

Wind Turbine Slip Ring And Fibre Optic Solutions

High performance rotary and fibre optic components for onshore and offshore wind turbines



ADVANTAGES

- High reliability - slip rings with 100+ million revolutions
- No maintenance slip rings utilising fibre brush technology
- Flexible design with modular slip ring configuration
- Proven and tested models
- A complete solution for wind applications by integrating fibre optic components

APPLICATIONS

- Onshore wind turbines
- Offshore wind turbines
- Floating offshore platforms
- Small and mid-size community wind

Wind turbines require delivery of power and data signals to the rotating hub by a reliable rotary assembly. These high performance components must operate continuously in harsh environments, often in remote locations, where regular maintenance and monitoring are difficult and expensive. Moog provides rotary products that are designed to operate efficiently in these rugged environments.

Moog's rotary and fibre optic products incorporate the latest design technology. Product features are based on years of proven performance in numerous aerospace and demanding industrial applications. Our wind power products have standard configurations that are flexible and allow us to quickly tailor a product to meet each customer's unique set of requirements.

Slip rings are commonly used in wind turbines to provide electrical signals and power for blade pitch control systems. For hydraulic pitch, Moog can supply integrated fluid rotary unions that carry hydraulic fluids across the rotary joint. Moog has innovative solutions in both of these applications.

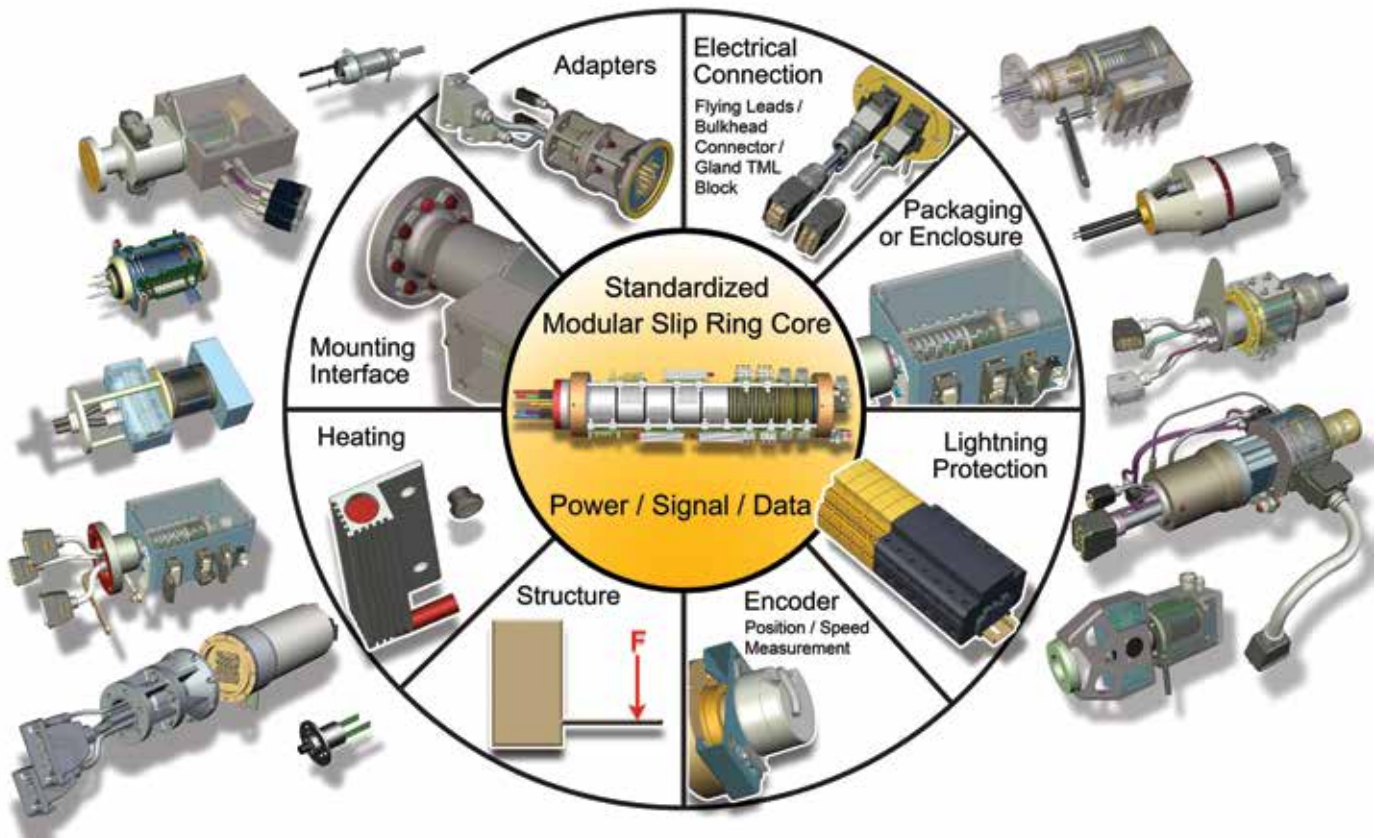
Moog's "no maintenance" slip rings utilise fibre brush contact technology and eliminates the need for frequent slip ring maintenance procedures -- no vacuuming of brush debris, no lubrication, no regular inspection for brush wear and no brush replacement.

MOOG SLIP RING AND FIBRE OPTIC SOLUTIONS FOR WIND TURBINES

Flexibility

Moog has established a modular system for developing and manufacturing its slip rings. Our building-block configuration is precisely matched to meet each customer's specifications. This business model offers faster delivery and cost effective solutions.

- Up to 500 A continuous current capability
- Discrete signal circuits, Ethernet, RS serial buses, CANbus and CANopen options available
- Fibre Optic Rotary Joint (FORJ), Fluid Rotary Unions (FRU) and encoders can be integrated
- Silver fibre brush technology
- No routine maintenance or lubrication required
- 100+ million revolutions expected life
- Other elements can be integrated as required (example lightning protection)



Moog Modular Wind Turbine Slip Ring

Fibre Brush Advantages

Moog developed the fibre brush technology in the early 1970s and became the first company to use this patented design in its slip rings. Fibre brush technology enables a maintenance-free slip ring design. The advantage of the fiber brush technology is its ability to achieve remarkable life without lubrication over a wide range of temperature, humidity and rotational speeds. Moog understood the value of this unique design for long life, space efficient slip rings and used its expertise to develop hundreds of different slip ring models for challenging applications, including helicopter rotor blade de-icing, satellite solar array drive power transfer, industrial packaging equipment, radar pedestals and wind turbines. Today, Moog's proven fibre brush technology has become synonymous with high performance slip rings around the world.

- Maintenance free for 100+ million revolutions
- Minimal wear debris generated
- No lubrication required
- Wide operating temperature range
- Lower life-cycle cost

Contactless Technology

Moog engineers spend significant time investing in research and developing new technologies. One example of this is the contactless slip ring that offers the transfer of electrical power across a continuously rotating interface without electrical contact.

- 5 kW solutions available, 12 kW in development
- Inductive transformer to achieve power transfer with > 90 percent efficiency
- Associated electronics can be designed to suit your application requirements
- Contactless data channel can be provided by a fibre optic rotary joint

Fibre Optic Data Transmission

Optical data transmission is available using a complete line of Fibre Optic Rotary Joints (FORJ) integrated into the rotary unions. The very high bandwidth capability of fibre provides tremendous opportunity to reduce the number of lighting protection circuits and minimize the number and size of signal cables - reducing cost and weight, improving reliability and EMI performance.

Fibre optic communication electronics are used to multiplex multiple signals onto a single optical fibre. Optical fibre is used to transmit many high bandwidth bidirectional communication signals throughout the turbine using various standard protocols. A non-contacting fibre optic rotary joint (FORJ) is used to transmit optical signals over the rotary interface between the hub and nacelle, and fibre optic electronics are used to combine multiple signals onto a single fibre and provide link monitoring.

Fluid Rotary Unions

Hydraulic pitch actuation systems require both electrical and fluid transfer to and from the turbine blades. While slip rings provide the electrical transmission across the rotary interface, fluid transfer is accomplished through fluid rotary unions (FRU). Typically, two fluid channels are required to provide supply and return hydraulic power to the blade actuators. Special seals and shaft coatings have been developed to ensure long life of the FRU. Seals are selected based on chemical compatibility, design pressure, design temperature, required service life and acceptable leakage rate.

Slip rings are often integrated with fluid rotary unions into rotary union assemblies. It is also common to include rotary position sensors and fibre optic rotary joints for a complete rotary interface solution. Special techniques are required in these integrated assemblies to ensure the reliable operation of each of the specific functional components.

MICRO-GENERATION WIND	AFTERMARKET / RETROFIT WIND
<p>Moog offers products tailored to the wind segment that includes wind-minded consumers and small and mid-size community wind applications. Our technology has been packaged specifically for the performance requirements and cost targets of these customers. Slip rings and alternators are available solutions.</p> <ul style="list-style-type: none"> • Slip rings up to 15 kW turbine designs • Conventional brush slip ring solution for 1.5 kW generator • Alternators available up to 150 kW 	<p>Wind turbine operators use Moog pitch slip rings to replace low reliability, high maintenance designs in existing turbines. These models are developed as direct replacements in major wind turbine models.</p> <ul style="list-style-type: none"> • Direct form, fit, function replacement • Easy installation • Maintenance free

MOOG WIND TURBINE PRODUCT MATRIX

PRODUCT	MODEL	FEATURES / ADVANTAGES
	Pitch Actuation Slip Ring	<ul style="list-style-type: none"> - Modular design adds flexibility - 100+ million revolutions for high reliability - No maintenance; lower operating costs
	Wind Turbine Slip Ring WP58484	<ul style="list-style-type: none"> - Compact size - Stainless steel housing - IP65 sealing
	Wind Turbine Slip Ring AC7008	<ul style="list-style-type: none"> - GE 1.5 MW direct replacement - High power capacity - Heavy duty bearing - No maintenance
	Wind Turbine Slip Ring WP7129	<ul style="list-style-type: none"> - NEG Micon NM72 / 82 replacement - Sealed - No maintenance
	Fibre Optic Rotary Joint 197S	<ul style="list-style-type: none"> - Single-pass, multimode FORJ - Fully sealed - Allows transfer of optical signals
	Fibre Optic Rotary Joint 285 / 286	<ul style="list-style-type: none"> - Single-pass, singlemode (285) / multimode (286) - Optimally suited for integration inside slip ring - Allows transfer of optical signals
	Fibre Optic Rotary Joint 292	<ul style="list-style-type: none"> - Ultra-compact, two pass, multimode FORJ - Enables bidirectional using separate fibres or fibre redundancy - Allows transfer of optical signals on two separate optical fibres
	Multiplexer 920-EDM	<ul style="list-style-type: none"> - Ethernet and data multiplexer - Combines multiple channels in a single interface box - Reduces system cost and space - Combines multiple channels onto a single fibre - Link monitoring using open standard Ethernet based protocols
	Fluid Rotary Union	<ul style="list-style-type: none"> - Low leak rates - Can be integrated with slip ring and fibre optic rotary joint - Offers a total rotary system solution
	Wind Turbine Alternator	<ul style="list-style-type: none"> - Direct drive power generating device - Available up to 150 kW - Housed and frameless designs available

Specification and information are subject to change without prior notice.
 © 2007 Moog Inc. MS1070, rev. 3 11/15

Americas
 Moog Components Group
 1213 North Main Street
 Blacksburg, VA 24060
 United States

Tel: +1 540-552-3011
 Fax: +1 540-557-6400

Asia-Pacific
 Moog Components Group
 Nisseki Yokohama Bldg. 14F
 1-1-8 Sakuragi-cho, Naka-ku
 Yokohama, Kanagawa 231-0062
 Japan

Tel: +81 45-680-2503
 Fax: +81 45-680-2509

Europe
 Moog Components Group
 30 Suttons Business Park
 Reading, Berkshire RG6 1AW
 England

Tel: +44 (0) 118-966-6044
 Fax: +44 (0) 118-966-6524

MOOG
 COMPONENTS GROUP

www.moog.com/components

Email: mcg@moog.com