



OKS Speciality Lubricants
***examples of use for
wind energy plants***

www.oks-germany.com



***INNOVATIVE PRODUCTS FOR
PRODUCTION AND MAINTENANCE TECHNOLOGY***

Speciality Lubricants
Maintenance Products

30 YEARS OF TRIBOLOGICAL EXPERTISE

AVAILABLE WORLDWIDE

OKS – your professional partner for chemotechnical special products



The OKS brand stands for high-performance products for reducing friction, wear and corrosion. Our products are used in all the areas of production and maintenance technology in which the performance limits of classic lubricants are exceeded.

Quality – Made in Germany

The continued success of OKS for more than 30 years is decisively characterised by the high quality and reliability of our products, as well as the fast implementation of customer requirements through innovative solutions.

The products developed by OKS engineers and technicians are produced under strict quality requirements in Munich, Germany, our company's headquarters. From here just-in-time sales are carried out worldwide, supported by the modern logistics centre in nearby Maisach.

The high OKS quality standard is proven by our certification by the TÜV SÜD Management Service GmbH in the fields of quality (ISO 9001: 2008), environment (ISO 14001: 2004) and work protection (OHSAS 18001: 2007).

A company of the Freudenberg Group

Since 2003 OKS Spezialschmierstoffe GmbH has been part of the international Freudenberg Group, with headquarters in Weinheim, Germany.

We utilize the comprehensive know-how and the innovative power of the Freudenberg Chemical Specialities (FCS) division for the further development of new products and markets to ensure the continued dynamic growth of our company in the future.

OKS Partner to Trade

Our speciality lubricants and chemotechnical maintenance products are sold exclusively via the technical and mineral oil trades. The consistent strategy of "sales only via trade", the smooth processing of orders and our comprehensive technical service make us one of the preferred partners for demanding customers the worldwide.



Use of lubricants during the manufacturing and maintenance of wind energy plants

Growth technology wind energy

Wind energy has been growing steadily for years. For example the worldwide installed capacity of wind energy plants grew from 2.5 GW to more than 120 GW between 1992 and 2008. This corresponds to an average annual growth rate of 25 %.

This rapid development is due to the continuous increase in the size and efficiency of wind energy plants that resulted in increased cost effectiveness and thus competitiveness of these plants. Meaning that the expenditure per produced kWh has been reduced by more than 40 % over the last 20 years.

Cost factor maintenance and servicing

This positive cost development is chiefly driven by sustainable improvements both in the production as well as in the operation and maintenance of wind energy plants, whereby the costs for operation and maintenance amount to approx. 20–25 % of the total costs during the lifecycle of a plant.

Our solutions for your applications

The high manufacturing and in particular maintenance quality at wind energy plants places specific requirements to the lubricants and chemotechnical maintenance products used. Reliability, cost effectiveness, user friendliness, environmental compatibility and work safety are only some aspects that have to be taken into consideration when developing optimal lubricant solutions for use in wind energy technology as illustrated by the enclosed examples of use.

Experts from a wide range of different disciplines work in our laboratories with state-of-the-art systems and test equipment to modify existing or develop new products for special application cases.

**Also use our specialist's know-how.
Put us to the test.**





Over 150 high-performance products
from one supplier

www.oks-germany.com



- **Pastes** for easy assembly and dismantling
- **Oils** with high-performance additives for reliable lubrication
- **Greases** for long-term lubrication under critical operation conditions
- **Dry lubricants** – the alternative for special application cases
- **Corrosion protection** for reliable preservation during storage and shipping
- **Maintenance products** for ongoing service
- **Cleaners** for thorough removal of soiling and lubricant residues

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CONSULTING AND SALES

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® = Registered trademark

For a world in motion

Mounting of wind energy plants

MoS₂-Multipurpose High-Performance Grease

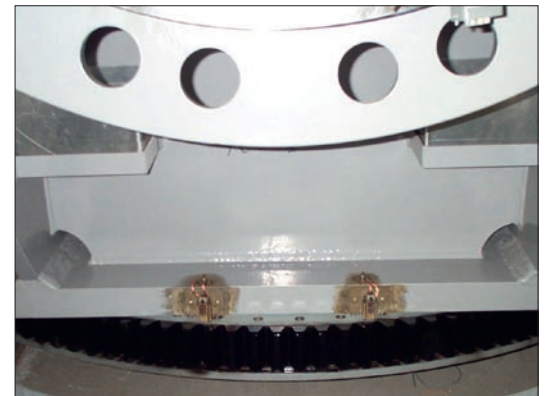


Advantages and benefits

- Eminently suitable for highly stressed lubrication points
- Highly effective due to dual lubrication effect
- Economical due to possible reduction in frequency of lubrication
- Saving of maintenance and lubricant costs by reducing downtimes and corrective maintenance due to wear

Solid lubricants are substances that, due to their structure and their chemical/physical properties, form closed sliding and parting films on metal surfaces. These films are so thin that fits and tolerances do not have to be changed in mechanical engineering. The best lubrication properties are achieved with MoS₂ (molybdenum disulphide). The layer lattice structure and the chemically effective properties on the metal surface produce low friction, high pressure absorption capacity and an excellent wear protection. Even thin films produce an extremely stable layer.

The resultant surface segregation is very welcome during mounting work, especially in the case of the material combination steel on steel. The mounting process then becomes manageable even under adverse conditions of the construction site. During the process of joining segments that weigh several tons of the tower and the nacelle, the components, bolts, sockets and cones have to be joined smoothly.



The MoS₂ high-performance grease **OKS 400** is a speciality lubricant that is used in particular at sliding surfaces subjected to high loads. The molybdenum disulphide contained in the grease can play out its advantages in particular in the field of boundary and mixed friction or during insertion processes. Under load the MoS₂ forms a sliding film on the surface that reduces the friction coefficient at very high surface pressures and prevents direct contact of the components with each other.

Lubrication of crown gears of the yaw drive

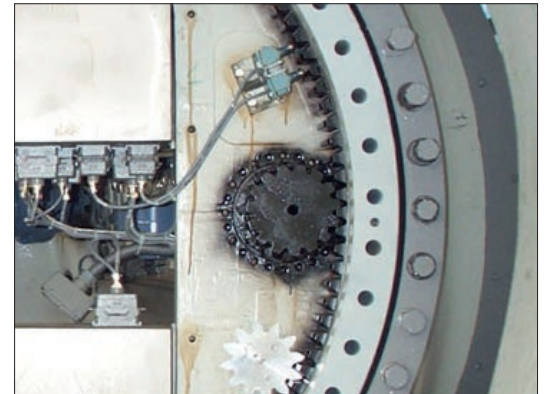
Adhesive Lubricant



Advantages and benefits

- Highly effective due to good adhesion properties and surface covering
- Increased operational reliability of moving parts due to run-in-supporting formation of sliding film
- Special formulation for establishing wear- and run-in-protecting basic lubricating films before further lubrication in the system

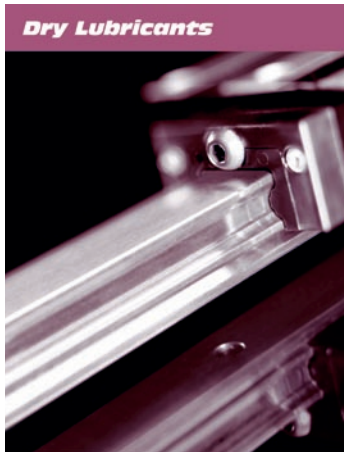
The open pinion gears at the wind energy plant are particularly endangered before the initial usage. Insufficient lubrication can result in initial damage to the meshing. OKS 495 is used as an adhesive lubricant in order to ensure lubrication of the tooth flanks of the yaw drive or also the pitch drives before the central lubricating system becomes active. OKS 495 is also used at the regularly planned maintenance intervals. OKS 495 is applied directly to the load-bearing tooth flanks. Intensive incorporation in the tooth flanks prevents the occurrence of air inclusions that negatively influence the establishment of an even lubricating film. A thin application is sufficient as corrosion protection for the non-load-bearing flanks. OKS 495 can also be used for contact pattern checking during aligning and the first operating hours.



OKS 495 is an adhesive lubricant for lubricating open crown gear drives. The grease based on graphite is soft and can be applied well. Thanks to the aluminium-complex soap it can be used excellently under influences such as water, steam and humidity and at the same time ensures the required corrosion protection. High graphite contents, special EP additives and a strong adhesion allow wear protection also under very high pressure loads.

Bonded coating priming of crown gears of the yaw drive

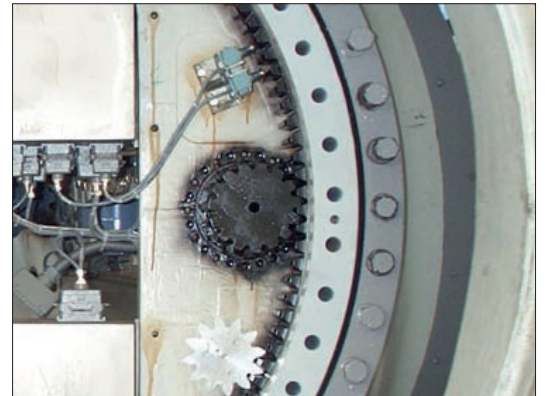
MoS₂-Bonded Coating, fast-drying



Advantages and benefits

- Highly effective due to good adhesion to prepared substrates
- Consistent coefficient of sliding friction under heavy loading of sliding film
- Increased wear protection of sliding points that can otherwise not be lubricated
- Radiation and vacuum-resistant

One of the most important lubricating points of a wind energy plant is the yaw drive that is used to align the nacelle to the wind direction. The large slewing bearings implemented with a straight spur toothing nowadays do not have an additional drive crown gear. A toothing cut into the bearing rings simplifies the design and reduces the production costs. Depending on the model the bearings reach diameters of up to eight meters. Dynamic load peaks with high application of force during acceleration and braking including the vibrations result in extreme stressing of the tooth flanks. In order to counteract these, absorb the peak loads at the head flank and to avoid direct metallic contact, the tooth flanks are coated with a bonded coating priming OKS 510 on the customer's request when the large bearings are manufactured. During current operation the toothing is relubricated with OKS 495.



OKS 510 is applied as a bonded coating with a dry film coat thickness of 15 µm. The grease- and oil-free lubricating film hardens and improves the run-in lubrication. During longer standstills the bonded coating guarantees a durable lubricating film, offers temporary corrosion protection and especially during the initial lubrication reduces the tribocorrosion on the surface caused by oscillating movements.

Cleaning of rotor blades



BIOlogic Industrial Cleaner, water-based concentrate



Advantages and benefits

- Synergetic combination of active ingredients with temporary corrosion protection
- Free of solvents, no harmful vapours
- Biodegradable
- Good separation behaviour. Gentle to plastics, seals, rubber and sensitive metal surfaces
- Registered under Number 129003 in Category A 1 by the NSF

Despite state-of the art monitoring electronics a wind energy plant has to be maintained regularly, usually every 4 or 5 years. In order to inspect the plant the wind turbine is turned windward, stopped and the rotor locked to position. To check the rotor blades service engineers check the surface of each blade centimetre by centimetre. The rotor blades are examined for cracks, soiling and the state of the lightning conductors checked. Minor cosmetic repairs are carried out immediately, recorded and, if necessary, further repair measures are initiated. Precise inspection is very important since the plant is subjected to high stresses during operation. The rotor tips reach speeds of up to 300 km/h.

The aerodynamic properties of the rotor blade are decisive for the performance and output of the wind energy plant. Soiling can result in turbulences and performance drops. Therefore the rotor blades are usually cleaned parallel to the inspection.



Environmentally friendly water-based cleaning agents are used for cleaning. **OKS 2650** has proved to be very successful since this cleaning agent can be used in a high concentration or diluted with water depending on the degree of soiling. The industrial cleaner **OKS 2650** is solvent-free and marking-free in accordance with 1907/2006/EC and is 85% biodegradable within 28 days as specified in DIN EN 2988.