012, when at Fanipol, in the southwest suburbs of Minsk, representatives from Stadler, Belkommunmash and the Minsk and regional municipalities laid the founda-

tion stone for a new factory for a joint venture which was originally intended to be known as Elektricheski Transport. However it will be called **Stadler Minsk**, since the joint venture was

created by Stadler (with a 60 % share) and a „Regional committee of Minsk Municipality“. Around 150 employees will be employed initially, and completion is scheduled for late 2013.

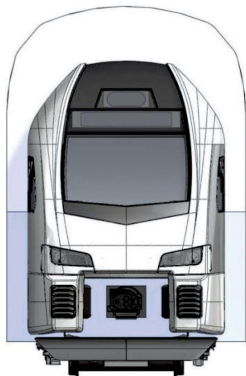


*This was the very first time that a Stadler-built train visited Russia. One of the EP<sup>G</sup> FLIRTs, becoming a new face of Belarus railways, was sent to the EXPO 1520 trade fair, which took place at the Shcherbinka test circuit between 7 and 10 September 2011. In the left background is ChS4<sup>T</sup>-373.*



The establishment is to be equipped for the production of EMUs and DRAMs for suburban and inter-regional services, and also for the possible construction of batches of trams and metro trains. With Belkommunmash being very active in trolleybus construction, it is even envisaged that these vehicles might be built there using some Swiss technologies. The factory is a significant move. The cost of around 6 million EUR per FLIRT EMU is a high one for an evolving post-Soviet economy, in spite of the undeniable high quality of the end product. With BCH keen to modernise its fleet of passenger trains, and offer attractive services, a workable form of collaboration had to be devised.

On 6 December 2012 BCH placed a **second order** with Stadler, for six Class EP<sup>R</sup> EMUs. These new inter-regional trains will have five-cars on account of increasing passenger patronage in FLIRTs. They will be 92,790 mm in length over couplings, fitted with 303 seats, and have a total capacity of 672 passengers, whereas the existing four-car EP<sup>R</sup> EMUs have 216 seats and a total capacity of 564 passengers. Designed for operation off 25 kV 50 Hz, they will have a top service speed of 160 km/h, and have a continuous power rating of 2,000 kW, as is the case with the earlier batch, but their acceleration rate will be slightly less dynamic - 1.1 m/s<sup>2</sup> instead of 1.2 m/s<sup>2</sup>. Like the earlier trains, they will have 3,200 mm wide bodysheils, but for future projects it is envisaged to create a FLIRT of 3,500 mm wide to meet the ample Belarus loading gauge. Future orders could well be quite substantial - there is talk of acquiring around 80 more trains.



The upper images compare the size of a KISS EMU built for the European loading gauge with a similar double deck EMU built to the Russian loading gauge.

The right-hand image is of Stadler's Aeroexpress EMU. Compared with the initial KISSes, the front end has been radically restyled, and is more aerodynamic. By early February 2013 133 KISS EMUs had been sold, or were under construction or on order for clients in four countries - Switzerland, Germany, Austria, and Luxembourg. Aeroexpress's trains will increase the number of KISSes built by 24, and add Russia to the list of countries in which these trains will operate.

**Deliveries** of this second batch of BCH FLIRTs, numbered EP<sup>R</sup>-005 to 010, are planned to run between 2013 and 2014. The bodysheils will come from Stadler's Berlin-Reinickendorf works (see R 1/11, p. 43), and the final assembly will be realised at Siedlce, about 100 km from the Belarus border. The first four EP<sup>R</sup> EMUs will be delivered in 2013, the last two in 2014. All trains are to be finally accepted in March and April 2014, in readiness for the World Hockey Championship in Belarus.

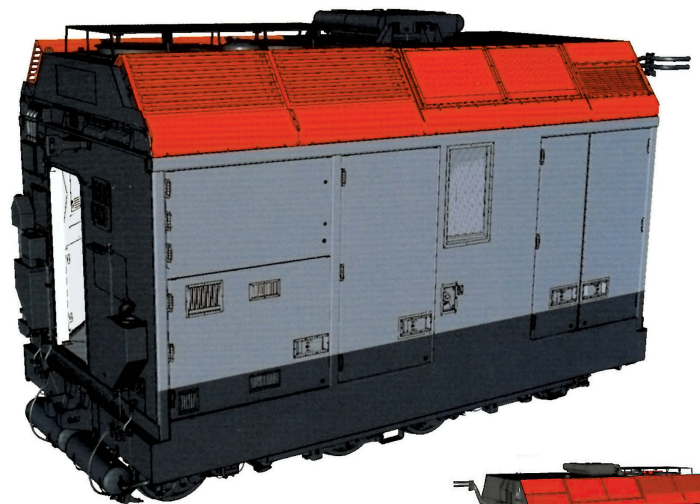
## ... On To Estonia...

From Belarus we move north, where in August 2010 Elektriraudtee ordered a batch of 12 three-car and six four-car FLIRT EMUs and six two-car, eight three-car and six four-car FLIRT DMUs - 38 trains in all. We described these trains in detail in R 6/12, pp. 24 - 26. By mid-February 2013 EMUs 1401 to 1403 and DMUs 2404 and 2405 had been delivered. The EMUs are scheduled to be put into passenger service in June 2013, the DMUs in August 2013.

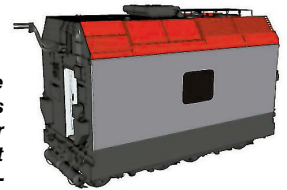
Since 2006, out of a **total** 803 FLIRTs sold by Stadler until 7 February 2013 (thence including the most recent WestfalenBahn order, see p. 44), 95 have gone, or are destined for countries with rail networks of 1,520 or 1,524 mm gauge. Finland will have 41 EMUs, Belarus 16 EMUs, and Estonia a mix of 20 DMUs and 18 EMUs.

## ... And Into Russia!

Stadler notched up its very first success in Russia at the end of 2008, when RZD invited tenders for a new generation of DMUs. Metrovagonmash of Mytishchi (part of Transmashholding) won the contract in October 2010



*In the GTW+ power module diesels will be mounted on the centreline of the vehicles. This necessitates the provision of a side corridor to enable passengers to move from one part of the train to another, and for natural illumination of this a window will be provided, as shown in the smaller image. These are the first Stadler power modules with this particular configuration.*



with a train design based on GTWs. This implied the use of diesel electric power modules, built by Stadler (see R 5/12, p. 52). Each DMU will incorporate two power modules, designated **GTW+**, and five non-powered cars, two of which will be end cars. The power modules will have steel bodysheils. In consequence, in May 2011 Metrovagonmash awarded Stadler a contract for 100 GTW+ modules (two prototypes and 98 batch modules). The two prototypes are currently at the final assembly stage at Bussnang, and will be delivered to Mytishchi in April 2013.

Each module is designed for a max. speed of 160 km/h, and is 7,300 mm long over couplings, 3,480 mm wide and stands 5,300 mm high above rail top. It has two bogies, each with a wheelbase of 2,100 mm, and wheels of 870 mm diameter when new (800 mm when worn). The prime mover is a 1,119 kW Cummins QSK38 Stage IIIA engine, Cummins being chosen not only for the specifications of the engine, but also because the manufacturer

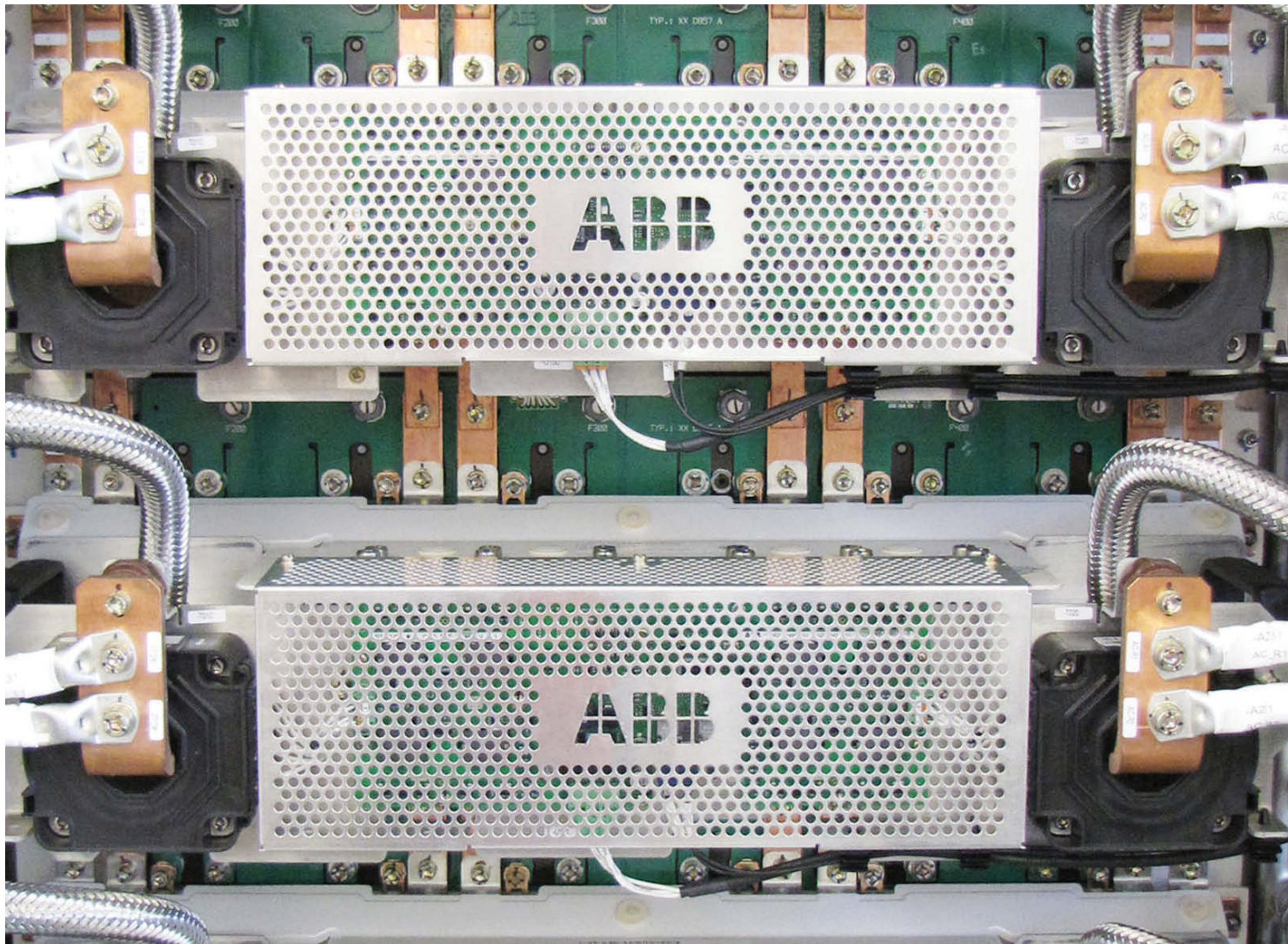
has a wide sales and maintenance network in Russia. The GTW+ modules are designed to withstand a compressive force of 2,000 kN, a tensile force of 1,000 kN, and will have a maximum axle-load of 20.5 t.

Stadler continues the development of designs for further trains for the 1,520 mm gauge. Among these are double deck multiple units. On 12 February 2013 **Aeroexpress** officially announced the results of its invitation to tender for a batch of double deck EMUs. The final stages of the bidding whittled the number down to just three competitors, Stadler (Switzerland), Alstom (France), and ŠKODA (Czech Republic). Stadler's bid was chosen, and a framework contract worth around 350 million EUR will be signed for 172 cars. Of these, 112 are to be built as the first part of the contract, to form 16 four-car and eight six-car EMUs.

These 24 trains are to operate Aeroexpress shuttle services linking Moskva with the capital's three major airports, Sheremetyevo, Domodedovo

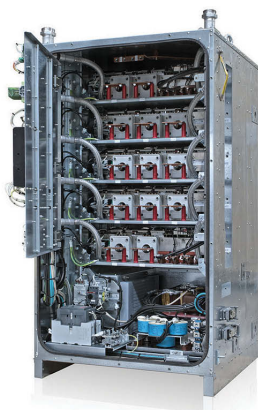






Field-proven, high-performing traction systems?

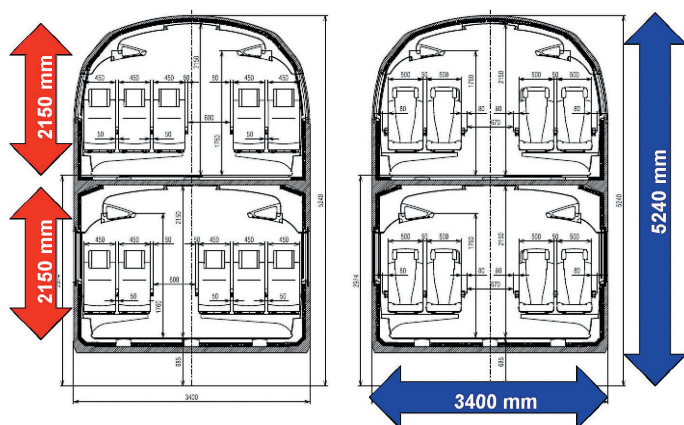
Certainly.



For Stadler Rail's single and double-deck multiple unit trains in Central and Eastern Europe, ABB supplies the most advanced traction system technology. Whether the trains run under 3kV DC or 25 kV AC catenary, with Diesel-Electric or dual mode systems, ABB propulsion provides high reliability and energy-efficiency as well as low life-cycle cost. Interested to learn more about our projects and deliveries?

[www.abb.com/railway](http://www.abb.com/railway)





The upper diagram shows the external and internal dimensions of a cross-section of the Russian version of the KISS EMU.



Two views of the Aeroexpress double-deck EMU interiors - economy (upper) and business (lower). BORCAD's REGIO and REGIO+ seats are visible in this accommodation.

and Vnukovo. The option clause in the contract envisages a further 13 trains (60 cars). Aeroexpress services are growing rapidly in popularity, and the only way to cater for the demand - and to cope with the growing constraints on infrastructure capacity - is to opt for the use of double deck stock. It is reckoned that the new EMUs will create an increase in Aeroexpress's fleet's carrying capacity by between 30 and 40 %. Following the arrival of the new trains, Aeroexpress plans to move its older EMUs to one of its other operations, but has not yet decided on which.

This is Stadler's second contract in Russia, following the GTW+ power modules for the RZD DMUs. It is worth mentioning that the new Aeroexpress EMUs will be the **second type** of new double deck stock being developed for Russia. Double-deck cars and EMUs are already being developed for RZD by Alstom and TMH. Moreover, with Aeroexpress, this is a second operator to be exploiting double-deck trains in Russia (although one of the operator's shareholder is RZD).

The Aeroexpress double-deck EMUs will have a top service speed of 160 km/h, and will have a power rating of 6 MW. Their design will be based on that of the **KISS**, and they will incorporate asynchronous traction equipment, with tried-and-tested ABB traction

converters and traction motors supplied by TSA. Their design will be tailored to meet the demands of Russian climatic extremes, for operation in a temperature range from -50 to +40 °C. Experience from the FLIRTs built for the severe winter climates of Finland, Norway, Estonia and Belarus will be incorporated in the design.

The bodysells will be made of lightweight aluminum, but will be significantly larger than those of European double-deck trains: the 1,435 mm gauge KISSes are 2,800 mm wide and 4,500 mm high, the Aeroexpress trains will be 3,400 mm wide and stand 5,240 mm above rail top. Two accommodation classes will be offered, Business and Economy, with comfortable, bright interior furnishings. Deliveries are to run from early 2015 until late 2016. Construction will take place partly in Switzerland and partly at Stadler's new factory in Minsk.

**Jaromír Perníčka**  
using Stadler sources  
and information of  
Yrjö Judström/Junakalusto

*Photos by author,  
diagrams by Stadler*



Stadler is also expanding its range of 1,435 mm gauge trains. One project is the **IC FLIRT**. This is a third generation of the FLIRT EMU, which was originally developed for local and suburban services with a maximum speed of 160 km/h. A second generation was the IR/IC FLIRT with a maximum speed of between 160 and 200 km/h (characterised by NSB FLIRT EMUs). The IC FLIRT will be a Class 2 vehicle, with a maximum service speed of 249 km/h.

This is the first time that Stadler will have created a train designed for carrying passengers at speeds in excess of 200 km/h. It was resolved not to take one step further, into the 250 to 350 km/h speed range (Class 1 vehicles), since this is a very specialised category, involving relatively small markets and very sophisticated technologies. Moreover, only a limited number of countries have rail networks designed for trains capable of these speeds.

The IC FLIRT will emerge with a redesigned front end. It will also feature comfortable passenger accommodation, suitable for longer journeys. The technical enhancements will include a dining car and various optimisations to carry handicapped passengers. 3 kV DC, 15 and 25 kV AC versions, and multi-voltage versions will be available. Trains of up to ten cars in length are envisaged, with a maximum power rating of 6 MW. The IC FLIRT is very close to becoming a reality - it will be offered on the market from 2013.



Stadler has also recently entered the market for **metro** trains, with a contract awarded by Berliner Verkehrsbetriebe (see R 4/12, p. 26). This specifies two pre-production Type IK trains (shown in the photomontage), and an option clause for a batch of 34.

## Powerful DMU Traction Converter For Russia

**Stadler Rail's GTW+ modules for the Russian fleet of new DMUs require a new type of diesel-electric propulsion converters. This compact converter, BORDLINE® CC1500 DE, extends the power range of the classical ABB BORDLINE® CC750 DE of which more than 450 units are in operation in many European countries and in the USA.**

### Global References

Stadler Rail and ABB cooperate for GTW type DMUs since 2003. More than 220 of such trains are in reliable operation in Austria, Germany, Italy, the Netherlands and the United States. The same converter platform has also been used for diesel-electric shunting locomotives in Switzerland and Spain and some rack rail DMUs in Greece.

This platform has now been expanded to two new converter types with higher power and still higher compactness: one type is used for diesel-electric FLIRTs in Estonia (see R 5/12, p. 27), driving each two traction motors instead of one. The other type, BORDLINE® CC1500 DE, is discussed here, driving up to four traction motors and providing higher on-board power for the longer Russian trains.

### Traction System Overview

The GTW+ modules contain a diesel engine which drives an asynchronous generator, supplying 500 to 1,200 V input voltage to the BORDLINE® CC1500 DE Compact Converters. The latter contains an active rectifier, two independent motor inverters, a high-power auxiliary converter, and two braking choppers connected to the braking resistors. Each motor inverter can drive one or two motors. The auxiliary converters feed the 3-phase 50 Hz 400 V train power supply line through a sine filter and an auxiliary transformer.

### ABB Compact Converter BORDLINE® CC1500 DE

Apart from their reliability, ABB traction converters are known for their compactness and high integration, their modular design, and easy maintenance. They are efficiently water-cooled, resulting in long lifetime of all the components and small converter size. The coolant (regular tap water with glycol) dissipates energy through an external heat exchanger. The cabinet of the BORDLINE® CC1500 DE is a rugged, traction-proven IP54 housing. The control module is mounted on a swing frame in front of the power modules, providing excellent accessibility of all key components. The converter complies with the Russian GOST standards.

### Integrated Auxiliary Converter/Head-End Power

The auxiliary converter generates a current limited three-phase output voltage directly from the DC-link voltage.

For the train power supply line, each auxiliary converter provides 300 kVA „head-end power“. A sine filter evens the PWM modulated output voltage, so that a sine wave voltage waveform is available which is transformed to 400 V output. The auxiliary converters of two BORDLINE® CC1500 DE converters can be synchronized without the need of any control signal exchange between the BORDLINE® CC1500 DE units.

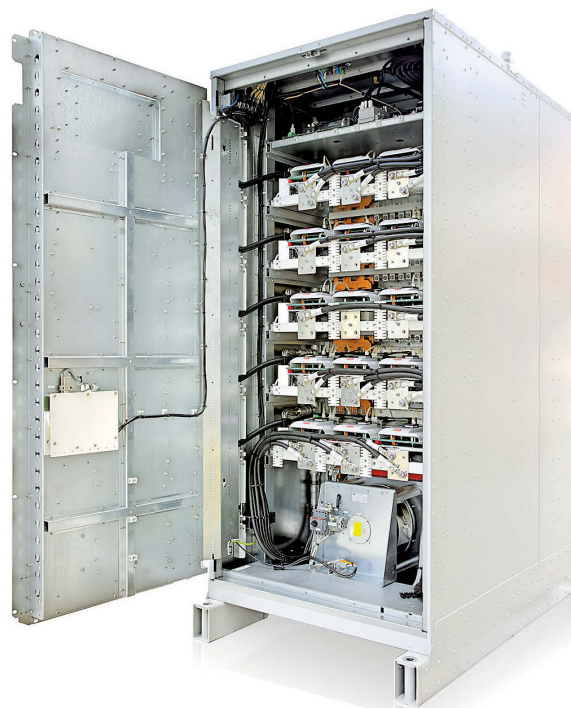
### Converter Control System

Reliability, speed, and precision require a powerful control unit. The ABB high-end control platform AC 800PEC is used in all ABB traction converters, as well as in a wide range of industrial applications. This unit covers all control and protection functions, sensor inputs, diagnostics and it provides a simple interface to the vehicle control.

In cooperation with the train control management system, standard ABB software modules control for example the slip-slide-functionality, or enhanced electrical braking mode. Modular visual programming ensures quick, reliable coding and easy adaptation of the control software. This leads to fast and flexible engineering for tailor-made solutions in customer projects.

**Harald Hepp**

**Photo and drawing:**  
**ABB**



**BORDLINE® CC1500 DE Compact Converter.**

### Principal Technical Data of BORDLINE® CC1500 DE\_D\_M\_1400 Converter:

Generator Voltage	3 x 470 to 1,200 V/23 - 60 Hz
Propulsion Output	3 x 0 to 1,250 V AC, 2 x 800 kW at wheel
Braking Chopper	2 x 700 kW
Head-End Power Supply	3 x 400 V/50 Hz, 300 kVA
Vehicle Control Interface	Can Open
Dimensions (W x L x H)	1,394 x 900 x 2,055 mm
Weight	1,200 kg

