BORDLINE® designed for EMU/DMU

Propulsion and auxiliary converters or complete traction packages

ABB IS THE PARTNER OF CHOICE

to power your Multiple Unit Trains (EMU/DMU)

THE EXPERT FOR POWER ELECTRONICS

In Switzerland, three ABB sites with approximately 2'000 employees (predominantly in R&D and engineering) work closely together to develop power semiconductors and power electronic applications for many different industries. ABB leverages synergies through standardization of modules, control hardware, and control software. You benefit from ABB's deep experience with components and algorithms, service and life cycles in different environments.

POWERFUL CONTROL PLATFORM

BORDLINE® traction converters employ the AC 800PEC control platform, which is used in a wide range of industry applications – from metal mills to wind turbine plants. This fast powerful control is built on industry-grade power PCs. MATLAB®/Simulink® [1] programming ensures quick, reliable coding and easy adaptation of the control software.

STRONG SERVICE OFFER

Our service concept centers on high availability of BORDLINE® converters, spare parts and assistance. Many customers rely on ABB empowering their service personnel to successfully take over all on-site maintenance.

ABB's service offer is modular and includes, for instance, special testing (combined tests), commissioning support, training, spare part logistics, module repair, field operating analysis, product maintenance and upgrades.

TRANSPARENT DIAGNOSTICS

Our converters are shipped with BORDLINE®-View, a diagnostic tool that visualizes signals, parameters and states of the traction system. It includes an advanced Self-Diagnosis Function, which gives advice and instructions for maintenance and repair. BORDLINE®-View is easy to use and runs on a standard laptop.

Cutting-edge technology at ABB labs in Switzerland

Versatile ABB control platform AC 800PEC

Power Electronic Building Block

BORDLINE®-View diagnostic tool

FEM analysis of mechanical robustness for a roof-mounted BORDLINE® CC750

PRODUCT OVERVIEW
BORDLINE® CC750

CC750 DE	Propulsion converters for diesel-electric regional trains
CC750 DC	Propulsion converters for 1.5 kV_{DC} and 3 kV_{DC} grids
CC750 AC	Propulsion converters for 15 kV_{AC} and 25 kV_{AC} grids
CC750 MS	Customized multi-system solutions for AC and DC grids and hybrids
Traction Packages	Complete solutions with converters, transformers, motors, generators, and other power elements

BORDLINE® CC750 as roof, under-floor and machine room mounted version

THE POWER COMPONENT SUPPLIER TO THE RAIL INDUSTRY

Today, ABB is one of the leading suppliers of power components to the rail industry. ABB stands for reliability, service, and innovative solutions both for new vehicles and fleet refurbishment. As a fully independent component supplier, ABB is uniquely positioned for trustful partnerships with train manufacturers and transport operators. For this industry, ABB offers high-quality converters, motors, and other electrical components.

QUALITY ASSURANCE

Good project management and quality assurance are the prime concerns of our company. ABB traction converters are IRIS-certified.

IRIS Certification

COMPACT DESIGN

BORDLINE® converters excel in compactness and smoothly fit your train design. ABB supplies them as roof, under-floor or machine room mounted versions. To achieve the most compact and economic solution, the propulsion converters are cooled with ordinary service water and are equipped with integrated auxiliary converters and battery chargers. Every BORDLINE® CC750 converter can either control one or two motors in parallel.

POWER ELECTRONIC BUILDING BLOCKS

Rail vehicles are highly customized. BORDLINE® converters fit a broad range of vehicle designs because ABB standardizes at the level of the power electronic building blocks. These modules are reliable and well tested in the field. Product maintenance at the module level allows ABB to support your vehicles throughout their entire lifetime and guarantee high availability of spare parts.

[1] *MATLAB®/Simulink® is a trademark of Mathworks™*

ABB COMPACT CONVERTERS FOR DIESEL-ELECTRIC TRAINS

BORDLINE® CC750 DE

BORDLINE® CC750 DE converts diesel generator power into propulsion power for the traction motors and auxiliary power for onboard consumers (AC, DC, and battery).

BORDLINE® CC750 DE employs an active inverter module (IGBT) rectifying the asynchronous generator voltage to feed the DC-link. This completely decouples the DC-link voltage from the engine speed. Hence, the engine always runs at best efficiency. An identical inverter module is used to control the traction motor which greatly simplifies the component set-up.

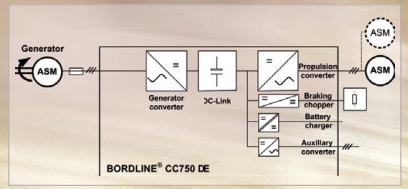
For technical data please refer to product reference sheets.

ECONOMIC & GREEN TECHNOLOGY

Both the traction motors and the onboard consumers are connected directly to the same DC-link. Energy recuperated during braking is fed back into the DC-link and can be supplied to the battery or to the other onboard consumers.

To achieve the most compact and economic solution, the system is realized in low voltage (480 V_{AC}).

In the near future, energy storage systems will furthermore reduce energy consumption and pollution levels of diesel-electric propulsion. You can bet that ABB will be part of that story!



Single-line diagram of a BORDLINE® CC750 DE

BORDLINE® CC750 DE; under-floor version

BORDLINE® CC750 DE for the Stadler GTW in Merano (Italy)

COMPACT CONVERTERS FOR 1500 V_{DC} GRID

BORDLINE® CC750 DC 1500V

BORDLINE® CC750 DC 1500V converts the power from the 1500 V_{DC} line into propulsion power for the traction motors and auxiliary power for onboard consumers (AC, DC, and battery).

For technical data please refer to the product reference sheets.

CONFIGURABLE DESIGN

The single line diagram of this Compact Converter corresponds to the 3 kV_{DC} solution depicted on the next page.

BORDLINE® CC750 DC 1500V can alternatively be equipped with two separate motor converter modules. This enables individual axle control of two motors which simplifies the wheel maintenance.

COMPACT CONVERTERS FOR 3 kV_{DC} GRID

BORDLINE® CC750 DC 3kV

BORDLINE® CC750 DC 3kV converts the power from the 3 kV_{DC} line into propulsion power for the traction motors and auxiliary power for onboard consumers (AC, DC, and battery).

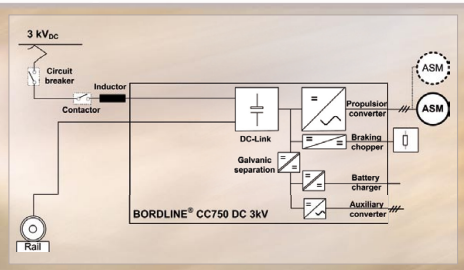
This Compact Converter is based on ABB's well-proven 3-level topology, which has several advantages over conventional 2-level solutions: It is better for the motor, better for the grid, and it saves energy!

For technical data please refer to the product reference sheets.

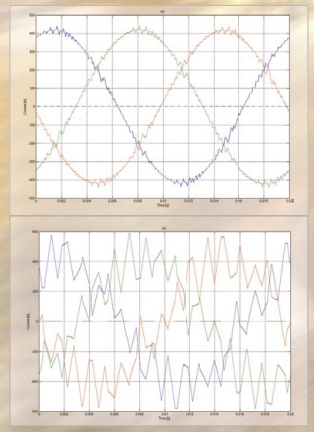
BETTER FOR THE MOTOR

The BORDLINE® CC 3-level inverter has double the conventional semiconductor switching frequency which leads to a quasi-sinusoidal current waveform. Current and torque ripples are reduced by more than a factor of 4, which in turn dramatically decreases losses, audible noise and the mechanical stress on the traction motor.

Additionally, in the sophisticated configuration of the converter, only one half of the line voltage is connected to the motor windings during each IGBT commutation, which cuts the voltage gradient stress on the motor's insulation materials by two.



Single-line diagram of a BORDLINE® CC750 DC 3kV



Comparison of motor phase currents in 3-level topology with 3.3 kV IGBTs (above) and 2-level topology with 6.5 kV IGBTs (below)

BORDLINE® CC750 DC 3kV for the Stadler FLIRT in Mazovia (Poland)

BETTER FOR THE GRID

The inherent features of the 3-level technology minimize the line interference current. Neither bulky DC-capacitors, nor higher order filters or even active filters are needed to comply with typical grid codes. Furthermore, engineering time and effort for the homologation in different countries is minimized.

ENVIRONMENTAL FRIENDLY

Optimum control, together with a constantly high switching frequency through the whole speed range leads to very smooth, silent and energy efficient operation.

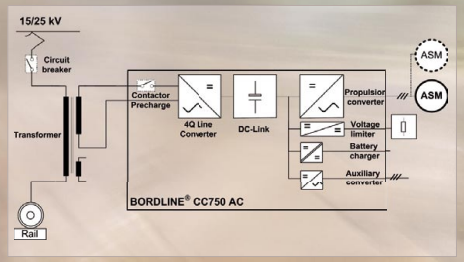
COMPACT CONVERTERS FOR 15/25 kV_{AC} GRID

BORDLINE® CC750 AC

BORDLINE® CC750 AC converts the power from the 15 kV 16.7 Hz or 25 kV 50 Hz line into propulsion power for the traction motors and auxiliary power for onboard consumers (AC, DC, and battery).

Transforming the input voltage down to 480 V_{AC}, ABB employs technological and economic advantages of low voltage components. This innovative design makes use of the higher switching frequency capability of low-voltage IGBTs and the increased power density of low-voltage capacitors. Hence, not only the converter, but the complete power installation of the EMU can be optimized.

For technical data please refer to the product reference sheets.



Single-line diagram of a BORDLINE® CC750 AC

"MINIMIZED" TRANSFORMER

The main transformer is the heaviest component on an EMU vehicle, and also the place of the highest energy losses. BORDLINE® CC750 AC, with its high-frequency, low-voltage IGBTs and its advanced grid control, can reduce the transformer impedance by up to a factor of 2 compared to medium voltage solutions. This allows either to reduce the transformer weight, or alternatively to increase its efficiency.

SERVICE AT LOW VOLTAGE

The low-voltage design has the further advantage that any electrician without MV-training can install, maintain, and repair the Compact Converter.

BORDLINE® CC750 AC for the Stadler FLIRT in Algeria

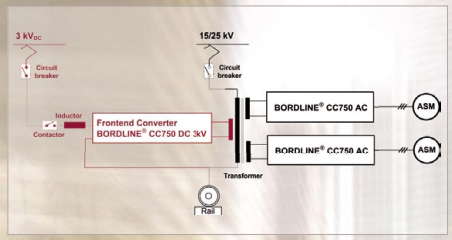
MULTI-SYSTEM-SOLUTIONS AND TRACTION PACKAGES

BORDLINE® CC750 MS and Hybrids

BORDLINE® CC750 MS has been developed for various network-crossing EMU types. For example, in Europe there is a growing market for trains that can run under 3 kV_{DC} as well as under the 15/25 kV_{AC} voltages. Other power-system combinations like 1.5 kV_{DC}/15 kV_{AC} are currently under development.

Essentially, ABB can recombine the modules of the BORDLINE® CC750 platform to deliver any kind of multi-system or hybrid solution (diesel-electric and catenary).

For technical data please refer to product reference sheets.



Single-line diagram of a BORDLINE® CC750 MS

MULTI-SYSTEM PLATFORMS

A good example for ABB's multi-system platform is the famous upgrade concept for FLIRT trains from an AC version to an AC/DC solution, using most of the same converter components. Today, these converters are used for service between Italy (3 kV_{DC}) and Switzerland as well as Austria (both 15 kV_{AC}). Many other regions with more than one line voltage have shown interest.

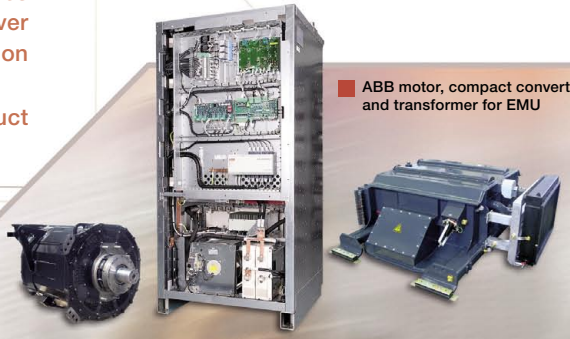
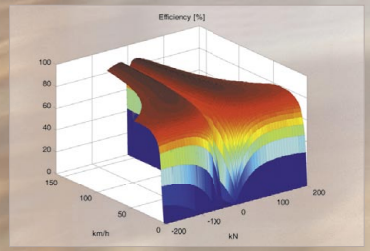


ABB motor, compact converter and transformer for EMU



Traction chain simulation

ABB TRACTION PACKAGES FOR ALL POWER SYSTEMS

BORDLINE® CC750 + MOTORS, TRANSFORMERS, …

ABB can supply all power electronics on the train together with associated components such as transformers, generators and traction motors.

The vehicle manufacturer or train operator benefits from one single interface to the supplier and from the optimization potential that lies within that subsystem.

ENERGY-EFFICIENT MOTOR CONTROL

With a constant switching frequency of 2 kHz, BORDLINE® CC750 AC generates a quasi-sinusoidal current waveform, which dramatically reduces the losses, the audible noise and the mechanical stress on the traction motor.

DUAL VOLTAGE CONVERTER

BORDLINE® CC750 AC is intrinsically a dual voltage converter. With a suitable transformer, it can run under both 25 kV 50 Hz and 15 kV 16.7 Hz.

SMALL, LIGHT, AND COMPACT

With low voltage capacitors, which have a threefold higher energy density, the converter size and weight can be minimized. Furthermore, the additional large and heavy 2nd-harmonic filters (33.3/100 Hz), usually installed in the DC-link, is not necessary.

Since the main transformer already provides the safety insulation, the integrated auxiliary converter is directly coupled to the main DC-link, without an additional galvanic separation. This reduces the amount of installed components and consequently the size and weight.

SYSTEM DESIGN AND SIMULATION COMPETENCY

After analyzing the customer's needs, ABB performs all relevant vehicle simulations. Mission profile, energy consumption and line interference simulations allow configuration of the optimum system solution.

System performance will usually be tested and approved by a full-scale combined test and digital real time simulation in our power laboratories.

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