GE VERNOVA

RAILWAY TRACTION POWER SUPPLY

CHALLENGE

To increase speed and capacity on a segment of ca. 50 km along the European Corridor CE30 from Knappenrohde, Germany to the system interface at the polish border, Deutsche Bahn extends and electrifies an existing rail line. As part of this project, a static converter station to feed the 16.7 Hz 15 kV overhead catenaries was contracted as a turn-key project in Lohsa, Germany to a consortium lead by Power Conversion. The key objectives of the project were to achieve the highest conversion efficiency, reliability and system availability at the lowest possible cost.

CONVERTER STATION LOHSA

System overview

The Lohsa station consists of three independent blocks operating fully redundantly. It connects to the 110 kV 3-phase grid through an oil-immersed transformer (ONAN cooling system) and feeds the 15 kV 16.7 Hz overhead catenary system directly as well as through a system of auto transformers.

For maximum efficiency, each block employs air-core reactors on the 15 kV rail electrification side (transformer-less design). Connection of a 50 Hz filter is not necessary thanks to the innovative converter concept and control algorithm. On the 15 kV rail side, only a small passive filter is required to meet the strict harmonics requirements of DB.

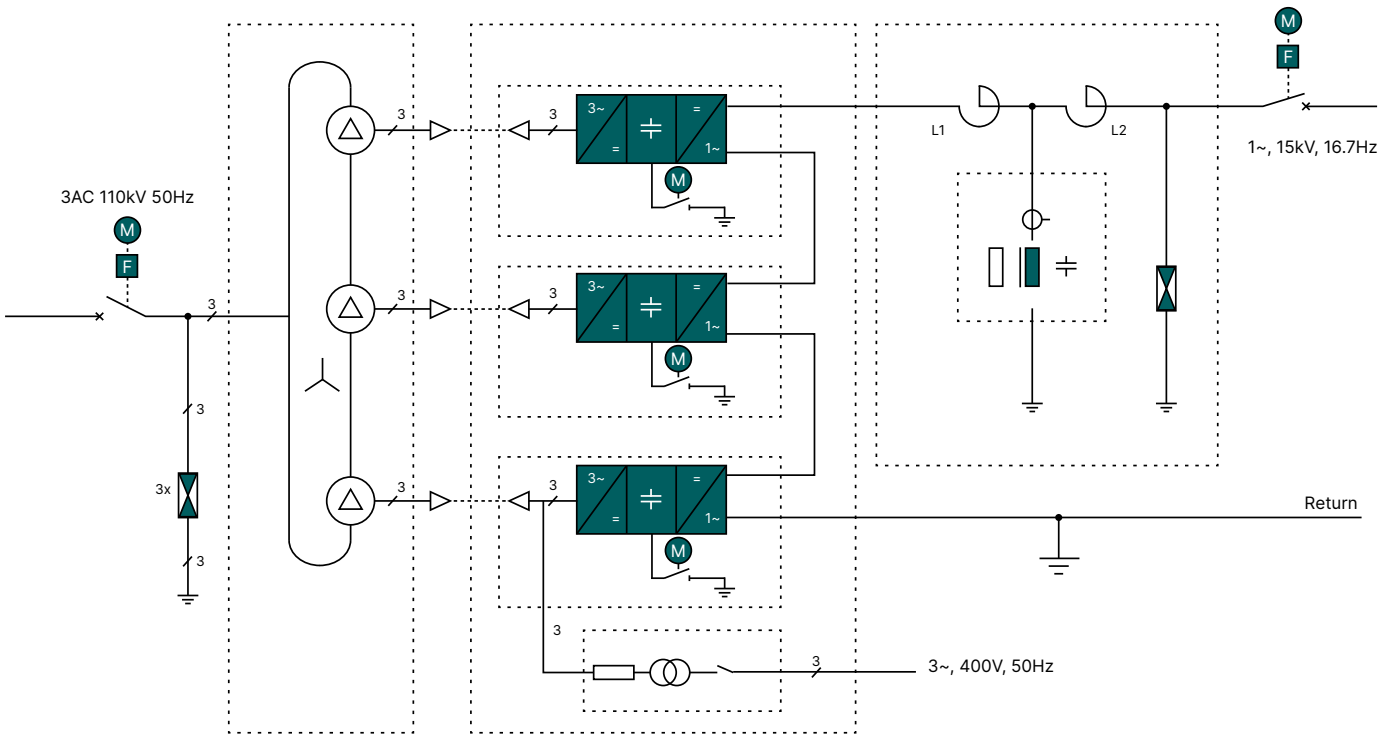
Converter system

Each block employs three converters based on the proven MV 7000 type, with the main components being:

- An input 3-phase pulse controlled sub-inverter
- A DC link with an integrated 33.4 Hz filter and a fast discharge/ earthing device
- An output 1-phase 4QS sub-inverter

Each sub-inverter contains press-pack IGBT modules organised in phase-segments and fitted with a patented pull-out mechanism including the IGBT control amplifiers.

PROVIDING THE INTERFACE TO THE DISTRIBUTION GRID



Circuit diagram of one converter block

Cooling system

Each converter block has its own dedicated closed-circuit cooling system with a mix of glycol and water. The power electronics is directly cooled with this fluid, to achieve compact design and small space requirements. The heat is then dissipated in a water-air heat exchanger. Two SFC-controlled water pumps are installed (100% redundancy) to provide continuous circulation. All systems are automatically monitored and the pumps are regularly switched over. Additional secondary air-cooling is provided for the E-house in each block.

Control system

Internal converter control enables the following operation modes:

- Standard control in all 4 quadrants (according to the P/f, Q/U characteristic)
- Reactive Compensation/ STATCOM (supply of reactive power to the railway grid only)
- Parallel operation with other generation units integrated on the 15 kV line
- Isolated mode (creating independent rail grid), with automatic synchronization to three-phase grid before reconnection
- Remote control by sinusoidal reference signal (Pilot Mode) or Autonomous Mode based on asynchronous telemetry reference signal can be provided as well.
- Black Start-Up of rail grid

Remote short circuits are handled reliably by the control algorithms. The control system allows for either local or remote operation via a user-friendly HDM interface and integration to SCADA according to IEC 61850 (IEC 60870-105-4 can be provided as well).

OUR SFC TECHNOLOGY BRINGS MULTIPLE ADVANTAGES TO THE OPERATOR

BENEFITS

- High efficiency and low operating costs
- High availability owing to modular design and a high degree of standardization
- New cost-optimized design
- Transformer-less rail-side output
- IGBT design optimized for highly dynamic loads
- Maintenance-optimized design
- Short commissioning time
- Scalable concept

Project key data

Customer	DB Energie
Location	Lohsa, Germany
Project Structure	Consortium leadership with Balfour Beatty Rail
Scope of Supply	Engineering Delivery of technology Installation (consortial partner) Commissioning
Schedule	Contract awarded: 12/2012 Start of installation: 06/2014 Commissioned: 10/2016

STATIC FREQUENCY CONVERTER FOR RAILWAY APPLICATION

Application	Static frequency converter for railway application
Temperature range	-30...40 °C
Public Grid	3-phase AC 110 kV; 50 Hz
Railway Grid	1-phase AC 15 kV; 16.7 Hz
Number Blocks	3
Apparent Power Active Power	18.75 MVA per block 15 MW per block (cos φ = 0.8)
Availability	99.3%
Efficiency	97%
Cooling converter	Ambient air and mix glycol/ water
Cooling transformer	ONAN

About Power Conversion, a GE Vernova business

GE Vernova's Power Conversion business provides energy conversion technologies, systems, and services across the power and energy intensive industries, driving the electric transformation of the world's energy and industrial infrastructure.