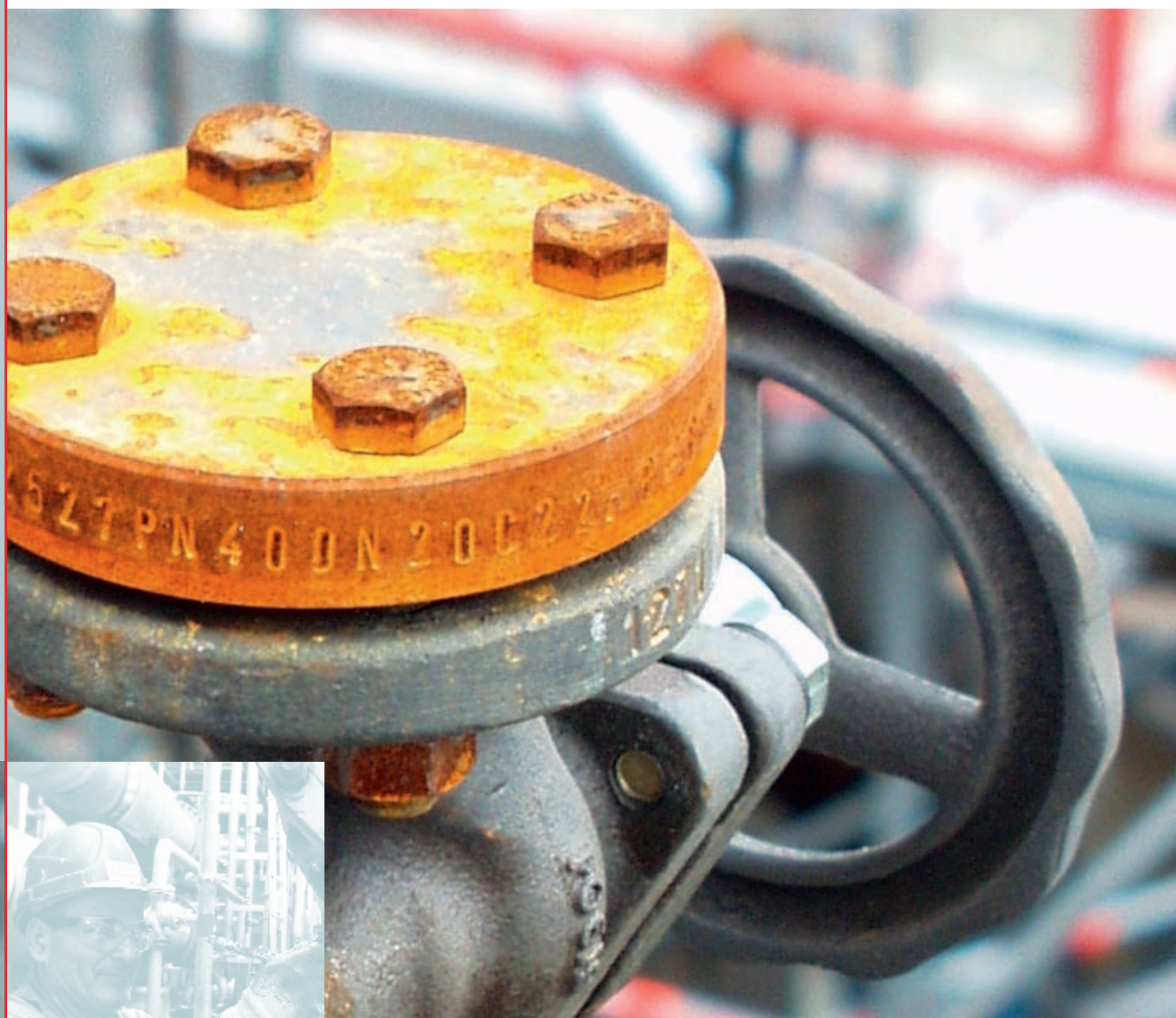




OKS Speciality Lubricants

***Examples of use for  
screw lubrication***

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***INNOVATIVE PRODUCTS FOR  
MAINTENANCE, REPAIR AND OPERATION***

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 Maisach, Germany, our company's headquarters. From here just-in-time sales are carried out worldwide, supported by the modern logistics centre.

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 Specialties (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.

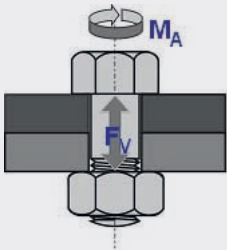


## Screw lubrication ensures reliability and cost advantages

### Function of a screw

Screws are used to fasten components and machine elements that can be loosened again.

A screwed connection is based on the conversion of a defined tightening torque ( $M_A$ ) via the screw head to the nut or inner thread into a pre-tensioning force (clamping force  $F_V$ ) in the screw shaft with which the parts to be connected are compressed. The clamping force generates the frictional adhesion of the screw in the thread. Only if the clamping force is sufficiently large, is the screwed connection of the component secure.



The frictional resistances in the thread and under the screw head impair the conversion of the tightening torque ( $M_A$ ) to the pre-tensioning force ( $F_V$ ). Therefore only approx. 10 % of the tightening torque is actually converted into the pre-tensioning of the screw. The corresponding coefficient of friction of the screwed connection depends in particular on the material and the surface of the thread and the screw. The size of the screws does not have any influence.

### Use of lubricants in screw lubrication

In industrial mounting it is of particular importance to achieve a defined clamping force. Through the use of special screw lubricants the required coefficient of friction of the screwed connection can be "set" correspondingly, thus ensuring a secure connection.

Dismantling of a screwed connection should be possible without any problems in reality. However, this is usually not the case, because screws may corrode into a "permanent lock" in particular at long periods of use and aggressive conditions of use. The use of special lubricants prevents corrosion and seizing of the screwed connection and notably reduces the time required and the costs involved to loosen these connections, for example during the inspection of supply lines, fittings and machines.

Choosing the right screw lubricant thus not only ensures the reliability of a screwed connection, but also facilitates dismantling later on – including corresponding cost advantages.

### OKS lubricants for screw lubrication

The reliability of a screwed connection and its trouble-free dismantling place high requirements on the lubricants, such as pastes, oils or anti-friction lacquer, used to this purpose. In addition to an optimum coefficient of friction and excellent corrosion protection, properties such as water and chemical resistance, suitability for food processing technology, compatibility to plastic, environmental compatibility, work safety and user friendliness have to be fulfilled.

Experts from a wide range of different disciplines work in our laboratories with state-of-the-art systems and test equipment in order to develop lubricants that fulfil these requirements optimally.

Use our specialists' 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

For your company's individual lubrication requirements please contact OKS.

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Freudenberg Group



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**For a world in motion**

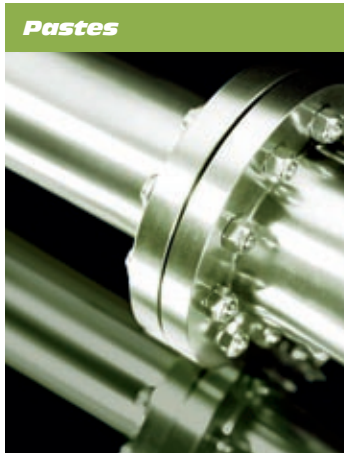


Product	Designation	Technical Data	Colour, Main Components	Characterisation	Examples of use
<b>OKS 217</b>	High-Temperature Paste, high purity	<ul style="list-style-type: none"> <li>Operating temperature: -40 °C to +1,400 °C</li> <li>Press-fit: <math>\mu = 0.11</math>, chatter from 4,000 N on</li> <li>Four-ball test rig (welding load): 4,400 N</li> <li>Thread friction (M10/8.8): <math>\mu = 0.10</math></li> </ul>	<ul style="list-style-type: none"> <li>black-grey</li> <li>semi-synthetic oil</li> </ul>	<ul style="list-style-type: none"> <li>Assembly lubrication of screw threaded connection made of high-strength steel, at high temperatures in aggressive environment</li> <li>Optimum ratio of screw tightening torque to achievable pre-tension</li> <li>No seizing and no rusting on and no reaction with metals</li> <li>For use in the chemical industry</li> </ul>	<ul style="list-style-type: none"> <li>Gas and steam turbines</li> <li>Combustion engines, screwed connections at pipe fittings, flange joints and fittings in superheated steam lines</li> <li>Exhaust pipe and combustion chamber screwed connections</li> </ul>
<b>OKS 235</b> <b>OKS 2351</b>	Aluminium Paste, Anti-Seize Paste	<ul style="list-style-type: none"> <li>Operating temperature: -40 °C to +1,100 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0,12</math></li> <li>Breakaway torque &lt; 3.0 Nm x tightening torque</li> </ul>	<ul style="list-style-type: none"> <li>metallic silver</li> <li>aluminium powder</li> <li>other solid lubricants</li> <li>synthetic oil</li> <li>inorganic thickener</li> </ul>	<ul style="list-style-type: none"> <li>Lubricating and separating paste for assembling screw and bolt threaded connections that are subjected to high temperatures and corrosive influences</li> <li>Optimum ratio of screw tightening torque to achievable pre-tension</li> <li>Prevents burning together or rusting on and avoids seizing</li> </ul>	<ul style="list-style-type: none"> <li>Screw connections, fittings, flange and plug-in connections</li> <li>Ovens, boilers, burners, engines in the chemical and petrochemical industry shipping and offshore sectors, in power and heating plants, glassworks and iron and steel works</li> </ul>
<b>OKS 240</b> <b>OKS 241</b>	Antiseize Paste (Copper Paste)	<ul style="list-style-type: none"> <li>Operating temperature: -30 °C to 200 °C/+1,100 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0.09</math></li> <li>Breakaway torque &lt; 2,5 Nm x tightening torque</li> </ul>	<ul style="list-style-type: none"> <li>copper brown</li> <li>copper powder</li> <li>other solid lubricants</li> <li>synthetic oil</li> <li>inorganic thickener</li> </ul>	<ul style="list-style-type: none"> <li>For assembling screw threaded connections subjected to high temperatures and corrosive influences</li> <li>Prevents burning together or rusting on</li> <li>Optimum ratio of screw tightening torque to achievable pre-tension</li> <li>Anti-seize paste for reliable, non-destructive dismantling</li> </ul>	<ul style="list-style-type: none"> <li>Combustion engines, threads on pipe fittings, flange joints and fittings of superheated steam lines, exhaust pipe and combustion chamber screwed connections, gas and oil burner mounting bolts</li> </ul>
<b>OKS 250</b> <b>OKS 2501</b>	White Allround Paste, metal-free	<ul style="list-style-type: none"> <li>Operating temperature: -40 °C to 200 °C/+1,400 °C (lubrication/separation)</li> <li>Thread friction (M10/8.8): <math>\mu = 0.12</math></li> <li>Thread friction (V2A M10 x 50-70): <math>\mu = 0.15</math></li> <li>Breakaway torque &lt; 3.0 Nm x tightening torque</li> <li>NSF H2 Reg. No. 131379 (OKS 250)</li> </ul>	<ul style="list-style-type: none"> <li>yellowish</li> <li>white solid lubricants</li> <li>Mo<sub>x</sub>-Active</li> <li>synthetic oil</li> <li>polycarbamide</li> </ul>	<ul style="list-style-type: none"> <li>For screws, bolts and sliding surfaces subjected to high pressures and temperatures</li> <li>Optimum ratio of tightening torque to achievable pre-tension</li> <li>Metal-free excellent corrosion protection</li> <li>Universal high-temperature paste</li> <li>For stainless-steel connections</li> </ul>	<ul style="list-style-type: none"> <li>Screw and plug-in connections made of steel or non-ferrous metals</li> <li>Combustion engines and turbines</li> <li>Corrosion protection at screws, bolts, flanges spindles and fits</li> </ul>
<b>OKS 252</b>	White High-Temperature Paste for Food Processing Technology	<ul style="list-style-type: none"> <li>Operating temperature: -30 °C to +160 °C/+1,200 °C (lubrication/separation)</li> <li>Thread friction (M10/8.8): <math>\mu = 0.15</math></li> <li>Thread friction (V2A M10 x 50-70): <math>\mu = 0.15</math></li> <li>Breakaway torque &lt; 3.2 Nm x tightening torque</li> <li>NSF H1 Reg. No. 135748</li> </ul>	<ul style="list-style-type: none"> <li>light grey</li> <li>white solid lubricants</li> <li>polyglycol</li> <li>silicate</li> </ul>	<ul style="list-style-type: none"> <li>Lubrication of screws, bolts and sliding surfaces that are subjected to high pressures, high temperatures at low speeds or oscillating movements</li> <li>Prevents seizing and rusting on</li> <li>Metal-free and highly adhesive</li> <li>Universal high-temperature assembly paste</li> </ul>	<ul style="list-style-type: none"> <li>Screw and plug-in connections made of steel or non-ferrous metals</li> <li>Screws, bolts, flanges, fits in food processing technology</li> <li>Separation of temperature-stressed threaded connections</li> </ul>

Product	Designation	Technical Data	Colour, Main Components	Characterisation	Examples of use
<b>OKS 600</b> <b>OKS 601</b> 	Multi Oil  ISO VG 7 DIN 51 502: C 7	<ul style="list-style-type: none"> <li>Operating temperature: -30 °C to +60 °C</li> <li>Base oil viscosity (40 °C): 7.3 mm<sup>2</sup>/s</li> <li>Condensed water test: 194 h (at 9 µm layer thickness)</li> </ul>	<ul style="list-style-type: none"> <li>light-coloured</li> <li>mineral oil</li> </ul>	<ul style="list-style-type: none"> <li>Low-viscosity multipurpose oil</li> <li>Extremely high creep capacity</li> <li>Good lubricating properties</li> <li>Displaces moisture</li> <li>Transport and storage</li> </ul>	<ul style="list-style-type: none"> <li>Cleaning, lubrication, maintenance and dismantling of seized or rusted-in parts such as screws, bolts, chain links, joints, levers, springs, valves, hinges or locks, protection of electrical contacts</li> <li>For industry, workshop and hobby applications</li> </ul>
<b>OKS 640</b> <b>OKS 641</b> 	Maintenance Oil	<ul style="list-style-type: none"> <li>Operating temperature: -50 °C to +80 °C</li> <li>Base oil viscosity (40 °C): 3.5 mm<sup>2</sup>/s</li> <li>Salt spray test (sprayed on): &gt; 110 h</li> </ul>	<ul style="list-style-type: none"> <li>yellowish</li> <li>mineral oil</li> <li>solvent</li> </ul>	<ul style="list-style-type: none"> <li>Good cleaning action</li> <li>Temporary protection against corrosion</li> <li>Displaces moisture</li> <li>Also at low temperatures</li> <li>Transport and storage</li> </ul>	<ul style="list-style-type: none"> <li>Dismantling of seized or sticky components or machine elements</li> <li>Locks, hinges, bolts, bushings, cranks, linkages, valves, slide rails, cable pulls, shafts</li> <li>For workshop, automobile and hobby applications</li> </ul>
<b>OKS 1300</b> <b>OKS 1301</b>	Sliding Film, colourless	<ul style="list-style-type: none"> <li>Operating temperature: -60 °C to +100 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0.08 - 0.10</math></li> </ul>	<ul style="list-style-type: none"> <li>colourless</li> <li>UV indicator</li> <li>synthetic wax</li> <li>solvent</li> </ul>	<ul style="list-style-type: none"> <li>Thread coating</li> <li>Sliding film for plastic, wood and metal</li> <li>Verifiable with UV indicator</li> <li>Prevents seizing</li> <li>For all screw materials</li> <li>Broad range of uses, in particular for precoating small and mass-produced parts</li> </ul>	<ul style="list-style-type: none"> <li>For assembly of axial face seals</li> <li>Dry sliding film for needle guides and gear rods of textile machines or cutting knives of paper processing machines</li> </ul>
<b>OKS 1710</b>	Sliding Film for screws, water-based concentrate	<ul style="list-style-type: none"> <li>Operating temperature: &gt; +60 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0.08 - 0.14</math> (depending on concentration and surface)</li> </ul>	<ul style="list-style-type: none"> <li>milky-white</li> <li>UV indicator, corrosion protection inhibitor</li> <li>synthetic wax</li> <li>water</li> <li>isopropanol</li> </ul>	<ul style="list-style-type: none"> <li>Thread coating, for controlled assembly</li> <li>Dry sliding film fast to handling</li> <li>Verifiable with UV indicator</li> <li>Can be diluted with water in a ratio of up to 1:5</li> <li>Controlled friction coefficients</li> <li>Economic precoating</li> </ul>	<ul style="list-style-type: none"> <li>Coating of threads with galvanised surfaces and VA and Al threads</li> </ul>
<b>OKS 1750</b>	Sliding film for wooden screws, water-based concentrate	<ul style="list-style-type: none"> <li>Operating temperature: &gt; +70 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0.08 - 0.14</math> (depending on concentration and surface)</li> </ul>	<ul style="list-style-type: none"> <li>yellowish</li> <li>UV indicator, corrosion protection inhibitor</li> <li>synthetic wax</li> <li>water</li> <li>isopropanol</li> </ul>	<ul style="list-style-type: none"> <li>Dry film fast to handling</li> <li>Verifiable with UV indicator</li> <li>Can be diluted with water in a ratio of up to 1:5</li> <li>Controlled friction coefficients</li> </ul>	<ul style="list-style-type: none"> <li>Coating of threads with galvanised surfaces, e.g. chipboard screws</li> </ul>
<b>OKS 1765</b>	Sliding film for thread-cutting screws, water-based concentrate	<ul style="list-style-type: none"> <li>Operating temperature: &gt; +70 °C</li> <li>Thread friction (M10/8.8): <math>\mu = 0.06 - 0.15</math> (depending on concentration and surface)</li> </ul>	<ul style="list-style-type: none"> <li>milky-white</li> <li>UV indicator, corrosion protection inhibitor</li> <li>synthetic wax</li> <li>water</li> <li>isopropanol</li> </ul>	<ul style="list-style-type: none"> <li>Dry film fast to handling</li> <li>Verifiable with UV indicator</li> <li>No cold welding</li> <li>Can be diluted with water in a ratio of up to 1:5</li> <li>Controlled friction coefficients</li> </ul>	<ul style="list-style-type: none"> <li>Coating of thread-cutting screws made of aluminium alloys, high-alloy steels, galvanised and austenitic steels</li> </ul>

## ***Lubrication of screws in the chemical industry***

High-temperature paste, high purity



### Advantages and benefits

- Prevents seizing and binding of screw threaded connections
- Separates up to 1400°C
- Does not react with metal surfaces
- Prevents material changes
- Suitable for V2A and V4A steels
- Low content of metal and alloys
- Free of sulphides, chlorides and fluorides

Everywhere in the chemical industry screws are used to connect different components. Thus, for example, approx. 130,000 screws varying between sizes M5 and M130 had to be loosened and checked at pipings, instrumentation and process control devices, valves, fittings, tanks and containers, heat exchangers during the routine shutdown of the OMV refinery in Schwechat, Vienna in Autumn 2005. To enable time and cost savings in the process “smooth” assembly of the screw threaded connections has to be ensured. For the screw paste this means that a constant coefficient of sliding friction has to be ensured in order to ensure the optimal ratio of tightening torque and attainable pre-tension even at the most varied screw dimensions and materials. In the case of screws made of high-alloy steels, cold welding must furthermore be avoided reliably.



Non-destructive dismantling of the screw threaded connection for service work or during the next shutdown is just as important. In the aggressive environment of a refinery the good protection of the paste against corrosion is decisive in this respect. However, the prevention of burning-together and of binding of the screw threaded connection at high temperatures is also very important.

## Lubrication of screws in the chemical industry

### Example of use: High-temperature paste, high purity

During the plant revision of the OMV refinery in Schwechat in Autumn 2005 OKS 217 was generally used as a screw paste for assembly lubrication at all the screw threaded

connections in order to prevent seizing, burning-together and corrosion. The overall requirement in the context of the shutdown activities amounted to approx. 2.5 t.



### Product description

OKS 217 based on a semi-synthetic oil with a mixture of various solid lubricants as well as additives, e.g. for corrosion protection. The special combination of solid lubricants does not react with metal surfaces. In addition to the extremely low contents of metals and metal alloys, OKS 217 only contains traces of sulphur, chlorine and fluorine. Lead compounds, sulphides, chlorides or fluorides are not contained at all.

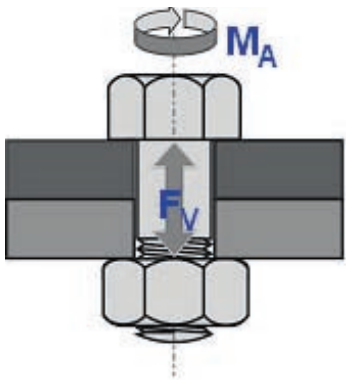
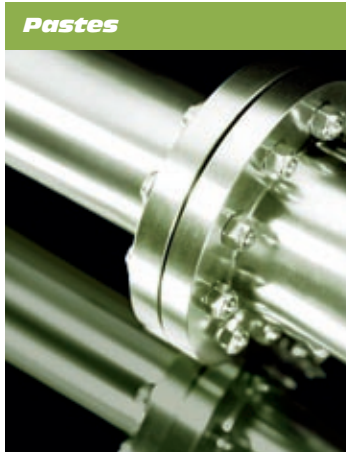
### Further OKS products for the chemical industry

<b>OKS 1110</b>	For lubricating fittings, seals, plastic parts, etc. in operation or during assembly
<b>OKS 611</b>	For rust removal, lubrication
<b>OKS 641</b>	For rust removal, cleaning, protection and lubrication
<b>OKS 701</b>	For lubricating measuring instruments
<b>OKS 2611</b>	For cleaning the lubrication points before use of the lubricants
<b>OKS 2621</b>	For cleaning electrical contacts and switches
<b>OKS 2801</b>	For ensuring imperviousness of lines under pressure



# Lubrication of screw connections

## White Allround Paste, metal-free



Consistent coefficients of sliding friction in order to achieve a defined pre-tension are imperative for fault-free mounting of a screwed connection. Screws base on the principle of transferring a tightening torque [ $M_A$  in Nm] into a pre-tension force [ $F_V$  in N] in the screw shank with which the connecting parts are pressed together (clamping force). In this case the transfer is effected by means of the screw thread between the head and the nut of the screw. Frictional resistances in the screw thread [ $\mu_G$ ] and at the screw head [ $\mu_K$ ] as a rule reduce the transfer of the tightening torque [ $M_A$ ] into the pre-tension [ $F_V$ ]. However, they also make a fastening thread, such as at a thread, self-locking. Weldings of the thread surface, so-called cold welding, can result time and again when screws are mounted, in particular at high-alloy steels (austenitic materials), so that a defined pre-tension can no longer be achieved or is prevented.

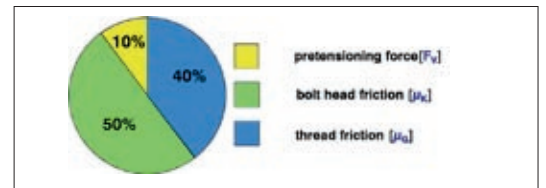
Problems also occur time and again when screw threaded connections are dismantled, for example through burning together at high operating temperatures (>200 °C).

### Product description

OKS 250 is a white, metal-free high-temperature screw paste that was developed specially for special-steel screws. OKS 250 does not contain any sulphurous additives and solid lubricants such as  $MoS_2$  that can influence the screw material negatively under extreme conditions of use. The white solid lubricants separate the thread surfaces reliably during mounting, thus preventing

### Advantages and benefits

- Optimum ratio of tightening torque to achievable pre-tension
- Separates reliably
- Excellent corrosion protection
- Metal-free (no graphite, no  $MoS_2$ )
- Resistant to cold and hot water
- Suitable for stainless-steel connection
- NSF H2 registered (Reg.-No. 131379)



In the process oxidation of the surface arises and layers of scale are formed that can result in a thread being blocked. At normal temperatures corrosion, caused by the capillary property in the thread that lets moisture ingress, can make it impossible to open a screw without destroying it.

cold welding. The consistent coefficient of sliding friction ensures optimal transfer of the tightening torque into the pre-tension. The smooth consistency of the paste allows it to be applied evenly and thinly to the thread. Thanks to its excellent corrosion protection OKS 250 makes it possible to dismantle a screw without destroying it — also after a long period of use and under extreme conditions.

## Lubrication of screw connections

### Example of use: White Allround Paste, metal-free

A German manufacturer of locomotives uses OKS 250 when mounting all screws at the locomotives. As a universal paste OKS 250 is suitable for all common screw materials. Thus only a single paste has to be used in mounting instead of various special pastes. In addition to simplifying procurement, errors caused by confusing pastes are also avoided.

Great value is also placed on being able to unscrew a connection even after longer use under aggressive conditions. With its metal-free solid lubricants OKS 250 reliably prevents tribo-corrosion in the thread. The contained corrosion protection additives protect the lubricating point reliably against corrosion for a long period. Even after subjection to high-temperature stress, the solid lubricants allow the connection to be dismantled without destruction.



picture 1



An example is the mounting of the braking sand reservoir (picture 1) for the locomotives. This is mounted in front of the front bogey of the locomotive and is thus subjected to rain, snow, cold and heat. OKS 250 is applied with a brush to the four large fastening screws of the sand reservoir before mounting (picture 2).



picture 2

#### Further OKS products for screw connections

OKS 2610/2611	to clean screws
OKS 214, OKS 217, OKS 240/241, OKS 255/251	further screw pastes
OKS 1300/1301, OKS 1700, OKS 1750 and OKS 1765	for pre-coating of screws (for reliable processing).
OKS 600/601, OKS 610/611, OKS 621, OKS 640/641	for non-destructive dismantling of rusted screw connections



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