

Advanced Solutions for wind turbines



Morgan Advanced Materials

Morgan Advanced Materials is a global materials engineering company which designs and manufactures a wide range of high specification products with extraordinary properties, across multiple sectors and geographies.

From an extensive range of advanced materials we produce components, assemblies and systems that deliver significantly enhanced performance for our customers' products and processes. Our engineered solutions are produced to very high tolerances and many are designed for use in extreme environments.

The Company thrives on breakthrough innovation. Our materials scientists and applications engineers work in close collaboration with customers to create outstanding, highly differentiated products that perform more efficiently, more reliably and for longer.

Morgan Advanced Materials has a global presence with more than 10,000 employees across 50 countries serving specialist markets in the energy, transport, healthcare, electronics, security and defence, petrochemical and industrial sectors. It is listed on the London Stock Exchange in the engineering sector.

Key Benefits

Morgan Advanced Materials design and manufacture lightweight, compact, high-performance solutions that thrive in the extreme environments that wind turbine generators experience.

Offering:

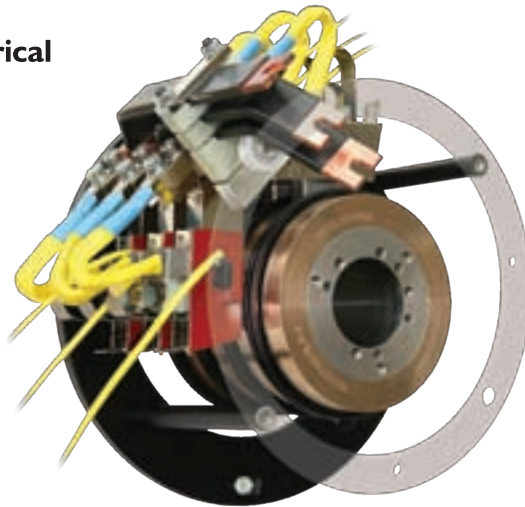
- **Proven field-tested solutions**
- **Team-based approach, including engineering, design, R&D and customer service to support your needs**
- **Research and development centres of excellence**
- **Bespoke design solutions meeting your environmental challenges**
- **Worldwide application engineering knowledge**

Morgan Advanced Materials provide technically proven solutions for the wind turbine industry

The extreme diversities of the global environment have a great affect on the performance of wind turbines. Morgan Advanced Materials design and manufacture lightweight, compact, high performance solutions that thrive in these demanding climates.

Our proven field tested electrical components include:

- Power generator brushes
- Earthing brushes
- Lightning protection brushes
- Brush holders and cartridges
- Power slip rings
- Hub control slip rings



Application Engineering Technical & Design Support

From design to after sales, Morgan Advanced Materials provides global technical support committed to on going improvements, optimisation of solutions, improving lifetime costs and continued design development.

Morgan Advanced Materials offer

- Global application engineering experience
- Local sales engineering support, including up-tower
- Over a century of experience in carbon brush technology
- Innovative in-house designed solutions
- Materials Research and Development
- State of the art testing and analytical laboratories
- Technical training courses
- Field proven solutions



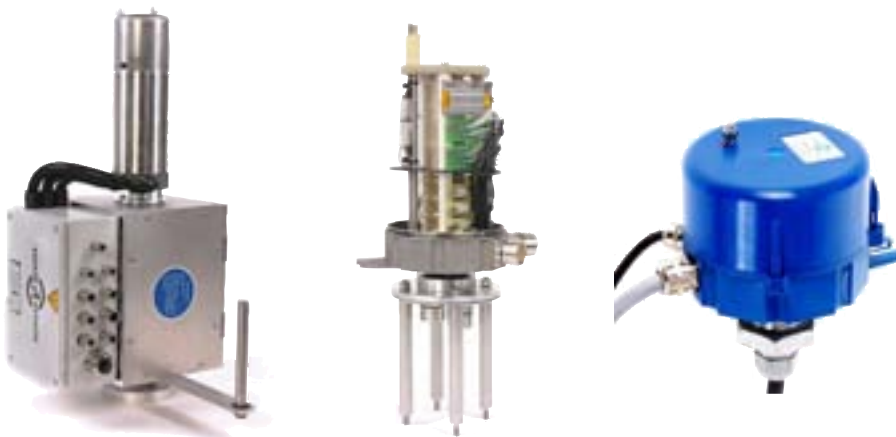
Hub Control Slip Rings

Our market leading products, sold under our Rekofa brand, have been developed through decades of experience in global markets. Depending on customer requirements, each modular system includes either advanced, slip rings, wire systems, metal contacts, metal-graphite brushes or other components engineered to suit any wind application.

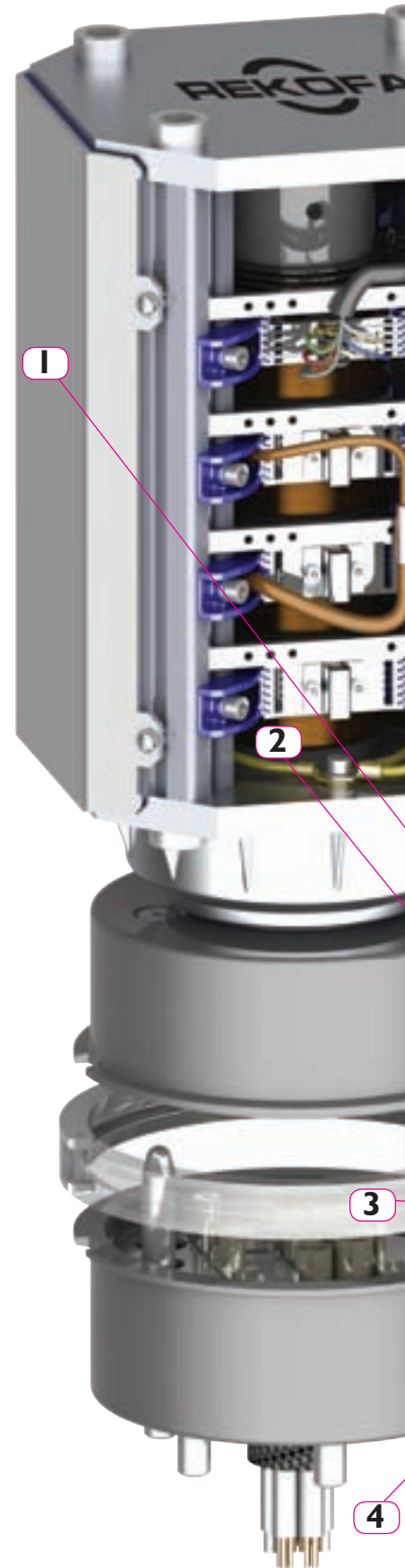
Key Features and Benefits:

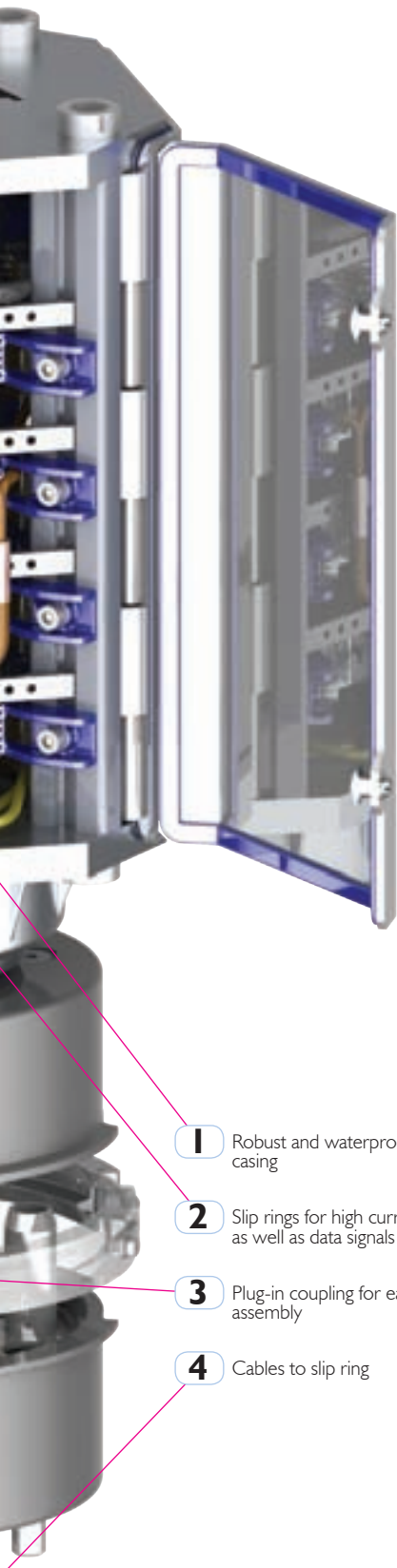
- A lifetime of up to 20 years or 200 million rotations
- Up to 5 years free maintenance and lubrication
- Data transmission capacity up to 400Mbit/s
- Shock and vibration resistance.
- Hybrid systems utilising wire systems and metal-graphite brushes
- Fibre optic rotary joints up to 1Gbit/s

Slip Ring Transmitter for Wind Turbines in global operation



Casing	Ergonomical and robust, seawater resistant, made of aluminium or stainless steel
Protection Class	up to IP67
Bearing	Equipped with integral bearing for highest load and long life time
Flanges/Connectors	Standard or customised solutions
Combination	With encoders and/or rotary unions
Humidity	Trouble free operation from 0% up to 95% humidity
Temperature	Resistance from -40°C to +75°C
Vibration	According to MIL-STD 810 514.5
EMC	Trouble-free transfer of all signals





Rotary Transfer Systems for Wind Turbines



30A



80A



500A

System	Standard 30A (Gold wire)	Standard 80A (Gold wire)	Standard 500A (Metal graphite)
Maintenance free	up to 150 mio. revolutions	up to 100 mio. revolutions	up to 200 mio. revolutions
Lifetime	Up to 20 years	Up to 15 years	Up to 20 years
Max. Current	30A	80A	500A
Max. Voltage	600	600V	600V
Max. Data rate	400 Mbit/s	400 Mbit/s	1.5 Mbit/s
Lubrication	Not necessary	Not necessary	Not necessary
Standards	UU/SA, VDE	UU/SA, VDE	UU/SA, VDE

Transmitter materials



Metal graphite



Gold wire

Brushes

Selecting the correct carbon brush for your application can reduce slip ring wear, maximise brush life and contribute to outstanding generator performance. Our experienced application engineers can help you select the correct grade and design for your needs.

Brush Types

- Power generation brushes
- Non drive end earthing brushes
- Lightning dissipation brushes

Materials we offer

- Copper graphite
- Silver graphite
- Natural graphite
- Electro graphite



Our Carbon Brushes feature:

- Exceptional performance from no-load to high-load
- Low friction through extreme atmospheric conditions and low humidity
- Contamination tolerance
- Excellent lifespan with minimal ring wear
- Low brush-to-brush wear differential
- Engineering and performance specific to your application



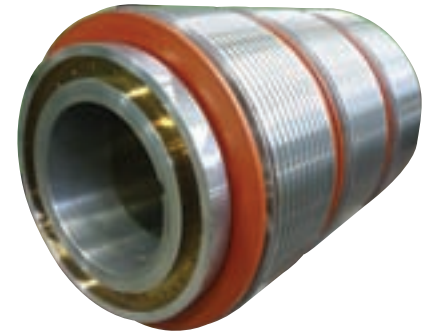


Power Slip Rings

Rekofa power slip rings manufactured by Morgan Advanced Materials provide high performance solutions that thrive in extreme environments.

These feature:

- Moulded or built-up capabilities
- Availability in steel, stainless steel, bronze or cupro nickel
- Testing for high potential, over-speed, temperature extremes and more
- Cost-efficient design
- Complimentary quality brush holders and mounting cage assemblies
- Design specific to your application



Quality Assurance and Testing

Further to our standard products we offer customised units which are specifically designed for your purpose. Our focus here is on cooperation and support from the beginning of the project to find the best possible solution.

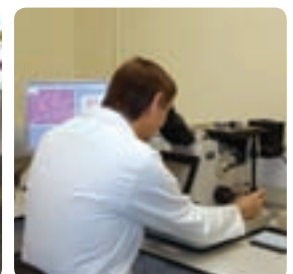
We are certified according to ISO 9001:2008.

Our Quality Assurance department further executes the following tests:

- Vibration and IP tests by accredited institutes (e.g. VDE)
- Temperature and humidity tests in our climate chambers
- Electrical tests on our rotary inspection tables (noise, high voltage, continuity)
- Life time simulation in our test laboratory
- Friction & Contact Drop testing
- Application specific testing

Material Specific Testing Capabilities

- Optical microscopy
- Atomic emission spectroscopy
- Atomic absorption spectroscopy
- FTIR spectroscopy
- Thermo gravimetric analysis
- Particle size analysis
- Mercury porosimetry
- Controlled stress rheology
- Thermal expansion
- X-Ray analysis



ABOUT MORGAN ADVANCED MATERIALS



Morgan Advanced Materials is a global engineering company offering world-leading competencies in materials science, specialist manufacturing and applications engineering.

We focus our resources on the delivery of products that help our customers to solve technically challenging Problems, enabling them to address global trends such as energy demand, advances in healthcare and environmental sustainability.

What differentiates us?

Advanced material science and processing capabilities. Extensive applications engineering experience.
A strong history of innovation and reinvention. Consistent and reliable performance.
A truly global footprint. We find and invest in the best people.

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