Efficiency, clean energy, safety and security for Rolling Stock

Rolling Stock White Paper

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Synopsis

This report is intended to give a general overview of the global Rolling Stock market and provide information about how Nexans is continuing to provide new products, solutions and services to serve that market.

It opens with a broad description of the world Railway Industry and how it is impacted by global transportation requirements, the cost of energy, climate change, customer demand, geographical constraints and recent technical developments. Both sides of the rail equation – infrastructure and rolling stock – are affected by these major trends, and both in turn affect each other. They are highly symbiotic.

Then the paper briefly examines current trends in Rolling Stock, itself. Some developments are demand-driven; others are related to urban trends, technical developments, government policy, and the public demand for safety, information and comfort. This concludes with a brief list of customer expectations.

The third section explains Nexans’ integrated products and solutions under the FLAMEX® brand name, and focuses on several specific products for cost-effectiveness and safety, followed by a presentation of the suite of services especially designed for Rolling Stock.

Finally, it concludes with a brief review of major successfully delivered recent projects worldwide.
INTRODUCTION: BROAD INDUSTRY TRENDS

“Technological innovation can achieve a faster and cheaper transition to a more efficient and sustainable European transport system by acting on three main factors: vehicle efficiency through new engines, materials and design; cleaner energy use through new fuels and propulsion systems; better use of network, and safer and more secure operations through information and communication systems.”

EU Roadmap to a Single European Transport Area – 2011

World population growth is expected to increase to nearly 10 billion by 2050, with most people living in or near cities, a fact that impacts the movement of people and goods, especially in areas of high congestion. Already, every year the planet’s rail lines carry 10 billion tons of freight and 21 billion people. Demand for rail is outpacing capacity and infrastructure creating bottlenecks and the efficiency of legacy systems.

Energy dependency, climate change, speed, etc.

Since rail is two to five times more energy-efficient than road or air, the EU’s Roadmap (quoted above) foresees cutting oil dependency and reducing greenhouse gases in transport by 60% by 2050, with 50% of road freight over 300 km shifted to rail by mid-century. Today, High Speed Rail (HSR) accounts for about a third of total long-distance passenger rail traffic in Europe overall, while France and Germany, HSR accounts for nearly two-thirds of domestic long-distance service. The EC roadmap calls for tripling the HSR network by 2030, which means that by 2050 most medium-distance passengers will opt for rail over road and air travel.

Multimodal hubs and standardization

Demand currently outstrips capacity at many of Europe’s airports. In fact only about a dozen airports are connected to long-distance main lines or HSR. Under the EU’s TEN-T program, multimodal hubs will be introduced at 37 key airports.

At present, 20 different signaling and speed control systems are operating in Europe. They use various frequencies and voltages to handle rail traffic. That is why the European Rail Traffic Management System (ERTMS) is striving to create a unique signaling and communication standard throughout Europe, which will increase efficiency and reduce costs.

Standardization is also an IT issue. Introducing new interoperable and integrated standards will make processing easier, and simplify ticketing, especially where interlining with other rail carriers is involved. This will allow rail companies to compete more efficiently with air travel, and will make life easier for travelers wishing to book a complex cross-border journey. As one analyst expressed it: “We must never again forget that the passenger (and one might add, the shipping agent) is King!”

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1 For many of these trends, consult: http://ec.europa.eu/digital-agenda/futurium/en/content/trends-rail-transport

Nexans White Paper
Geographical development

Approximately 90% of all railway traffic (freight and passenger) is concentrated in six major networks: North America, China, India, Russia, Japan and the EU 25.

The U.S. rail freight demand is expected to increase by 88% by 2035 and China is poised to quintuple its traffic by 2020. In fact, both China and India show sustained and rapid growth for passengers and freight. China, whose vast network of HSR lines average speeds of 350 km/hr, is even planning to create a two-day high-speed rail link between Beijing and London via India, Pakistan and the Middle East. Russia is set to invest in electric locomotives and trams/light rail, while Japan is planning an innovative superconductive Maglev 286 km route between Tokyo to Nagoya, which will reach the incredible speed of 500 km/h.

Meanwhile, Europe, which has been a market leader and experienced steady growth over decades, will see a series of transformations, driven by congestion and policy concerns. The UK and France are already investing heavily, and ERTMS is continuing to be rolled-out in three Levels of implementation, with interoperability and standardization as prime concerns.

As for new areas of development in what has become a truly global industry, a recent UNIFE study signals that outside of the incumbents, the highest rate of growth in the coming years will be in Africa, the Middle East and in Latin America (from +7.5% to +10%).

Railway innovation

Innovations are creating smarter rail systems around the world. They will become increasingly instrumented, interconnected and intelligent. The global explosion in the use of Radio Frequency Identification (RFID) tags and remote sensors can track the location of cargo, operational status, and the movement of people through urban networks and regional and mainline railway systems.

In 2013, UNIFE’S Shift2Rail initiative proposed doubling capacity, increasing reliability by 50% and halving life-cycle costs by encouraging “step-change innovation in all aspects of the rail system.” But what is on the more distant horizon? According to “A Vision for Railways in 2050”:

If technological change continues or quickens (which is more likely) we can expect trains without crews (done today in some Metros); real-time system management of all trains without wayside signals throughout the US and the EU; real-time monitoring of all equipment condition and maintenance planning (already done by many airlines and some US freight railways); and even tighter integration of rail services into logistics chains.

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2 “Back on Track: Making the shift to a 21st century rail network,” Amadeus, 2012
5 Railway Gazette International, June 2013, p. 3
Key drivers

The railway world is not monolithic, due to geographical, historical, economic political, and cultural differences. However, among key factors likely to transform the rail industry:

- a growing public concern for safety
- a wish for improved comfort, quality, and information access
- greater service frequency and more high-speed networks
- reduction of congestion through multimodality and hubs
- seamless travel through pre-ticketing and air-rail, rail-rail integration
- operational efficiency to control costs and fund future expansion

CURRENT TRENDS IN ROLLING STOCK

Along with highways, air, and sea, rail provides sustainable travel, including energy efficiency for mass suburban commuting, freight transport, and high-speed links for intercity corridors. In recent years, mobility needs have stimulated 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 over 40 billion Euros per annum by 2016.

European rail renewal, emerging economies, and international sporting events continue to drive rolling stock growth. Brazil was an exceptional case, largely revamping its metros for the 2014 World Cup, and now for the 2016 Olympics. In France, Germany, Russia and South Africa railways are being upgraded (especially regional lines). China is targeting railways to lift the economy, and India has approved hundreds of rail projects. Meanwhile, 150 million-plus cities are looking to rail to resolve urban congestion and facilitate inter-city travel.

Driven by customer-demand for cheaper, safer, more comfortable and efficient rail travel, and national policy objectives for carbon reduction and transportation efficiency for urban populations, rolling stock manufacturers are undergoing significant changes, many of which require advanced cabling solutions. In addition, they are increasingly asking for services from partner-suppliers: from inventory management to customer tailored packaging, recycling, the resolution of technical and installation problems, and design to cost.
1. The move towards smarter cities

Under the intense pressure of urban growth, light rail, metros, and trams are continuing to offer an alternative to highway congestion, pollution, and gridlock, which can put a damper on economic and social progress, and create serious health problems for the general population.

This bleak situation has inspired many world cities to rejuvenate their transportation systems. Seventeen Chinese cities now have metros in operation, with another 13 under construction, and up to 20 more cities are planning their first routes. Beijing now has the world’s longest metro, with 442 km in operation, overtaking Shanghai, London and New York.7 In fact, Asian cities accounted for nearly half of all metro car orders reported during the past five years! Meanwhile, several emerging and developed countries are continuing to invest in metros, suburban rail, tramways and people movers.

However, to provide an attractive alternative to private automobiles, taxis and buses, urban rail must offer more in terms of frequency, speed, fuel-efficiency, operational reliability, and passenger comfort, information and safety. Each one of these goals depends on high-performance vehicles equipped with appropriate cables and solutions, from power cables for locomotives, drives and wagons to advanced onboard signaling, data transmission cables.

2. New advances in high-speed train technologies

For the time being, High Speed Rail (HSR) seems to be the prerogative of Europe and the Far East, with no real “high speed” yet to be seen in the Americas, South Asia, Africa or the Australasia. However, high speed seems to be a real temptation in California and the American northeast corridor and elsewhere, in Scandinavia and the Middle East.8

In the current high-speed club, China, France, Spain, Japan and Taiwan are in the champions league, with timings exceeding 250 km/h. China dominates the race, with its fastest trains (now operating at +300 km/h) out-speeding second place France by more than 40 km/hr.

On the Beijing--Shanghai route, trains cover a 1,023 km route at an average of about 280 km/h. Meanwhile Spain has overtaken Japan in high speed, and holds third position. RENFE hopes to start running at 350 km/h, once ETCS Level 2 is fully introduced.

Second-tier speeds in the speed stakes are between 200 km/h--249 km/h, and the third tier (usually upgraded conventional lines) run from 160 km/h--200 km/h. Far below this is the misnamed Silver Meteor in the US, which runs from NYC to Miami at 80 km/h, significantly slower than Algeria’s Oran--Alger express (105 km/h).

The conclusion here is that HSR is here to stay, and that there is incredible room for growth for manufacturers. The corollary to this is that much of this high-speed achievement is due to a new generation of cables and solutions that can efficiently operate with in an entirely new set of standards, demands and operational criteria, in terms of heat, stress and reliability.

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7 See “Smarter cities are on the move” in the Railway Gazette International, March 2013, p. 3 for these facts and other interesting observations.
8 See Jeremy Haretill’s “How fast is fast enough” in conjunction with the World Speed Survey 2013. See the Railway Gazette International, July 2013, p. 31
3. The European Rail Traffic Management System (ERTMS)

ERTMS is a European Union initiative to promote cross-border interoperability and the procurement of signaling equipment and onboard components and systems to create a single Europe-wide standard for train control and command.

It was planned and developed in and for Europe, and is now being installed in 22 European countries. However, it is also a truly international phenomenon, and is being further deployed in South-east Asia, the Middle East, Australasia, South and Central America, and Africa.9

The two main components of ERTMS are the European Train Control System (ETCS), a standard for in-cab train control; and GSM-R, the GSM mobile communications standard for railway operation. The equipment is further divided between onboard and infrastructure equipment.

In many countries, we are now at Level 2 implementation, a digital radio-based system, whereby voice communications and data transmission is continuous via GSM-R. Upgrades in 2015 will allow additional functionality such as automatic train operation, or the use of satellite navigation systems.10

What this means is that train movement authority and other signal aspects are displayed in the cab for the driver, largely dispensing with visual trackside signaling (which is hard to see at ultra-high speeds). Eurobalises are used at Level 2 as passive positioning beacons or “electric milestones”

Between two balises, the train determines its position via onboard sensors (axle transducers, accelerometer and radar). Meanwhile, the onboard computer, the European Vital Computer or EVC, continuously monitors the data collected and calculates the maximum permissible speed. This information is automatically reported to the Radio Bloc Center, while the driver is kept informed via a Driver-Machine Interface (DMI), indicator panels and a monitor.

Apart from interoperability and enhanced cross-border mobility, ERTMS has major benefits:

- Higher line speeds and shorter headways between high-speed trains
- Increased line capacity
- Greater safety and efficiency for passengers
- Increased earnings for operators
- Lower maintenance and life-cycle costs

Although, up until now trackside infrastructure has been a priority, train set manufacturers are now offering an entire suite of onboard ERTMS equipment and components, which include everything from modular Driver Machine Interfaces for the driver’s cab to European Vital Computers (EVCs), GSM-R and GPS antennas, Euro Antennas, radars and sensors.

All of these vital elements need power and integration, and that requires extremely reliable cabling, including Profibus cables, harnesses, and even optical fiber, all of which have to meet high standards in terms of reliability at extreme temperatures and weight constraints.

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9 For details, see: [http://www.ertms.net/?page_id=55](http://www.ertms.net/?page_id=55)
4. Operational Safety

2013 was an *annus horribilis* for train safety. July was an especially bad month, with Lac-Megantic (in southern Quebec), Brétigny (in France) and Buenos Aires, followed by the derailment at Santiago de Compostela in Spain. In the latter tragedy, of the 218 passengers on the train, more than a third were killed and almost all of the others injured. Just a few days later, there was a head-on collision between two local trains in Switzerland.

2014 also saw its share of tragedies but on a lesser scale, like the freight train derailment near the Katongola Bridge in the Democratic Republic of Congo which cost the lives of 48 people, a train crash in northern Uttar Pradesh state in India, and a derailment in the Swiss Alps near Saint Moritz in August 2014.

According to the European Railways Agency’s (ERA) Railway Safety Performance Report, there is on average a derailment or a collision every second day in the EU, “causing significant disruptions to railway operations.”

On the positive side, according to the ERA’s 2013 health and safety report, “comparisons of fatality risks for travelling passengers reveal that train is one of the safest modes of transport.” The fatality risk for an average train passenger is around 0.15 fatalities per billion kilometers – three times lower than the risk for a passenger on a bus or coach. Commercial flight passengers have the lowest risk with 0.1 fatalities per billion kilometers. All the same, fatal train collisions and derailments have gradually improved since 1990.

Thus, trains are still a very safe alternative to cars and buses. However, manufacturers and operators want to make rail even safer and more efficient to attract new generations of passengers and freight handlers.

Cables live tough lives on the rails, and are constantly menaced by cold, heat, stress, water chemicals, impact and vibration. That is why they need protection around the core of the cable, often through new kinds of insulation, or armoring which assures the mechanical integrity of the cable, and protects against electromagnetic interference.

Above all, cables must deal with high temperatures in locomotives and meet optimal performance in terms of fire safety in the case of an accident, being both flame and fire-retardant, emitting low smoke and toxicity to protect the travelling public.

Current standards for fire protection on railway vehicles concern:

- Fire behavior of materials and components
- Fire safety for rolling stock design
- Fire control and management systems

All of these involve diverse high-quality rolling stock cables.

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5. Enhanced onboard information, communication and comfort for passengers

Passengers also desire enhanced communications, especially comprehensive IP services which include Internet access, travel information, dynamic route maps and entertainment, whether waiting in train stations or in movement.

In a world where the Internet is enriching so many of our leisure and work activities, it should come as no surprise that train travel, whether urban mass transit, suburban, regional or main line will have to make information access an important part of the travel experience, if growth is to be assured.

One recent study observes the following:

A final factor pushing in favor of rail is what’s happening with mobile phones, tablets and laptop computers. Every year these devices now boast display and telecommunications links that are bigger and stronger than in the past. On trains therefore, mobile devices can and will more and more be consulted for timetables, or used as boarding passes, or as a means of making payment.

The growing role of mobile devices in everyday life favors trains more than cars or planes, where customer use of IT is constrained for safety reasons. On trains, it should be easy to book extra journeys, or additional services – services delivered while you are still on the move, or for when you arrive at your destination or a station near it. It should be easy, and it will be easy, if rail companies fully realize that the customers would like a lot more from rail IT than they are currently getting.  

Enhanced communications, especially comprehensive IP services which include Internet access, travel information, dynamic route maps and entertainment also require a complete rethinking of the onboard data environment, and this, too, implies a significant upgrade of the cable and wireless environment.

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13 Amadeus: see “Back on Track: making the shift to a 21st century rail network” by James Woudhuysen at: http://info.amadeusrail.net/back-on-track-thank-you?submissionGuid=fa1452d1-a1ac-491c-9dad-db437ebd03aa
Expectations of a cable manufacturer

OEMs and suppliers of systems, subsystems and components are playing a critical role in the Rail Revolution worldwide. They want to meet railway and transit authority demands for quality, safety and reliability. They are also interested in improving supply and delivery logistics and creating new customer-driven services. Passenger and freight transport are increasingly global and need a wide range of cable solutions that are readily available and fully compliant with national and world standards.

- Comprehensive range of high-quality rolling stock cables
- Common products that meet rolling stock standards worldwide
- Integrated systems and harnesses to simplify installation
- Longer lifetime for cost savings and lower maintenance
- Increased energy-efficiency, compactness and lightness
- Services to lower cost-of-ownership and increase competitiveness
NEXANS: A GLOBAL LEADER IN THE INDUSTRY

Nexans is a highly experienced, vertical market supplier who can manufacture the hundreds of specialty products necessary to outfit a complete train set. It has 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.

Nexans is a globally recognized leader in the industry with a strong reputation for delivering high-quality, reliable products. Its expertise in the field of rolling stock is evident in its ability to supply a wide range of cables and accessories that are essential for the operation of modern trains. From power cables for locomotives and EMUs to control cables for operational performance and safety, Nexans offers a comprehensive range of solutions that meet the specific needs of the railway industry.

Its FLAMEX® cable solutions include power cables for locos, EMUs, and self-propelled bogies, like the Alstom AGV which offers speeds up to 360 km/h. It developed high-temperature solutions for locomotives, high-voltage connectivity between pantograph and transformers, and low-voltage power for cars.

Control cables assure operational performance and safety, while data cables provide surveillance, video and Internet. Cable harnesses and jumper cables include optical fiber in hybrid cable systems.

Nexans assures compliance to standards, with rigorous testing done in its research laboratories. Growing safety demands have driven it to find better ways to assure electrical circuit integrity and improve fire performance. Energy concerns of operators have inspired it to develop smaller, lighter products; and a pressing need for train management have led to significant advances in data cable designs.
High-performance rolling stock products

POWER CABLES

1. **Rolling stock power cables:**
   A wide range of flexible, Class 5/6, tinned copper single and multi-core rubber cables to meet the power needs, with fire resistance for circuit integrity for enhanced safety.

2. **High-temperature flexible power cables:**
   To deal with extreme temperatures and weight constraints, light and compact silicone cables can operate in temperatures from -50° to 150° C.

3. **Silicone motor connection wires:**
   For high-voltage machines, transformers, motors and generators, where high temperatures prevail and flexibility is required, with good abrasion resistance and high tear-resistant performance.

4. **HV connection cables, bushings, connectors:**
   Carrying electricity from the pantograph to the locomotive’s transformer, flexible HV cables (up to 45 kV) can be supplied as a pre-mounted, pre-tested set complete with bushings and connectors.

CONTROL CABLES

5. **Standard, thin-walled, ultra thin-walled control cables**
   Single or multi-core, shielded or unshielded, for all command and surveillance functions: doors, lighting, converters/ transformers. A full range of fire-resistant cables ensures circuit integrity of key components.

DATA CABLES

6. **Databus cables:**
   For passenger video services/surveillance and vital equipment, twisted-pair databus cables (different impedances and layups) meet Profibus, MVB, WTB, Ethernet protocols.

7. **Coaxial cables:**
   For multimedia and GSM radio transmissions for rail traffic management and train control.

8. **Optical fiber cables:**
   Instead of a twisted-pair bus cable, a multimode optical fiber cable brings high bandwidth for onboard services: video, interactive passenger information, WIFI and Internet.
HARNESSSES

9. Rolling stock harnesses:
Consolidate wires, connectors and identification systems throughout the train: single harnesses and looms, integrated subsystems for driver’s desks or brake control.

JUMPER CABLES

10. Jumpers:
To link cars/bogies/wheels, strong and flexible jumper cables carry information and energy in an open, moving environment (for over one million cycles).

All cables are halogen-free, non-toxic, non-corrosive, low smoke, flame and fire-retardant. On top of that, Nexans offers a full range of fire-resistant cables to assure passenger exit or train movement to a safe zone.
Robust and durable cables are tested for 20,000 hours of operation to ensure high levels of safety for passengers and equipment. Besides complying with EN 45545-2 for fire, smoke and toxicity, our Flamex® solutions meet various standards like NFF 16101, DIN 5510-2, BS 6853, IEC 11170-3, NFPA130 and GOST-R.
Innovative solutions for cost-effective upgrades and safety

SIWO-KUL®-SIL high-temperature cables for locomotives

SIWO-KUL®-SIL high-temperature connection cables provide flexibility, temperature and fire-resistance for high-voltage (1.1 kV to 15 kV) transformers, motors, machines, and generators used in locomotives and drives.

By using a silicone rubber insulation instead of polyurethane, the resin epoxy used in motor/generator coils does not stick to the cable. Moreover, the outer protective braiding does not split and fray when the cable is cut.

SIWO-KUL®-SIL is designed to be a connection cable for electric motors and other related power applications. It carries energy to the enclosed and stationary stator coils from an external power supply. Because of this double environment – one quite cool and the other extremely hot – a part of the connection cable is subjected to intense heat and a chemical resin-epoxy threat coming from the winding wire coils located within the motor casing. SIWO-KUL®-SIL cables survive the heat in these tough onboard conditions.

Enhanced jumpers for high-speed trains

This cable with a silicone-rubber sheath contains power, control, coaxial, and data cables to transmit energy, control signals and data between high-speed train coaches. Instead of halogen-free polyolefin, silicone endows it with high dynamic flexibility and enhanced fatigue and abrasion resistance.

Jumper cables with a flame-retardant polyolefin sheath are a safe and time-proven product; however high-speed trains require exceptional performance. Tested and approved by China’s Sifang Research Institute (SRI) for rolling stock, Nexans silicone rubber cables deliver 500,000 cycles.

This innovative manufacturing process can also be applied to all thermal plastic cables (such as foam polyethylene), especially where short lengths are needed, from three to four meters long. Not only are these cables used on high-speed trains, they could also be used for metros and people movers, or other applications which combine energy, control and data in dynamic conditions.
A suite of services designed for rolling stock

**Inventory management**
Nexans uses high-performance analysis tools to carry out diagnostics and propose personalized solutions to speed up supply chain flows to reduce costs, cash flow and free up warehouse space and simplify project management. It gives strong leverage to our customers in reducing the Total Cost of Ownership of their cables needs.

**Custom-tailored packaging**
Cables are delivered on special reels, custom packaged with added protection (protective film wrap, lagging, hooping) and cross-docking to consolidate deliveries. This facilitates rollout of new projects and reduces waste.

**Recycling**
For 30 years, Nexans has collected and recovered cable waste from production plants and from cables at end-of-life. **Recycable** (35%-owned by Nexans) recycles cable cores to produce new wires, while polymers are transformed into useful items.

**Innovation**
For OEMs, Nexans makes available R&D tools like numerical modeling, electron microscopy, laboratory testing and engineering expertise. Innovation accelerates time-to-market, optimizes performance, and lowers development costs.

**Technological consulting**
Nexans optimizes electrical, thermal and mechanical designs for rolling stock, and conduct life-cycle analysis to assess environmental impact. For major projects, a resident engineer oversees the project and provides maximum onsite support.

**Design to cost**
On-site experts identify solutions and technical alternatives to make cable purchases leaner and reduce total cost-of-ownership. Bills of materials are optimized, both in terms of process and performance, to reduce the Total Cost of Ownership of the cables.

**Extranet**
Through personalized access, customers can track orders/deliveries, create pre-selected catalogues, and consult inventory, and product availability, etc. This provides a secure electronic library of all technical, administrative and commercial documentation over a project’s lifetime.
CONCLUSION

Nexans: a global expert in rolling stock solutions

During its half-century of involvement in the rail industry, the company has gained invaluable experience by working closely with rolling stock engineers and operators to find solutions which respect their many priorities, from concerns of cost, efficiency and safety, to wider issues of reducing CO\_2 emissions.

With its customers, Nexans is anxious to see “sustainable mobility” achieved for main line high and ultra-high speed lines, but also for revamping regional lines, as well. It also recognizes that rail transport has major advantages in the urban context. It has special experience in metros, tramways, light rail, and driverless people movers; and can make a contribution towards the development of intermodal urban mobility systems to meet the expectations of tomorrow’s citizens, especially in terms of today’s information-rich travel experience.

Nexans recognizes that expensive breakdowns, accidents, and short-lived cabling and equipment pose real threats to long-term viability and growth. That is why the products, technologies and systems that Nexans offers are intended to improve efficiency, prolong product life, and assure the highest standards of safety.

Nexans sees its role in the coming years as a “privileged supplier” to rolling stock, as it continues to demand a global procurement policy, integrating buying, standardization and interoperability. More than ever before, Nexans strategy is to go “beyond cable” in order to add value to products, do innovative research, and provide a host of relevant services, reducing the Total Cost of Ownership of the electrical function for its clients.
APPENDIX:
Some Nexans Rolling Stock headlines and milestones

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<th>FLAMEX® cable solutions for safety, performance and comfort</th>
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<td>Nexans provided a full range of FLAMEX® cable solutions for Bombardier’s Francilien project serving the Greater Paris region and beyond. It includes power cables for electrical motors; high-voltage connectivity between the pantograph and the transformer; low-voltage power supply for cars; control cables, harnesses, jumpers, and data cables throughout the train set for everything from train control to surveillance, video and Internet. Low Fire Hazard (LFH) cables ensure low toxicity and minimal smoke for enhanced safety, while all cables (including data) meet the latest classification standards. Some 25,000 kilometers of Nexans cables are used in the first phase of this renewal project which will initially run until 2015. If all options are exercised, 200 train sets could be added by 2022.</td>
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<th>Nexans services help upgrade Brazilian metros and Polish tramways</th>
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<td>Sao Paulo, Brazil’s largest city, invested massively in its metro for the Football World Cup and the Olympics to serve millions of visitors. In addition to providing FLAMEX® power, control and jumper cables, our engineering team standardized Bills of Materials, and coordinated and scheduled deliveries to reduce transport costs for customers, which included Korea’s Hyundai Rotem for new train sets; and Siemens, IESA, TTrens and Tejofran for modernization. Meanwhile, to prepare for the UEFA EUROP football matches in Warsaw (2012), over 3,000 km of cable and systems were installed to enable air-conditioning, CCTV and extendable buggy and wheelchair ramps for 186 Swing-type tramways produced by Poland’s PESA.</td>
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Other recent important projects

- TRAXX locomotive – Bombardier: Power, control and data cables for the modular locomotive platform, which meets the various European requirements.
- ÖBB Railjet – Viaggio Comfort – Siemens: With seven coaches, this train is faster, more modern and more comfortable than any other currently operating in Austria. Nexans supplied FLAMEX® power, control and data cables for the complete train set.
- Hyundai Rotem – Hong Kong project: This metro is operating on the MTR rapid transit railway system in Hong Kong.
- Alstom NS 74 in Chile: modernization of the 49 trains that operate on Lines 2 and 5 of the Santiago de Chile Metro system and which dates from the seventies.
- Very High Speed Train (AVG) – Alstom: With an average operation speed of 360 km/hr, this class of train is operating in Europe, Asia, and soon in Africa and the Middle East. Nexans delivered a complete suite of cables, including jumpers, aluminum power cables, HV pantograph cables and harnesses.
- Zefiro 380 – Bombardier Sifang Transportation: 60 train sets destined for China’s growing high speed network. Nexans delivered all control/data communications and a portion of the power cables.
- CPH – Very High Speed Train – CNR: Development of China Railways to connect major cities, including Beijing, Shanghai, Wuhan and Guangzhou. 16 cars with a design speed of 350 km/, carrying 1,026 passengers. Nexans provided environmentally-friendly and halogen-free cables from its entire FLAMEX® range.
About the authors

François Renier is Segment Manager for the Rolling Stock Market at Nexans. He has seven years of experience in the cable industry. Before moving to his current position, he had various responsibilities within Nexans at Corporate level and for the automotive segment. Previous to joining Nexans, he worked for some years in the automotive Industry on a worldwide basis for a first-tier supplier.

Yannick Goutille is Product Manager for Rolling Stock at Nexans. He has ten years experience in the cable industry. Before moving into his current position, he held various positions within Nexans Research Center. He is an expert on several Standardization Committees for industrial applications.

About Nexans

Nexans brings energy to life through an extensive range of cables and cabling solutions that deliver increased performance for our customers worldwide. Nexans’ teams are committed to a partnership approach that supports customers in four main business areas: Power transmission and distribution (submarine and land), Energy resources (Oil & Gas, Mining and Renewables), Transportation (Road, Rail, Air, Sea) and Building (Commercial, Residential and Data Centers). Nexans’ strategy is founded on continuous innovation in products, solutions and services, employee development, customer training and the introduction of safe, low-environmental-impact industrial processes.

In 2013, Nexans became the first cable player to create a Foundation to introduce sustained initiatives for access to energy for disadvantaged communities worldwide.

We have an industrial presence in 40 countries and commercial activities worldwide, employing close to 26,000 people and generating sales in 2013 of nearly 6.7 billion euros. Nexans is listed on NYSE Euronext Paris, compartment A.

For more information, please consult: www.nexans.com

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