

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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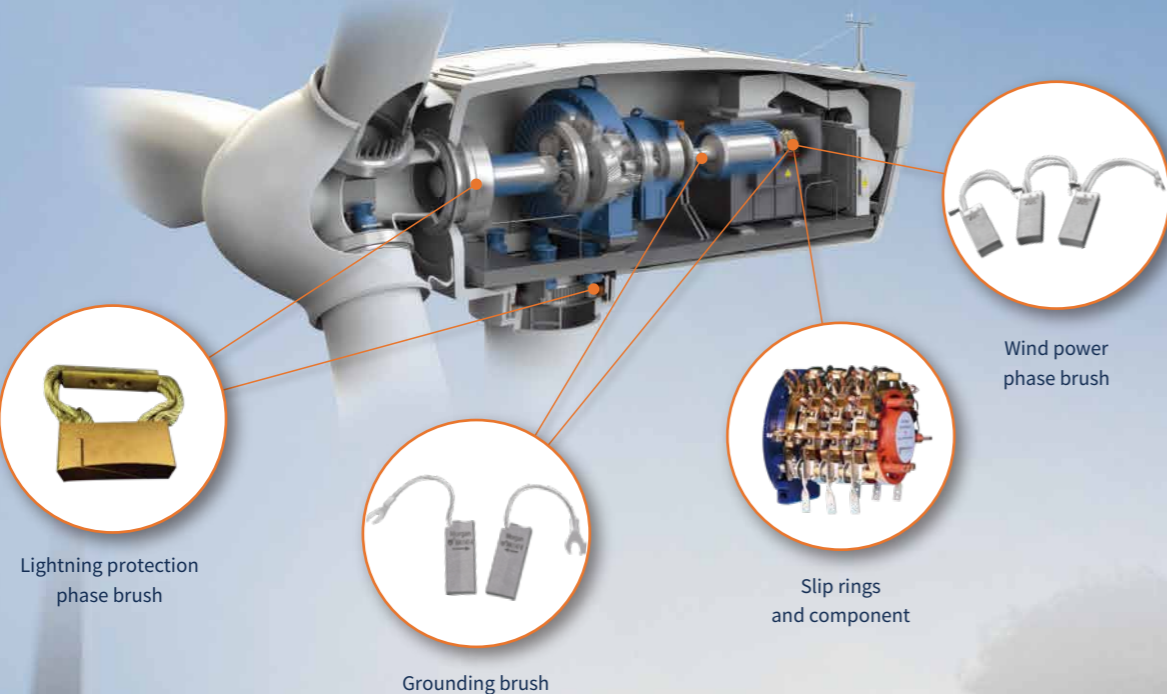
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Innovative and customized solutions for wind power generation



ELECTRICAL CARBON



Solutions for Wind Power

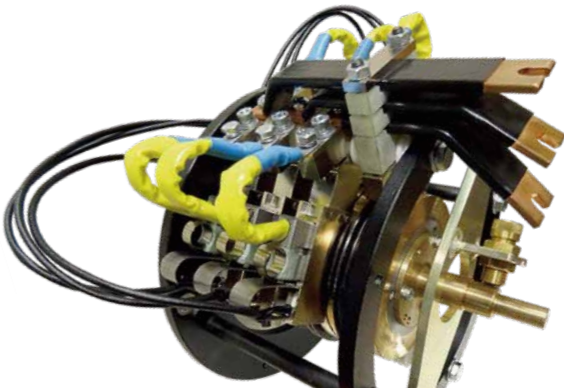
As global demand for renewable energy continues to increase, the locations of new wind farm developments are becoming more remote and challenging from both a service and climatic perspective.

Morgan Advanced Materials has developed and continues to develop class leading products for all environments. Our focus is to reduce the cost of ownership of the systems we offer. Our carbon brushes offer class leading performance in terms of brush and slipring life in all environments. Service times are reduced, offering significant savings to the operator. Morgan have tailored our carbon brush portfolio to give optimal performance on both stainless steel and bronze sliprings. Our brush grades, slipring and holder solutions offer optimum performance both on and offshore.



Wind Power Products Selection Guide

Carbon Brush Selection Guide				
Collecting ring	Material hardness	Application	Carbon brush current density	Applicable Morgan brush grade
Steel slip rings	150-250	Phase brush	8-13A/cm ²	MG1127
			13-18A/cm ²	MG1147 (General), MG1157 (Plateau), MG1167 (Marine)
		Grounding brush	≤ 15A/cm ²	MA1147 (General), MA1157 (Plateau), MA1167 (Marine)
Copper slip rings	90-150	Phase brush	8-13A/cm ²	MG1127
			13-18A/cm ²	M50BR
			18-25A/cm ²	S4149 (silver included)
Other carbon brushes in the nacelle		Grounding brush	≤ 15A/cm ²	MA1147 (General), MA1157 (Plateau), MA1167 (Marine), MG1127
		Lightning protection brush	-	MG1165
			-	MG1190
		Pitch control brush	6-12A/cm ²	CE50



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Carbon Brushes for Wind Turbines

Morgan offers class leading carbon brushes for all applications found commonly in the wind power industry. Phase, Earth, Lightning protection and Pitch control brushes are fully covered. Morgan continues to develop our range of materials to drive reliability, component life and reduce servicing requirements to new levels.

Morgan continues to redefined the expectations for brush performance within the industry often doubling and even trebling the current brush life with no detrimental wear to the sliprings. Dust generation is minimised.

The selection of the correct materials is key to optimise performance. Morgan’s global team of Application Engineers are here to assist and make specific recommendations based on your generator type and location.



Product Features:

- Stable patina formation to minimise friction.
- Tailored materials for slipring type if required.
- UL and DIN specification accommodated.

Main Advantages:

- Maximise brush life.
- Reduced collector wear.
- Reduced dust generation.
- Global engineering support.

Customer Benefits:

- Reduced maintenance requirements.
- Less turbine downtime.
- Significantly reduced cost of ownership.



Typical Values of Carbon Brushes for Wind Turbine Applications

	Grade	Continuous Current Rating		Continuous Speed Rating		Resistivity		Bulk Density		Metal Content	Common Application
		A/cm²	A/in²	m/s	ft/s	μΩm	10 ⁻⁴ Ω in	g/cm³	lb/ft³		
Phase Brushes	S4258	12	78	40	131	15.00	5.91	2.10	131	25	Low load Bronze Rings <850kW
	MG1157	18	118	40	131	3.30	1.30	2.98	186	40	Steel Rings, Film Forming Cold Environments
	MG1147	18	118	40	131	3.20	1.26	2.95	184	47	Steel Rings, High Wind, Standard Environments
	CM9	18	118	35	115	2.00	0.79	2.90	181	50	Steel Rings Standard, Environments
	LL587	18	118	30	98	1.78	0.70	3.26	204	50	Optimal life, Steel Rings, all environments.
	M50BR	18	118	30	98	2.00	0.79	3.20	200	50	Optimal life, Bronze Rings, all environments.
	S4149	25	164	30	98	0.25	0.10	3.70	231	65	High Load Silver Grade, All environments.
Grounding Brushes	S4189	16.5	108	50	164	18	7.09	1.68	105	8	High Speed Grounding, Stable contact.
	MA1127	-	-	40	131	-	-	-	-	20	Dual Grade Shaft Grounding
	CM9	18	118	35	115	2.00	0.79	2.90	181	50	Standard shaft earthing steel
	M50BR	18	118	30	98	2.00	0.79	3.20	200	50	Optimal life, shaft earthing, Steel/bronze
	538	18.6	122	30	98	6.9	2.72	2.86	179	58	Standard shaft earthing steel
	S4165	20	131	30	98	0.6	0.24	3.5	219	64	Standard shaft earthing steel and bronze
	CM5H	-	-	30	98	0.3	0.12	4	250	67	Hub and Yaw Lightning Protection
	634/S4149	-	-	30	98	-	-	-	-	65	Dual Grade Shaft Grounding
	M195	25	164	20	66	0.1	0.04	6.7	418	95	Heavy Duty Hub Lightning Protection

Note: For advice on your specific application and to discuss the full range of Morgan materials available please contact your local Morgan Application Engineer



Definition of coefficient of friction

H	High	Above 0.4
M	Medium	0.22-0.4
L	Low	Below 0.22

Beware of imitations

Counterfeit and shoddy products will not only cause direct economic losses to you and the company, but also immeasurable damage and safety hazards to machinery and equipment! Therefore, we remind you to identify Morgan's trademarks and products and choose proper channels. Please be wary of products with "too low" prices, beware of similar trademarks or grades, scan the code on the goods upon arrival, and beware of imitations!

The product technical parameters are subject to change without prior notice. Please consult the sales representative for the specifications of actual shipment. The user takes sole charge of the safe use of the product as the actual use conditions of the product are beyond the control of Morgan Advanced Materials (Shanghai) Co., Ltd. This product manual has no legal effect, nor is it regarded as any patent invention license or suggestion under the condition of no license. It is only for reference, research and verification.

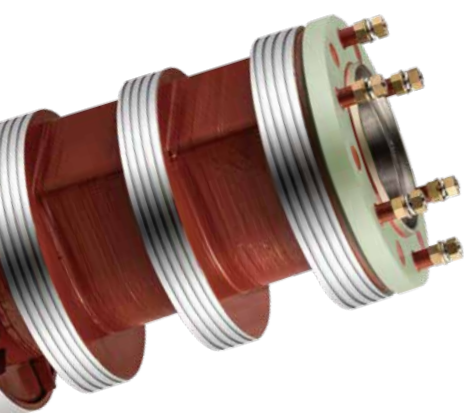
Sliprings and Brushgear for Wind Turbine Generators

Morgan Advanced Materials offers complete brush, rocker and slipring packages in a full range of sizes from 150mm to 450mm diameter.

Our range of sliprings are offered in Stainless Steel, Bronze, Cupronickel with moulded and built-up solutions available. Generic designs from 850kW to 6MW can be quickly tailored to meet OEM requirements for new build or retrospective approval.

Designs can be tailored for specific operating environments both onshore/offshore, high/low temperature and high/low humidity.

Morgan Advanced Materials works closely with end users to enhance generator performance with upgraded slipring and holder packages to significantly reduce downtime and servicing requirements.



Morgan Advanced Materials works closely with OEM's and end users to enhance generator performance with upgraded slipring and holder packages to significantly reduce downtime and servicing needs.

Contact Morgan to discuss your requirements with one of our global team of Application Engineers. All aspects of the system will be reviewed, brush design/material, holders, slip ring and just as important but often overlooked the grounding system.

With respect to generator and gearbox grounding, in addition to our solutions to improve the performance of the systems in this area Morgan are also pleased to be able to offer tailored solutions using AEGIS® technology in the form of complete rings, split rings and segments to offer class leading and long-term reliability in ground high frequency voltages commonly found in the wind power industry.

Grounding Product Features:

- Consistent ground contact.
- Increased brush length.
- High Frequency grounding with AEGIS®

Main Advantages:

- Improved brush life
- Reduced collector wear.
- Reduced dust generation.
- Greatly Improved bearing Protection.

Customer Benefits:

- Reduced maintenance requirements.
- Less turbine downtime.
- Significantly reduced cost of ownership.

We provide full support in tailoring a package of upgrades including on site testing to ensure full customer satisfaction.

