
APPLICATION NOTE

World's most powerful rail frequency converter

Record-breaking system helps boost energy supply to German rail network



ABB has delivered the world's most powerful rail frequency converter system to E.ON, the leading German utility. The converter station is located at the Datteln railway hub, and is capable of supplying up to 413 MW (megawatt) to the German railways.

Project highlights

- Four converter blocks each rated at 103 MW
- High-level control ensures optimized operation
- Built-in overload capability ensures maximum efficiency
- Grid code compliance without line filters
- Maintenance under full load conditions (one block redundant)
- Reliable IGCT* technology

* Integrated Gate-Commutated Thyristor

The challenge

E.ON is building a new coal-fired power plant at Datteln in northwestern Germany, to replace an existing one that has reached the end of its economic and technical lifecycle. The 303 MW plant was originally built in the 1960s to solely feed DB Energie's traction power system, providing a 110 kV (kilovolt), 16.7 Hz (Hertz), single-phase supply. A powerful and efficient railway power supply converter station was to be constructed at the site of the new power plant in order to cope with an increased demand of 413 MW.

ABB's solution

To meet E.ON's railway power supply needs, ABB has provided a turnkey rail frequency converter system. Rated at 413 MW and equipped with the most advanced power electronics, the system efficiently converts electricity from the country's three-phase high-voltage grid, with a rated frequency of 50 Hz, to the 16.7 Hz required by the single-phase 110 kV grid of Deutsche Bahn.

The system consists of four identical converter blocks to provide steady power supply. Designed to ensure exceptionally high levels of system availability and reliability, it enables maintenance work to be carried out on one of the converter blocks without compromising the conversion capacity of the entire plant.

As part of the turnkey contract, ABB was responsible for the design, engineering, installation and commissioning of the system. Key components of the containerized solution include transformers and static frequency converters (SFC) as well as control and cooling systems.

Technical data – Rail SFC for E.ON in Datteln, Germany

System	SFC
Type	PCS 6000 Rail
Application	Traction power supply, 110 kV mains power supply
Installation	Outdoor
Ambient temperature range	-20°C ... +40°C
Number of units	4
Frequency	3-ph AC 50 Hz / 1-ph AC 16.7 Hz
Grid three-phase system	3-ph AC 400 kV
Traction system voltage 16.7 Hz	1-ph AC 110 kV
Active power 16.7 Hz per converter	134 MW (overload)
Cos phi 16.7 Hz	1.0
Converter cooling	Water / air

ABB's rail static frequency converter solutions

ABB can draw on a long history of SFC technology, providing reliable railway interconnections since 1994. The success of ABB's rail SFCs is based on continuous development and technological innovation. Its medium-voltage rail SFC solution allows the connection of three-phase public grids to single-phase railway power grids, at rated frequencies of 16.7, 25, 50 or 60 Hz. The SFC not only acts as a voltage and reactive power source, but is also able to handle the smooth and interruption-free transition from interconnected system operation to island mode in case of disturbances in the grid. Furthermore, it is capable of acting as sole power supply to an isolated section of the

railway, and of subsequently re-synchronizing with the rest of the railway grid after the disturbance has been cleared.

Key features and benefits

- Higher system availability
- Reduced maintenance costs (no rotating parts)
- Improved efficiency over entire power range
- Controlled bi-directional active power transfer
- Proven fault ride-through (FRT) functionalities
- Reliable black-start and island mode operation
- Reactive power compensation of the public and railway grid
- Prepared for active power flow control
- Grid synchronization capability with converter in operation
- Standardized container modules
- Comprehensive life-cycle services and support

Available configurations

- Modular system for ratings from 15 MW to 120 MW
- Indoor and outdoor solutions
- Mobile solutions
- Direct feed to AT-line (auto transformer) catenary systems
- Direct catenary feed solutions
- Feed to centralized railway grid (110 kV / 132 kV) solutions

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Inside view of a rail SFC container delivered to E.ON's Datteln site



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Rail frequency converter system installed at E.ON's Datteln site, Germany

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