



FLAMEX®

**A complete range of cable solutions
for rolling stock worldwide**

The growth of world rail transport requires...

Modern transportation must address diverse requirements. Highways, air, and sea offer solutions for governments and populations, but only rail can provide sustainable combinations, including energy efficiency for mass suburban commuting, freight transport, and high-speed links for intercity corridors. Rail provides a green answer to economic, energy and environmental challenges.

This accounts for recent record expansion of global rail networks and extraordinary technological advances. The intermodal and mobility needs of both developed and emerging economies have meant a surge in rolling stock orders, including high-speed trains, electrical multiple units (EMUs), locomotives and metros. Growth is likely to average 2 to 2.5% annually, and total market volume is expected to reach well over 100 billion Euros by 2016.

Europe, NAFTA, and the Asia/Pacific region are the key markets today. However, with countries like China and India investing heavily in railway systems, Asia/Pacific is already moving into second place. Meanwhile, Eastern Europe, the Middle East and Africa are rapidly becoming major accessible markets for the industry.

Major OEMs and railway equipment suppliers who make systems, subsystems and components for rolling stock, are playing a critical role in the Rail Revolution worldwide. They want to meet the growing needs and expectations of railroad and transit authorities in terms of quality, safety and reliability. They are also interested in refining supply and delivery logistics and creating new customer-driven services. Passenger and freight transport are increasingly global and need a wide range of cable products which are both readily available and fully compliant with leading national and world standards.

What you expect from a cable producer:

- Comprehensive range of high-quality rolling stock cables
- Common products that meet railroad standards worldwide
- Integrated systems and harnesses to simplify installation
- Advanced fire safety for tunnels, stations and platforms
- Longer lifetime for cost savings and lower maintenance
- Broadband to enhance operations and passenger comfort
- Increased energy-efficiency, compactness and lightness



...FLAMEX® cable solutions for safety, performance, and comfort



Nexans is more than just a rolling-stock cable and accessories provider. We are a highly-experienced, vertical market supplier who can manufacture the hundreds of specialty products necessary to fit out a complete trainset. We have supplied over 80% of the cables used for major projects, like Bombardier's Intercity AGC and the high-altitude Tibet Line, Alstom's two-level RGV2N TGV, and Siemens VAL 208 driverless metro, often consolidating supply and subsystems in order to eliminate the need for multiple sub-contractors.

Our full range of FLAMEX® cable solutions include power cables for diesel/electric locomotives, EMUs, and even new self-propelled bogie concepts, like the Alstom AGV which offers commercial speeds up to 360 km/h. Nexans power expertise developed high-temperature solutions for hot locomotives, high-voltage connectivity between the pantograph and the transformer, and low-voltage power supply for cars. Our control cables are installed almost everywhere throughout the train and especially under the train driver's desk. Our data cables

assure peak performance in everything from surveillance to new passenger services, like personal video and Internet. Cable harnesses and jumper cables are specialties in themselves, and here Nexans has continued to integrate and innovate, with optical fiber increasingly included in hybrid cable systems.

Because our customers want rapid approbation, we assure compliance to standards through OEMs and national railway operators, drawing on our research laboratories for rigorous testing under all anticipated railway conditions. Growing safety demands have driven us to find better ways to assure electrical circuit integrity and improve fire performance. Energy concerns of operators have inspired us to develop smaller, lighter products; and a pressing need for even more bandwidth for train management and passenger comfort have led to significant advances in data cable designs and onboard optical fiber systems.



Finally, Nexans is the right partner to work with to reduce stock levels and optimize manufacturing costs. We have developed JIT (Just-In-Time) solutions adapted to the rolling stock industry, and can supply pre-cut, pre-fitted cables and complete installation kits.

FLAMEX® for on-track safety and train performance

- Complete data/energy cables and components for rolling stock
- Full conformity with national and international standards
- Integrated harnesses and subsystems, and ERTMS/ETCS solutions
- Fire-performance cables to protect the public, personnel and equipment
- Rugged, long-lasting cables tested for 20,000 hours of operation
- High-performance data cables, including fiber for multimedia
- Aluminum conductors; reduced cross-sections for high-temperature cables
- Services throughout trainset life cycle, from conception to replacement/recycling

FLAMEX® rolling stock cable solutions...

POWER CABLES

Rolling stock power cables

Nexans manufactures a wide range of flexible, Class 5, tinned copper single and multi-core rubber cables to meet the power needs of today's locomotives and EMUs. This includes cables specifically designed for 3-phase variable frequency drives.

Nexans has provided power cables for over 300 mainline TRAXX locomotives built by Bombardier. This modular electric and diesel-electric locomotive platform is used across Europe and comes in both freight and passenger variants.

Low and high-temperature power cables for locomotives and drives

To deal with extreme temperatures and weight constraints (especially for ultra high-speed trains), Nexans has developed a new generation of light, compact silicone cables which can operate in temperatures from -45° C to 150° C (tested to 200° C).

This cable is used on Alstom's new AGV (high-speed self-propelled carriage) which has distributed traction with motors under the floors of the passenger wagons. It is also used on Alstom's Metropolis metros, and Bombardier's new breed of Spacium high-capacity commuter trains

Silicone motor connection wires

For high-voltage machines, transformers, motors and generators, where high-temperatures prevail and flexibility is required, Nexans developed silicone cables with good abrasion resistance and high tear-resistant performance.

These cables are lighter and more flexible than rubber cables and will endure higher temperatures. They are used on Alstom's locomotives, 1,800 of which have been sold worldwide.

HV connection cables, bushings, connectors

To carry electricity from the roof-mounted pantograph to the locomotive's transformer, Nexans manufactures flexible high-voltage cables (up to 45 kV) which are supplied as a pre-mounted, pre-tested set, complete with bushings and connectors. These cable sets have been adopted by Bombardier, Siemens and Skoda.

For the environmentally-friendly Swedish Regina high-speed (180–200 km/h) trains built by Bombardier, Nexans supplied the medium-voltage pantograph connectors. A complete solution included initial measurements, technical drawings, pre-installation with terminations and tests.

CONTROL CABLES

Standard, thin-walled, ultra-thin-walled control cables

Nexans' wide range of single or multi-core control cables (with or without shielding) assure all command and surveillance functions, like doors and lighting in the passenger wagons, and for controlling converters, transformers, and the motor from the train driver's desk. Both silane and e-beam cross-linked cables are available.



Nexans has developed new solutions and offers fire-resistant cables with circuit integrity.

Nexans control cables are used everywhere in the rail industry: intercity trains and mass transit, like Alstom's Citadis tramway program (1,000 trainsets), Siemens fully-automated, driverless people mover, the VAL 208 linking terminals at Paris CDG Airport, and Siemens Austrian Railjet project (67 trainsets).



Harnesses
for all train management systems



Coaxial cables
for multimedia and GSM radio transmissions



Standard and thin-walled LV control cables

for communication systems, public address, lighting, etc.



Jumper cables

to carry information and energy between cars



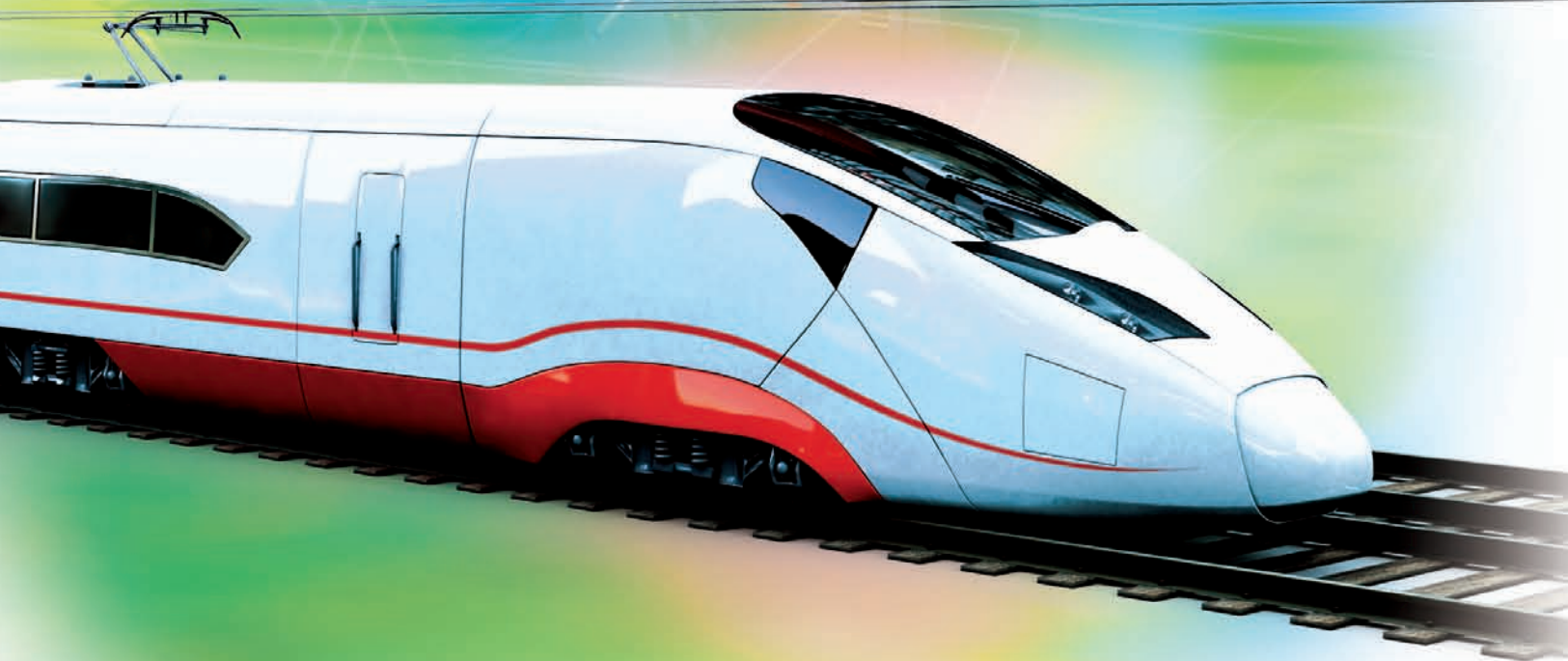
HV connection cables and connectors

to carry electricity from the pantograph to the transformer



Rolling stock power cables

for power needs of locomotives and drives



Optical fiber cables

to carry vital onboard data



Silicone motor connection cables

for HV transformers, motors and generators



Low and high-temperature power cables

to provide energy and deal with extreme temperatures and weight constraints



Databus cables

to assure surveillance and video liaisons

...make rail travel fast, safe and reliable

DATA CABLES

Databus cables

To assure passenger video services and surveillance between both extremities of a train and vital equipment, Nexans offers a series of copper, twisted-pair data cables with different impedances and layups (twins, quads, and special constructions, including hybrid). These databus cables meet the main data standards protocols used in rolling stock, like Profibus, MVB, WTB, Ethernet, etc.

Nexans has been supplying cables for Siemens Chinese CRH3 high-speed Velaro project (60 trainsets) and Changchun Railway Vehicles Co's (CRC's) extensive building program, including EMU links between Harbin and Beijing (1,250 km). Increasingly, personal video screens at the passenger seat are being used for long trips.

Coaxial cables

Also for multimedia and GSM radio transmissions for rail traffic management and train control, Nexans has developed a series of coaxial cables, answering all railway requirements, including audio/visual for passenger information or train surveillance.

Nexans coaxial cables come in various sizes and scopes of attenuation, and have special sheathings for safety, flexibility and crush resistance, making them both easy-to-install and durable. They respect RG and KX connectivity standards.

Optical fiber cables

Instead of a twisted-pair bus cable, rolling-stock manufacturers can use our high-performance multimode optical fiber cable to bring higher bandwidth for a host of new onboard services, including video, interactive passenger information, WIFI and Internet.

Onboard fiber will enrich the travelling experience in AGC (high-capacity trains for regional and intercity travel) and the newest generations of high-speed trains, like the silent and ergonomic AGVs operated by Italy's NTV. Optical fibers are impervious to electro-magnetic interference, providing added safety and performance.

HARNESSES

Rolling stock harnesses consolidate wires, connectors and identification systems not only in the locomotive, but throughout the train. Nexans designs, manufactures, pre-mounts and end-tests a complete family of harnesses: single harnesses and looms; integrated subsystems for driver's desks, communications and brake control; and complete train harnesses delivered JIT (Just-In-Time).

Nexans harnesses are found in many rail products manufactured by Alstom, Bombardier, and Siemens, including high-speed trains, tramways, locomotives, and people movers. Acquisition of the Swiss, French and German-based Confecta Group, and local production in emerging economies mean that Nexans can serve its traditional European customers, as well as new ones in North Africa, North America/Mexico, Eastern Europe, China and India.

JUMPER CABLES

As links between cars/bogies or between wheels (for sensor data), short jumper cables carry information and energy in an open, moving environment. Nexans jumpers use a special construction and materials for high flexibility, strength and durability (over one million cycles).

Jumper cables incorporating optical fiber are being installed on the new high-capacity, two-level RGV2N TGVs manufactured by Alstom which can accommodate 1,200 passengers. Nexans also supplied jumper cables (NFF standard) for the Singapore and Shanghai metros. Because of curves, vibration, and shorter wagon length, metro jumpers must be extra-flexible and specially sheathed to assure optimum safety.

For onboard safety and security

- All cables are halogen-free, non-toxic, non-corrosive, low smoke, flame/fire-retardant, and fire-resistant to assure passenger exit or train movement to a safe zone.
- In our COFRAC-certified labs, we conduct specific rolling-stock tests on flame/fire propagation, corrosion, smoke generation, fire-resistance, vibration, aging, etc.
- We conform to IRIS (Int. Railway Ind. Stand.), EN (European Norm), NFF (France), VDE (Germany), BS (UK), plus all national and international standards.

FLAMEX® for sustainable railways

GLOBAL EXPERTISE

Nexans' complete offer includes a full mastery of rolling stock cable solutions. These safe, high-quality solutions incorporate customized products, new materials and advanced techniques, and are delivered via integrated logistics everywhere.

LOCAL PRESENCE

Because railways are a world industry, Nexans has extended its international manufacturing footprint to serve its European customer base's global activities, while at the same time creating opportunities in expanding economies to develop and encourage local resources.

INNOVATION

With its OEM partners, Nexans co-develops new rolling stock solutions for special needs like ERTMS/ETCS. It has pioneered high and low-temperature cables, achieved weight and space gains, and enhanced manufacturing efficiency through modular subsystems.





With energy as the basis of its development, Nexans, the worldwide leader in the cable industry, offers an extensive range of cables and cabling systems. The Group is a global player in the infrastructure, industry, building and Local Area Network markets. Nexans addresses a series of market segments from energy, transport and telecom networks to shipbuilding, oil and gas, nuclear power, automotives, electronics, aeronautics, material handling and automation. With an industrial presence in 39 countries and commercial activities worldwide, Nexans employs 23,500 people and had sales in 2008 of 6.8 billion Euros. Nexans is listed on NYSE Euronext Paris, compartment A.

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