APPLICATION NOTE

Extending the life cycle of proven rail converters

ABB keeps Deutsche Bahn's (DB) railway network on track with a customized retrofit solution

ABB delivered a customized static frequency converter (SFC) retrofit to the railway operator Deutsche Bahn (DB). After more than 15 years of reliable operation, three rail SFCs, located in Wolkramshausen and Düsseldorf, needed a control hardware upgrade. ABB's retrofit solution resulted in a fast execution, such that the rail power feeding point in Wolkramshausen was operational in record time.

Project highlights

- Customized retrofit of three SFC systems each rated at 15 MW
- Higher availability and future reliability by using the newest control technology
- Downtime reduced to less than 2.5 months
- Reduced maintenance costs
- Optimized work conditions and minimized expenses
- Efficient, fast and reliable project execution

The challenge
DB is using SFC technology for more than 20 years. The railway converter station in Wolkramshausen directly feeds the 15 kilovolt (kV) 16.7 Hertz (Hz) railroad network of DB and helps to secure the energy supply line between Halle and Kassel since 2001. In Düsseldorf one SFC is in operation since 1999 and feeds the 110 kV transmission network of DB.

After more than 15 years of continuous operation the control hardware of the three SFCs at both sites had become obsolete. Spare parts for maintenance are very limited. Thus a customized retrofit solution plan was needed ensuring that for the more important SFCs in Wolkramshausen, the downtime is reduced to a minimum.

ABB's solution
In 2014 DB awarded ABB the contract to deliver a customized retrofit solution for the three existing SFCs in Wolkramshausen and Düsseldorf. As part of the turnkey contract, ABB was responsible for the design, engineering, installation and commissioning of the retrofitted SFC systems.

The fact that all three SFCs have the same container design, enabled ABB and DB to plan an interchange of the containers between the sites.

At Düsseldorf's station, the first standard converter container, which was not urgently needed, was removed and transported to ABB's factory in Switzerland to be retrofitted. Once completed, the retrofitted container was delivered to Wolkramshausen and installed as ‚Unit 1'. The existing Wolkramshausen unit, which was replaced by the retrofitted Unit 1, was sent to Switzerland where it was upgraded and returned to Wolkramshausen as ‚Unit 2'. Finally, the second unit from Wolkramshausen was retrofitted by ABB and installed in Düsseldorf.

ABB's approach meant DB retained ongoing use of its investment in power electronics, transformers and switchgears throughout the retrofit. This solution minimized the reduction of available power and loss of redundancy at the more critical Wolkramshausen site. The retrofit only lasted two-and-a-half months. The retrofitted SFCs reduced DB's maintenance costs and ensured higher availability and future reliability by using the newest control technology. The converters are now ready to supply power to Germany's rail network – uninterrupted – for the coming decades.

This customized retrofit proves the feasibility and flexibility of ABB and its containerized standard converters. The solution extends the lifetime of the complete converter system. ABB converter retrofits increase energy efficiency across the complete system by enabling speed control of motors and software functions of the control system.

Technical data – Rail SFCs for Wolkramshausen[1] and Düsseldorf [2]	
System	SFC
Type	PCS 6000 Rail
Application	Traction power supply
Installation	Outdoor
Ambient temperature range	-20°C ... +40°C
Number of units	2 [1] / 1 [2]
Frequency	3-ph AC 50 Hz / 1-ph AC 16.7 Hz
Grid three-phase system	3-ph AC 110 kV [1] 3-ph AC 20 kV [2]
Traction system voltage 16.7 Hz	1-ph AC 15 kV [1] 1-ph AC 110 kV [2]
Active power 16.7 Hz per converter	15 MW
Cos phi / Apparent power 16.7Hz	0.8 / 18.75 MVA
Converter cooling	Air / water-glycol

ABB's rail static frequency converter (SFC) solutions

ABB has 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 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) functionality
- 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

— Installation of retrofitted SFC container at Wolkramshausen

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3BHS987016 E02 REV A