Tver Revisited
Czech Raildays Report
Class 395 Fleet Complete
Testing The Sapsan In Russia
New Life For Lithuanian ChME3s
Power For Tango And Variobahn Trams

Power electronics for light rail vehicles are usually split into two systems: propulsion converters feeding and controlling the traction motors, and auxiliary converters supplying energy to all other on-board electrical devices. ABB’s BORDLINE® CC800 compact converter contains both systems integrated in one cabinet.

But the integration goes even further: it comprises two independent propulsion converters, two braking choppers, line filters and main switches, a battery charger, and two auxiliary converters (see drawing on the right).

System Overview

The BORDLINE® CC800 is designed for operation at nominal line voltages of 600 V DC and 750 V DC. The equipment is efficiently water-cooled, resulting in a very compact construction. The coolant dissipates energy through an external heat exchanger. ABB supplies the heat exchanger, an ABB BORDLINE® HEX, which is based on a modular platform, to the vehicle’s needs. It can include the cooling of the motors and it can also be combined in one cabinet with the braking resistor for roof mounting.

Propulsion Converter

The converter can be used for axle control as well as for individual wheel control. Each propulsion converter is able to control either one or two motors together with the respective braking chopper. During braking the energy is first used for the auxiliaries, then recuperated, or, when this is not possible, dissipated in the resistors.

Auxiliary Converter

The auxiliary converter provides two separate three-phase sinusoidal AC outputs and a DC output for charging the battery. One AC output at 50 Hz feeds the on-board power supply while the other supplies the blowers at a variable frequency. For safety, all outputs are insulated from the DC line voltage through a medium frequency transformer.

Control System

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

Standard ABB software modules control, for example, the slip-slip-functionality, pantograph bounce, enhanced braking mode, self-cleaning mechanism of the heat exchanger, and the noise reduction mode for the blowers. MATLAB®/Simulink® programming ensures quick, reliable coding and easy adaptation of the control software. This leads to fast and flexible engineering of tailor-made solutions for different vehicle applications.

Mechanical Design

The BORDLINE® CC800 is housed in an IP65 aluminum cabinet, resulting in a very low total weight. Exactly the same converter is designed for mounting either underfloor or on the roof of the vehicle. Thanks to its modular design, it facilitates access for maintenance.

Diagnostics And Servicing

The service-friendly modular design, with standard components, ensures high reliability and low life cycle cost. For maintenance, an Ethernet interface is available. In-depth data can be obtained using BORDLINE®View, a diagnostic tool including an advanced Self-Diagnosis Function, which gives advice and instructions for service and repair. It runs on standard PCs.

Platform Concept

BORDLINE® CC800 is based on an ABB traction converter platform for trams and light rail vehicles with a very wide range of applications. The mechanical design and the flexible cooling system allow fitting it to various tram, metro, and light rail vehicle designs. The control is easily adapted to any project-specific requirements.

Since a two-car tram usually needs lower motor power than a six-car light rail vehicle, it should be possible to combine single converter units in a flexible way. Such a unit with 400 kW per pair of axles is available for use with many vehicle designs. Converters based on this platform have been delivered to Stadler Pankow, Stadler Aalen and other vehicle manufacturers.

Dr. Fabiana Cavalcante
Dr. Harald Hepp

Photos and drawing: ABB

Principal Data Of ABB Bordline® CC800 Converter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Line Voltage</td>
<td>600/750 V DC</td>
</tr>
<tr>
<td>Propulsion Converter</td>
<td>0 - 500 V AC, 2 x 150 kW</td>
</tr>
<tr>
<td>Braking Chopper</td>
<td>2 x 250 kW</td>
</tr>
<tr>
<td>Auxiliary Converter</td>
<td>3 x 400 V/50 Hz, 60 kW</td>
</tr>
<tr>
<td>Blower Control</td>
<td>3 x 400 V/50 Hz, 60 Hz</td>
</tr>
<tr>
<td>Battery Charger</td>
<td>24/36/72/110 V DC, 8 kW</td>
</tr>
<tr>
<td>Vehicle Control Interface</td>
<td>Can Open, I/Os</td>
</tr>
<tr>
<td>Dimensions (Length x Width x Height)</td>
<td>1,800 x 1,800 x 430 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>ca 550 kg</td>
</tr>
</tbody>
</table>

Converter module for LRV motors.