CONNECT AND PROTECT

Wind Power Solutions

CADDY ERICO HOFFMAN RAYCHEM SCHROFF TRACER

nVent

Foundation Grounding and Construction, Bonding, Power Connections, Surge Protection, and Lightning Protection

nVent offers a complete range of foundation grounding and construction, bonding, power connections, surge protection, and lightning protection products for the wind energy industry. In addition to our extensive product offering, our engineers and designers are ready to provide design assistance for your facilities worldwide.

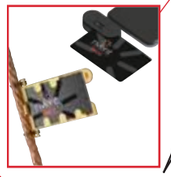
nVent ERIFLEX Flexibar Advanced

Low-Voltage Insulators

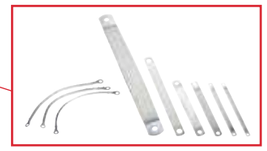
Power Blocks

nVent ERICO Blade Lightning Protection Components and Assemblies

Lightning Registration System



Bolt Couplers



Grounding and MBJ Braids

Power and Control Surge Protection

Standard Couplers and Position Couplers

Cable to Rebar Connections

nVent ERICO Ground Enhancement Material (GEM)

nVent ERICO Cu-Bond Round Conductor

nVent LENTON Terminator Rebar End Anchors

nVent ERICO Cadweld Connections

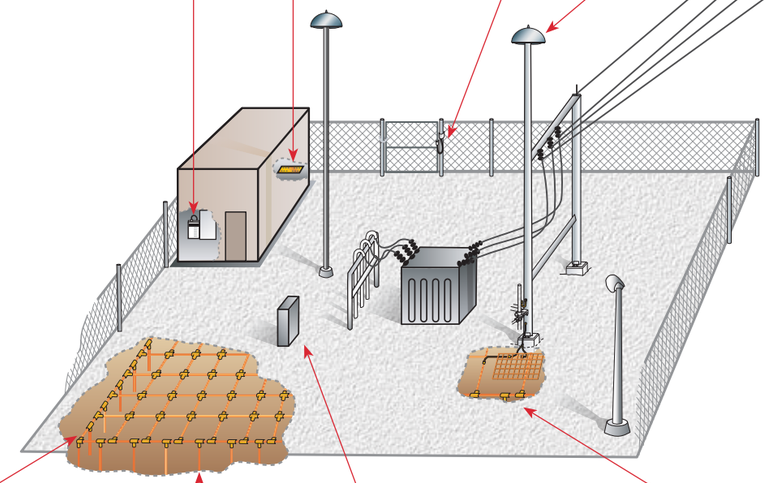
Cable to Rebar
Cable to Cable
Cable to Ground Rod

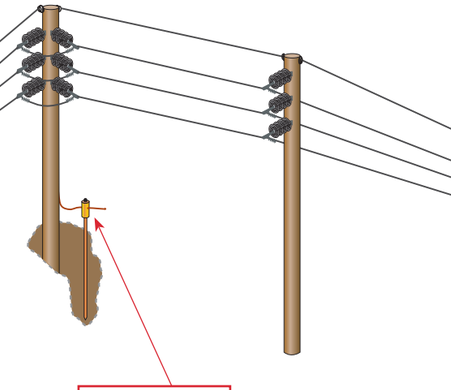
Power Surge Protection

Equipotential Ground Bars

Fence and Gate Jumper Assemblies

nVent ERICO System 3000 Lightning Protection



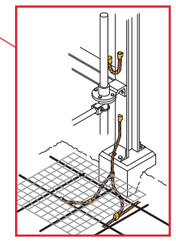


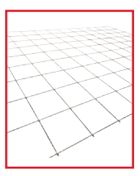
nVent ERICO Hammerlock and Ground Rod

Power and Control Surge Protection for SCADA and Power Connections

Universal Transient Barrier (UTB)

Prefabricated Mesh for Switch Shaft and Operating Handle Grounding





Ground Rods

Copper-bonded Steel
Galvanized Steel
Stainless Steel

Introduction

Years of experience in the fields of grounding and bonding, lightning protection, low voltage power distribution and reinforced concrete construction, combined with global manufacturing capabilities, allow nVent to provide comprehensive solutions for the wind energy industry. We offer a full range of solutions including facility electrical protection products, low-voltage power distribution products and concrete reinforcement products.

BLADE

Lightning protection assemblies have been installed on thousands of wind turbine blades worldwide. Components cover a range of nVent ERICO products, including receptors, Cadweld exothermically welded connections, conductors, lightning event counters/ lightning registration systems.

NACELLE

To help protect the electrical components housed within the nacelle, nVent ERIFLEX supplies products, such as grounding braids, insulators, Flexibar Advanced, power blocks and conductors.

TOWER

Tower lightning protection products include grounding braids, insulators, conductors, Flexibar Advanced and copper busbar.

FOUNDATION GROUNDING AND CONSTRUCTION

Grounding products include Cadweld exothermically welded connections, rebar clamps, ground/earth testers, nVent ERICO Ground Enhancement Material (GEM) and ground rods. Foundation construction products include bolt couplers, nVent LENTON Terminator rebar end anchors and standard couplers.

SURGE PROTECTION

nVent offers a complete line of surge protective devices that can be coordinated into an effectively staged electrical protection plan.

POWER CONNECTIONS

Products recommended for power distribution throughout the nacelle, tower and power hut include: splice blocks, power shunts, distribution blocks, Flexibar Advanced and busbar supports.

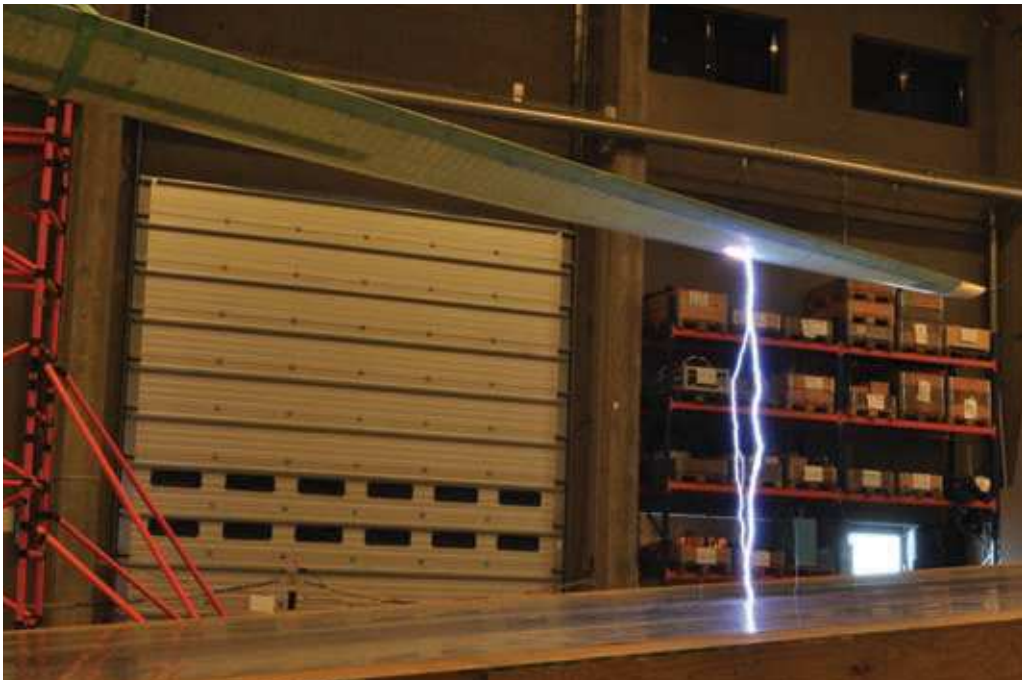
SUPPORT AND TRAINING

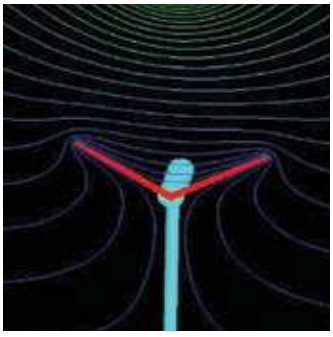
nVent project managers, engineers and researchers have decades of domain expertise and continue to develop new products for improved performance and installation efficiency for the ever-evolving wind power industry. We are trusted to deliver cost-effective, long-term solutions through turn-key, rapid-response engineering, design and integration services for the unique demands of the wind energy industry.

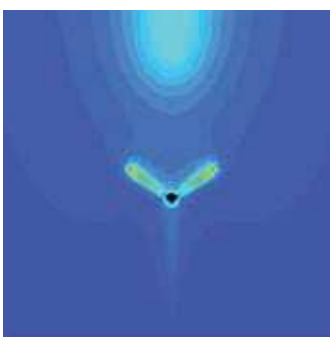
nVent ERICO specializes in:

- Custom design and packaging of lightning protection assemblies for wind turbine blades
- Grounding and bonding applications of the nacelle and tower
- Design and manufacture of lightning protection downconductors and connection systems
- Computer grounding layouts and analysis for the foundation

nVent provides extensive training and consultative services to OEMs, engineers and contractors on our product capabilities and installation techniques to help ensure optimum performance.

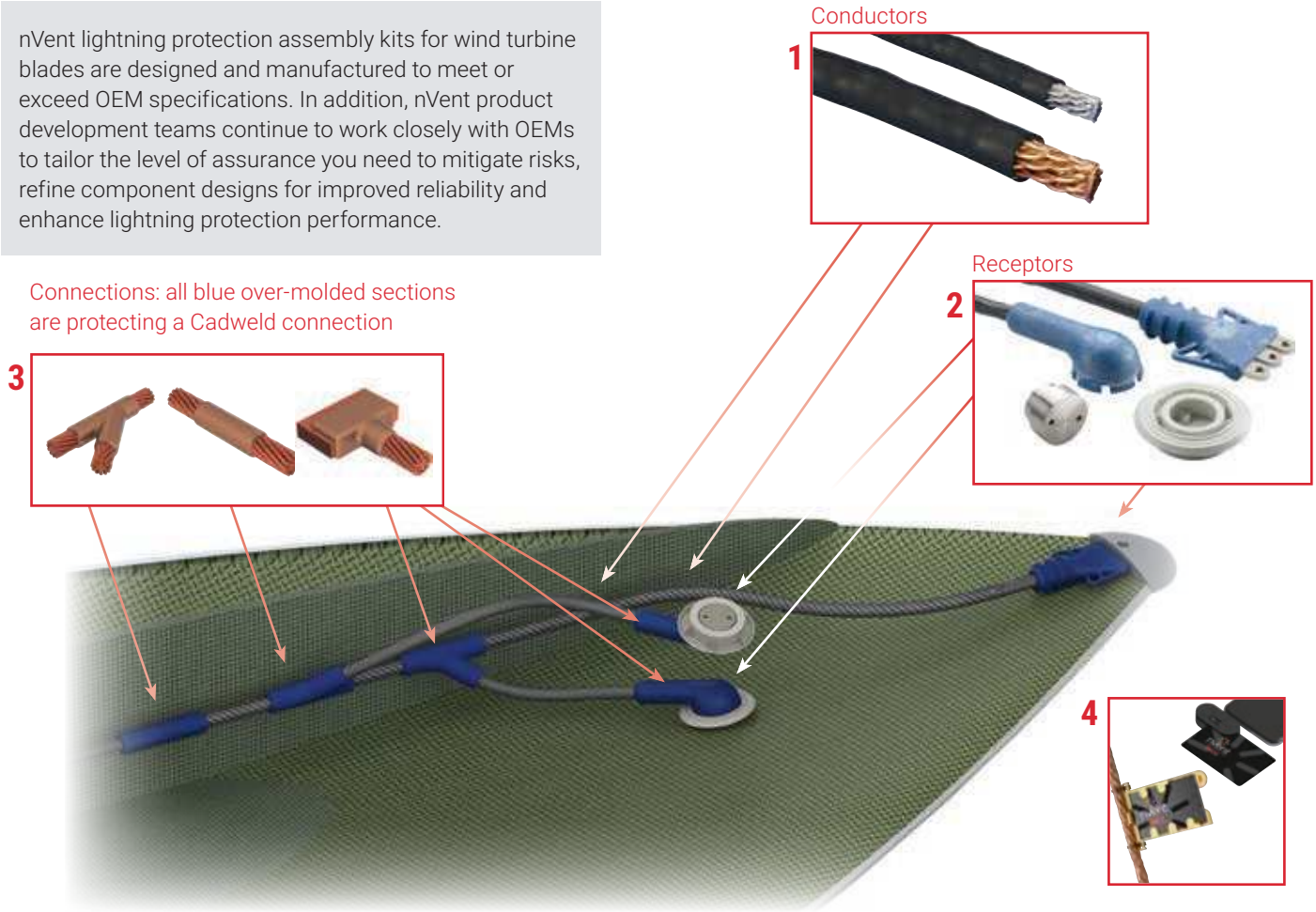






Blade

nVent lightning protection assembly kits for wind turbine blades are designed and manufactured to meet or exceed OEM specifications. In addition, nVent product development teams continue to work closely with OEMs to tailor the level of assurance you need to mitigate risks, refine component designs for improved reliability and enhance lightning protection performance.



1. CONDUCTORS

Designed and manufactured to meet specific criteria for effective and reliable conduction, lightning conductors should have:

- Low inductance per unit length and low surge impedance
- Current-carrying capability to withstand, without degradation, the thermal and mechanical effects of lightning
- Resistance to environmental effects and mechanical fatigue

Conductors offered include:

- Aluminum, copper and stainless steel
- Insulated and non-insulated
- Solid and woven conductors in both flat and rounded configurations

2. RECEPTORS

As a world leader in the design of strike termination devices, nVent applies this expertise to the design of its lightning receptors. Important factors include:

- Blade material and manufacturing process
- Ease of receptor installation and insulation requirements
- Attachment method to lightning protection conductor
- Attracting the lightning strike to a preferred attachment point
- Field serviceability

3. CONNECTIONS

Blade lightning protection connections may range from a Cadweld welded connection to a mechanically bolted connection. Considerations include:

- Lightning protection conductor material
- Resistance to vibration and corrosion
- Material impedance
- National/international standard requirements
- Costs and benefits

4. LIGHTNING REGISTRATION SYSTEM

nVent provides the ability to collect data for the analysis of lightning strikes in wind turbines. By installing a card with a special magnetic code trail, the magnetic field generated by the lightning will delete the data in the area where its strength is higher than the resistance of the code trail. The maximum lightning current to which a card has been exposed can then be read by the card reader. Immediately access lightning strike data with a mobile platform utilizing the mobile card reader and an app available on Apple or Android devices.

Nacelle

nVent offers a full line of nVent ERIFLEX low-voltage products to protect the electrical components housed within the nacelle from the devastating effects of lightning strikes. Products include:

- Power blocks designed to provide a safe entry point for incoming power generated by the wind turbine
- Grounding braids for any grounding and bonding power connection
- Flexibar Advanced to help improve power density within the nacelle, tower and power hut
- Conductors to withstand the electromechanical effects of lightning
- Low-voltage insulators to promote stability of electrical and mechanical parameters

1. GROUNDING BRAIDS

Grounding braids consist of tinned, electrolytic, woven copper wire. Each braid has solid hole-punched ends for easy connection. Grounding braids are the first cost-effective alternative to grounding cables with crimped lugs.

Grounding braids can be used for any grounding and bonding power connection. Because of their low contact resistance, they are particularly adapted to decrease EMC problems.

nVent can provide Made-to-order (MTO) custom configurations to your drawing specifications. Copper braids can be made to custom lengths, widths, thicknesses and hole patterns, with PVC insulation, in flat or tubular shapes, in continuous coils or with soldered studs or crimped lugs.

2. FLEXIBAR ADVANCED

Flexibar Advanced is an effective alternative to using cables and lugs to help improve power density within the nacelle, tower and power hut and improve safety of your installation due to its unique and safer Advanced insulation. It offers space and weight savings of up to 70 percent (improving power density).

By eliminating the need for compression lugs, Flexibar Advanced improves the reliability of the power connection and reduces the number of power connections that are needed. It also extends power density to even greater levels within the nacelle, tower and power hut using MTO Flexibar Advanced and MTO braids. MTO products from nVent can be configured to your specifications, helping to reduce equipment and packaging sizes.

3. CONDUCTORS

Designed and manufactured to meet specific criteria for effective and reliable conduction, lightning conductors should have:

- Low inductance per unit length and low surge impedance
- Current-carrying capability to withstand, without degradation, the thermal and mechanical effects of lightning
- Resistance to environmental effects and mechanical fatigue

Conductors offered include:

- Aluminum, copper and stainless steel
- Insulated and non-insulated
- Solid and woven conductors in both flat and rounded configurations

4. POWER AND DISTRIBUTION BLOCKS

A complete power block range are the entry point for incoming power generated by the wind turbine, carried to the inverter.

5. SURGE PROTECTION

DIN rail mounted components

- UL and IEC Listed
- Enhanced temporary over voltage (TOV) withstand capability
- Retaining clip ensures enhanced vibration and shock resistance performance

6. LOW-VOLTAGE INSULATORS

nVent offers nVent ERIFLEX brand of low-voltage insulators.

- Manufactured of rugged, polyamide, halogen-free nylon material, which is reinforced with glass fiber
- Low-voltage insulators, from 15 mm to 100 mm height, for indoor use
- Very high resistance to leakage current
- Great stability of electrical and mechanical parameters
- Meets the requirements of UL 94 V-0 for self-extinguishing materials
- Working temperature -40°C to +130°C
- UL Recognized

7. LIGHTNING PROTECTION

Isolated Down Conductor provides a low impedance insulated path past critical equipment.

Lightning Registration System

nVent provides the ability to collect data for the analysis of lightning strikes in wind turbines. By installing a card with a special magnetic code trail, the magnetic field generated by the lightning will delete the data in the area where its strength is higher than the resistance of the code trail. The maximum lightning current to which a card has been exposed can then be read by the card reader. Immediately access lightning strike data with a mobile platform utilizing the mobile card reader and an app available on Apple or Android devices.

Nacelle

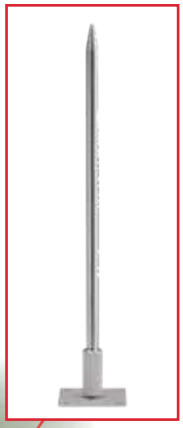
Flexibar Advanced

2

Conductors

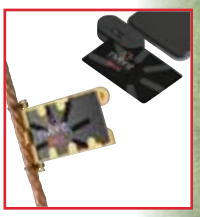
3

Air Terminals

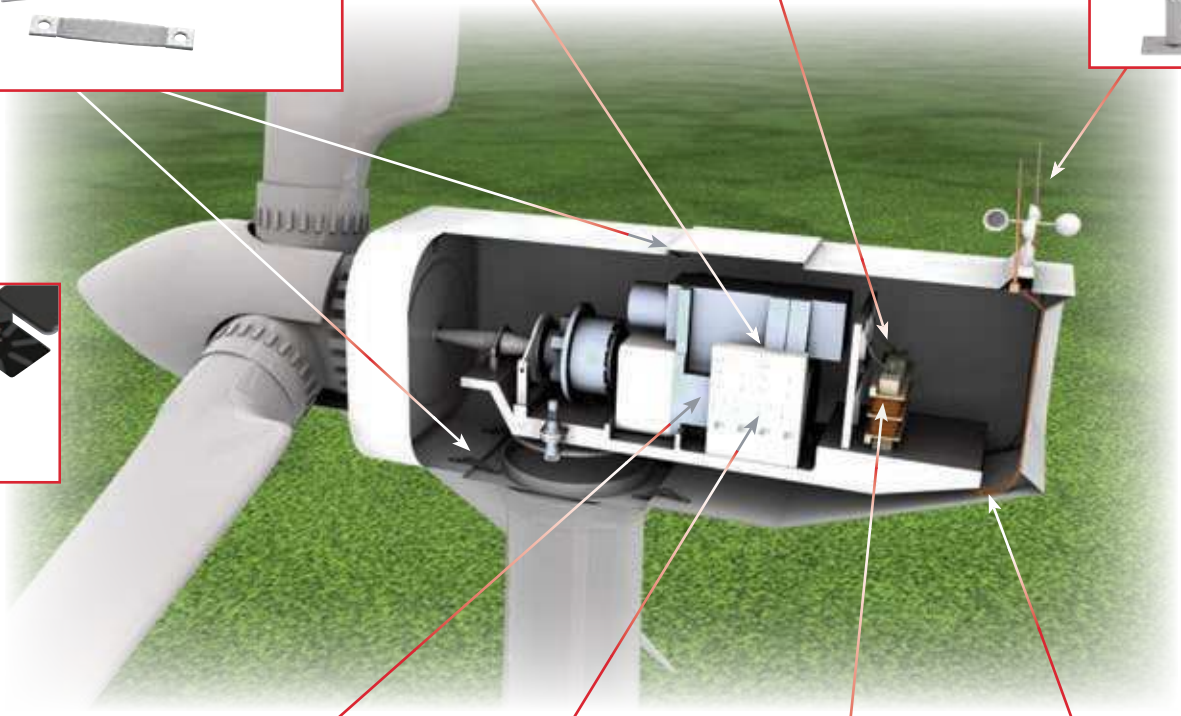


Grounding Braids

1



Lightning Registration System



4

Power Blocks

5

Transient Discriminating Panel Protector

6

Low Voltage Insulators

7

Isolated Lightning Protection Conductor

Tower

nVent offers a variety of products to help create effective lightning protection and power distribution systems for the wind turbine tower. Designed to meet the current IEC®, NFPA® or a proprietary design method, lightning protection and power distribution systems from nVent are ideal for use with the three styles of tower design:

- Tubular steel towers
- Precast concrete towers
- Lattice towers

1. GROUNDING BRAIDS

Grounding braids consist of tinned, electrolytic, woven copper wire. Each braid has solid hole-punched ends for easy connection. Grounding braids are the first cost-effective alternative to grounding cables with crimped lugs.

Grounding braids can be used for any grounding and bonding power connection. Because of their low contact resistance, they are particularly adapted to decrease EMC problems.

nVent can provide MTO custom configurations to your drawing specifications. Copper braids can be made to custom lengths, widths, thicknesses and hole patterns, with PVC insulation, in flat or tubular shapes, in continuous coils or with soldered studs or crimped lugs.

2. COPPER BUSBAR

nVent offers a variety of electrolytic copper bars – plain, punched or threaded. Busbar/connectors are also available.

- Threaded Busbars
  - *Electrolytic copper*
  - *Rounded corners*
  - *Thickness from 2 to 10 mm*
  - *Length from 1,000 to 2,000 mm*
- Punched and Plain Busbars
  - *Design and assembly time-saving*
  - *Current up to 7400 A*
  - *Thickness from 4 to 40 mm*
  - *Length from 1,000 to 4,000 mm*
- Busbar Connectors
  - *Quick and easy connections*
  - *Large and versatile range*
  - *Connections from 2.5 to 35 mm^2*

3. FLEXIBAR ADVANCED AND BRAIDS

Flexibar Advanced is an effective alternative to using cables and lugs to help improve power density within the nacelle, tower and power hut. This innovative flexible insulated busbar offers space and weight savings of up to 70 percent (improving power density).

By eliminating the need for compression lugs, Flexibar Advanced improves the reliability of the power connection and reduces the number of power connections that are needed. It also extends power density to even greater levels within the nacelle, tower and power hut using MTO Flexibar and MTO braids. MTO products from nVent can be configured to your specifications, helping to reduce equipment and packaging sizes.

4. CONDUCTORS

Designed and manufactured to meet specific criteria for effective and reliable conduction, lightning conductors should have:

- Low inductance per unit length and low surge impedance
- Current-carrying capability to withstand, without degradation, the thermal and mechanical effects of lightning
- Resistance to environmental effects and mechanical fatigue

Conductors offered include:

- Aluminum, copper and stainless steel
- Insulated and non-insulated
- Solid and woven conductors in both flat and rounded configurations

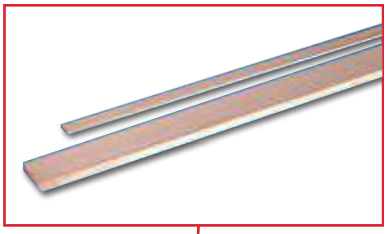
5. POWER BLOCKS

High conductivity tinned copper blocks provide a good solution to interconnect two elements of the tower. They can be mounted directly inside the tower or pre-assembled in junction panels.

Tower

Copper Busbars

2



Braids

3

3

Flexibar Advanced

Grounding Braids

1

4

Conductors

5

Power Blocks

Foundation Grounding and Construction

Site location is critical to capture the wind and often involves areas of high soil resistivity. The increasing height of newer wind turbines enhances the threat of lightning strikes. Proper design and integrity of a grounding grid facilitates long-term safety and operation of any wind turbine site during both lightning and fault current events.

Wind turbine grounding system design has to meet three main criteria:

- Satisfy the step-and-touch potential requirements regarding the safety of personnel
- Provide sufficient ground reference potential to assure proper functionality of electrical equipment
- Effectively dissipate the lightning energy

The application engineering team at nVent can analyze and provide grounding system design assistance for tower and power substation grounding using the latest grounding design software. nVent also offers an extensive line of grounding products to meet your specific foundation grounding needs.

CONSTRUCTION

1. BOLT COUPLERS

Bolt couplers, part of the nVent LENTON line of concrete products, provide a full strength joint between a reinforcing bar and a standard parallel thread bolt. Both the S4 and S5 couplers are for use in North America and provide continuity between reinforcing bar and imperial UN or UNC all-thread rod or bolts. The S13 couplers provide continuity between reinforcing bar and ISO 965 metric all-thread rod and bolts. The bolt couplers are typically used to tie a pedestal base to the foundation and to anchor miscellaneous equipment to the foundation.

2. TERMINATOR

The Terminator is an over-sized end anchor that is secured to the end of a length of reinforcing steel, creating anchorage within the concrete. Terminator replaces hooked bars and provides anchorage, and also eases congestion.

3. STANDARD COUPLERS AND POSITION COUPLERS

Standard couplers are designed to splice the same diameter bars where one bar is free to move and can be rotated. Position couplers are designed to splice two curved, bent or straight bars when neither bar can be rotated.

3. GROUND ENHANCEMENT MATERIAL (GEM)

GEM is a low-resistance carbon concrete that improves grounding effectiveness in areas of poor conductivity. GEM is ideal for wind turbine foundations where limited space makes adequate grounding difficult by conventional methods.

4. EXOTHERMICALLY WELDED CONNECTIONS

The Cadweld molecular bonding process is superior in performance to any known mechanical or compression-type surface-to-surface contact connector. By virtue of the molecular bond, Cadweld connections provide current-carrying (fusing) capacity equal to that of the conductor and will not deteriorate with age.

Cadweld connections are UL Listed and satisfy IEEE® Standard (Standard for Permanent Connections Used in Substation Grounding).

5. GROUND/EARTH TESTERS

nVent offers a range of ground/earth testers that are lightweight and portable for ease of use in the field. The ground testers are ideal for determining soil resistivity prior to designing the wind turbine foundation ground system and for testing the final resistance of the ground system after installation.

GROUNDING

1. GROUND RODS

Copper-bonded steel ground rods exceed the requirements of ANSI®/UL and IEC. They are also highly corrosion resistant and provide at least a 30-year service life in most soils.

2. MECHANICAL CONNECTORS

The durable RC70/RC100 rebar clamps provide two connection points to rebar in the wind turbine grounding foundation and meet the NEC® standard requirement for bonding to rebar.

6. CONDUCTORS

Below grade, nVent ERICO Cu-Bond Round Conductors are ideal as earthing and bonding conductors where copper theft may occur. The conductor can be used as an interconnecting grounding conductor between wind towers or as a grounding grid at the base of a wind tower.

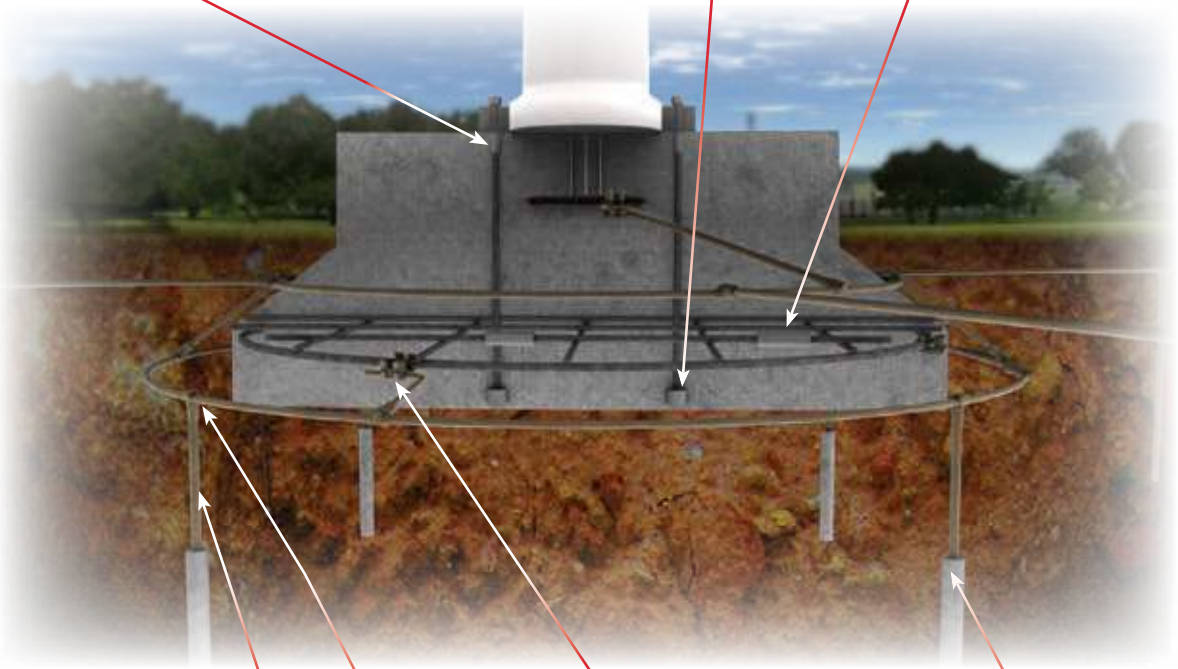
Foundation Grounding and Construction

CONSTRUCTION

1 Bolt Couplers

2 Terminator

3 Standard Couplers & Position Couplers



GROUNDING

1

Ground Rods

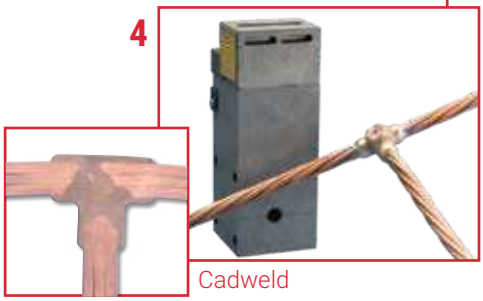
2

Mechanical Connectors

3

Ground Enhancement Material (GEM)

4



Cadweld

5

Ground/Earth Testers

Our powerful portfolio of brands:

CADDY ERICO HOFFMAN RAYCHEM SCHROFF TRACER

nVent

nVent.com

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