FOCUS ON WIND TURBINES

YOUR ADVANTAGE IN AN INDUSTRIAL WORLD
Castrol focuses on all lubrication areas of your wind turbine, using proven applications expertise to deliver lubrication solutions that provide reliable and economical performance.

Wind energy technology is advancing rapidly. Turbines have grown in power from a few kWs to 6MW or more today, placing far higher demands on turbine lubrication. Heavier duty cycles leading to increased bearing and gearbox loadings, and accessibility problems associated with service and repair all require specific solutions. With the added need to reduce dependence on fossil fuels, and extend the cost-competitiveness of wind energy against conventional energy sources, the reliable operation of all equipment has never been more important.

Gearbox and bearing lubrication is particularly challenging due to the complexity of the gearbox and the high mechanical loads that are experienced. Gearbox and bearing problems are a common cause of costly downtime.

At Castrol, we have focused on all lubrication areas of your wind turbine, using proven applications expertise and advanced products to deliver solutions that provide reliable and economical performance. Working with key component manufacturers, we can better understand and deliver on the technical demands of the industry, pioneering innovative technology for the future.
A COMPLETE SOLUTION DESIGNED AROUND WIND TURBINES:

WE CAN EXTEND UPTIME THROUGH CONSISTENCY IN LUBRICATING CRITICAL COMPONENTS

- With careful product selection and extensive testing against OEM and turbine manufacturers’ specifications we can lessen customer risks from product trials and lubricant changeovers.
- We understand the need for the strictest levels of quality control and cleanliness to provide consistent and predictable product performance.
- We can provide global consistency in supporting all aspects of our solution from product availability and support services to best practice transfer.

WE CAN INCREASE EFFICIENCY AND IMPROVE ECONOMIC COMPETITIVENESS AGAINST OTHER ENERGY SOURCES

- We can reduce friction and minimise energy losses across a range of operating conditions through the use of synthetic lubricants with friction-modifying properties.
- By extending product life we can lower maintenance and servicing costs.
- By skilful application of lubricants we can ensure optimum performance without excessive lubricant use.

WE WILL WORK CLOSELY WITH RESEARCH AND DEVELOPMENT TO UTILISE ADVANCED TECHNOLOGY SOLUTIONS

- We engage with research, development and design engineers at major component manufacturers to understand future performance targets and work together towards solutions for tomorrow.
- We help keep the turbine manufacturer at the forefront of technology and ahead of competitors through on-going technological developments.
- We use our specialised test facilities to screen technologies and simulate specific operating conditions.

CASE STUDY

AUTOMATIC GENERATOR BEARING LUBRICATION

BY USING CASTROL LONGTIME PD 2 WITH SINGLE POINT LUBRICATORS, THE AMOUNT OF MAINTENANCE REQUIRED WAS CONSIDERABLY REDUCED. EACH BEARING WAS AUTOMATICALLY SUPPLIED WITH 0.64 CC EVERY 12 HOURS AND THE LUBRICANT CARTRIDGES ONLY HAD TO BE REPLACED EVERY SIX MONTHS. PREVIOUSLY, THE SAME COMPONENTS WERE RE-LUBRICATED MANUALLY EVERY THREE MONTHS USING A LEVER-TYPE HAND GUN.
CASE STUDY

100% increase in oil service life

Replacing a mineral-oil based product with Castrol Optigear Synthetic X 320 in a wind turbine gearbox resulted in a significant increase in oil-change intervals: the service life of the oil was increased by 100% from 18 months to 36 months.

CASE STUDY

STOP MICRO-PITTING DAMAGE

Both in tests and service use, Castrol Optigear Synthetic A and Castrol Tribol 1710 reliably stopped micro-pitting damage had been occurring. In some cases, the special plastic deformation additive technology incorporated in these products repaired the damaged surface.
A RANGE OF CHOICES

CASTROL OFFERS A DIVERSE RANGE OF HIGH-PERFORMANCE PRODUCTS FOR WIND TURBINES - MINIMISING MAINTENANCE WHILE MAXIMISING OPERATIONAL RELIABILITY.

OUR SERVICES:

• Oil analysis, e.g. viscosity, neutralisation number, contamination measurements
• Particle counting as a specialised test
• On-line access to your oil analysis data and trend analysis
• Used oil examination in mechanical/dynamic tests to verify the long-term characteristics
• Lubricators or small-scale central lubricating systems
• Customised training focusing on tribology, lubrication basics and applications

LUBRICATING MAIN BEARINGS

Castrol offers a complete range of greases and high-performance oils for lubricating highly loaded rolling element bearings. These are tailor-made for the operating conditions encountered in the main rotor bearing, ensuring sustained and reliable lubrication.

LUBRICATING GENERATOR BEARINGS

Improved operational reliability and optimised lubricating performance can be achieved by using Castrol rolling element bearing greases that are approved by generator manufacturers. Automatic lubricators reduce maintenance work and simplify service interval planning.

LUBRICATING MAIN GEARS

A complete range of high-performance gear oils based either on mineral or various synthetic base stocks ensure optimised lubrication of your gearbox. Castrol’s high-performance oils combine high load carrying capacity with a low coefficient of friction, reducing wear and lowering in-service operating temperatures. They are also suitable for lubricating rolling element bearings.

CORROSION PREVENTIVES

Castrol’s comprehensive range of synthetic and mineral oil products provide better and more consistent protection against corrosion, reducing costly scrap and re-work.

ASSEMBLY

A broad range of assembly, screw, and high-temperature pastes cover all applications during assembly, operation and maintenance of wind turbines.
**PRODUCTS AND APPLICATION AREAS**

**CASTROL’S OILS AND GREASES ARE DESIGNED FOR EVERY PURPOSE.**

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>BASE OIL</th>
<th>ANTI-WEAR ADDITIVES</th>
<th>ISO VG</th>
<th>TEMPERATURE APPLICATION RANGE °C</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASTROL OPTIGEAR SYNTHETIC X</td>
<td>PAO</td>
<td>MFT 2</td>
<td>100 - 680</td>
<td>-30 to + 95</td>
<td>New fully synthetic gear oil for cylindrical, bevel gears and planetary gears, for the main gear of wind power plants, as well as for oil-lubricated rolling bearings.</td>
</tr>
<tr>
<td>CASTROL OPTIGEAR SYNTHETIC A*</td>
<td>PAO</td>
<td>MFT</td>
<td>100 - 320</td>
<td>-30 to + 95</td>
<td>Fully synthetic gear oil, highly suitable for wind energy sector, use in sliding and rolling bearings, industrial gears at high temperatures and under high mechanical loads.</td>
</tr>
<tr>
<td>CASTROL TRIBOL 1710*</td>
<td>MINERAL OIL/PAO</td>
<td>TGOA</td>
<td>220 - 460</td>
<td>-30 to + 95</td>
<td>Partially-synthetic gear oil with special high-performance additives for wind-power gears but also suitable for other industrial areas.</td>
</tr>
<tr>
<td>CASTROL TRIBOL BIO TOP 1418*</td>
<td>ESTER</td>
<td>EP/AW</td>
<td>150 - 460</td>
<td>-25 to + 90</td>
<td>Biodegradable high-performance gear oil based on synthetic esters, used in gears, rolling and sliding bearings, as well as in revolving equipment, oil sump temperature to +90°C, CEC L-33- A94&gt;80%.</td>
</tr>
<tr>
<td>CASTROL TRIBOL 1100</td>
<td>MINERAL OIL</td>
<td>TGOA</td>
<td>68 - 1500</td>
<td>-20 to + 90</td>
<td>Modern cylindrical and worm gear pairs, rolling and sliding bearings, revolving equipment, oil-sump temperature under high mechanical loads to +90°C.</td>
</tr>
<tr>
<td>CASTROL OPTIGEAR BM</td>
<td>MINERAL OIL</td>
<td>MFT</td>
<td>68 - 1500</td>
<td>-10 to + 90</td>
<td>Spur and bevel gear units, even under severe operating conditions, worm gear units, rolling and sliding bearings, gear couplings, circulating systems.</td>
</tr>
<tr>
<td>BP BARTRAN HV 32</td>
<td>MINERAL OIL</td>
<td>ZINC-FREE</td>
<td>32</td>
<td>-20 to + 80</td>
<td>Severely stressed hydraulic systems requiring a high level of anti-wear performance or ultra fine filtration.</td>
</tr>
</tbody>
</table>

*Note:* Not all products may be available in every region.

**OILS**

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>ISO VG</th>
<th>TEMPERATURE APPLICATION RANGE °C</th>
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<tbody>
<tr>
<td>MFT</td>
<td>100 - 680</td>
<td>-30 to + 95</td>
</tr>
<tr>
<td>MFT 2</td>
<td>100 - 320</td>
<td>-30 to + 95</td>
</tr>
<tr>
<td>TGOA</td>
<td>220 - 460</td>
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</tr>
</tbody>
</table>

**ADDITIVES**

- MFT = MicroFlux Trans
- MFT 2 = Second Generation Microflux Trans
- TGOA = Tribol Grease and Oil Additive
- EP = Extreme Pressure
- AW = Anti-Wear
- PAO = Poly Alpha Olefin
- Zinc-Free

**APPLICATION**

- New fully synthetic gear oil for cylindrical, bevel gears and planetary gears, for the main gear of wind power plants, as well as for oil-lubricated rolling bearings.
- Fully synthetic gear oil, highly suitable for wind energy sector, use in sliding and rolling bearings, industrial gears at high temperatures and under high mechanical loads.
- Partially-synthetic gear oil with special high-performance additives for wind-power gears but also suitable for other industrial areas.
- Biodegradable high-performance gear oil based on synthetic esters, used in gears, rolling and sliding bearings, as well as in revolving equipment, oil sump temperature to +90°C, CEC L-33- A94>80%.
- Modern cylindrical and worm gear pairs, rolling and sliding bearings, revolving equipment, oil-sump temperature under high mechanical loads to +90°C.
- Spur and bevel gear units, even under severe operating conditions, worm gear units, rolling and sliding bearings, gear couplings, circulating systems.
- Severely stressed hydraulic systems requiring a high level of anti-wear performance or ultra fine filtration.
CASE STUDY

OUTSTANDING BEARING PROTECTION
INVESTIGATIONS ON ROLLER-BEARING TEST STANDS DEMONSTRATED THAT CASTROL OPTIGEAR SYNTHETIC X OFFERS OUTSTANDING WEAR PROTECTION WITH VARIOUS DEGREES OF LUBRICATION. FURTHERMORE, IT HAS AN EXTREMELY LOW TENDENCY TO FORM AGGRESSIVE, INSOLUBLE AGEING PRODUCTS. THESE ARE JUST TWO REASONS WHY LEADING BEARINGS MANUFACTURERS RECOMMEND CASTROL OPTIGEAR SYNTHETIC X FOR LUBRICATING WIND TURBINE GEARS.

GREASES

<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>BASE OIL</th>
<th>THICKENER/ SOAP-BASE</th>
<th>NLGI-GRADE</th>
<th>ISO VG</th>
<th>TEMPERATURE APPLICATION RANGE °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASTROL LONGTIME PD 2</td>
<td>MINERAL OIL</td>
<td>LITHIUM-12- HYDROXYSTEARATE</td>
<td>2</td>
<td>100</td>
<td>-35 to + 140</td>
</tr>
<tr>
<td>CASTROL TRIBOL 4020</td>
<td>MINERAL OIL</td>
<td>LITHIUM COMPLEX</td>
<td>1, 2</td>
<td>220, 460</td>
<td>-30 to + 150</td>
</tr>
<tr>
<td>CASTROL TRIBOL 3020/1000*</td>
<td>MINERAL OIL</td>
<td>LITHIUM</td>
<td>000, 00, 0,1,2</td>
<td>1000</td>
<td>-40 to + 120</td>
</tr>
<tr>
<td>CASTROL OPTIPIT</td>
<td>MINERAL OIL</td>
<td>LITHIUM-12- HYDROXYSTEARATE</td>
<td>2-3</td>
<td>1350</td>
<td>-10 to + 140</td>
</tr>
<tr>
<td>CASTROL MOLUB-ALLOY 538/680-1*</td>
<td>MINERAL OIL</td>
<td>MIXED SOAP</td>
<td>0</td>
<td>1660</td>
<td>-15 to + 100</td>
</tr>
<tr>
<td>CASTROL OPTITEMP TT1*</td>
<td>SYNTHETIC OIL</td>
<td>ORGANIC/ INORGANIC</td>
<td>1</td>
<td>15/22</td>
<td>-60 to + 120</td>
</tr>
<tr>
<td>CASTROL MOLUB-ALLOY 3038/680-1*</td>
<td>MINERAL OIL</td>
<td>LITHIUM</td>
<td>1</td>
<td>680</td>
<td>-20 to + 120</td>
</tr>
</tbody>
</table>

APPLICATION

- High-performance grease with MFT technology (plastic deformation) for high-speed rolling and sliding bearings or those subjected to high mechanical loads.
- Sliding and rolling bearings, medium and high mechanical load conditions, water resistant, permanent temperature up to +150°C (short-term +160°C).
- Rolling and sliding bearings at low speeds, gears that are not oil-tight, general grease lubrication.
- Adhesive grease for rolling and sliding bearings with MFT, very high base oil viscosity, especially suitable for large units with low peripheral speeds in damp, dusty environments, as well as for open gears.
- Adhesive lubricant with solid lubricants (incl. molybdenum disulphide MoS₂) under high mechanical loads and at low speeds, water-resistant, sprayable and solvent-free.
- Low-temperature grease, can be used at temperatures as low as -60°C due to a special grease thickener and a low viscosity synthetic base oil. Used for long-term lubrication at high speeds or where large temperature differences exist.
- Rolling and sliding bearings at low speeds and high loads or shock loads under unfavourable ambient conditions. The shear-stable thickener has an excellent sealing effect.

Note:* Not all products may be available in every region.