



Forward at every turn

Introducing Castrol's suite of advanced products, solutions and expertise, engineered to help your wind business move forward at every turn.

Use the navigation at the top of each page to explore.

For best user experience, please open this interactive PDF in full-screen mode in Adobe Acrobat. To navigate this document, use your up and down arrows, swipe left and right, or click on the navigation bar above. This document can be opened in a web browser, but the experience may be compromised.

Castrol and bp around the world



- No. 1 wind lubricant provider in wind¹
- Sold in over 120 countries
- By over 550,000 customers
- To over 200 million consumers
- Across Automotive, Metal Manufacturing, Wind Energy, Aerospace and Mining

- bp aims to be a world leader in offshore wind, safely developing and operating a multi-gigawatt global pipeline over the next decade.
- And we are on track to deliver:
 - an offshore wind pipeline of 9.6GW net
 - 1.7GW onshore wind capacity in the US



 Key Castrol technology centres  Head offices

¹ Kline Wind Lubricants Report 2023

Answering the three core needs of wind industry businesses

Castrol is chosen by leading turbine manufacturers for first fill when their machines go out to market. We are the trusted supplier for thousands of wind farms across the globe, not just for the warranty period, but for the entire working life. That's due to our deep understanding of three core needs for wind operators...

1 Lowering LCOE

Lowering the levelised cost of energy to make your business more profitable today and tomorrow.

2 Reducing downtime

Tackling heat, wear, and unplanned maintenance, to optimise efficiency in the field.

3 Filling the skills gap

Nurturing and training a new generation of experts and advocates in the wind industry.

The Castrol pathways to wind industry success

Advanced products

Fighting friction, corrosion and wear as the application demands, to optimise performance and efficiency, while helping extend asset and tool life.



New efficiencies

By automating the collection of data, we can offer actionable insights that aid decision-making linked to lubrication maintenance. Helping cut downtime, boost productivity and unlock value.



Shared expertise

Sharing knowledge through expert technical advice, training and dedicated onsite support to help your operations run smoothly and efficiently.

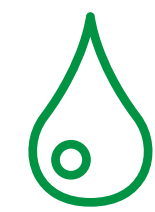


More circularity

With a circularity-first mindset, we want to support your business and help accelerate progress towards a sustainable future.



The Castrol pathways to wind industry success



Advanced products

- Castrol Optigear Synthetic CT 320
- Castrol Optigear Synthetic X 320
- Castrol Optigear Synthetic CT 320 AD
- Castrol Tribol GR SW 460-1 / 680-1
- Castrol Tribol grease in Hove Cartridges
- Castrol Hyspin AWH-M 32 Superclean
- Castrol Spheerol LC 2 NG
- Castrol PD Technology
- The Lubricant Oracle



Shared expertise

- Engineering & monitoring services
- Wind Academy
- Virtual Engineer



New efficiencies

- Hove Cartridges
- Virtual Engineer



More circularity

- Path 360





Advanced products

Fighting friction, corrosion and wear as the application demands, to optimise performance and efficiency, while helping extend asset and tool life.

Castrol. High performing lubricants for the wind industry.

Chosen by leading manufacturers for first fill. Trusted by owners, operators and engineers over the entire working life of a turbine.



Gearbox oils

Protection that optimises efficiency for less downtime

- Castrol Optigear Synthetic X 320
- Castrol Optigear Synthetic CT 320



Oil life extension

For large wind farms, our booster could save millions¹ of dollars in maintenance costs every year

- Castrol Optigear Synthetic X 320 AD



Grease

Protecting your wind turbine's critical components

- Castrol Tribol GR 1350-2.5PD
- Castrol Tribol GR SW 460-1
- Castrol Tribol GR SW 680-1
- Castrol Tribol GR 100-2 PD

Castrol Optigear Synthetic X 320

Enhance energy efficiency by up to 1% and save **\$3,700** per year per wind turbine

Castrol Optigear Synthetic X 320 AD

Cuts downtime and delivers¹

\$215,000 saved

Eliminating just one oil exchange over the life of a turbine saves at least **\$4,300²** per turbine.

The supermajor has topped up 50 turbines with Castrol Optigear Synthetic X 320 AD.

4 hour

shutdowns avoided

Removing the need to change the oil means the turbine can remain operational and avoid the usual downtime of **4 hours**.

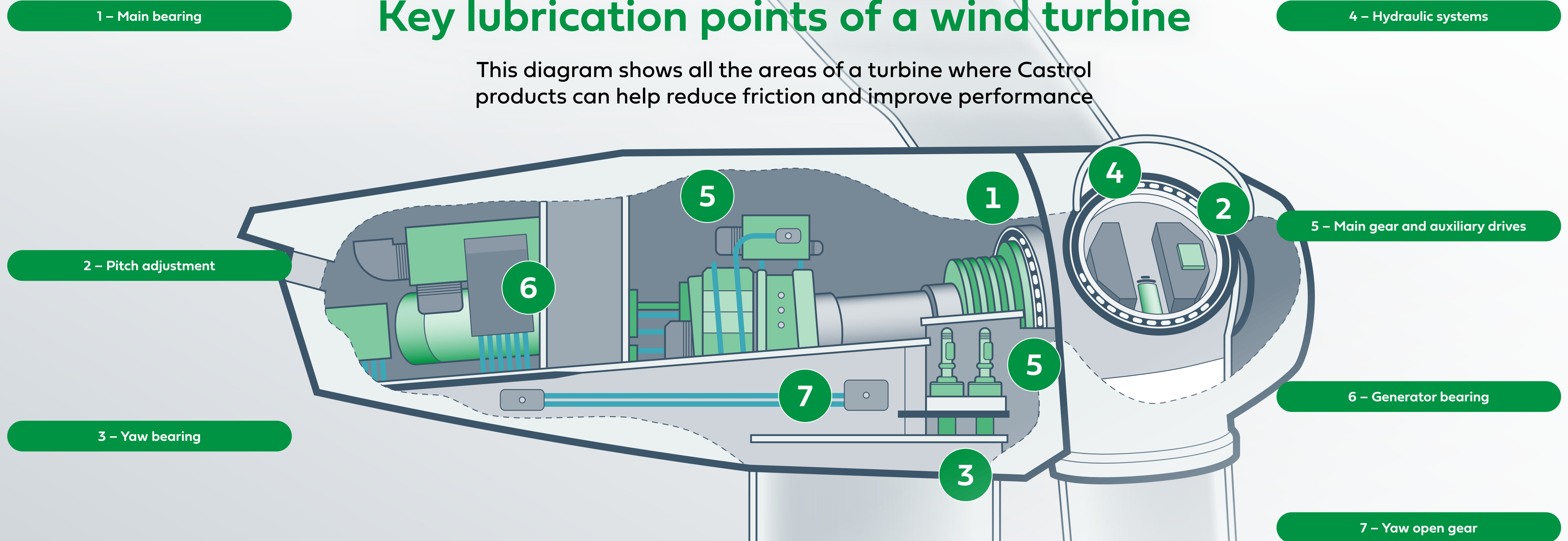
¹ Field case study with tier one wind turbine OEM manufacturer. Details of the case are available on request

² Kline: Wind Turbines report 2022

³ Based on Castrol Optigear Synthetic X 320 AD being used on the top-up of 50 turbines to date, each turbine can save \$4,300 through elimination of oil change (significantly more for offshore farms). Calculated in UK trial with major wind OEM in 2017. Data approved and verified.

Key lubrication points of a wind turbine

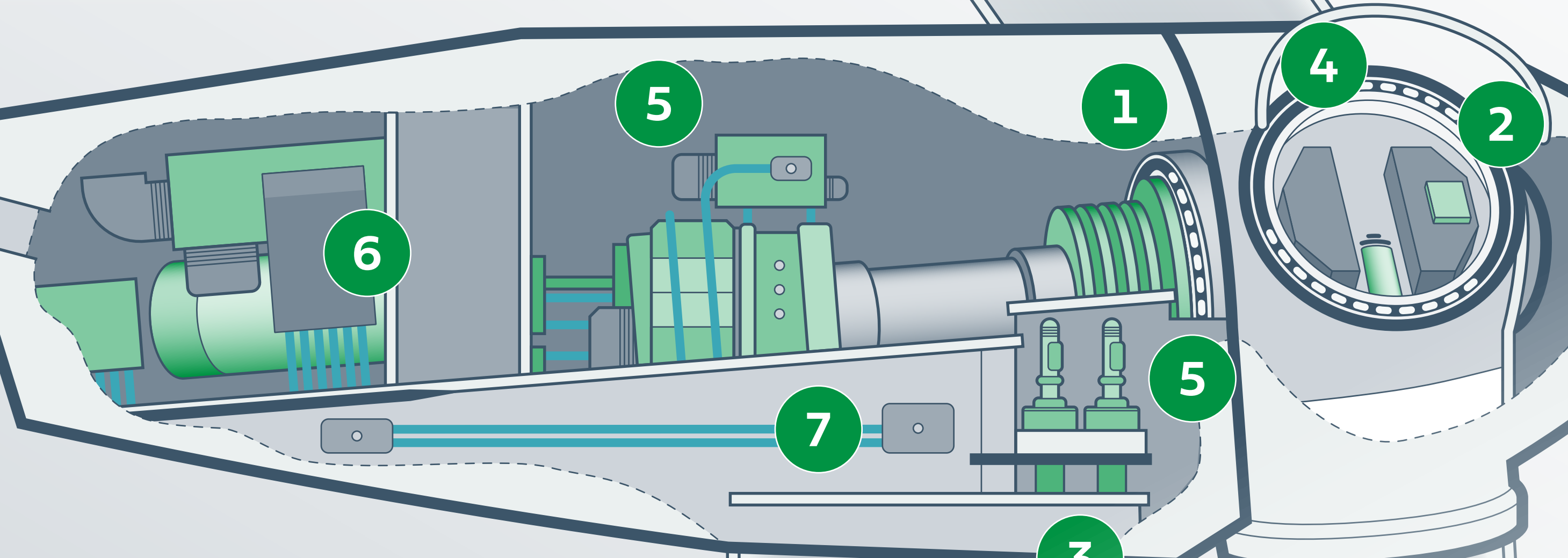
This diagram shows all the areas of a turbine where Castrol products can help reduce friction and improve performance



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Key lubrication points of a wind turbine

This diagram shows all the areas of a turbine where Castrol products can help reduce friction and improve performance



1 – Main bearing

[Castrol Spherol LC 2 NG](#)

[Castrol Optigear Synthetic X 320](#)

[Castrol Optigear Synthetic CT 320](#)

[Castrol Tribol GR SW 460-1](#)

[Castrol Tribol GR SW 680-1](#)

2 – Pitch adjustment

[Castrol Tribol GR SW 460-1](#)

[Castrol Tribol GR SW 680-1](#)

[Castrol Spherol LC 2 NG](#)

3 – Yaw bearing

[Castrol Tribol GR 1350-2.5 PD](#)

[Castrol Tribol GR SW 460-1](#)

[Castrol Tribol GR SW 680-1](#)

4 – Hydraulic systems

[Castrol Hyspin AWH-M 32 Superclean](#)

[Castrol Hyspin AWH-M 32](#)

[Castrol Hyspin HVI 32](#)

[Castrol Brayco 717](#)

5 – Main gear and auxiliary drives

[Castrol Optigear Synthetic X 320](#)

[Castrol Optigear Synthetic CT 320](#)

[Castrol Optigear Synthetic A 320](#)

6 – Generator bearing

[Castrol Tribol GR 100-2 PD](#)

[Castrol Tribol GR 4541 HT](#)

7 – Yaw open gear

[Castrol Tribol GR 1350-2.5 PD](#)

[Castrol Molub-Alloy OG 936 SF Heavy](#)

[← Back to wind turbine](#)

[Document link](#) [External link](#)

Availability subject to market

Product highlights

Castrol Optigear Synthetic CT 320

Robust gear protection that optimises efficiency for less downtime

A premium synthetic oil for wind turbine gears operating in wide temperature ranges and under high loads. It delivers robust surface protection and reduces gear friction. Tested and proven in both the lab and field by customers and independent experts, it gives wind farm operators control over their levelised cost of energy.

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Castrol Optigear Synthetic CT 320 helps wind operators reduce their levelised cost of energy through:

Less Downtime

Through greater resistance to gearbox breakdown, simplified maintenance.

Greater efficiencies

Reduced foam and heat means less wear on the gearbox and makes energy generation more efficient.

Product highlights - Features

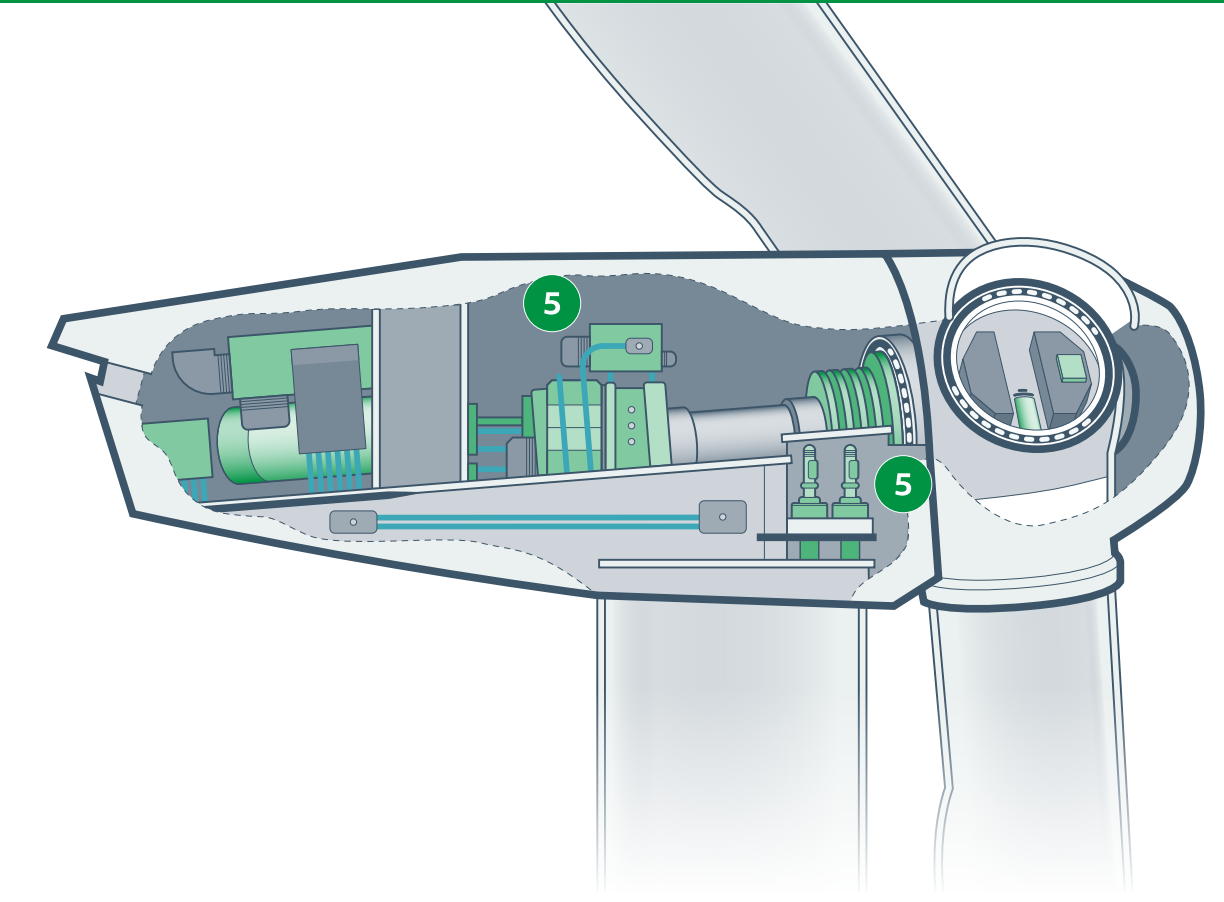
Castrol Optigear Synthetic CT 320

Key features

- Formulated with advanced 'ashless' technology that is proven to run up to 8°C cooler¹, providing consistent wear protection for many years of effective oil life².
- Tests have proven it generates up to 28% less foam³ than competitors.
- Lower water content than competitors resulting in an extended Relative Bearing Life.

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¹ Sincro Mecánica WindOilEvaluation 2016.
² 8-year customer field inspection (USA, 2017).
³ 3-year field trial – 2013.



Lubrication points:

- 5 – Main gear and auxiliary gear drives

Key information

- Suited for high capacity wind turbine gears
- Has a wide operating range
- Often chosen by operators with mixed wind turbine fleets or complex maintenance schedules
- Approved by multiple OEMs

[See OEMs table](#)

Product highlights

Castrol Optigear Synthetic X 320

Unique gear protection that optimises efficiency for less downtime

A premium synthetic oil for wind turbine gears operating in wide temperature ranges and under high loads. It delivers best-in-class surface protection and reduces gear friction.

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Castrol Optigear Synthetic X 320 has proven to enhance energy efficiency by up to 1%:

More revenue

In a typical scenario, 1% higher efficiency means ~ **\$3,700** of added turnover per year per turbine. Over lifetime of a turbine (25 years), this means near **\$100,000** of added revenue per turbine.

Ultimate protection

Less friction reduces heat and wear, providing greater resistance to gearbox breakdown.

Product highlights - Features

Castrol Optigear Synthetic X 320

Key features

- Tested and proven in both the lab and field by customers and independent experts.
- Formulated with Castrol's Plastic Deformation (MFT-PD) technology which is proven to give 30%¹ less friction and superior surface protection compared to other commercially available wind gear oils. This reduces critical gearbox stress, operating temperatures and wear², allowing bearings to emerge from tough qualification tests as good as new³.
- Can significantly slow down⁴ any further damage in pre-micropitted gears, reducing critical gearbox stress.

Find out more about [Castrol PD Technology](#)

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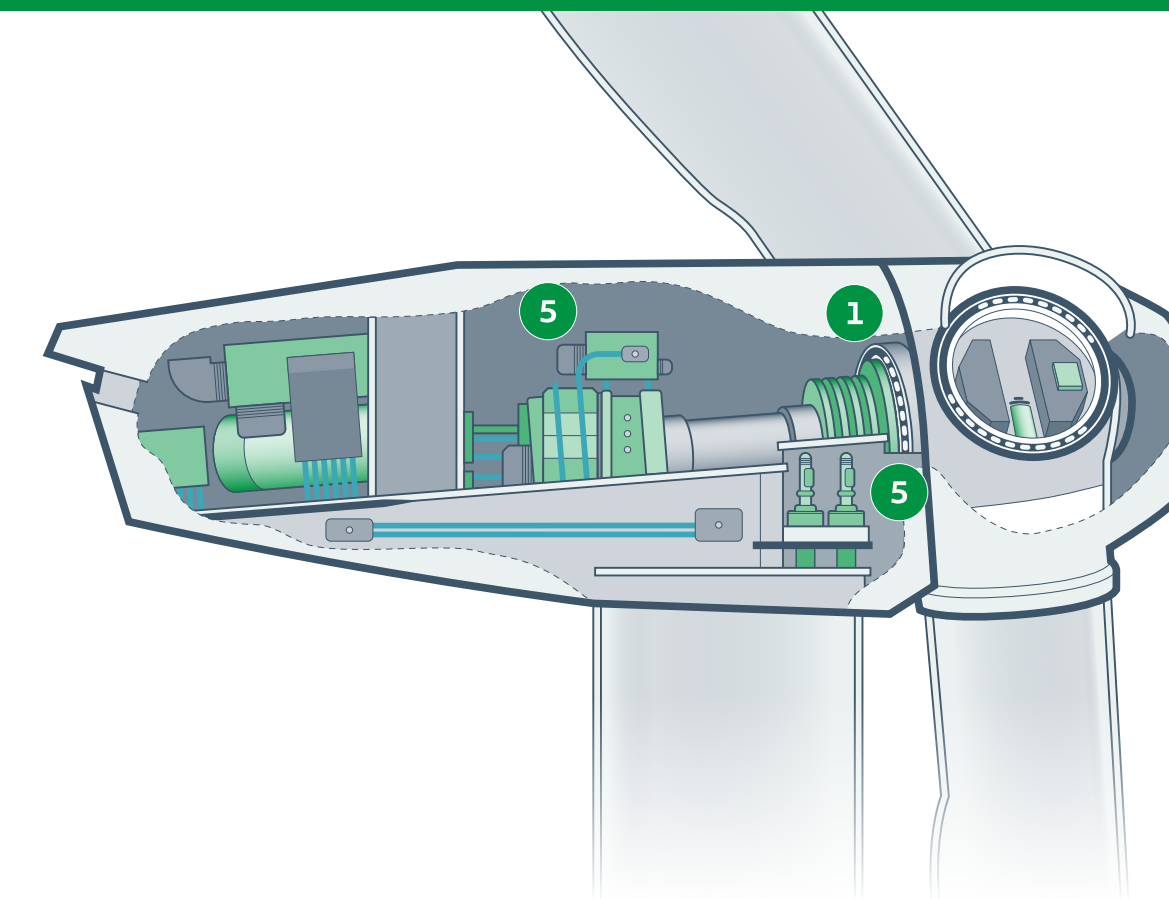
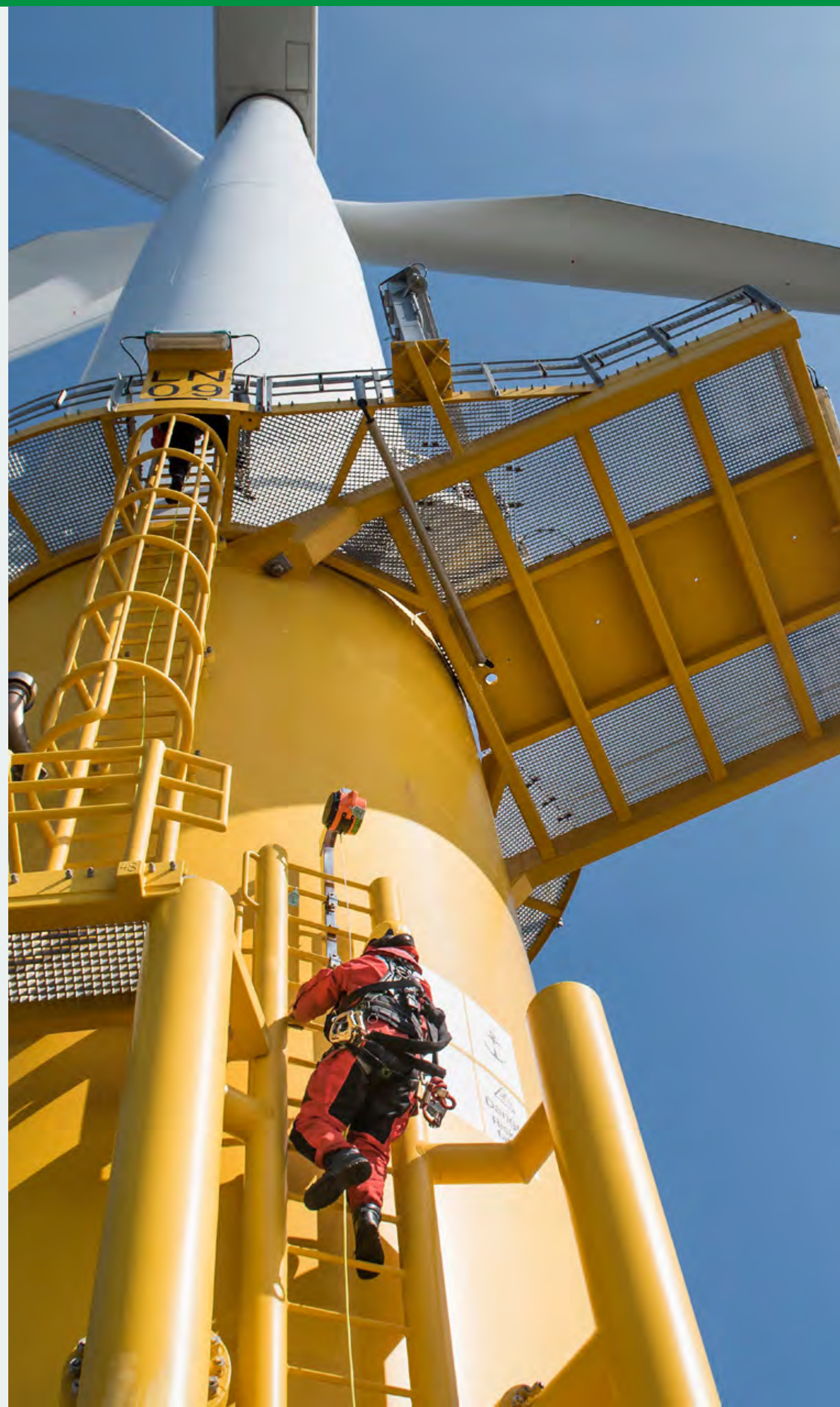
¹ The SRV friction (5ae) Test, 2016/2017.

² Sincro Mecánica Wind Oil Evaluation 2016.

³ After 7 years field experience:

FE8 - Roller bearing wear test for lubricating oils according DIN 51 819-3 (D-75/90-80) in 2016.

⁴ Source: FZEG Micropitting test 2010



Lubrication points:

1 – Main bearing

5 – Main gear and auxiliary gear drives

Key information

- Suited for high capacity wind turbine gears
- Compatible with Castrol Synthetic X 320 AD to extend oil life
- Approved by multiple OEMs

[See OEMs table](#)

Product highlights

Oil life extension with Castrol Optigear Synthetic X 320 AD

Reduce levelised cost of energy even further

Oil condition depletion in turbines can cause problems for energy operators. The need for oil changes presents challenging maintenance issues, but by extending the useful life of Castrol Synthetic X 320 beyond current expected service levels with our unique booster pack, wind operators can not only add financial value, it lowers the HSSE risk associated with oil changes.

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Our booster pack has been called 'a game changer for the wind industry' and will help deliver real benefits to your business:

Increase revenue

Eliminating just one oil exchange over the life of a turbine can save at least **\$4,300¹** per turbine, and, removing the need to change the oil means the turbine can remain operational and avoid the usual downtime of up to 4 hours.

Ultimate protection

Less friction reduces heat and wear, providing greater resistance to gearbox breakdown.

¹ Calculated in UK trial with major wind OEM in 2017. Data approved and verified.

Product highlights - Features

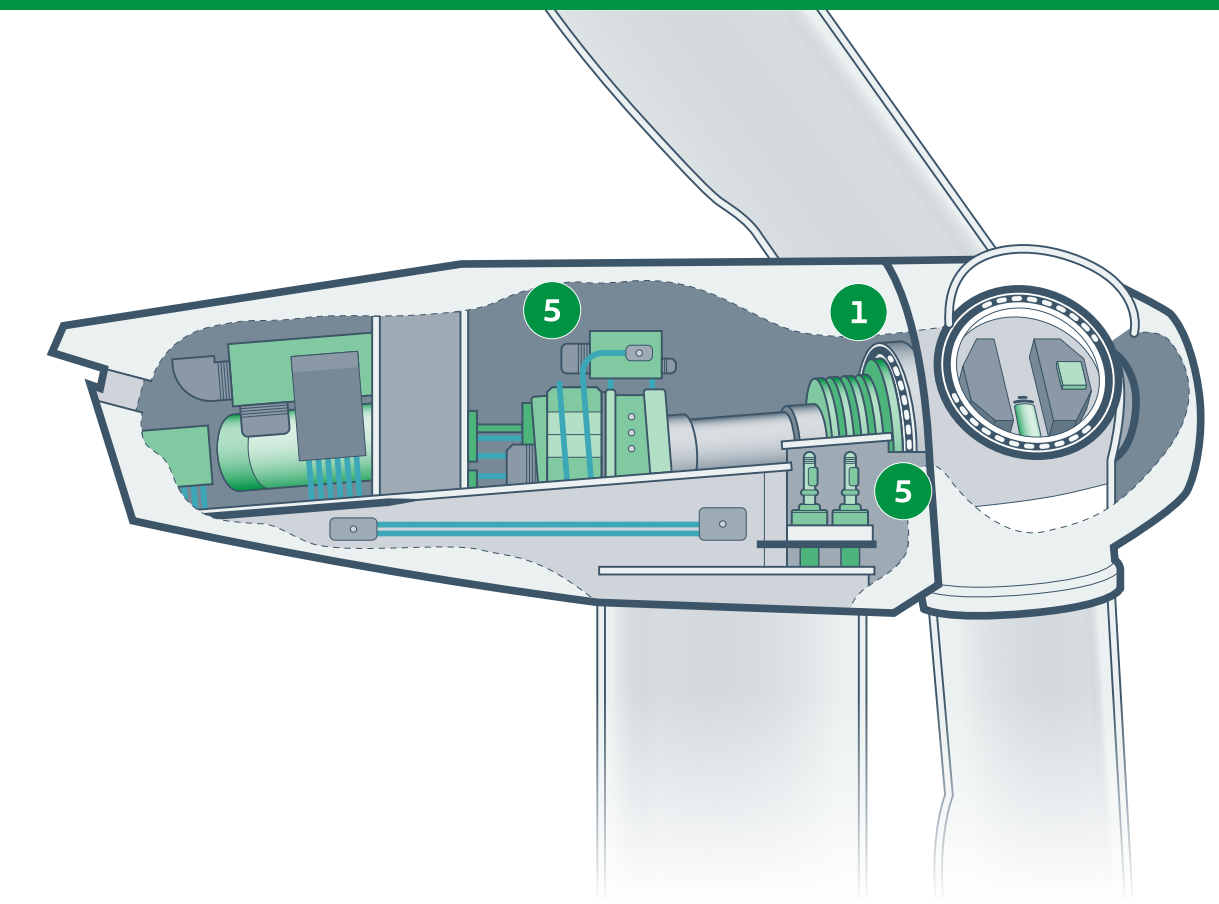
Oil life extension with Castrol Optigear Synthetic X 320 AD

Key features

- Formulated with Plastic Deformation (PD) technology, which creates a protective layer on metal surfaces to reduce micropitting and wear, and potentially prolongs bearing life.
- PD technology has extremely low coefficient of friction even. Under severe load, components of PD are activated, initiating an improvement of surface friction characteristics through plastic deformation.
- Reduces critical gearbox stress, operating temperatures and wear.
- Significantly reduces further damage in pre-micropitted gears.

Find out more about [Castrol PD Technology](#)

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Lubrication points:

- 1** – Main bearing
- 5** – Main gear and auxiliary gear drives

Key information

- Suited for high capacity wind turbine gears
- Can be simply added to gearbox oil Castrol Optigear Synthetic X 320 to replenish additives and ensures longer life from the oil
- Approved by multiple OEMs

[See OEMs table](#)

Product highlights

Castrol Tribol GR SW 460-1 Castrol Tribol GR SW 680-1

Protecting your wind turbines critical components

Castrol Tribol greases are formulated to meet the many challenges Wind Turbine Main Bearings, Pitch and Yaw Bearings face in tough environmental conditions. Both adapt to offer outstanding bearing protection under high loads at low to moderate speeds and in applications where water resistance is critical.

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Adaptive protection for improved equipment reliability:

Reduce downtime + maintenance costs

Due to reduced wear, rust and corrosion and extended service life with longer intervals between re-lubrication.

Increase bearing life

Due better wear control from axial thrust, reduced pitting risk due to low coefficient of friction.

Easy be converted to

Tribol GR SW 680-01 is compatible with Mobil® SHC 681 WT and all major grease products on the market, making conversion easy¹.

¹ Confirmed by Independent ASTM testing that the introduction of Castrol® Tribol® with existing manufacturer's grease will not cause a deterioration in performance.

Product highlights - Features

Castrol Tribol GR SW 460-1

Castrol Tribol GR SW 680-1

Key features

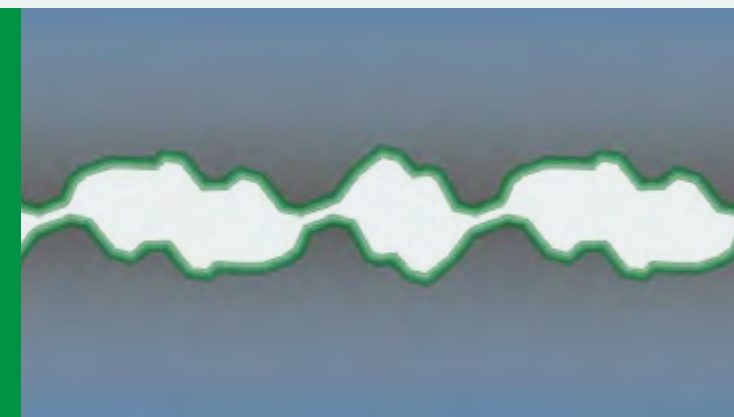
- Formulated with Plastic Deformation technology (PD), which creates a protective layer on metal surfaces to reduce micropitting and wear, and potentially prolongs bearing life.
- PD has extremely low coefficient of friction even. Under severe load, components of PD are activated, initiating an improvement of surface friction characteristics through plastic deformation.
- Help reduce wear from static vibration known as false brinelling and from sliding motion due to axial thrust. These are the most prominent failure modes in Wind Turbine main bearings.
- Under strict, independent criteria, Castrol Tribol GR SW 680-1 demonstrated superior wear protection over the Mobil® SHC 681 WT.

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Step 1

Protection

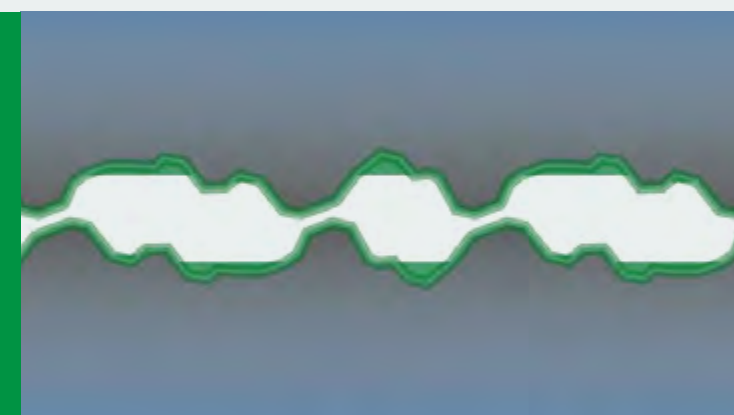
Protective layer forms immediately



Step 2

Compression

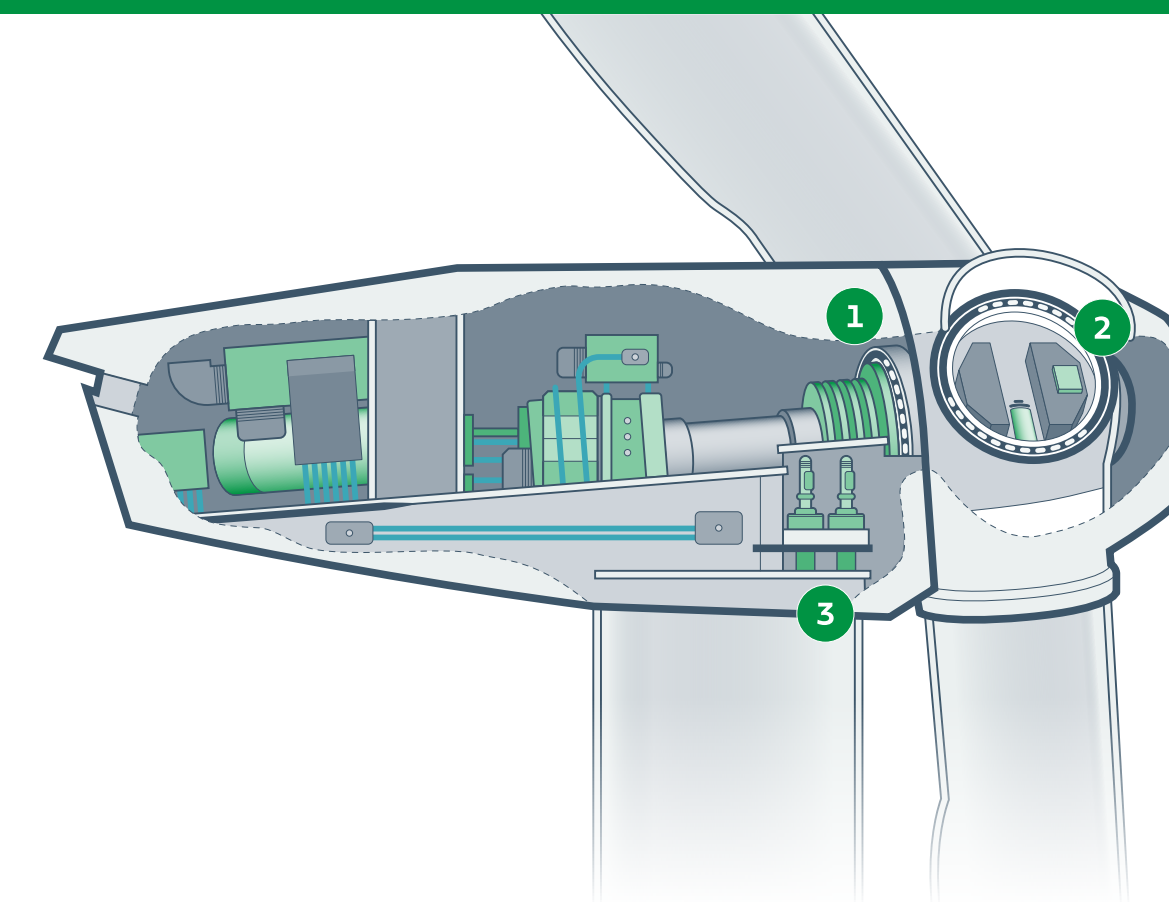
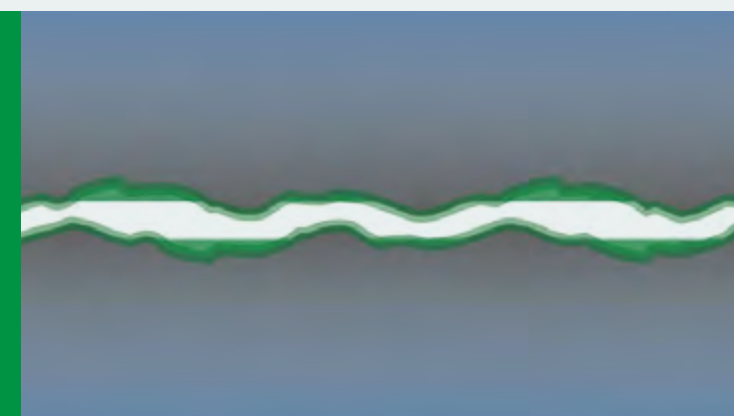
Protective layer compressed, reducing friction



Step 3

Micro-smoothing

Additives migrate into metal surface



Lubrication points:

- 1 – Main bearing
- 2 – Pitch adjustment
- 3 – Yaw bearing

Key information

- Tribol GR SW 680-1 is compatible with Mobil® SHC 681 WT
- Castrol Tribol grease is subject to availability
- Approved by multiple OEMs

Please talk to your Castrol representative to find out more

[See OEMs table](#)

Product highlights

Castrol Tribol grease in Hove Cartridges

Simplify bearing protection with Castrol Tribol greases and Hove lubrication technologies

Castrol's unique MicrofluxTrans Plastic Deformation technology (MFT PD) creates a protective layer on metal surfaces to reduce micropitting and wear, and potentially prolongs bearing life.

Castrol Tribol GR SW 460-1 is designed to meet the many challenges faced by wind turbines in tough environmental conditions – conditions where temperature and humidity can't be controlled, and where hard-to-reach locations result in long re-lubrication interval.

When used together with Hove advanced lubrication technologies, wind operators can unlock new maintenance efficiencies, keeping the machinery working at optimum efficiency, as well as increasing its operational life.

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¹ Based on data provided by Hove for 100 turbines over 5 years



Castrol Tribol greases and the Hove lubrication technologies will help wind operators:

Reduce downtime + maintenance costs

Automating traditionally manual tasks allows wind operators to save up to 1.5 hours per service visit, which can save up to 50% in labour costs for lubrication over 5 years¹.

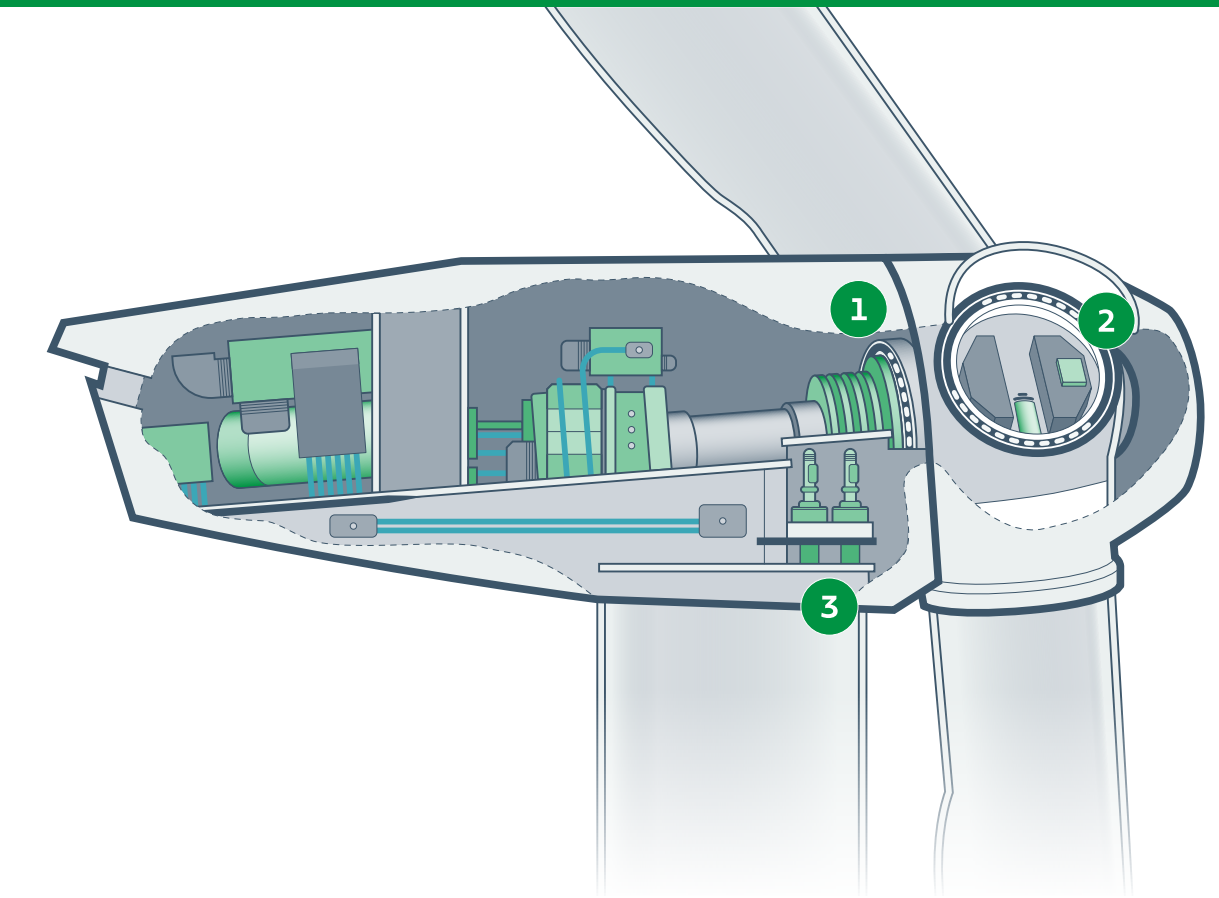
Castrol Tribol greases help reduce wear, rust and corrosion, while extending service life through longer intervals between re-lubrication.

Product highlights - Features

Castrol Tribol grease in Hove Cartridges

Hove lubrication technologies key features

- Hove Cartridges are designed for maximum durability and have been drop tested according to MIL-STD-810H w/Change 1 standard, as of May 18, 2022. Their compact design ensures easy installation and removal, streamlining your maintenance processes.
- When used with Hove pumps, operators can save up to 1.5 hours per service visit, significantly reducing manual errors and minimising the risk of contamination. With a variety of pumps available – whether you require high flow, high pressure, or both – Hove provides the right solution for your operational needs.

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Lubrication points:

- 1 – Main bearing
- 2 – Pitch adjustment
- 3 – Yaw bearing

Key information

- Castrol Tribol grease is approved by multiple OEMs
- Hove lubrication technologies are made to fit all grease points with custom hoses for specific WTG models

[See OEMs table](#)

Product highlights

Castrol Hyspin AWH-M 32 Superclean

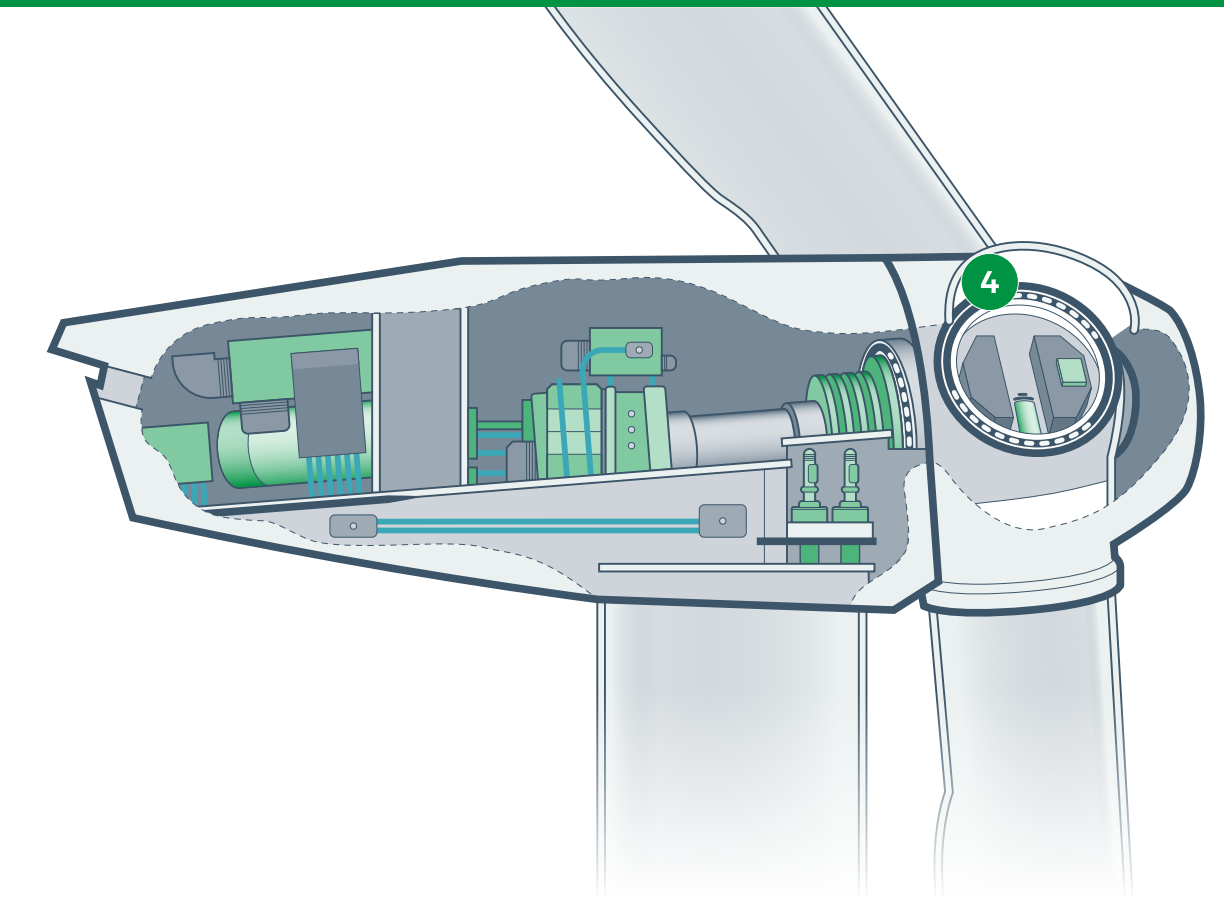
**Maximum quality,
minimum cost.**

A hydraulic oil that contains a shear stable additive system which helps maintain the viscosity characteristics of the product over a wide temperature range even during prolonged use and imparts a very low pour point which enables the product to be used in very cold environments. It exhibits excellent corrosion and wear protection as well as outstanding thermal and oxidative stability.

Key features & benefits

- High viscosity index with low pour point enables use over wide temperature range.
- Excellent anti-wear performance provides extended wear protection for hydraulic pumps, reduced downtime and saving on replacement part costs.
- Superior water separation provides prolonged lubricant life and increased equipment reliability.
- Cleaner system with less frequent filter change.

Type of system	Silt sensitive control system with very high reliability
Typical component	High performance servo valves
Sensitivity	Super Critical

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Lubrication points:

4 – Hydraulic systems

Meets the following industry standards:

- Filtered to ISO class 15 / 13 / 10
- DIN 51502 – HVLP
- ISO 6743 / 4
- Cincinnati Milacron P68
- Denison HF – 0
- US Steel 126 & 127
- Eaton (formerly Vickers) I-286-S & M-2950-S
- Bosch Rexroth RE90220

Product highlights

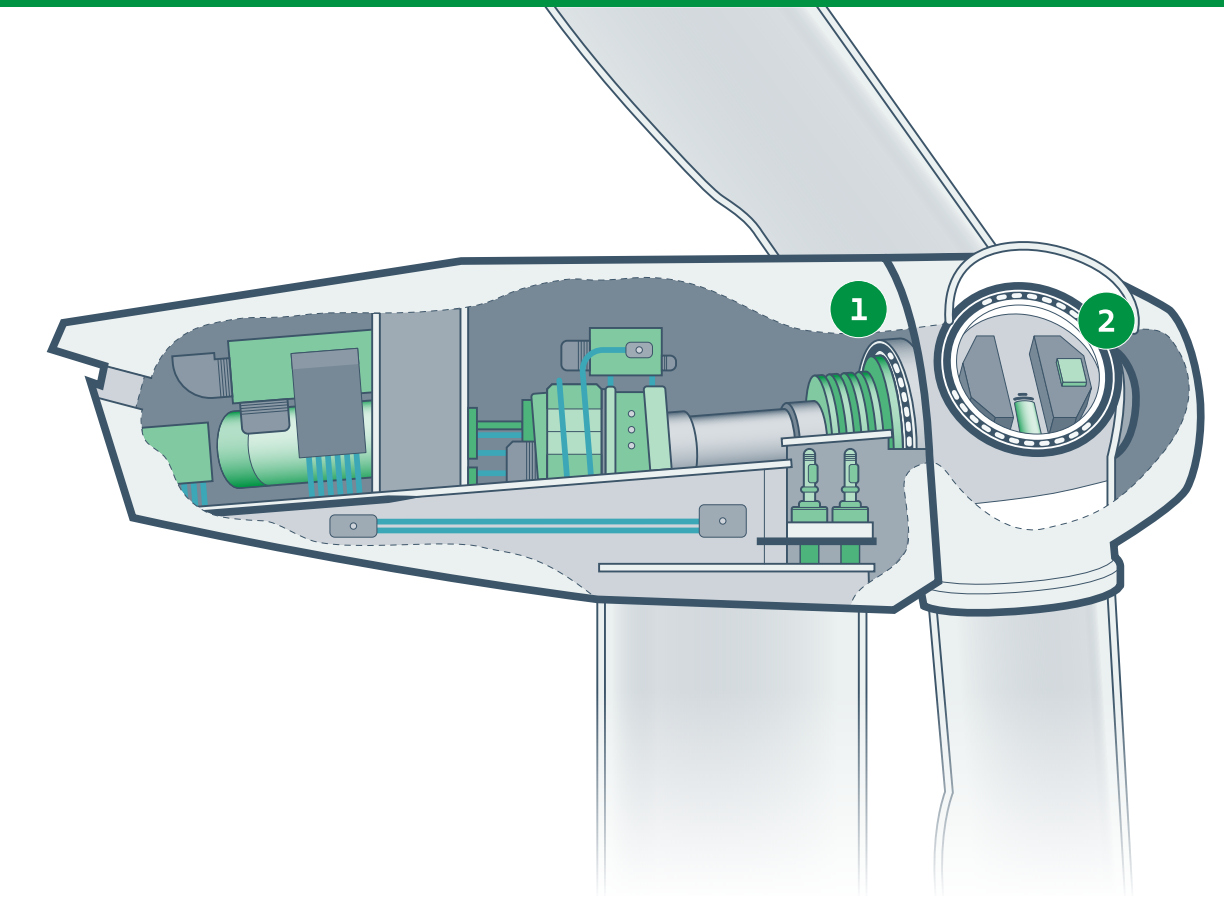
Castrol Sphero LC 2 NG

A long-term heavy-duty grease for the lubrication of bearings in Turbines. Based on lithium-calcium thickener and mineral oil. Specially selected additives provide an outstanding wear protection, excellent corrosion prevention and long-term lubrication properties for many different areas of operation.

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Key features & benefits

- **Excellent water resistance:**
the lubricating film is not washed off even in the presence of water. Outstanding anti-wear properties – protects equipment and helps minimise bearing wear.
- **Superior mechanical stability:**
helps reduce product consumption in high volume applications.
- **High dropping point:**
withstands breakdown in high temperature applications. Resists oxidation and prevents corrosive activity on bearings in aggressive process water environments.



Lubrication points:

- 1 – Main bearing
- 2 – Pitch adjustment

Castrol PD Technology

How PD Technology works and differentiates from conventional additive technology

Step 1:

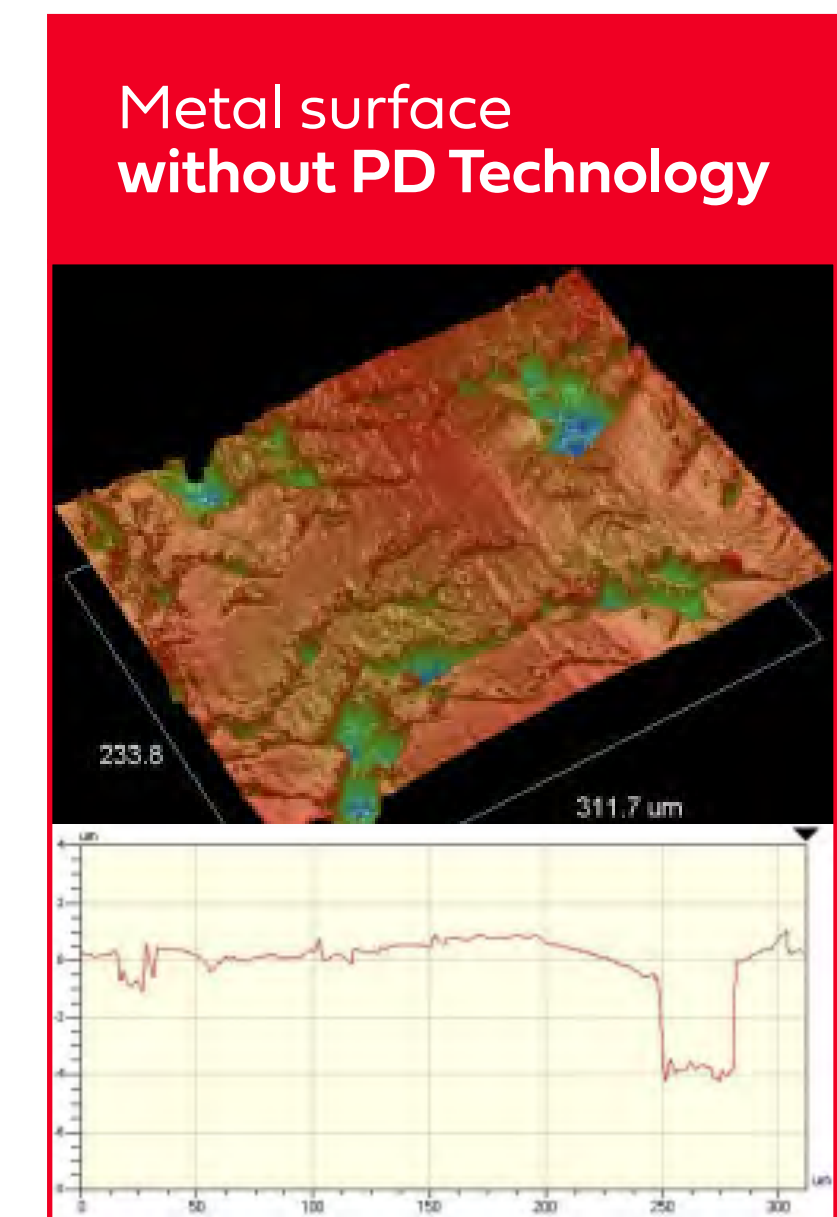
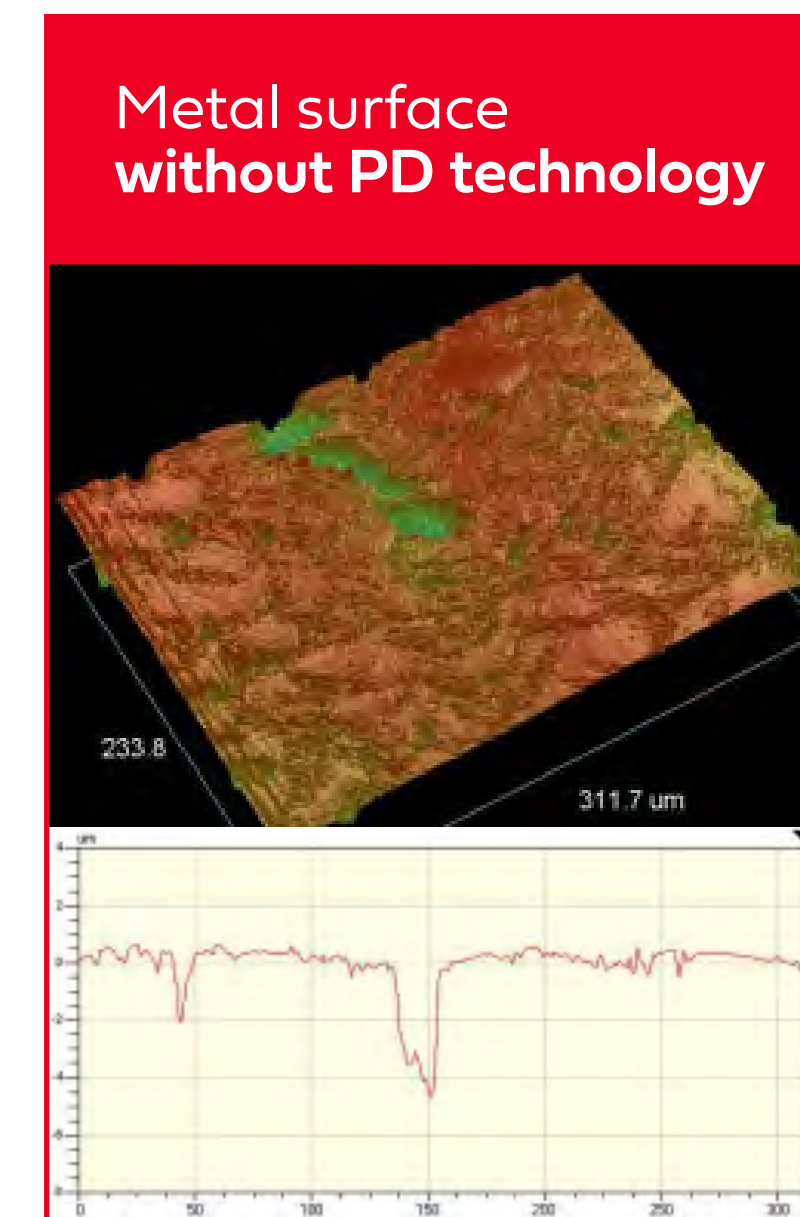
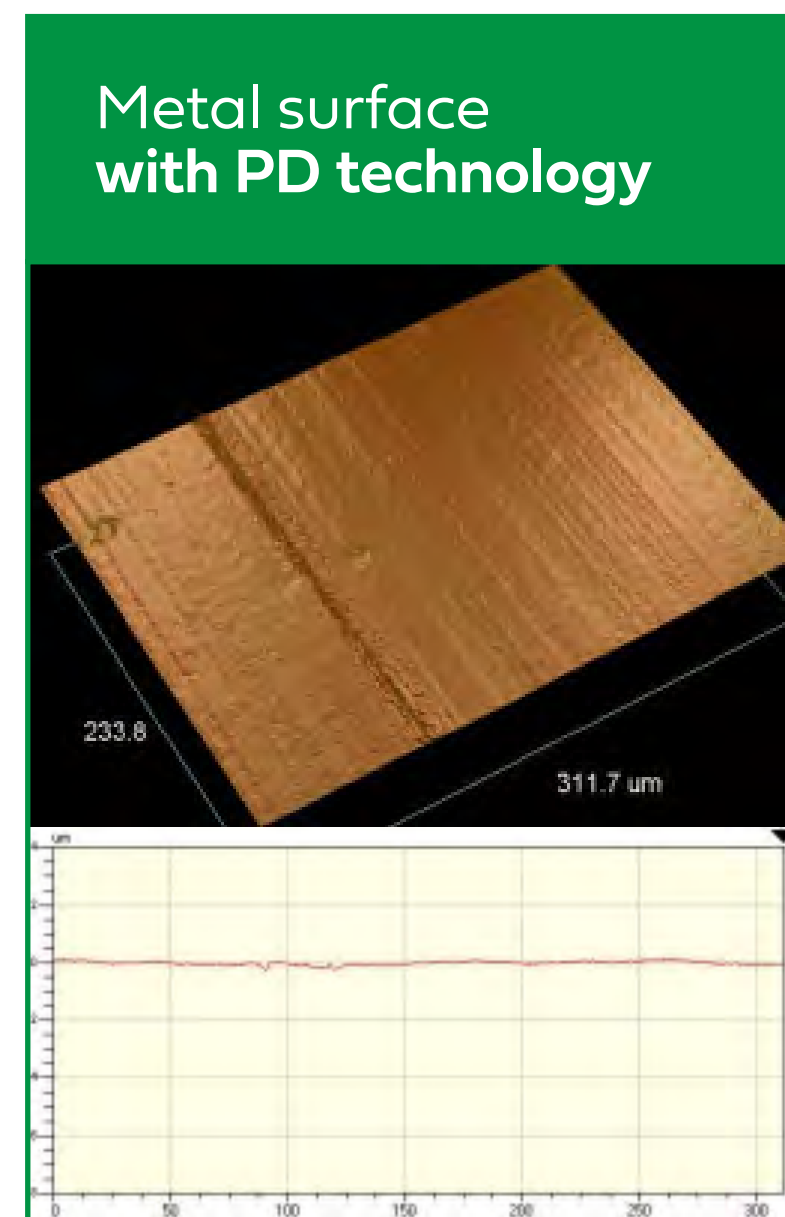
- Create a **lubricating protective layer**

Step 2:

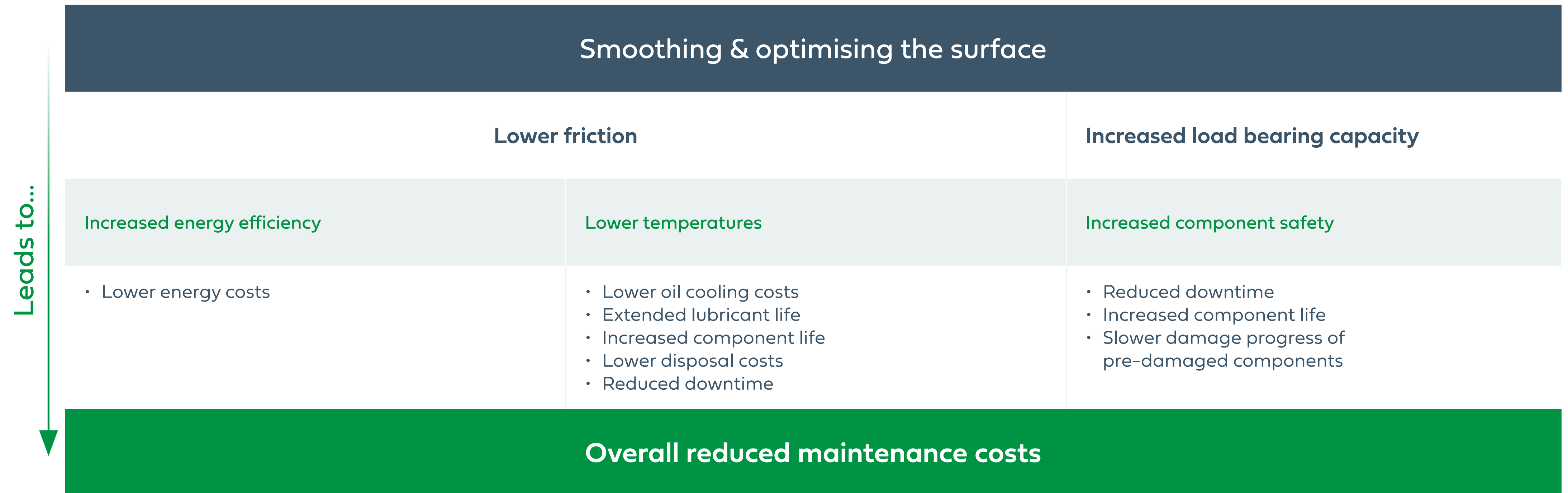
- **Compression** of the **protective layer** as the load increases

Step 3:

- **Additive components diffuse into** the structure of the **metal surface** at increasing load and result in a **surface smoothing reaction**
- Reaction products forming extremely **adhesive** and **slippery tribopolymers**
- When smoothing takes place, the 'peaks' of the surfaces push into the 'valleys' and thus lead to a load carrying capacity increase of **up to four times** and correspondingly **reduced friction**



Advanced technology that helps reduce maintenance costs¹



¹ PD Technology compared to conventional extreme pressure and anti-wear (EP/AW) additives. Potential benefits depend on application.

OEM gear oil approvals

For products in main drives

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Castrol is chosen by many of the leading wind turbine manufacturers for first-fill when their machines first go out to market.

And we're the trusted supplier for thousands of wind farms who chose OEMs for their fleet, not just during the warranty period, but for the entire working life of their assets.

	Elckhoff	Winergy	ZF WPA	Moventas	NGC	CG Gearbox	Other / Unspecified
Generally approved	Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT	Castrol Optigear Synthetic CT	Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT	Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT		
GE Verona		Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT	Castrol Optigear Synthetic CT	Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT			
SGRE		Castrol Optigear Synthetic X Castrol Optigear Synthetic CT					
Vestas		Castrol Optigear Synthetic X Castrol Optigear Synthetic CT...NG	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT...NG	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT			
Suzion		Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear BM					
Senvion (historical)	Castrol Optigear Synthetic A Castrol Optigear Synthetic X Castrol Optigear Synthetic CT		Castrol Optigear Synthetic CT				
Nordex		Castrol Optigear Synthetic X Castrol Optigear Synthetic CT	Castrol Optigear Synthetic CT				
SE Wind	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT				Castrol Optigear Synthetic A Castrol Optigear Synthetic X	Castrol Optigear Synthetic A Castrol Optigear Synthetic X	
MHI			Castrol Optigear Synthetic CT				Castrol Optigear 1100

OEM gear oil approvals

For products in use in China

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	NGC	CN Gpower	DHHI	Nanfang Aviation	ZF	Winergy	QSY	Wangjiang	Other Unspecified
Envision	Castrol Optigear Synthetic X								
MingYang	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT			Castrol Optigear Synthetic CT					
SE wind	Castrol Optigear Synthetic X	Castrol Optigear Synthetic X				Castrol Optigear Synthetic X			
United Power	Castrol Optigear Synthetic X								
Sinovel	Castrol Optigear Synthetic X		Castrol Optigear Synthetic X		Castrol Optigear Synthetic X				
CNR	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT		Castrol Optigear Synthetic CT						
CSR	Castrol Optigear Synthetic X Castrol Optigear Synthetic CT						Castrol Optigear Synthetic CT		
CSIC	Castrol Optigear Synthetic CT	Castrol Optigear Synthetic CT						Castrol Optigear Synthetic CT	
HEAG	Castrol Optigear Synthetic CT	Castrol Optigear Synthetic CT							
Goldwind									Castrol Optigear Synthetic CT

OEM grease approval matrix

OEM grease approvals

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And we're the trusted supplier for thousands of wind farms who chose OEMs for their fleet, not just during the warranty period, but for the entire working life of their assets.

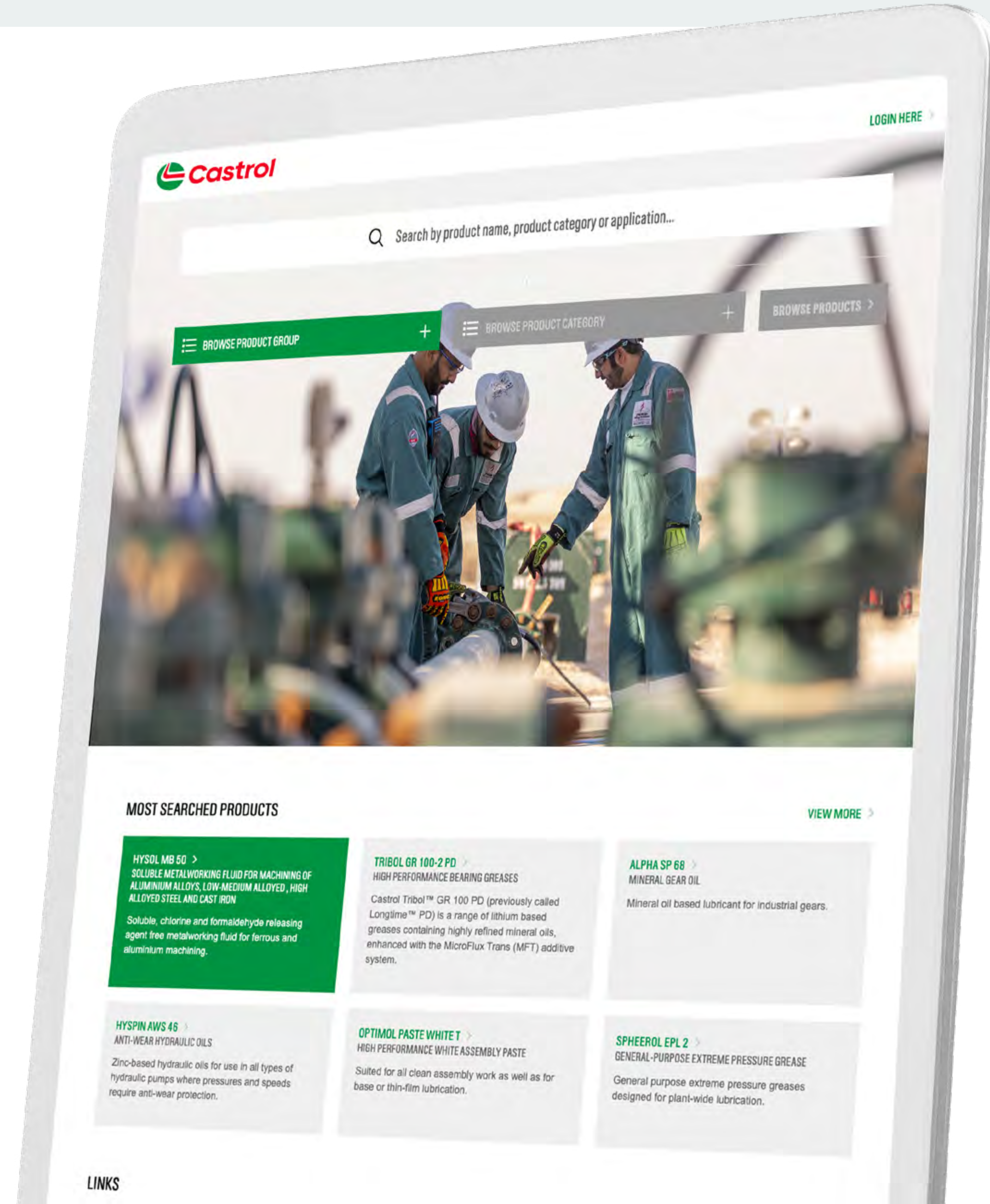
OEM, Application	Nordex main bearing	GE main bearing	Timken main bearing	NTN main bearing
Grease	Castrol Tribol GR SW 460-1	Castrol Tribol GR SW 680-1 <small>(Aftermarket approval. Full/first fill approval pending)</small>	Castrol Tribol GR SW 460-1 & 680-1	Castrol Tribol GR SW 460-1 & 680-1

The Lubricant Oracle

Explore our product range online 24/7

- Search by sector, product category or application for all your fluid needs
- Get product and safety data sheets
- Check out our high-performance reference guide covering all the need-to-knows of high-performance lubrication
- Register online access to OEM approvals

Register for the Castrol Lubricant Oracle





Shared expertise

Sharing knowledge through expert technical advice, training and dedicated onsite support to help your operations run smoothly and efficiently.





A new way to connect with our experts

Wherever you're based in the world, whatever your industry¹, when you have a challenge or simply need some technical advice, our Castrol experts want to help.

Through our new digital solution, Castrol Virtual Engineer, we can now virtually visit your site, vessel or factory at any time, from anywhere in the world, without the travel.

¹ Where service is offered by Castrol and subject to connectivity and compatibility of your device.





Engineering and monitoring services

When maximising the whole life of your assets, no variable should be outside your control. Castrol's engineering, monitoring and lubrication products, tools and expertise combine to help you accurately predict component life and optimise maintenance cycles.

Talk to your Castrol representative.
Services subject to regional availability.

List of services:

- Monitoring software and hardware
- Inspection and software services
- Machinery diagnostics
- Condition monitoring retrofit



Ensuring your team has the knowledge and skills to perform at the highest level

The wind industry, while growing at a brisk pace and adding 50+ GW per year, is experiencing a severe skills shortage.

In a recent survey conducted by the European Wind Energy Technology Platform, 78% of wind energy stakeholders stated that finding suitably trained staff as either 'Difficult' or 'Very Difficult'.

With over 250,000 skilled employees required annually to meet wind's demand through to 2024, the skills gap needs to be urgently filled in order for the industry to continue to thrive.

Benefits of the Castrol Wind Academy

At Castrol we are completely committed to alternative energy and a low-carbon future.

With our understanding of today's industry challenges, we've created the Castrol Wind Academy.

Our Academy training can cover basic, intermediate and advanced modules for wind turbine maintenance, depending on your team's needs.

We combine turbine drivetrain engineering, predictive engineering and lubricants expertise to achieve higher efficiency and reduced LCOE.

"Operations technicians and site managers are at the heart of the wind energy industry. It is important that they are up-skilled and trained to implement best practice operations on site as conditions in the market are intensified over the coming years..."

Cassandra Higham,
Industrial Solutions
Marketing Director







Why we created the Wind Academy

The Castrol Wind Academy integrates industry expertise to deliver a comprehensive programme. It equips site managers and technicians with the latest knowledge and skills to perform at the highest level while getting the best from the products, tools and services they use every day.

- 1 – To share industry knowledge and expertise with your technicians and site managers
- 2 – To educate your team on how some of the leading solutions and dedicated support can help
- 3 – To focus on optimising operation efficiency and maintenance of your wind-turbine drivetrain

<p>Step 1</p> <h2>Online e-learning</h2>	<p>Introductory sessions covering a variety of topics. Materials are available online.</p> 
<p>Step 2</p> <h2>Webinars and training events</h2>	<p>Intermediate classes are held either online or at a castrol facility, covering advanced topics.</p> 
<p>Step 3</p> <h2>Hands-on training</h2>	<p>In-depth classes at customer sites. Explaining best practices and running demonstrations.</p> 

The Castrol Wind Academy will help address the skills gap with technicians and site managers helping wind farms improve efficiency and reduce cost

First course modules include:

- Basics of Icoe
- Gearbox failures
- Predictive maintenance
- Wind turbine drivetrain & gearbox fundamentals
- Optimum lubrication for enhanced efficiency

Each learning module includes a short online assessment at the end for technicians to complete. Successfully completing the online assessment for each module will result in being awarded a Castrol Wind Academy Certification. Follow on training can include face-to-face events and onsite training.



New efficiencies

Through digital automation, we share data and insights. Through equipment automation, we are helping replace inefficient manual processes. Combined, these new solutions help cut downtime, boost productivity and unlock value.



Unlock new maintenance efficiencies through grease automation

With Castrol Tribol grease in Hove Cartridges

Simplify bearing protection with Castrol Tribol greases and Hove lubrication technologies.

Castrol's unique MicrofluxTrans Plastic Deformation technology (MFT PD) creates a protective layer on metal surfaces to reduce micropitting and wear, and potentially prolongs bearing life.

Castrol Tribol GR SW 460-1 is designed to meet the many challenges faced by wind turbines in tough environmental conditions – conditions where temperature and humidity can't be controlled, and where hard-to-reach locations result in long re-lubrication interval.

When used together with Hove advanced lubrication technologies, wind operators can unlock new maintenance efficiencies, keeping the machinery working at optimum efficiency, as well as increasing its operational life.

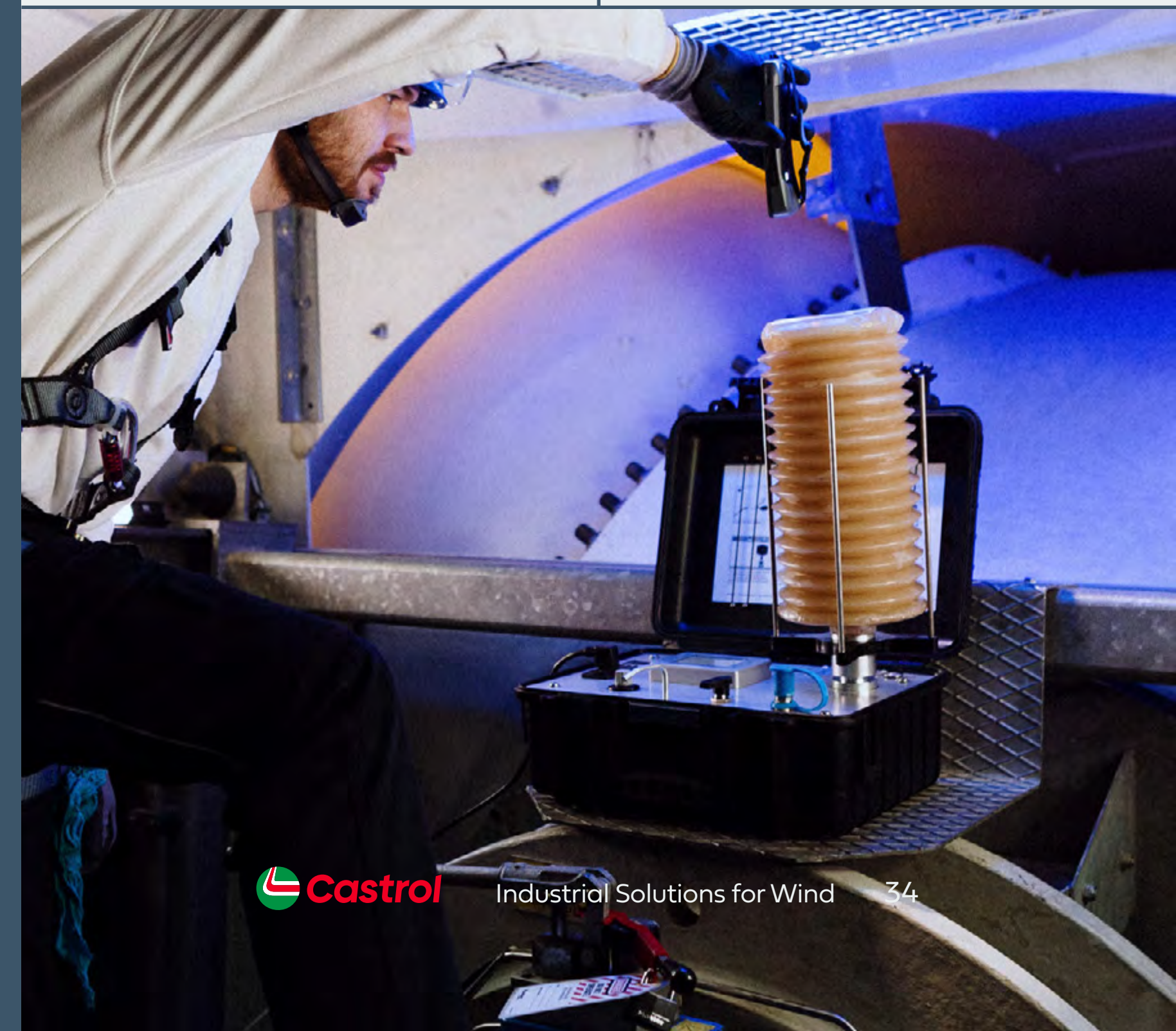
Lubrication points:

- 1 – Main bearing
- 2 – Pitch adjustment
- 3 – Yaw bearing

Key information

- Castrol Tribol grease is approved by multiple OEMs
- Hove lubrication technologies are made to fit all grease points with custom hoses for specific WTG models

[See OEMs table](#)



Unlock new maintenance efficiencies through grease automation

Hove lubrication technologies key features

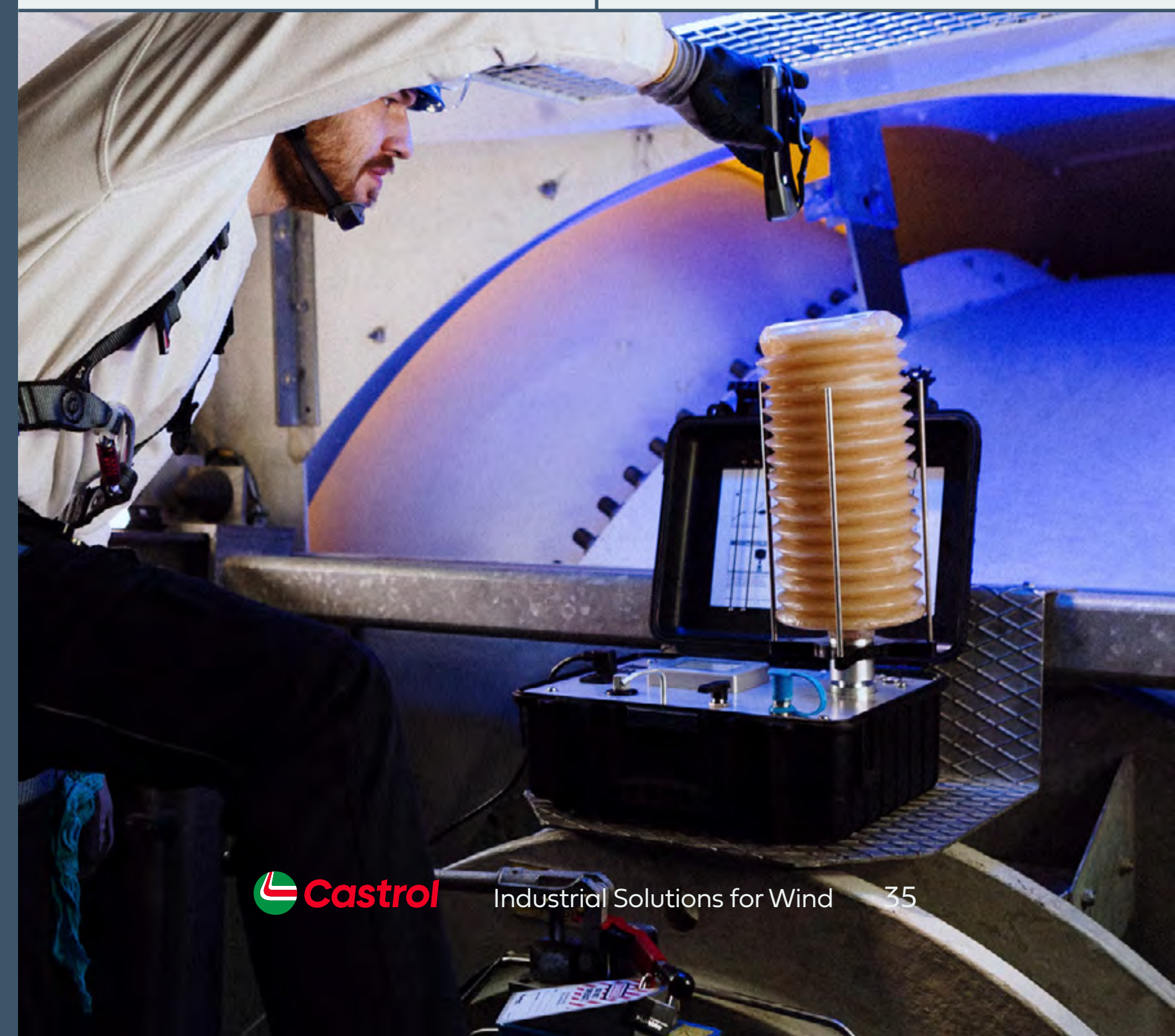
- Hove Cartridges are designed for maximum durability and have been drop tested according to MIL-STD-810H w/Change 1 standard, as of May 18, 2022. Their compact design ensures easy installation and removal, streamlining your maintenance processes.
- When used with Hove pumps, operators can save up to 1.5 hours per service visit, significantly reducing manual errors and minimising the risk of contamination. With a variety of pumps available – whether you require high flow, high pressure, or both – Hove provides the right solution for your operational needs.

Castrol Tribol greases and the Hove lubrication technologies will help wind operators:

Reduce downtime + maintenance costs

Automating traditionally manual tasks allows wind operators to save up to 1.5 hours per service visit, which can save up to 50% in labour costs for lubrication over 5 years¹.

Castrol Tribol greases help reduce wear, rust and corrosion, while extending service life through longer intervals between re-lubrication.



¹ Based on data provided by Hove for 100 turbines over 5 years.



A new way to connect with our experts

Wherever you're based in the world, whatever your industry¹, when you have a challenge or simply need some technical advice, our Castrol experts want to help.

Through our new digital solution, Castrol Virtual Engineer, we can now virtually visit your site, vessel or factory at any time, from anywhere in the world, without the travel.

¹ Where service is offered by Castrol and subject to connectivity and compatibility of your device.





More circularity

With a circularity-first mindset, we want to support your business and help accelerate progress towards a sustainable future.



Together, let's embrace circular thinking

Castrol's PATH360 strategy

At Castrol, we're continuing to develop products and services that help our customers save energy, waste or water. In essence, we want to help them do more, using less.

Castrol Optigear is just one example of that. Our wind gearbox oil has been proven to lower the coefficient of friction by up to 60% compared to standard gear oils, helping to reduce gearbox operating temperatures and actively resist wear and pitting.

Today a quarter of the world's energy is lost to friction, corrosion and wear¹

Visit our website to find out more about Castrol Path 360 and discover all the ways we are embracing circular thinking - looking at the life-cycle of our products to see how they can be improved, extended, reused or recycled.

Please see castrol.com/path360 to find more information.

¹ Influence of tribology on global energy consumption, costs and emissions
Kenneth Holmberg & Ali Erdemir¹ Influence of tribology on global energy consumption, costs and emissions
Kenneth Holmberg & Ali Erdemir



Case studies

Discover how Castrol has helped Wind Energy businesses like yours solve problems, create new efficiencies and increase productivity.



Cutting downtime

\$215,000 savings for a wind energy supermajor

Situation

Oil condition depletion in turbines was causing problems for one of the world's leading wind energy operators. The need for oil changes presents challenging maintenance issues – from significant financial outlay, operational downtime and investment of important resources.

Solution

Smart top ups keep turbines turning. Castrol Optigear Synthetic X 320 AD, a premium synthetic oil for wind turbine gears, was added to the company's wind turbine main gearbox oil to replenish the additives. The top-up technology is fully compatible with the first fill gear oil, Castrol Synthetic X 320 in 2007, providing a new lease of life with no need for a time consuming, costly oil change.

Outcome

The top-up technology is fully compatible with the OGSX 320 fluid added to the turbines in 2007, providing a new lease of life with no need for a time consuming, costly oil change.

- Less demand on technician time
- Reduced risk of oil spillage
- Longer oil life
- Avoiding complex hazardous waste removal and disposal processes
- Better employee safety for wind technicians
- Up to 1% higher energy efficiency



Savings

\$215,000 saved

Eliminating just one oil exchange over the life of a turbine saves at least \$4,300* per turbine.

The supermajor has topped up 50 turbines with Castrol Optigear Synthetic X 320 AD.

4 hour

shutdowns avoided

Removing the need to change the oil means the turbine can remain operational and avoid the usual downtime of 4 hours.

Extending oil life

Castrol Optigear Synthetic X 320 AD

Situation

Changing the main gearbox oil has always been a challenging maintenance task – financial outlay, detailed logistical planning for new oil and flushing oil, technician time spent in what can be a hot and humid workplace, disposing of used oil, increase risk of oil spills and the environmental impact of oil consumption are a few of the main considerations.

Offshore turbines are even more challenging. Even with good quality pure PAO synthetic gear oils offering extended drain intervals, a step change in oil technology is needed.

Solution

- SGRE has used Castrol Optigear Synthetic X 320 globally since 2011. Initially starting with a calendar-based 5 year main gearbox oil change interval, this has been extended over time
- Castrol has developed an additive boost package, Optigear Synthetic X 320 AD, that can be added very simply to the main gearbox oil to replenish additives and ensure the oil remains suitable for further use
- In-depth analysis of Optigear Synthetic X 320 was carried out by Castrol working with an SGRE Project Engineer, and field trial data showed that a further extension was possible, using Optigear Synthetic X 320 AD

Outcome

- Based on test data from field trials, Optigear Synthetic X 320 AD can eliminate one (or two depending on the turbine type) main gearbox oil changes over the life of the turbine
- Cost savings in eliminating one main gearbox oil change for each turbine include taking technician time, oil fill cost and lost turbine revenue into account
- Only tangible savings have been considered, other positives such as increased operator safety and minimised environmental risk are also beneficial
- Implementing this cost saving will involve updating maintenance schedules but with no other significant outlay. The cost saving can be implemented very quickly



“This is a
game-changer
for the wind industry*”

**Reduced carbon footprint, reduced HSSE risk
and a reduction in LCOE.**

Castrol’s innovative additive boost package can be used to extend the useful life of Optigear Synthetic X 320 even further than before.

Removing at least one main gearbox oil change during the lifetime of each turbine can result in significant cost savings.

Reducing oil usage, as well as using a certified carbon neutral oil for initial fill, helps to minimise the turbines impact on the environment.

* Major wind OEM

Maximise quality, minimise cost

Castrol Optigear Synthetic X 320, Castrol Hyspin AWH-M 32 Superclean

Situation

Gear oils were delivered to a central customer facility and spot checks carried out to ensure cleanliness met specification before shipping to the point of use.

Hydraulic oils were delivered to the same facility, but shipped internally for re-filtering in the central facility before being returned to the initial location until demand called for transport to the final destination.

As well as high internal transport costs, a significant cost was attributed to the sampling and filtering of the oils.

Further costs could be seen in filter cartridge disposal and CO₂ emissions for the internal transportation of products.

Solution

- After receiving a clear brief from the customer, a virtual team was formed to ensure timely project delivery
- Global Supply Chain within Castrol was consulted and it was quickly agreed that cleanliness on delivery was possible
- A final agreement was reached a few months after the initial project launch, to guarantee cleanliness on delivery

Outcome

- Using the Castrol gear and hydraulic oils meant that a guarantee of cleanliness on delivery could be reached very quickly
- Historical sample analysis data verified the quality of Castrol lubricant deliveries, building confidence that the project could be delivered
- The cost savings to the customer are based on minimising costs associated with filtration, including administration, handling, man hours and maintenance, and significantly reduced transportation costs between facilities which has the added benefit of reducing overall CO₂ emissions
- Indirect benefits post-implementation include increased flexibility, improved global processes and support, and reduced internal processing costs



“Finalising this project has hugely reinforced our confidence and trust in Castrol as a long term partner, and has delivered considerable savings to us”

Castrol delivers quality products, which can minimise internal costs.

Trusting Castrol to deliver quality means less resource is used on non-core activities.

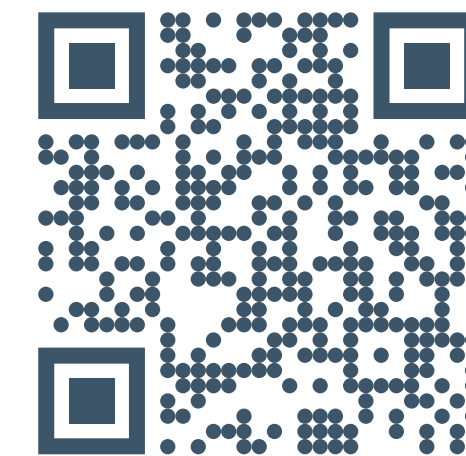


Let's move forward together

Talk to your local Castrol representative
[castrol.com/wind](https://www.castrol.com/wind)

For industrial inquiries:
technical-support@castrol.com

Phone: +49 (0) 800 / 863 73 70
From abroad: + 49 2 344 366 1260
Fax: +49 (0) 800 / 83 22 200



Sign up today

Sign up today to hear about new Castrol product innovations, service developments and wind industry insights.

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