



---

**Optimizing your aerial transmission network  
through high-performance cabling solutions**

# Secure power transmission depends on...

With electrical power consumption growing continuously worldwide, utilities and Transmission System Operators (TSOs) are faced with increasing congestion management, overloading, bottlenecks, seasonal peaks of demand and even costly blackouts. Moreover, additional power generation (like windfarms) are further straining available network links. It is therefore becoming essential to upgrade the existing network with optimized solutions and/or to expand it with new lines to improve the reliability of the grid while respecting the design criteria and assuring sustainable energy supply far into the future.

## **Refurbishment and upgrade of existing lines**

Since the objective is to secure delivery of energy to final users increasing capacity and transmission network reliability at reasonable cost, transmission planners want to re-use existing towers and installations to save money and time, and avoid very long right-of-way authorizations. Therefore, the most efficient way to perform it is maintaining existing structures meaning that you have to improve OHL with new conductors that can deliver higher ampacity allowing better adaptation to seasonal peaks (seaside during summer period, winter period in cold countries...), operate safely at higher temperatures, without straining towers and pylons, or generating dangerous sag. Moreover, realtime monitoring systems, installed directly on the lines are a good solution to further improve the operating capacity and reliability of the network during critical periods of time.

## **New lines and interconnections**

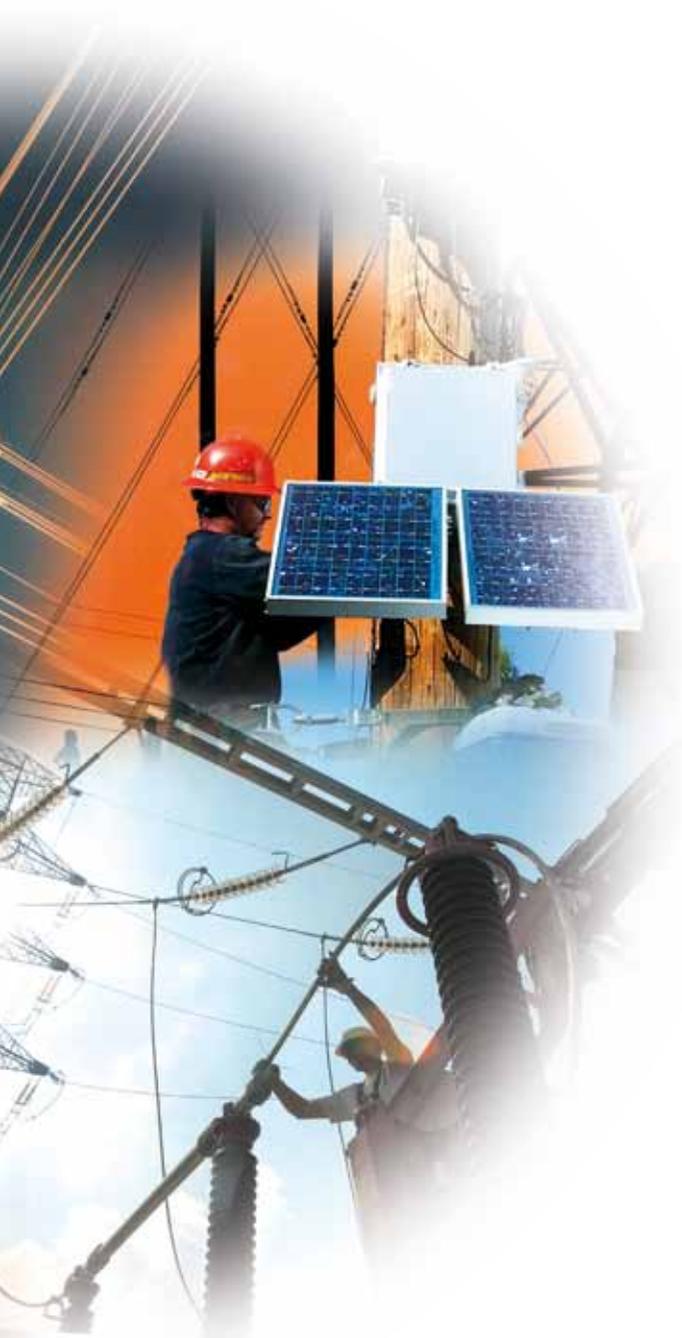
To achieve higher capacity with reduced capital investment, it is now feasible to use fewer towers and longer conductor spans. This means incorporating the latest generation of carbon core conductors which are lighter and offer higher mechanical strength. These new conductors can also be designed to operate at higher temperatures thus allowing temporary or permanent increases in capacity, and strengthening the reliability of the network.

## **What you expect from a conductor expert:**

- Global solutions to assure a long life cycle and easy upgrades
- Own and trustfull R+D department searching for the most efficient and suitable materials
- Engineering support in network design, conductor type selection and line monitoring
- Wide range of fully-tested conductors, compatible fittings and hardware for safe operations
- Training and on site initial supervision during installation
- Installation friendly solutions
- Maximizing the cost-efficiency rate
- Integration of solutions for a secure and reliable "meshed" grid
- World references for optimized power line projects



## ...integrated solutions for high capacity and reliability



Nexans does more than just sell bare conductors to connect two points for aerial transmission; it offers highly integrated solutions that optimize your power network for years to come, while assuring its evolution to meet the growing energy needs of your customers; tailor made design suiting the demand from each customer.

**Phase 1.** Our enriched offer begins with preliminary studies which take into account fundamental parameters, like designed capacity, environmental limitations, system losses, operating and maintenance costs, reliability and upgradeability to determine a target network configuration.

**Phase 2.** For upgrading, upgrading and creating new networks, Nexans recommends the use of High-End conductors which add value for the customer by offering a wide choice of enhanced conductors, incorporating special alloys and/or composite materials and with advanced designs that allow:

- improved capacity and less energy losses respecting existing infrastructures
- improved capacity and lower sag respecting existing infrastructures
- fewer tower, lower towers and/or longer distances between them

**Phase 3.** Our complete system solutions are validated with worldwide hardware and fittings manufacturers and standards, coming with fully compatible accessories, and detailed stringing and laying instructions. We can even propose stringing or laying supervision with local or international partners.

**Phase 4.** On existing lines for upgrades or for new installed lines, our CAT-1 Transmission Line Monitoring System provides real-time monitoring of the actual capabilities of the overhead transmission lines by measuring mechanical tension at the dead-ends of the conductor and local weather parameters, and feeding the information on additional capacity and time until maximum sag is reached back to your Network Control Center for increased efficiency, safety and reliability.

**Phase 5.** As an environmentally responsible company (ISO14001), we can also manage the recycling of old conductors by removing them after Nexans' High-End conductors are installed.

**Phase 6.** Nexans continues to safeguard your future by ongoing innovation in overhead design, and providing a continuous supply of products from our plants around the world, and contributing with our monitoring systems to obtain the best operational results for your network.

# From advanced conductors...

## HIGH-CAPACITY CONDUCTORS DESIGNED TO RUN AT HIGH TEMPERATURE UP TO 250°C

### ACSS: Aluminum Conductor Steel Supported

Conductor manufactured with external layers of annealed aluminum wires (round, trapezoidal or Z shaped compositions) and an internal core of special steel providing high tensile strength, which depending on the final UTS to be reached can be HS, EHS, UHS, Mischmetal or Aluminum Clad Steel. These conductors allow doubling the existing ampacity of the OHL and provide reduced sag, even when operating at up to 250°C compared to standard conductors. *Nexans has provided thousands of kilometers of various cross-sections of ACSS to European and North-American Transmission System Operators (TSOs) to increase the reliability and the security of refurbished lines.*

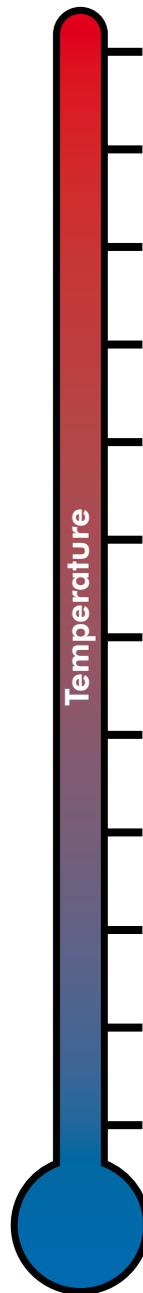
### High Capacity Lo-Sag™: aluminum alloy conductor composite core

An innovative lighter conductor designed, with outer layers in thermal aluminum alloy Z shaped wires and central core of composite fibers. It offers a compact design, well balanced high tensile strength, good internal protection, low linear expansion coefficient carbon fibers in epoxy matrix acting as the core, which can withstand temperatures up to 180°C

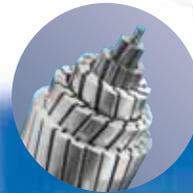
(according to overload duration) with extremely low sag and no galvanic corrosion of the core, and high breaking load (i.e. longer spans between distant pylons). *High Capacity Lo-Sag™ is a unique, high-value replacement technology for any overhead conductor. A state-of-the-art conductor, this composite system allows longer spans, reducing the number of towers/structures in the landscape and significantly lowering the height (and cost) of towers when spanning broad rivers. Under overloaded conditions, it allows more reliability and security (low sag).*

### Nexans advanced Aero-Z® design

The compact Z-shaped wire design can also be applied to all the above high-capacity conductors providing an interesting improvement to the OHL capacity as well as installation friendliness and maximizing the cost-efficiency rate for our customers.



ACSS: Aluminum Conductor Steel Supported



High Capacity Lo-Sag™



ACSR: Aluminum Conductor Steel Reinforced



ACAR: Aluminum Conductor Aluminum Reinforced



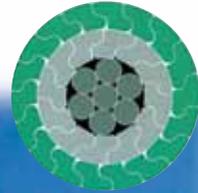
**Nexans advanced  
Aero-Z® design  
(high-capacity conductors)**



**Pre-tested fittings  
and accessories**



**Nexans advanced  
Aero-Z® design  
(conventional conductors)**



**AAAC: All Aluminum  
Alloy Conductors**



**Lo-Sag™: Aluminum  
Alloy Conductor  
Composite Core**



**Secure Cat-1 line  
monitoring**

## ...to accessories, fittings and monitoring systems

### FITTINGS

#### Pre-tested fittings and accessories

Because conductors and accessories must work perfectly together to deliver line security and grid reliability, Nexans checks, tests and certifies accessory suppliers according to international standards and to our own rigorous specifications. Our compatibility tests cover joints and tension sets (dead end clamps, joints sleeves, pulling sleeves), suspension clamps, spacers, repair armor rods, and aeolian vibration damping systems) to deliver a 100% compatible Complete System.

### MONITORING SYSTEMS

#### Secure Cat-1 line monitoring

CAT-1 real-time Transmission Line Monitoring systems can be very quickly installed on existing or new lines. They measure ambient weather parameters and collect mechanical line-tension information. This vital information is then computed and forwarded in real time to the operator's Control System (SCADA), indicating the actual additional available capacity and sag that the line can safely accept within the conductor's design temperature. By providing advanced warnings when approaching limit conditions, CAT-1 helps to increase the reliability of network and gives information to quickly react and avoid severe problems.

*Over 300 CAT-1 systems have already been deployed in North American and European transmission grids to provide information on conductor behavior and improve the reliability and the capacity of the grids.*

#### CONVENTIONAL CONDUCTORS WITH DESIGN TEMPERATURE UP TO 90°C

##### ACSR: Aluminum Conductor Steel Reinforced

A conductor with a steel core and outer layers of pure aluminum; widely used, this conductor assures reliable, and durable performance.

*Nexans has provided this conductor to many operators in countries with long distances to cover, like in North America, South America and South-East Asia.*

##### ACAR: Aluminum Conductor Aluminum Reinforced

A customized conductor with an aluminum alloy core and an outer layer of pure aluminum, it offers high ampacity (i.e. current rating). However, its lower mechanical strength does not allow it to be unduly stretched. *ACAR is much appreciated in parts of South America where there are no snow/ice or violent storms to cause dangerous sagging or line tension.*

##### AAAC: All Aluminum Alloy Conductors

By replacing both steel core and outer layers of pure aluminum with aluminum alloys, this conductor is stronger than conventional ACSR, and more resistant to corrosion.

*Developed in Europe, and widely used in Belgium and France, these conductors are also deployed in many African countries, like Algeria, Congo and Niger.*

##### Lo-Sag™: Aluminum Alloy conductor with composite core

An innovative lighter conductor with a core made of carbon fibers embedded in an epoxy matrix and outer layers made of aluminum alloy Z shaped wires. This conductor has high tensile strength and low linear expansion with extremely low sag and no galvanic corrosion of the core. Its high breaking load and reduced drag coefficient allows longer spans between pylons, as the transmitted efforts on towers are reduced.

Particularly suited for those distribution OHL where sag of existing old conductors has become an important issue, for river-crossing and to decrease the height or the number of towers on long transmission lines.

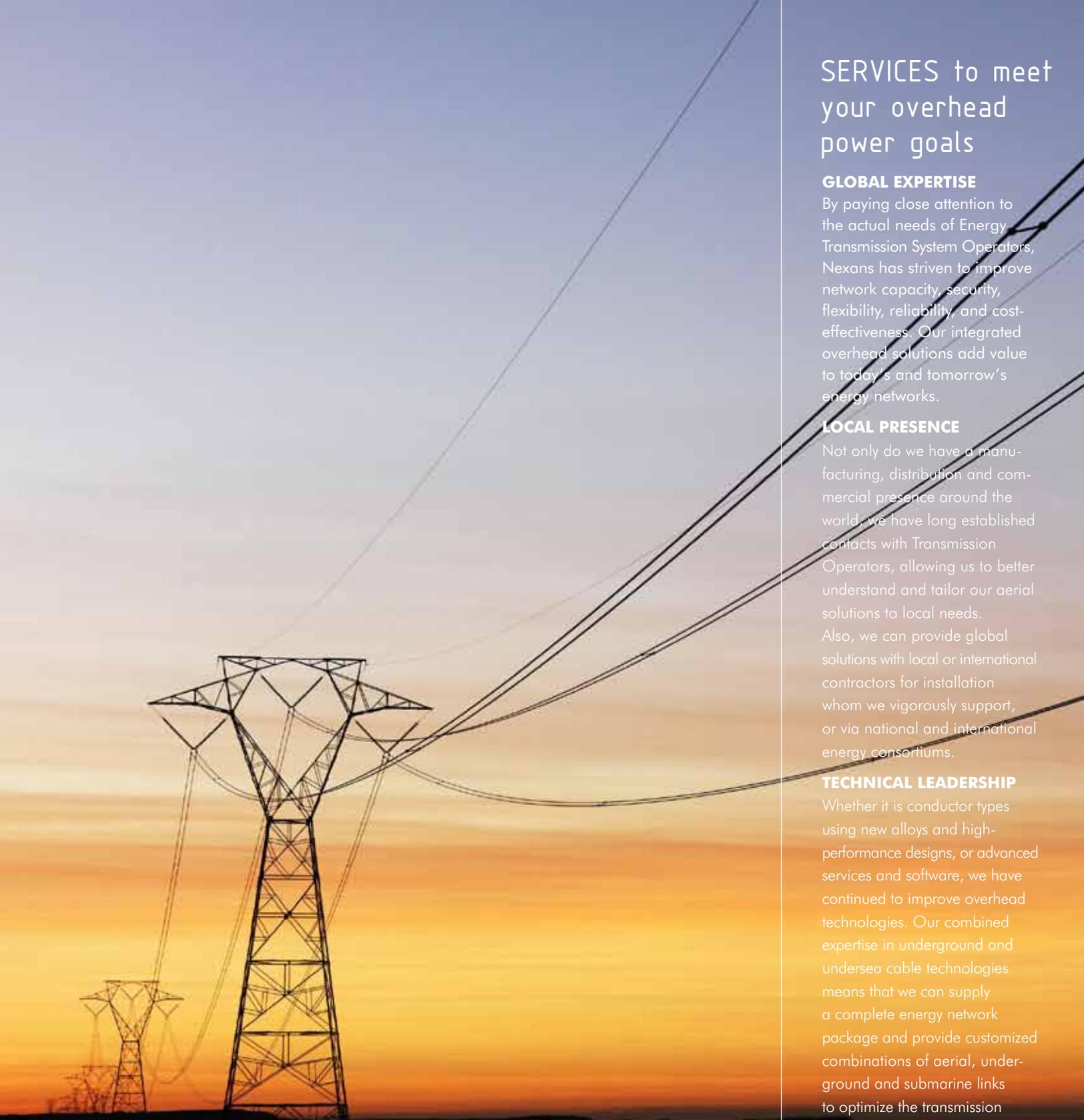
*A state-of-the-art conductor, this composite system allows for spans of up to 2.5 km, reducing the number of pylons in the landscape and significantly lowering the height (and cost) of towers when spanning broad rivers.*

##### Nexans advanced Aero-Z® design

For all the foregoing conductors, in addition to the conventional design with round wires, Nexans can also supply a compact design with Z-shaped interlocking wires. It reduces drag (i.e. pressure on lines due to strong winds), reduces galloping probabilities, lowers grease loss (impedes internal corrosion) and snow accretion, and raises ampacity about 20% (depending on OHL design conditions)

in an equivalent diameter or reduces Joule losses by 15% at the same ampacity. Aero-Z® has equivalent accessories, and can be installed in the same way and with the same equipment as conventional conductors. The Z shape Aluminium wires were first designed and commercialized by Nexans in middle 70's, becoming a revolution on the electrical market and remaining as one of the most important milestone achieved by a European manufacturer.

*An African premiere: Nexans installed 132 kV AAAC Aero-Z conductors on a 264-km-long line between Nigeria and Niger. Combined with capacitive compensation, this allows a total increase of electrical capacity by 75% between the two countries. Nearly 900 km of the same conductor were also recently installed in Peru to resolve problems related to Joule losses and the corona effect.*



## SERVICES to meet your overhead power goals

### **GLOBAL EXPERTISE**

By paying close attention to the actual needs of Energy Transmission System Operators, Nexans has striven to improve network capacity, security, flexibility, reliability, and cost-effectiveness. Our integrated overhead solutions add value to today's and tomorrow's energy networks.

### **LOCAL PRESENCE**

Not only do we have a manufacturing, distribution and commercial presence around the world, we have long established contacts with Transmission Operators, allowing us to better understand and tailor our aerial solutions to local needs.

Also, we can provide global solutions with local or international contractors for installation whom we vigorously support, or via national and international energy consortiums.

### **TECHNICAL LEADERSHIP**

Whether it is conductor types using new alloys and high-performance designs, or advanced services and software, we have continued to improve overhead technologies. Our combined expertise in underground and undersea cable technologies means that we can supply a complete energy network package and provide customized combinations of aerial, underground and submarine links to optimize the transmission and the distribution energy grids. Nexans is your global supplier.

### **INNOVATION is at the core of our overhead lines**

Nexans has engineers and technicians working in energy transmission and distribution in both our research center in Lyon (France) and in our Metallurgy Center in Lens (France). They draw on the collective knowledge of the 600 researchers and engineers group wide. Our metallurgy experts are continuing to experiment with new, more competitive and more efficient alloys. Nexans constantly adds value to conductors in terms of technical know-how and electrical engineering, while supporting complete networks from design, line management, to fully integrated accessories.



Global expert in cables and cabling systems

With energy at the basis of its development, Nexans, worldwide expert in the cable industry, offers an extensive range of cables and cabling solutions. The Group is a global player in the energy transmission and distribution, industry and building markets. Nexans addresses a wide series of market segments: from energy and telecom networks to energy resources (wind turbines, photovoltaic, oil and gas, and mining) to transportation (shipbuilding, aerospace, automotive and automation, and railways). Nexans is a responsible industrial company that regards sustainable development as integral to its global and operational strategy. Continuous innovation in products, solutions and services, employee development and commitment, customer orientation and the introduction of safe industrial processes with limited environmental impact are among the key initiatives that place Nexans at the core of a sustainable future. With an industrial presence in 40 countries and commercial activities worldwide, Nexans employs 25,000 people and had sales in 2012 of nearly 7.2 billion euros. Nexans is listed on NYSE Euronext Paris, compartment A.

Nexans S.A. – 8, rue du Général Foy – 75008 Paris – France  
Tel.: +33 (0)1 73 23 84 00 – Fax: + 33 (0)1 73 23 86 38 – [www.nexans.com](http://www.nexans.com)  
[marcom.info@nexans.com](mailto:marcom.info@nexans.com)

