

**N**exans



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**WINDLINK®**

**Reliable, high-performance cable solutions  
for wind turbines worldwide**

## When growth is in the wind...

After several years of double digit figures, wind turbine manufacturing is continuing to adapt to slower growth in Europe, although long-term perspectives are positive, driven by China and emerging markets.

Canada, Brazil, Australia and South Africa are still experiencing strong growth in wind power; and India, the UK and France have untapped potential. In Europe, the offshore market holds out the best promise for growth in the next decade.

However, uncertainty and structural overcapacities have led to aggressive pricing and competition. The cost of wind turbines has continued to fall, and that has led major OEMs to find new ways to design-to-cost, improve process and optimize their drive trains and generators. This is especially critical since we are now within reach of grid parity. If only greater efficiency can be achieved, wind power will be sustainable, even without subsidies.

Since the wind turbine itself represents over 50% of ownership, much of this effort requires innovative cables and complete cable solutions to improve overall efficiency and reduce installation and over-lifetime costs.

As a wind turbine manufacturer or supplier, you want to build larger, lighter wind turbines to assure high energy output and consistent, reliable operation.

That means new materials, lightweight cables, and better connectivity. To solve evolving challenges, you expect co-engineering, sound technical advice, pre-testing and easy-to-install kits.

To ensure growth, you are especially looking for cost-cutting innovations, supply chain excellence, fast delivery, and a local presence on the ground in what has now become a global industry.

### **What you expect from a cable producer:**

- A complete range of quality wind turbine cables and accessories
- Light, flexible cables that can handle torque, temperatures, oil, heat, vibration
- Technical innovation that keeps pace with the wind industry
- Customized products and services, including supply chain
- Integrated cable solutions: pre-cuts, kits, interconnectivity, accessories
- Easy assembly and installation, low failure rate, and exceptional durability
- Worldwide presence and expertise ensuring steady supply for your international projects
- Implementation assistance, cost-reduction, joint production planning
- Design engineering for critical areas, testing (temperature, stress, flexibility)



## ...WINDLINK® gives you reliability, confidence and security

Rather than just provide cables and components, Nexans' widely-recognized WINDLINK® solutions can outfit a complete wind turbine, assuring that all elements are fully interoperable and compatible. When we develop new products, like light aluminum or high-temperature energy cables, we do tests with connectors and power accessories under live conditions and mechanical stress to ensure compatibility and durability as an entire system.

We produce every cable in the nacelle, tower and base: from connection cables for generators, loop cables and fixed installation cables... to sensor, control, Fieldbus, Profibus, and optical fiber cables, including all connectors, accessories and medium-voltage jumpers, harnesses and kits. Moreover,

we manufacture active equipment, like intelligent Ethernet switches that can consolidate diverse applications: monitoring, IP telephone, IP camera surveillance, diagnostics, tower access and climate control... all on one fiber via Virtual Local Area Networks (VLANs).

Nexans has a proven reputation for cable reliability and technical expertise, and substantial production capacity worldwide to assure OEMs of product availability, especially in emerging markets. High-quality cables and components keep wind parks operating, avoiding power losses and costly shutdowns. That's why we offer reliability, confidence and security based on our wide experience in parallel fields, like automation, material handling, and offshore installations.

### **WINDLINK®, a wide range of reliable cable solutions for quality and performance**

- World supplier of all cables for wind turbines
- Innovative and customized wind power solutions
- Pre-engineering and special kits for easy end-assembly
- On-Time-In-Full (OTIF) delivery through advanced logistics
- Fire performance and protection through halogen-free insulation and sheaths
- Technical and R&D support for total life management
- International certification including UL/CSA, standardization and interconnectivity

# WINDLINK®: a full range of cable solutions...

## **SOLUTIONS FOR TOWERS**

### **Low-voltage loop rubber cables**

These cables (up to 1kV) reliably transmit energy produced in the generator to the transformer, usually located at the base of the tower. They come in Low-Smoke Zero-Halogen (LSZH) versions, and are also oil-, abrasion-, UV- and ozone-resistant.

*Whenever we supply this cable we do lifetime tests according to movement and torsion requirements.*

### **Medium-voltage loop rubber cables**

Similar to LV loop cables, they can handle up to 35 kV between the nacelle-based transformer and the switchgear at the base. *We are supplying MV loop cables to Vestas for all types of turbines.*

### **Low-voltage fixed installation cables**

Copper can be single or multicore, with EMC screening. Aluminum singlecore are larger; they weigh half as much, making them cheaper, and easier to handle and install in high towers. *Nexans has supplied a wide range of LV installation cables to Alstom Wind, Nordex, Siemens, etc.*

## **SOLUTIONS FOR NACELLES**

### **Low-voltage 120°C flexible cables with EMC**

For linking generators to transformers positioned high up in the nacelle, Nexans produces LV silicone cables that can endure intense heat (120°C). Available in LSZH version. *Nexans has outfitted Alstom's Eco 100, its most powerful wind turbine.*

### **Medium-voltage flexible cables**

Available in light, flexible and compact rubber versions for large turbines (2.5–6 MW), these 1-, 3-, or 4-core cables can withstand three full twists in either direction. *These cables can use standard connectors, and therefore save time and money.*

### **Medium-voltage 180°C singlecore cables**

Siwo-Kul™ flexible silicone-insulated singlecore connection cables carry high current in hot conditions, up to 180°C. Multicore versions also exist. They are used as output connections from the winding bars of Class H generators, and for current converter cabinets. *These durable, environmentally-safe cables are supplied to all major equipment suppliers.*

## **SOLUTIONS FOR TOWERS AND NACELLES**

### **Control cables**

Flexible shielded cables (2 to 100 cores) are used to carry energy (300 volts to 1kV) and low frequency signals to control the motor drive or the generator for breaking, positioning or optimizing rotor RPMs. Special sheathing is available for ultra-low temperatures, while smaller LIHCH cables are halogen-free. *Our torsion- and oil-resistant cables are designed to last for 20 years and more.*

### **Electronic and data transmission cables**

Thermoplastic Modified (TPM) 2 to 5-core sensor multicore and multipair cables measure wind speed, temperatures, and performance parameters, while 2-core Fieldbus cables are used in parallel with energy cables to digitally control all electronic and mechanical devices. 2-core Profibus cables deliver up to 12 Mbit/s for complex control services; and data transmission cables offer Industrial Ethernet speed. Increasingly, all cables are shielded for EMC protection. *Nexans has supplied electronic and data transmission cables to Hyundai Heavy Industries and Sinovel.*

### **Fiber-optic cables**

To assure high data transmission capacity for monitoring and control, Nexans' rugged, halogen-free FO cables offer Electromagnetic Compatibility (EMC) in energy-dense areas. They are very flexible and can handle high torsion. Large cores (200 microns) make connectivity easier. *Nexans developed new optical fiber pre-connectorized fiber for Alstom for easy "plug and play."*

### **Complete WINDLINK® solutions for Nordex**

Nordex signed a framework contract with Nexans for its WINDLINK® suite of wind turbine products, including cut-to-length, pre-connectorized cables and connectors destined for land-based wind parks across Europe. Nordex specified loop cables (450/750 V) and rigid tower cables to link the nacelle generator with the transformer at the base. Nexans' WINDLINK® goes far beyond high performance cables by offering a complete solution to meet design-to-cost requirements integrating drive trains and generators. Nexans also provided similar cable solutions for the first ever wind power project in Pakistan when Descon teamed up with Nordex to build thirty-three 1.5 MW wind turbines in Sindh province near Karachi, famous for its strong and steady coastal winds.



**Low-voltage 120° flexible cables**



**Low-voltage  
loop rubber  
cables**



**Medium-voltage  
loop rubber  
cables**



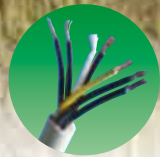
**Low-voltage  
fixed installation  
cables**



**Medium-voltage  
flexible cables**



**Medium-voltage  
180° singlecore  
cables**



**Control  
cables**



**Electronic and data  
transmission cables**



**Fiber-optic  
cables**

...to improve wind turbine output and performance



Fiber-optic accessories

### ACCESSORIES, KITS AND TESTING

#### Fiber-optic accessories

Nexans produces a full range of indoor/outdoor waterproof and pressurized closures to protect, store and splice fibers. A range of cassettes and splicing frames optimize individual fiber management.

*These housings are easy to install and service, and require virtually no maintenance.*



Low-voltage connectors

#### Low-voltage connectors

Able to withstand thermal cycling and tower vibration throughout a turbine's lifetime, our systems use a share-bolt connector with a rubber sleeve, or a heat shrink. A new bi-metallic connector (copper to aluminum) with a protective roll-on tube is fast and easy to install without special tools.

*These connectors offer protection, insulation, short-circuit stability and long-term reliability up to 3kV*



Medium-voltage connectors

#### Medium-voltage connectors

Nexans safe-to-touch T-shaped connectors are designed for the new generation of compact switchgears and transformers, and can also accommodate the larger cross-sections of large turbines and cable-to-cable connections.

*The compact design makes it easy to connect to the transformer's three phases without female units.*

#### Low-voltage kits

To facilitate assembly, Nexans provides pre-connectorized kits which bundle energy, control and data cables for wind turbine electronics. Also, cut-to-length, pre-connectorized, all-power cables are supplied to tower manufacturers for generator-to-switchgear-to-main-power-line links.

*Nordex appreciates the consolidation of several cable types into a single purchase.*



Low-voltage kits

#### Medium-voltage jumpers

Customized jumpers are lengths of MV cable from 1 meter to tower height, equipped on both sides with accessories to connect generators, transformers and switchgears.

*All jumpers are pretested in the factory to assure immediate and fault-free installation.*

#### Active switch systems for communication and monitoring

These small and rugged switch systems contain up to 3 fiber optic uplink ports and 8 copper ports for multiple applications via just one fiber. They are able to supply connected devices (IP cameras and phones, WLAN access points) with PoE, and come with a diagnostic monitoring function.

*A memory card allows non-IT maintenance personnel to replace and reconfigure the switches.*



Medium-voltage jumpers




Active switch systems

#### WindPower, Wobben and Vestas choose WINDLINK® solutions in Brazil

In Brazil, landscape and wind characteristics are creating a huge natural potential for wind power, initially estimated at 300–400 GW. Location of Brazil's population along the coast reduces the relative costs of long-distance transmission, while OEMs use coastal ports to transport components. Nexans Brazil is producing various LV rubber and XLPE power cables for wind turbines. This includes dedicated products for both WindPower (Impsa) and Wobben (Enercon). We are also providing MV cables for loop applications and kits to Vestas Brazil. LV copper and aluminum cables, MV rubber cables, and both LV and MV kits are all being produced locally. Brazil is increasingly being seen as a growth platform for further development in Argentina, Uruguay, Chile and Columbia.





Nexans'  
**WINDLINK®**  
for sustainable  
wind energy

**GLOBAL EXPERTISE**

Nexans has broad experience in land-based and offshore wind turbines of all types and sizes. Mastering both LV and MV energy cables and all necessary control cables, we are proven integrators who can supply complete systems, as well as customize cables and accessories.

**LOCAL PRESENCE**

Because the wind power industry is increasingly global, Nexans has organized its production and delivery logistics to support turbine producers anywhere in the world, and that includes obtaining pre-qualification in many countries, and providing interconnective commercial off-the-shelf products.

**TECHNICAL LEADERSHIP**

Nexans is creating the knowledge and technology needed to sustain an expanding industry which is constantly moving to larger megawatt turbines. Our innovative products are easy-to-install and have proven their ability to survive for long periods in extremely tough environments.



Global expert in cables and cabling systems

With energy as the basis of its development, Nexans, worldwide expert 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. 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 engagement, 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 24,500 people and had sales in 2011 of 7 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 84 84 - [www.nexans.com/windlink](http://www.nexans.com/windlink)  
[marcom.info@nexans.com](mailto:marcom.info@nexans.com)