Around 1000 Circuit-Breakers with 1000V Operating Voltage for the AVE Madrid-Lleida

AVE 102 built by Bombardier

Moeller has collaborated with Cobra Instalaciones y Servicios in the development of the Sistema de Detección II project involving the supply of electrical equipment for the AVE high-speed rail section between Madrid and Puigvert in Lleida. The AVE now completes the section from Madrid to Lleida in approximately one hour less than before. The train reaches a speed of over 300 km/h for about 100 kilometres of the 530 kilometre section. The project used 730 NZM2 1000V circuit-breakers and 230 NZM10 1000V circuit-breakers of which all were equipped with motor operators.

The Spanish railway company RENFE are the operators of the AVE. The Sistema de Detección II project consists of a power supply network provided with sensors along the section concerned. Twelve different types of sensors are used for the following functions: detection of objects falling on the rails in front of tunnels and overpasses, fire detection in tunnels, wind detection and hot box detectors. These sensors monitor all safety levels during operation according to the railway regulations for high speed travel. The network provides a constant power supply to the system, which integrates a number of its own substations, transformers or generators.

The entire power supply network is controlled from a central control station (CRC) in Saragossa via fibre optic cables (FOCs).

Altogether 241 sections were installed along the line. These consist of so-called consumer panels for supplying the different sensors as well as supplier panels that guarantee the constancy of the power supply.

The entire line is fed with a 750V AC single-phase voltage which is transformed in each section to 230V AC. All elements are remotely controlled with 24V DC and 125 V DC.

The consumer and supplier sections handle the following functions

Consumer sections:

- Feeding the single-phase current at 750 V AC from Lleida and Madrid.
- Voltage transformation from 750 V AC to 230 V AC.
- Voltage supply of 230 V AC to the electronic equipment (sensors).
- Remote control via fibre optic cable from a central control station.

Supplier sections:

- Voltage supply of 750 V AC and distribution in Lleida and/or Madrid.
- Voltage transformation from 750 V AC to 230 V AC.
- Voltage transformation from 220 V AC to 750 V AC.

Moeller industrial switchgear for the harshest operating conditions

Railways have some demanding requirements, and this especially applies to high-speed rail. The operating conditions are extremely harsh, and components must be particularly rugged in order to ensure reliable and safe service over a long lifespan. This is particularly the case since railways are considered to be the safest and most reliable form of transport. These demanding requirements are reflected in the special regulations and specifications applicable to railways. The relevant standards in Europe refer to other general standards that stipulate the requirements of ambient conditions, such as shock and vibration, an extended temperature range, humidity, salt mist or voltage variances. Operational reliability has to be ensured for very long periods.

Moeller supplied different products for the AVE, such as the NZM circuit-breakers up to 1 600 A, Xpole modular rail-mounted devices, DIL contactors from the xStart series and easy control relays.

The NZM circuit-breakers are designed with an operating voltage of 690 V AC for switch operations in two-phase systems.

Around 1000 NZM circuit-breakers are used for an operating voltage of 1000 V and different current ratings from 20 A. All the circuit-breakers are remotely controlled and are fed with a 24 V DC auxiliary voltage.

Around 1000 Xpole protective switches are used with different current ratings for various applications. Each protective switch is remotely controlled with a 24V DC supply and control voltage.

A system involving easy800 control relays is used for the selective tripping of circuit-breakers that protect and co-ordinate the 750V AC power supply (operation at normal and maximum load), and where the specified current rating must be observed precisely.

AVE (Alta Velocidad Española)

The AVE (Alta Velocidad Española) is the Spanish high-speed rail system based on the French TGV. Three connections are as yet designed and completed for use by high-speed trains in Spain: Madrid - Toledo (since 2005), Madrid-Lleida (since 2003) and Madrid-Seville (since 1992). The 2005 Madrid - Barcelona section has been under construction since the beginning of 2005. The sections were constructed for European standard gauge systems instead of the standard wide gauge used in Spain. The reason for this change was to later enable connection to the high-speed rail network in France. The normal track width in Spain is otherwise 1,668 mm, compared to the standard 1,435 mm used in most parts of Europe. The Spanish railway company, RENFE, is the owner of the AVE, and bought the train protection system and the overhead contact line of the completed sections from German suppliers. Moeller components, particularly circuit-breakers NZM 2 to 4 for 1000 V, provide the reliable power supply for the Madrid – Lleida section.

CONCLUSION

RENFE, the Spanish railway company, had decided on a further development of the TGV Atlantique for its new normal gauge sections in Spain. Thanks to German suppliers, the AVE is a derivative of the TGV with the German LZB linear train control system. During test runs on the Madrid - Seville section the AVE set 15 reached speeds of 356.8 km/h, a Spanish record.

MS1309