

MEGA

**Schmidthammer**

Elektrokohle GmbH



# Carbon Brushes for Windpower



2018

# Carbon Brushes for Windpower

## Introduction

The ever-growing need for energy demands sustainable solutions.

We from Schmidhammer Elektrokohle GmbH believe in power generation using regenerative energy sources. It is our opinion that among all technologies available, wind power has the highest potential.

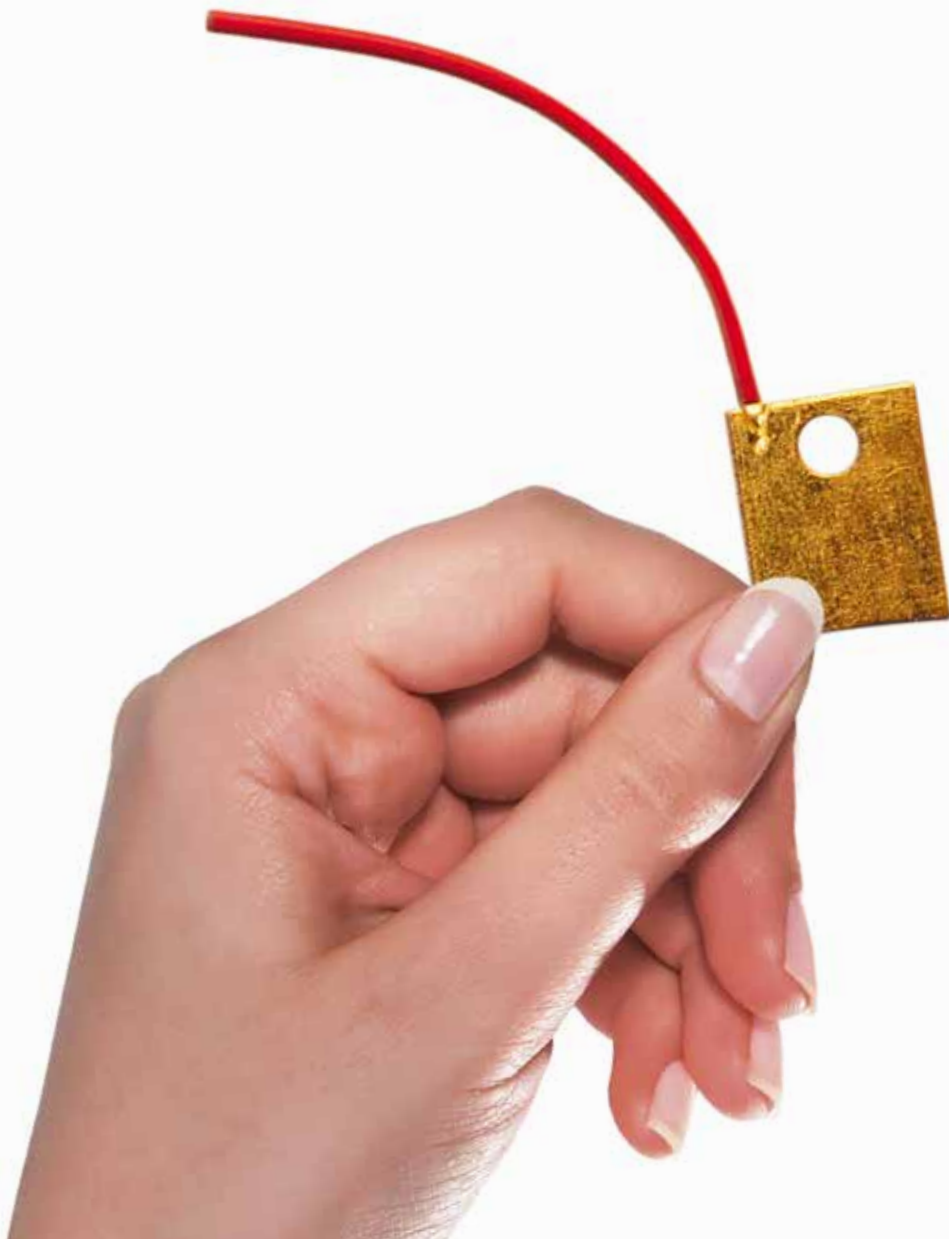
For many centuries, mankind uses the power of wind to perform work. Ingenuity and brilliant engineering led to the development of highly specialized constructions to harvest the power of wind.

Every seemingly insignificant component in today's wind turbines is highly optimized. After all the components of wind turbines onshore or offshore have to withstand nature's fury on a daily basis. At the same time wind park operators must keep a close eye on the profitability.

We accept the challenges wind power brings. With a century worth of know-how and experience in the production of electrical graphite and carbon brushes we want to be your contact in this field.

Together we will find a solution to your particular challenge.

On the next few pages we would like to give you an inside look into our portfolio introducing our carbon brushes for wind energy.





# Carbon Brushes for Windpower

## Power Brushes

Unlike in conventional power plants, wind turbines have to compensate strong fluctuations in the drive power. A proven technology able to cope with these fluctuations is the double fed induction generator (DFIG).

Commonly 12 to 24 carbon brushes are in this type of generator.

The task of the carbon brushes is to transport the varying energizing current into the rotor of the generator. The brushes need to operate at optimum efficiency untouched by the often extremely challenging environmental working conditions.

Since the replacement of used carbon brushes is generally accompanied by high cost, a low wear rate is of highest priority when acquiring new carbon brushes.

Additionally, the minimization of dust from wear of the carbon brushes is an important factor to be considered.

Hand in hand with many wind park operators all over the world, Schmidhammer Elektrokohle GmbH developed special brush grades that meet these requirements.

Grade	Specific resistance (Ohm x mm <sup>2</sup> /m)	Density (g/cm <sup>3</sup> )	Rockwell hardness HR <sub>10/40</sub>	Continuous load (A/cm <sup>2</sup> )	Speed (m/s)	Voltage drop (V)	Friction coefficient μ	Metal content %	Example of application
V816A	2	3.00	100	13	40	n.	n.	50	Nordex
V880	0.2	4.00	90	15	40	s.n.	n.	65	Vestas
V877	1.2	3.00	90	13	40	n.	n.	50	Gamesa
S35	4.00	4.00	100	20	30	s.n.	n.	65	Vestas

### Voltage drop:

s.n. (very low) = < 1,0 V  
n. (low) = 1,0 – 1,8 V

### Friction coefficient:

n. (low) = 0,15 – 0,20

MEGA Type #	J6580	J6692	J6694	J6693	J6517
Generatortype	Nordex	Nordex, VEM	Nordex, VEM	Vestas V90 (2MW Mk5&7)	Vestas V52
Grade	V816A	V816A	V816A	S35 or V880	S35 or V880





J6692 in V816A



J6580 in V816A



J6693 in S35



J6694 in V816A



J6517 in V880 and S35

# Carbon Brushes for Windpower

## Shaft Grounding Brushes

A well-known issue in generators is parasitic current. It is an undesired result of asymmetries in the magnetic field of electrical rotating machines.

This parasitic current can reach a voltage high enough to overcome the dielectric properties of the lubricant of gear and bearings, resulting in an instantaneous discharge through the path of lowest resistance.

If this discharged current flows through gears and bearings of the generator, spark erosion will occur which will damage the surface of these components.

It is not uncommon that the frequency of these discharges is in the range of several kilohertz, leading to a fast wear of the affected parts.

At first, wear will manifest with increasing noise during operation. Eventually the affected parts need to be replaced resulting in unwanted down-time and of course cost.

Due to our many years of experience, we recommend to use silver graphite brushes to avoid the described situation. Silver graphite shaft grounding brushes are perfectly qualified to eliminate the high frequency currents, thus protecting the sensible metal parts. For operations under very challenging conditions we offer sandwich brushes. Here the excellent conductive properties of the silver graphite are combined with the cleaning properties of a natural- or electrographite brush. This ensures constant contact between the silver brush and the shaft, where it drains the parasitic current efficiently.

Grade	Specific resistance (Ohm x mm <sup>2</sup> /m)	Density (g/cm <sup>3</sup> )	Rockwell hardness HR <sub>10/40</sub>	Continuous load (A/cm <sup>2</sup> )	Speed (m/s)	Voltage drop (V)	Friction coefficient $\mu$	Metal content %	Example of application
S35	4.00	4.00	100	20	30	s.n.	n.	65	Vestas V52, V66 V80, V90
S35/ET2	4 / 9	4 / 1.32	100 / 20	20 / 10	30 / 60	s.n. / n.	n. / n.	65 / -	Nordex, VEM
S35/T3	4 / 25	4 / 1.45	(HR <sub>10/40</sub> / HR <sub>10/20</sub> ) 100 / 75	20 / 10	30 / 75	s.n. / n.	n. / n.	65 / -	various generators
E/Ag5%	15	1.66	100	12	50	n.	n.	5	various generators

### Voltage drop:

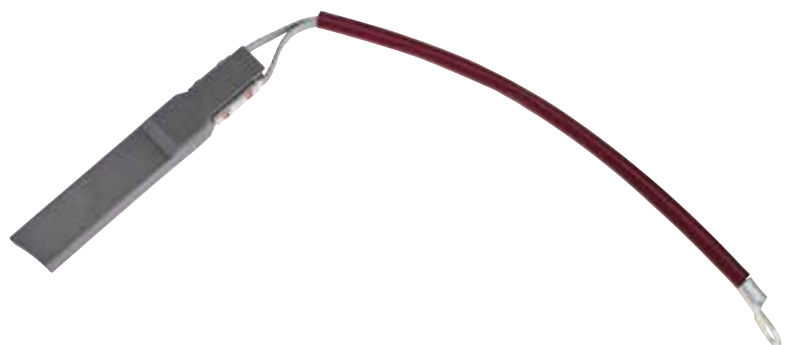
s.n. (very low) = < 1,0 V  
n. (low) = 1,0 – 1,8 V

### Friction coefficient:

n. (low) = 0,15 – 0,20



Sandwichbrush



J6691 in S35

## Lightning Protection Brushes

In contrast to conventional power plants, wind turbines are exposed to the unforgiving forces of nature. Especially thunderstorms can cause significant damage to the sensible parts in the nacelle of the wind turbine.

Carbon brushes made by Schmidhammer Elektrokohle GmbH minimize the risk of damage caused by lightning. In standardized lab experiments our grades could prove that they can withstand even the most powerful lightnings.

For protecting your wind turbine, we recommend the following grades.

Grade	Specific resistance (Ohm x mm <sup>2</sup> /m)	Density (g/cm <sup>3</sup> )	Rockwell hardness HR <sub>10/40</sub>	Continuous load (A/cm <sup>2</sup> )	Speed (m/s)	Voltage drop (V)	Friction coefficient $\mu$	Metal content %	Example of application
3450	0.15	4.00	90	15	40	s.n.	s.n.	65	Onshore
N51	0.1	5.50	50	40	25	s.n.	n.	90	Onshore
E010P	52	1.6	120	12	50	h.	n.	-	Offshore
Ei	16	1.59	110	12	50	n.	n.	-	Offshore

### Voltage drop:

s.n. (very low) = < 1,0 V  
 n. (low) = 1,0 – 1,8 V  
 h. (high) = 2,5 – 3,5 V

### Friction coefficient:

s.n. (very low) = < 0,15  
 n. (low) = 0,15 – 0,20



J6695 in 3450



Example of Application in N51

# Carbon Brushes for Windpower

## Pitch Control Brushes

The modern wind turbines can adjust the angle of the rotor to fit the wind conditions perfectly. This way the shaft speed can be precisely controlled by adjusting the angle of the rotor blades. Additionally, this so-called pitch control mechanism is a safety feature giving the wind turbine the chance to move the rotor out of gusty wind preventing damage to the system.

In our opinion, such a significant regulation and control feature should only be equipped with carbon brushes that can meet this task.

We recommend the following grades.

Grade	Specific resistance (Ohm x mm <sup>2</sup> /m)	Density (g/cm <sup>3</sup> )	Rockwell hardness HR <sub>10/40</sub>	Continuous load (A/cm <sup>2</sup> )	Speed (m/s)	Voltage drop (V)	Friction coefficient $\mu$	Metal content %
S8	0.04	7.1	115	32	20	s.n.	h.	92
N51	0.1	5.50	50	40	25	s.n.	n.	90
E02i	22	1.57	110	12	40	n.	n.	-

### Voltage drop:

s.n. (very low) = < 1,0 V  
 n. (low) = 1,0 – 1,8 V

### Friction coefficient:

n. (low) = 0,15 – 0,20  
 h. (high) = > 0,26



Pitch-Control brush in S8



Example of Application of a E02i Pitch Control brush



## Carbon Brushes for De-Icing-Systems

Not just lightning and thunderstorms are a threat to the performance of a wind turbine. Also freezing temperatures can lead to a significant decrease of the efficiency and therefore economy of a wind turbine. Especially in cold humid regions, such as mountain- and coastal areas, dangerous ice formation can occur on the rotor blades. This does not only affect the aerodynamic properties of the rotor but also poses a serious threat for man and machine.

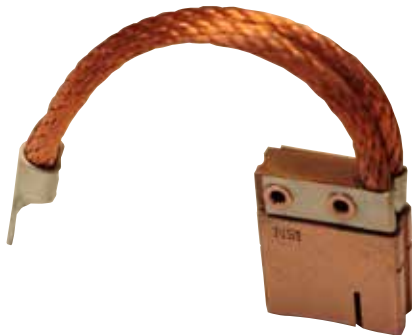
Thanks to tireless efforts of engineers in this field, today de-icing systems can be built in rotors which prevent the formation of ice on the rotor blades. At the core of many of these systems an electrical resistance heating is found.

To transport high currents to the heating systems in the blades, specialized carbon brushes are required. These specially for this purpose manufactured brushes are not only able to transport very high currents but have excellent sliding properties as well.

Grade	Specific resistance (Ohm x mm <sup>2</sup> /m)	Density (g/cm <sup>3</sup> )	Rockwell hardness HR <sub>10/40</sub>	Continuous load (A/cm <sup>2</sup> )	Speed (m/s)	Voltage drop (V)	Friction coefficient $\mu$	Metal content %
N51	0.1	5.50	50	40	25	s.n.	n.	90

**Voltage drop:**  
s.n. (very low) = < 1,0 V

**Friction coefficient:**  
n. (low) = 0,15 – 0,20



J4325-1 in N51



Sz1685 in N51

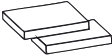


















### Remark regarding the grade N51:

Internal tests show, that continuous loads of up to 60 A/cm<sup>2</sup> are possible when using N51.

# Carbon Brushes for Windpower



# Our range of products

00	Carbon blocks	
01	Industrial carbon brushes	
02	Midget carbon brushes	
03	Micro carbon brushes	
04	Automotive carbon brushes	
05	Carbon contacts   carbon rolls	
06	High current carbon brushes	
07	Carbon inserts	
08	Carbon profiles	
09	Carbon vanes	
10	Graphite lubricating brushes	
11	Carbon bearings	
12	Thermistors	
13	Special armatures for brushes	
14	Flexible copper conductors	
15	Carbon welding rods	
16	Carbon brushes for fork lift trucks	
17	Holders for carbon brushes	
18	Special carbon brushes	

## Schmidthammer Elektrokohle GmbH

Walpersdorfer Str. 33-39  
D-91126 Schwabach

**Fon:** +49 (0)9122 - 18 06-0

**Fax:** +49 (0)9122 - 18 06-60

**Mail:** [mega@schmidthammer.com](mailto:mega@schmidthammer.com)

