GE VERNOVA

RAILWAY TRACTION POWER SUPPLY

CHALLENGE

The customer required a converter station capable of converting the energy from a public 220 kV 50 Hz grid to a level required for the railway-operated 110 kV 16.7 Hz distribution grid. The key objectives of the project were to achieve the highest conversion efficiency, reliability and system availability at the lowest possible cost.

CONVERTER STATION MANNHEIM

System overview

The Mannheim station consists of a single independent converter block. It connects to the 220 kV 50 Hz 3-phase grid through an oil-immersed transformer (ONAN cooling system) and feeds the German Railway owned and operated 110 kV 16.7 Hz single phase distribution network via a step up single phase transformer.

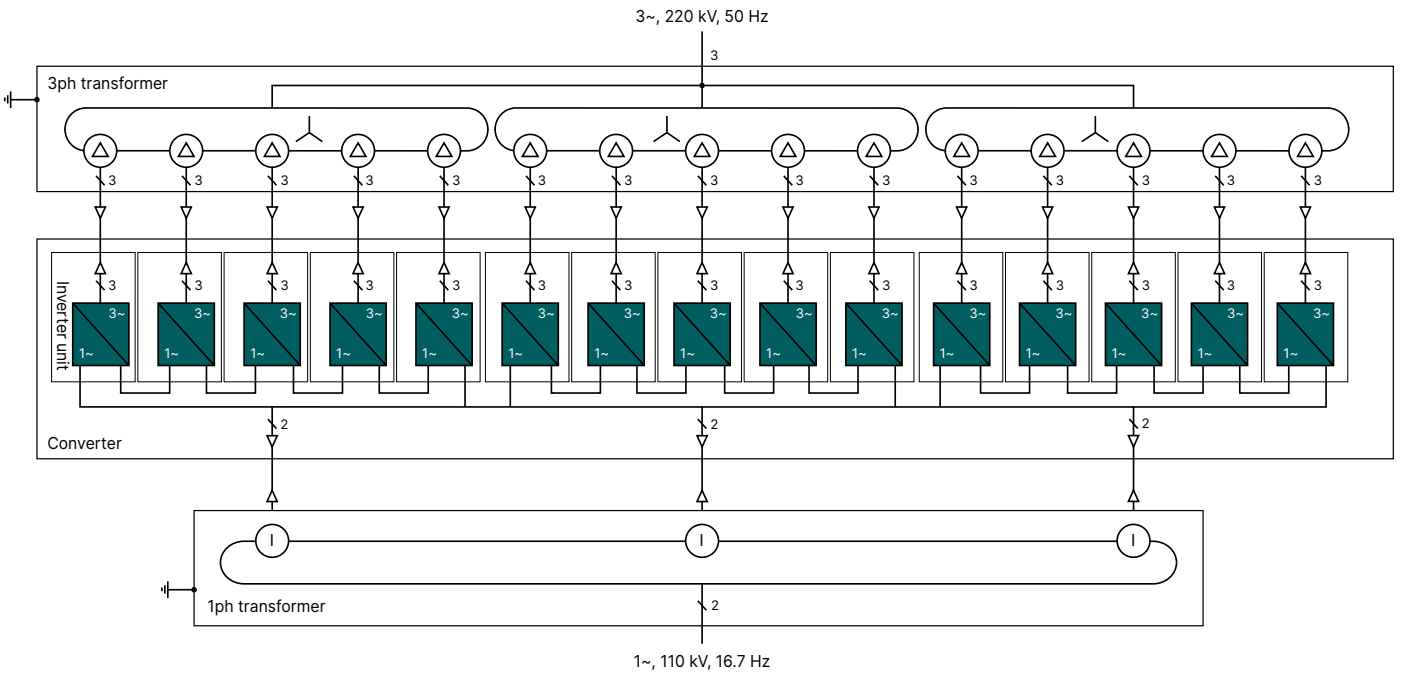
Converter system

The power part of the converter block consists of one converter system based on the proven MV 7000 converter type. The converter is rated at 150 MVA and is located in a single building. A single converter includes 3 × 5 medium voltage inverter units, each with the following main components:

- An input 3-phase pulse controlled sub-inverter
- A DC link with a 33.4 Hz filter
- An output 1-phase 4QS sub-inverter

The core components in each sub-inverter are the press-pack IGBT modules organised in two 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

The converter block has its own dedicated cooling system with a mix of glycol and water. The power electronics as well as other components of the inverter units are directly cooled with this fluid. The advantage here is compact design and small space requirements. The heat is then dissipated in a water-air heat exchanger. Two water pumps are installed (100% redundancy) to provide continuous circulation. All systems are monitored and the pumps are switched over every 24 hours. To reduce the space required, the heat exchangers are located on the roof of each converter block.

Additional air-conditioning is provided for the house premises.

Control system

Internal converter control enables the following operation modes:

- Standard control in all 4 quadrants (according to the P/f, Q/U characteristic)
- Phase shift operation (supply of reactive power to the railway grid only)
- Parallel operation with rotary frequency converter
- Black Start-Up of rail grid

The control system allows for either local or remote operation via a user-friendly HDM interface.

OUR SFC TECHNOLOGY BRINGS MULTIPLE ADVANTAGES TO THE OPERATOR

BENEFITS

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

Project key data

Customer	DB Energie
Location	Mannheim, Germany
Project Structure	Consortium leadership with Balfour Beatty Rail
Scope of Supply	Engineering Delivery of technology Installation (consortial partner) Commissioning
Schedule	Contract awarded: 07/2010 Start of installation: 02/2012 Commissioned: 11/2013

STATIC FREQUENCY CONVERTER FOR RAILWAY APPLICATION

Application	Static frequency converter for railway application
Temperature range	-20...40 °C
Public Grid	3-phase AC 220 kV; 50 Hz
Railway Grid	1-phase AC 110 kV; 16.7 Hz
Number Blocks	1
Apparent Power Active Power	150 MVA per block 120 MW per block (cos φ = 0.8)
Availability	99.3%
Efficiency	98%
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.