

Solutions for Wind Energy







SOMETIMES THE

GREATEST INNOVATIONS

COME WHEN SOLUTIONS THAT HAVE BECOME

STANDARD PRACTICE

IN ONE INDUSTRY ARE USED TO SOLVE PROBLEMS
IN OTHER INDUSTRIES.

Such is the case for LORD technologies and solutions that can be applied to challenges in the wind industry. Building on more than 80 years of innovation, we provide valuable expertise in passive vibration, motion and shock control and structural adhesives. Continually called upon by the aerospace, transportation, construction, manufacturing, electronics and U.S. defense industries to solve their toughest problems around the world, we are at the forefront of evolving technologies that provide improved value to our customers.

LORD is developing technologies for wind turbines and towers that will enable ease of assembly and inspection, longer component life and longer maintenance intervals. LORD not only offers standard products to meet most applications, but can analyze your individual requirements and provide the most effective and affordable product solutions. Save time and expense by collaborating with us ... Ask Us How.

Passive Motion Control

LORD pioneered the use of elastomeric components to control vibration and accommodate motion more than 85 years ago. These products were first introduced in the rail industry to reduce vibration and noise in traction drives. By technical evolution, passive elastomeric isolation devices found their way into helicopter applications to control motion, reduce vibration and noise and improve component life. Today, an extensive product line of our industrial rubber-to-metal mounts and drive train isolators are available for advanced applications in wind turbine machinery. Where unique applications require collaborative designs of new isolators, our design staff draws on decades of experience to create products that deliver precise performance ... Ask Us How.

Available in a wide variety of designs, from two-piece mounts to large bushings and drive train couplings, our mounts are readily available solutions for wind turbine machinery isolation applications.

Center-Bonded Mounts

LORD® Center-Bonded Mounts isolate vibration, control shock and reduce noise due to structure borne vibrations. Available in a full range of rated load capacities and able to withstand shock loads of 10 g's, these mounts effectively protect equipment and improve operator comfort. They are ideal for industrial, automotive, marine and railroad markets.



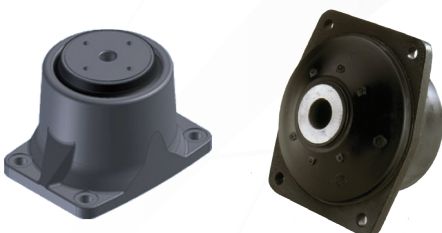
Drive Train Couplings

LORD drive train couplings are field-proven in the most demanding applications. Specifically designed to prolong gear and bearing life by reducing torsional vibration and accommodating misalignment, elastomeric couplings are available in a variety of sizes. Working with our engineers, unique and customized designs are available.



Special Mounts

Collaboratively designed mounts for precise performance and long service life with no maintenance required, our engineers can create products to meet almost any specification. Laminated rod ends, bearings and bushings are highly reliable and have provided value in many applications.



Elastomeric Bushings

Available in a wide range of sizes, LORD bushings provide long component life while enabling vibration and noise reduction and reducing stress in wind turbine machinery.

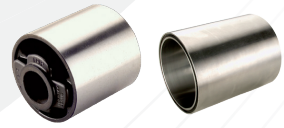




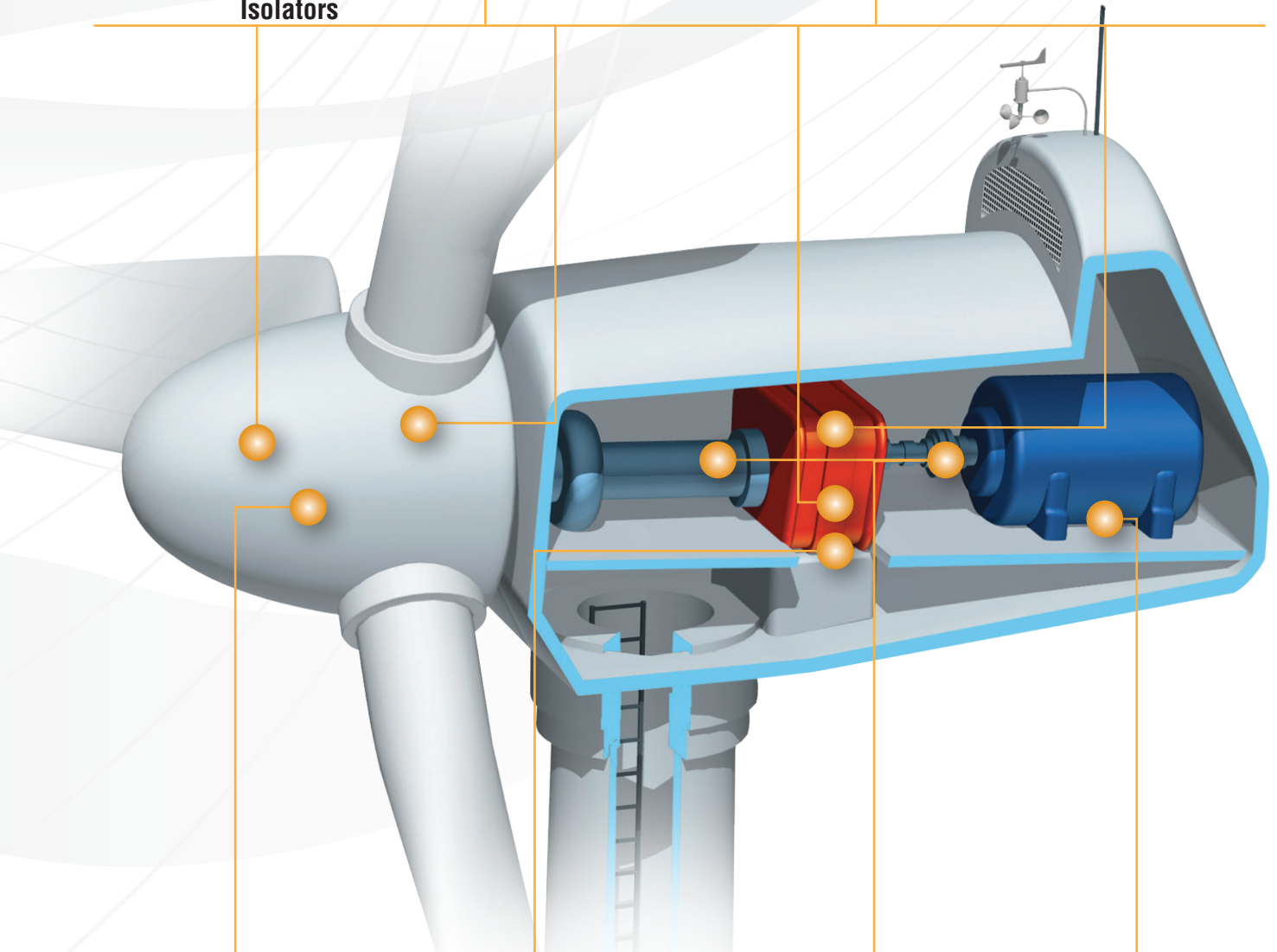
Small Component Mounts and Isolators



Rod End Bearings



Bushings

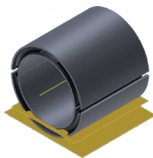


Center-Bonded Mounts

Gear Box Bushings

Drive Train Couplings

Generator Mounts



LORD® Structural Adhesives

With more than 40 years experience in developing and manufacturing structural adhesives, our extensive line of acrylic, epoxy and urethane adhesives improve appearance, strength and durability, while offering design flexibility and total cost savings. Compared to traditional fastening methods such as rivets, welds and tapes, LORD Structural Adhesives eliminate the costs associated with metal preparation and finishing operations and are formulated to offer a wide range of open times and cure speeds to improve manufacturing processes and final products. Curing at room temperature, our adhesives are suitable for a variety of composite, metal and plastic assemblies, and are readily available in convenience cartridge packaging to bulk packaging that includes gallons, pails, drums and totes for high volume applications. However, if a customized adhesive is what you're looking for ... Ask Us How.

Chemistries

We offer three major chemistries that allow us to match the specific chemistry to the appropriate application, substrate or performance requirements. If you need help choosing one of our standard adhesive products or if they don't quite meet your needs, let us help you achieve an appropriate solution ... Ask Us How.

ACRYLIC

Acrylic-based adhesives are primarily used to bond metals. They cure quickly at room temperature, require minimum surface preparation and also work well on plastics, but should be tested for compatibility.

URETHANE

Urethane-based adhesives are a good choice for bonding plastics, composites, wood and foam. They can be used for metal bonding applications where the metal is primed, painted, powder-coated or e-coated.

EPOXY

Epoxy-based adhesives have long open times for mating parts and cure can be accelerated with heat. They can be used on metals, plastics, composites, concrete, wood and foam. They are generally very strong and chemically resistant.

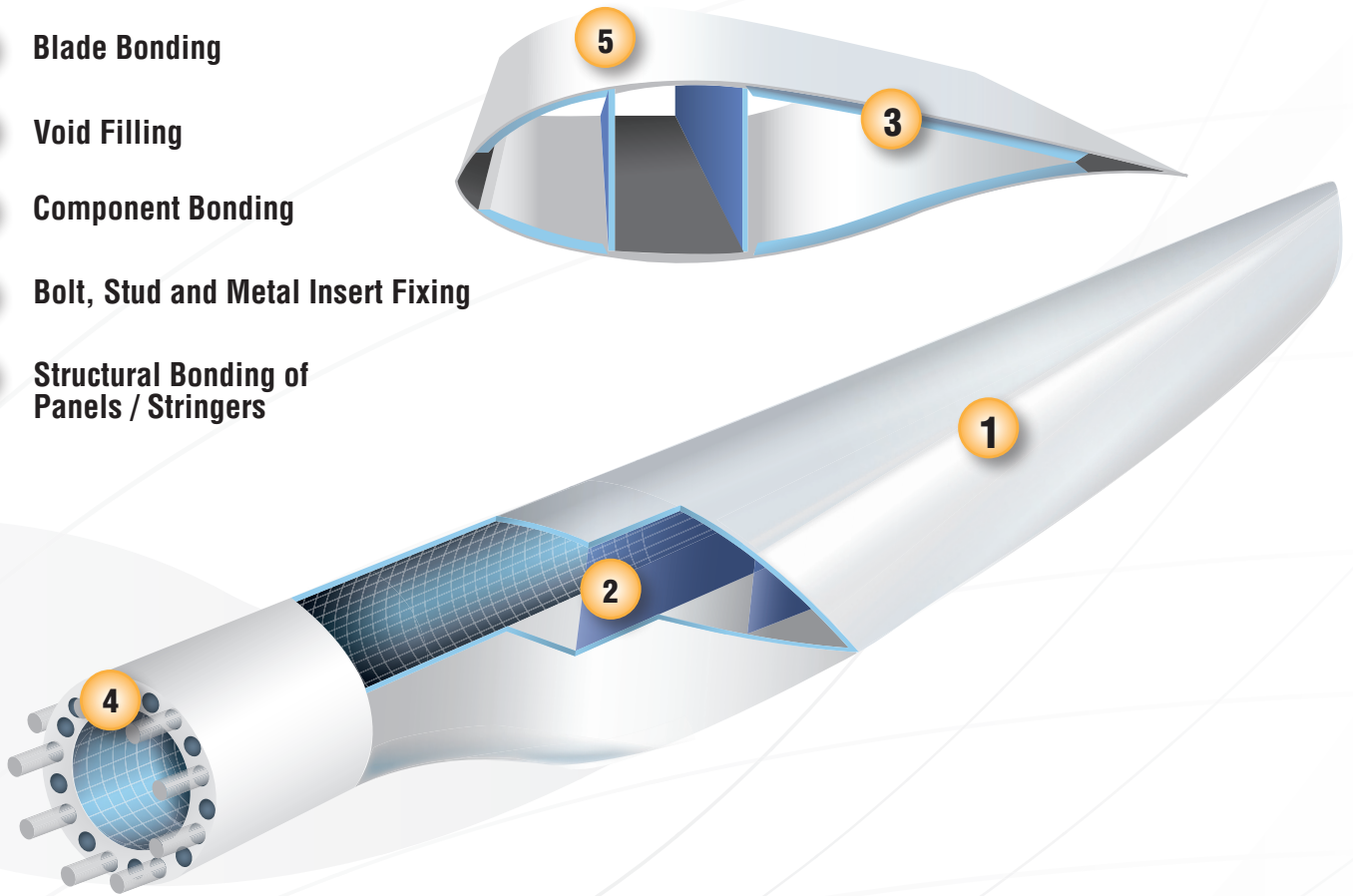


LORD Structural Adhesives can be used in many applications on a wind turbine or tower including:

- **Blade Assembly and Repair**
- **Nacelle Assembly**
- **Bearing to Hub Assembly**
- **Tower Assembly**
- **Magnet Bonding**
- **Sealing and Protection of Electrical Components**

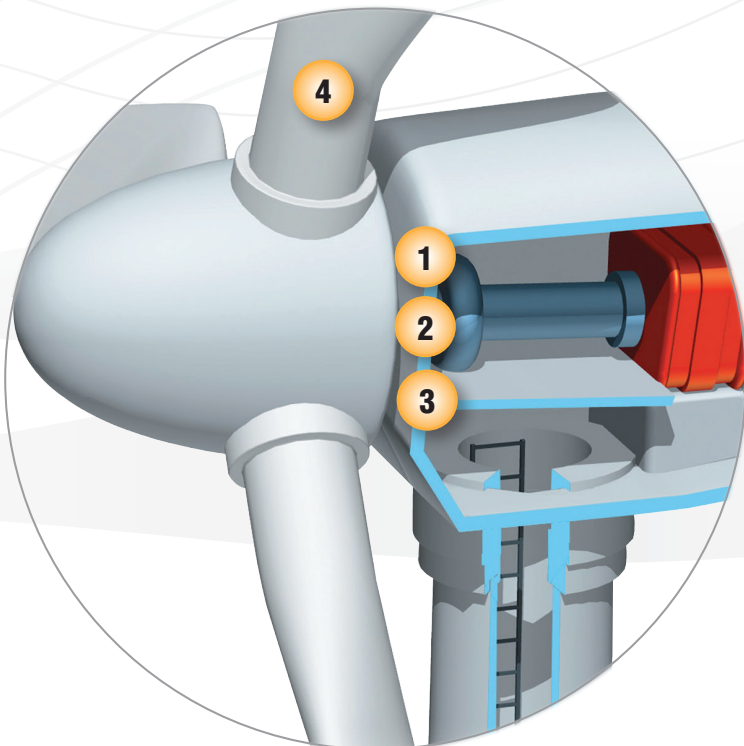
Blade Bonding Applications

- 1 Blade Bonding
- 2 Void Filling
- 3 Component Bonding
- 4 Bolt, Stud and Metal Insert Fixing
- 5 Structural Bonding of Panels / Stringers



Nacelle Applications

- 1 Bearing to Hub Assembly
- 2 Magnet Bonding
- 3 Component Bonding
- 4 Blade Repair



Sensors and Sensing Systems

Building on over 30 years of experience, LORD Sensing provides award-winning, reliable solutions for OEM and Test & Measurement applications. MicroStrain® inertial, wireless, and displacement sensing systems are ideal for installation on wind turbines to monitor components, including the blades, drive train, gear box, tower, and generator.

Wireless Sensing Systems

End-to-end wireless sensing solutions enabling the next generation of smart machines and structures to automatically report their condition

- Wireless Simplicity, Hardwired Reliability™
- Node-to-node synchronization up to $\pm 32 \mu\text{sec}$
- Scalable long-range solution
- Lossless data throughput in most conditions



Displacement Sensors

Micro-displacement sensors for precision positioning in industrial and harsh environment applications.

- Smallest displacement measurement solutions available
- Able to survive millions of cycles in corrosive media
- Readily customizable length, stroke, and diameter
- High dynamic range



Inertial Sensors

High performance measurement and navigation systems with lightweight, miniaturized form factor for embedded applications

- Smallest and lightest low-power solutions available
- Fully customizable data output for easy, rapid integration
- GNSS/INS, AHRS, IMU models available



SensorCloud™

Web-based, remotely-managed platform for secure sensor data storage, visualization, alerts, and analysis.

- Powerful cloud-computing technologies provide excellent data scalability, rapid graphing, and user-programmable analytics.
- All data transactions are encrypted and secure.
- Customize alerts to stay informed on your data 24/7.



SensorCloud™

Drive Train Vibration

Drive Train Torque

Gearbox Vibration and Individual Gear Damage



Blade Flutter

Flap-wise and Edge-wise Bending Moments

Tower Dynamics and Vibration (especially needed for offshore turbine)

Tower Bending Moments and Torsion

Magnet Coating

LORD JMC magnet coating is specially developed to meet needs of Neodymium (NdFeB) surface treatment. NdFeB nowadays is widely applied on direct-driven permanent magnet generator of wind power. Our JMC series magnet coating can help NdFeB to resist high temperature, corrosion, oil as well as meeting insulation and hardness requirement. High NdFeB performance is helpful to make generator much safer and steadier in meantime. Additionally, easy process and high environmental protection standard of magnet coating can help customer to simply process, raise efficiency and save total cost.

JMC-502K

Typical Properties, Uncured

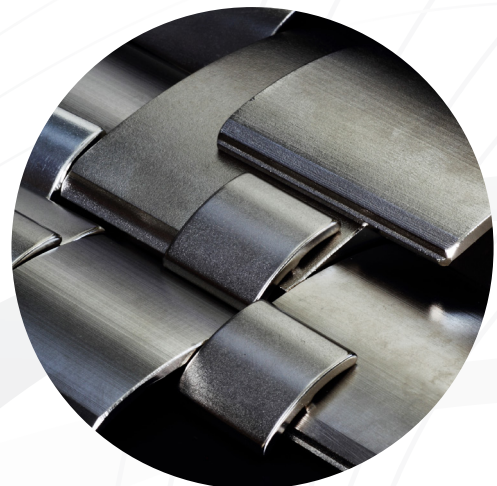
JMC-502K, Phenolic base	
Appearance	Black Liquid
Solids Content by Weight, %	33-37%
Viscosity, mPa.s@25°C	200 – 1000 mPa.s
Specific Gravity	1.00-1.05
Shelf Life	12 months from DOM, stock in 21°C -35°C

Test Result, 20µm DFT, Cured

JMC-502K, DF performance	
PCT (125°C, 85%RH)	500 Hours
Heat resistance 150°C	500 Hours
High temperature and humidity (85°C, 85%RH)	2000 Hours
SST (35°C, 5%NaCl)	2000 Hours
Thermal Cycle (-40°C~170°C)	500 Cycles

Property

- Excellent SST/PCT performance and high temp resistance
- Excellent adhesion (RT/HT) with magnet substrate and structural adhesive
- 5H-6H hardness to keep scratch away during assembly
Low DFT
- High insulation performance to keep eddy current away
- Easy process, high productivity, save total cost
- Excellent surface
- Over 10 year application experience





LORD Global Presence



UNITED STATES & CANADA

Regional Headquarters:
Cary, NC

EUROPE, MIDDLE EAST & AFRICA

Regional Headquarters:
Geneva, Switzerland

LATIN AMERICA

Regional Headquarters:
Cary, NC

ASIA PACIFIC

Regional Headquarters:
Hong Kong

KEY MARKETS

AEROSPACE & DEFENSE

- Commercial Aircraft
- Military Aircraft
- Missile Systems
- Military Ground Vehicles
- Aftermarket

AUTOMOTIVE, INDUSTRIAL & ELECTRONIC ASSEMBLY

- Automotive Assembly
- Tier Component Assembly
- Aftermarket Collision Repair
- Electronics
- Industrial Assembly

OIL & GAS AND INDUSTRIAL EQUIPMENT

- Oil and Gas
- Off-Highway Vehicles
- Truck & Bus
- Electronics
- Recreational & Marine
- Civil Engineering

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LORD provides valuable expertise in adhesives and coatings, vibration and motion control, and magnetically responsive technologies. Our people work in collaboration with our customers to help them increase the value of their products. Innovative and responsive in an ever-changing marketplace, we are focused on providing solutions for our customers worldwide ... Ask Us How.

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