DuPont Engineering Fibres

Nomex®

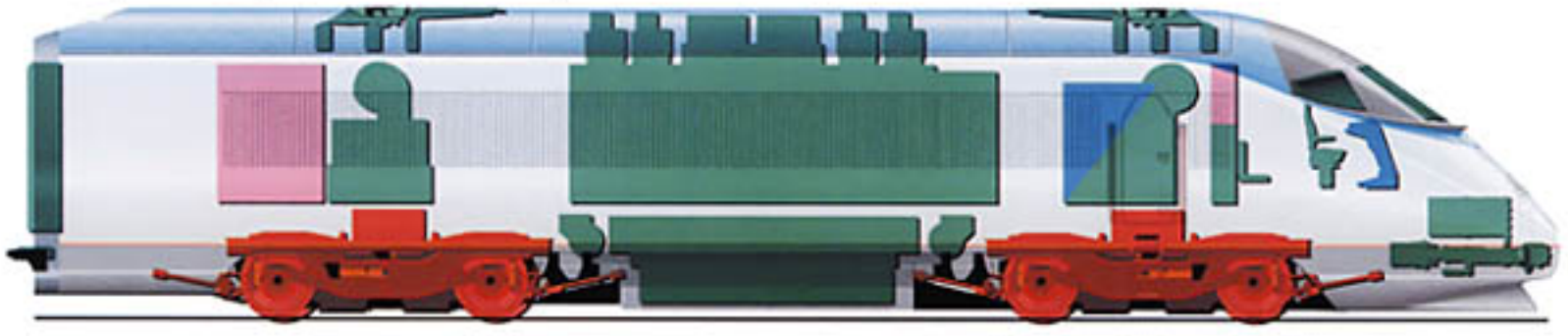
When it enters into service later this year, the "Acela Express" will bring high-speed rail travel to the United States.
© Bombardier Alstom Consortium

Weight, dimensions, reliability and thermal capability: the benefits of NOMEX® insulation for high-speed train traction transformers – the example of the "Acela Express"

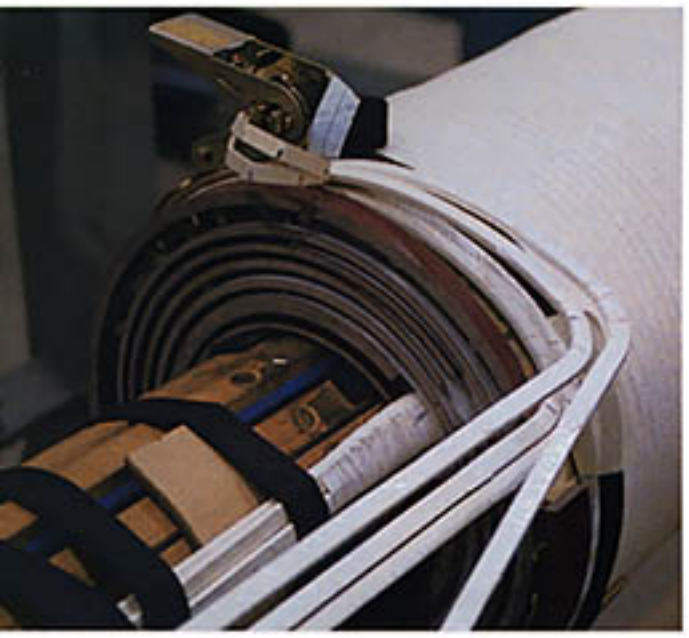
At the end of 1999, the "Acela Express" will become the first high-speed train to run in the United States on the line operated by Amtrak between Boston, New York and Washington D.C. known as the "Northeast Corridor". The Bombadier/Alstom consortium has been responsible for construction work.

Based on experience gained with the TGV Atlantique and Thalys routes and BB 36000 locomotives, Alstom has designed a triple current transformer for the "Acela Express" (25 kV/60Hz, 12.5 kV/60Hz, 12 Kv/25 Hz) known as Class "H" with 5745 kVA. Given the different supply voltages available on the "Northeast Corridor" and the installation of the power units below the locomotive, the use of NOMEX® brand insulation paper and pressboard has permitted a substantial reduction in weight and size.

Use of NOMEX® paper and pressboard made it possible to reduce the volume of the train's power transformer by 15-25% and reduce maintenance requirements.



Schematic showing the location of the power transformer in the motor coach of the "Acela Express". © Bombardier Alstom Consortium



Transformer coil manufactured at Alstom's Medford plant. NOMEX® paper and pressboard are used for the ultrasonically welded duct strips and NOMEX® paper for the conductor insulation.

Use of NOMEX® paper and pressboard for the insulation of transformer windings permits continuous operating temperatures of 160°C with 180°C peaks for a Class "H" transformer against 105°C and 120°C respectively for a Class "A" version. Class "H" technology has the advantage of permitting a substantial reduction in the cross-section of the copper conductors of the windings and an accompanying reduction of the weight and dimensions of most transformer components (magnetic sheets, tank, cooling oil volume), equivalent to a total gain of 15% on the weight of each transformer.

As the only material capable of ensuring appropriate electrical insulation at these temperatures, NOMEX® by DuPont is used in paper form to cover the copper conductors on the coils and in its pressboard version- for the spacers, separating the coil layers and acting as guides for the cooling oil.

Tafanel, a French company which makes spacers for the "Acela Express" transformers, has acquired a worldwide reputation in technology of ultrasonic welding of components made of NOMEX® paper and pressboard. The production equipment for the spacers is just one of the developments by its technical team whose performance

Duct strips made by Tafanel, using NOMEX® pressboard, ultrasonically welded on paper tapes or sheets of NOMEX®, combine easy processing with excellent mechanical strength, for optimum cooling efficiency.

is remarkable. It now supplements the traditional cutting and precision machining services made available by Tafanel to major manufacturers for many years.

Transformers for the "Acela Express" are built in the United States by the Alstom factory in Medford (Oregon). This resulted in technology transfer from Europe to the United States between Alstom, DuPont and Tafanel and the US production unit, in particular for the methods to apply NOMEX® paper and pressboard.

With its unique combination of electrical, mechanical, thermal and chemical properties, NOMEX® is the ideal material for critical high voltage insulation applications. It contributes to the reliability, service life and ease of maintenance of high performance equipment, such as traction transformers, power generation and distribution equipment.

The technical solutions proposed by Bombardier and Alstom with the use of paper and pressboard of the NOMEX® brand are a guarantee of performance, reliability, operating economy and reduced maintenance for Amtrak. The security provided by them enables the operator to focus on the comfort and services to passengers to make a journey by "Acela Express" a new experience in rail travel.

DuPont NOMEX®
Engineering Fibres
P.O. Box 50
CH – 1218 Le Grand Saconnex
Geneva, Switzerland
Tel: +41 22 717 55 54
Fax: +41 22 717 62 18
Internet: www.dupont.com/afs

Tafanel S.A
76ter, rue Etienne Dolet
B.P. 30
F-94231 Cachan Cedex
France
Tél: ++33 1 45 65 49 33
Fax: ++33 1 47 40 32 87
e-mail: vaillant@tafanel.fr

04/99 Printed in Switzerland
E-11907

DUPONT®
Nomex®
Only by DuPont