



CASE HISTORY

DUPONT™ NOMEX® FOR ABB'S DUAL-VOLTAGE TRACTION TRANSFORMERS

ABB, a leading power and automation technology group, recently landed a US\$ 19 million contract for 110 traction transformers to be installed on the ETR 500-2, the latest generation of Italy's high-speed ETR 500 trains.

The ETR 500-2, operated by Trenitalia, the Italian national railways' passenger-transport arm, will travel at up to 300 km/h on the Milan-to-Rome route, starting in 2004; it will be the fastest, most modern train in Italy. It will also operate on the Milan-Paris route, in conjunction with SNCF, the French national railway company.

One of the challenges facing ABB's transformer designers was how to give the 6 MVA transformers a dual supply system capability. Italian railways now run on a 3 kV DC network, but the network being built for the high-speed lines operates at 25 kV AC. The ETR 500-2 will have to run faultlessly on both voltages and current systems. The same voltage switch will occur when the train passes from the Italian 3 kV DC to the SNCF's 25 kV AC power networks.

Other constraints included a severe weight limitation: maximum weight per axle was set at 18 tonnes, compared to the more usual 22,5 tonnes. The traction units' centre of gravity had to be kept as low as possible, to allow them to negotiate bends at high speed, so the transformer is suspended under the chassis, between the motor axles. This severely limits its external dimensions.

Traction transformers must be capable of withstanding mechanical shocks and vibration; they have to take extremes of temperature and humidity in their stride. And all this must be achieved while reducing maintenance needs to a minimum, yet without compromising reliability and safety; reliability is of paramount importance, as the traction transformer is not duplicated in a traction unit and therefore must be fail-proof. Further requirements are load flexibility and reduced electromagnetic interference, in order not to disturb signalling and communication systems.

The ETR 500-2's traction transformer also provides power for the train's other electrical functions:

these include compressed air for the braking system, and heating, ventilation, air conditioning, lighting and cooking.

The liquid-filled transformers, with a power rating of 6 MVA and weighing 6 tonnes, are being designed and made by ABB Sécheron in Geneva, part of the Swiss-Swedish ABB Group. The transformers will be delivered to Bombardier Transportation, part of the TREVI consortium supplying the ETR 500-2 to Trenitalia. Delivery will be in two stages: 50 units in 2004, the rest in 2005. ABB Sécheron, the Group's global 'centre of excellence' for traction transformers, has pulled together the Group's immense expertise in transformer design and manufacture.

Based on their past experience, ABB Sécheron opted to insulate the transformers' conductors with DuPont™ NOMEX® brand paper, while the cooling ducts in the high-voltage section are made of NOMEX® brand pressboard. But there was more to this application than just choosing the right high-performance insulation material. The NOMEX® brand stands for DuPont's in-depth technology and



Oil filled traction transformer. Power: 6 MVA. Weight: 6 tonnes.

expertise which the company puts at the disposal of customers to help them develop superior new high-performance solutions in the realm of electrical engineering.

With NOMEX® brand paper insulation for coil windings and NOMEX® brand pressboard for the cooling ducts through which the liquid passes, the ETR 500-2's transformers can operate at higher temperatures. This means a substantial reduction in copper conductor cross-section, allowing ABB's designers to achieve a considerable overall reduction of size and weight.

Joël Vauchel, ABB's sales and marketing manager for traction transformers, has this comment to add: "This traction transformer contract is a real feather in ABB's cap. The ETR 500-2 is the first true multi-system high-speed train. It will be the first train not designed specifically for the French railways which nevertheless will be allowed to operate on the SNCF's high-speed TGV network."

"Our success here is due, at least in part, to DuPont™ NOMEX® brand materials and excellent co-operation with DuPont scientists, engineers and representatives around the world. We have worked together



closely to get the best out of their DuPont™ NOMEX® thermal technology for the ETR 500-2 breakthrough. We learned a lot together, but there is more left to be learned in future."

NOMEX® is a synthetic aromatic polyamide polymer that provides high levels of electrical, chemical and mechanical integrity. In electrical applications, NOMEX® brand paper and pressboard products can extend the life of electrical equipment, eliminate or reduce premature failures, and help to survive unplanned electrical stress situations.

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Product safety information is available upon request.

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