

Encoders and sensors for wind turbines

Smart solutions for every environment



Baumer

Passion for Sensors



Technology competencies and support – global and local.

The Baumer Group is a leading international manufacturer of sensors and system solutions. The company employs about 2,500 people worldwide in 36 locations and 18 countries. Baumer is a premier supplier of innovative and high quality encoders and sensors for wind turbines.

Our strong reputation and leading market position spanning many decades is built on a high customer focus and the innovative and all-encompassing product portfolio created by the product segments Sensor Solutions, Motion Control, Vision Technologies and Process Instrumentation.

The Baumer worldwide customer loyalty starts with competent on-site consultancy. To us, closeness to customers means being available at any time and place to listen to our clients' needs. Our international sales network of affiliates and distributors ensures prompt delivery and top-grade product availability. We stand by our customers as a trusted partner by international presence, innovative development work, in-depth application expertise and outstandingly high standards of support, service and quality.

Our highlights



Offshore



Cold Climate
-40 °C



Onshore



Robust without
integral bearings



Enhanced
Monitoring System



Gearless



Optical
absolute



Optical
incremental



Magnetic incremental
and absolute



High-pressure
resistant



Switching



Distance
measuring



ShaftLock



Ultimate
impermeability



Long-term tightness at
consistent temperature
fluctuations



Robust housing
with solid wall
thickness



Optimally
spaced bearings
at both ends

Your one-stop partner for sensors in wind turbines.

Pioneering reliable sensor technology

The members of the Baumer Group are setting new benchmarks – whether in rugged designs or in sensor performance. We anticipate our customers' needs and continuously complete our portfolio with market oriented products in order to bring even more value to our customers. We pool our expertise gathered in varied technologies and provide profound application know-how in a wide variety of industries. By virtue of innovative pioneering and sophisticated technologies, the Baumer engineers create

unique solutions to boost efficiency and system availability of wind turbines by intelligent encoder and sensor employment. Benefit from the Baumer expert know-how, pose a challenge to our engineers and tell us what you need!

Precision and quality

We are relentlessly committed to quality. Our products master their application objectives with utmost reliability and precision by virtue of exceptionally high quality standards behind develop-

Leading in
absolute encoders
Pitch, azimuth and slip ring

No. 1 in HeavyDuty
Generator and rotor

The complete
offshore portfolio
Pitch, azimuth and
generator



ment and manufacture. The principles of Lean Management combine with the Six Sigma methods for fail-safe process reliability to provide the basic foundation for our striving for continuous improvement. Baumer applications have proved long-term high utility value not only in the wind power industry but also in other industrial scenarios like port installation logistics, mining, medical technology and mechanical engineering.



Learn more.
Downloadable data sheets and more information about our products is available at:
www.baumer.com/wind

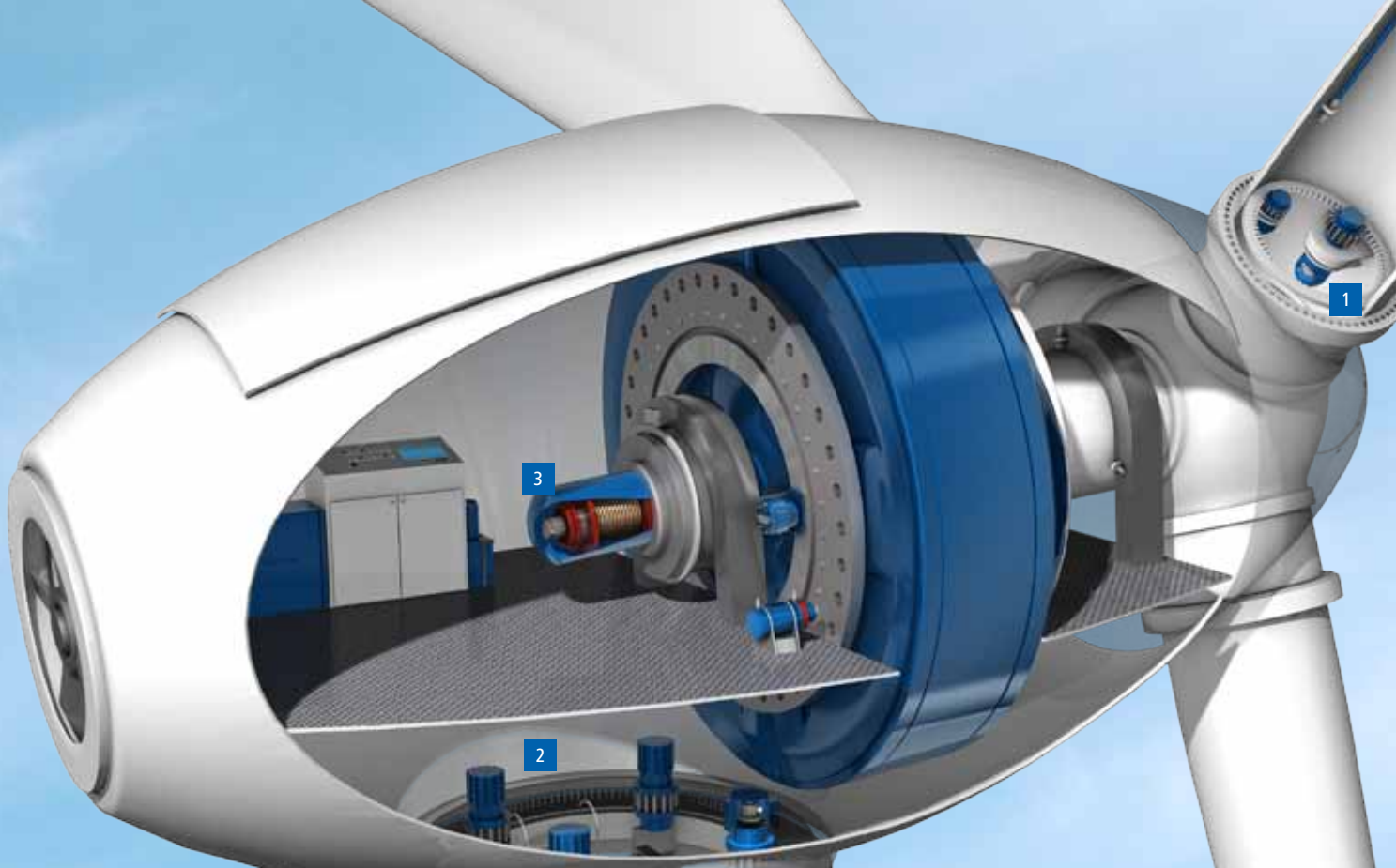
Pointing the way in terms of reliability and robustness

Level, leakage, air gap and brake

Pioneering in measuring sensors

Pressure, temperature, blade and tower





Leading in absolute encoders.



1 2 3

Leading in pitch applications (series GM400)

- Tried and trusted in the wind industry for more than 15 years
- Most efficient pitch control via precise SSI and supplementary incremental signals
- Non-contact and wear-free multiturn sensing technique
- Proven a million times over in industrial applications for more than 20 years

- Reliable and robust without gears
- Extreme immunity against magnetic field impacts by all optical technology
- Resilient ShaftLock feature to endure high shaft loads



1 2 3

Ultra-robust magnetic encoders (series ATD 2S / series MAGRES 58K SSI)

- Resistant against shocks and vibrations up to 500 g
- Unaffected by humidity, dust and dirt
- Top-grade reliability and long-lasting thanks to limited components
- Optionally available with integrated resolver



1 2 3

All-encompassing interface competencies (series GXMMW)

- SSI and BiSS with supplementary incremental signals
- All conventional fieldbus interfaces and profiles
- Realtime Ethernet, Profinet, Powerlink, EtherCAT and Ethernet/IP
- Modular bus cover or housing-integrated interface



Reliable position and speed for pitch, azimuth and slip ring.

1 Developed and perfected rotor blade positioning (Pitch)

As a worldwide premier manufacturer of absolute encoders, Baumer has been active in the wind power industry for more than 15 years. The close collaboration with engineering companies and vendors of systems and components has created a unique portfolio of products and state-of-the-art technologies offering the perfect solution for blade pitch control. The product portfolio is continuously updated to satisfy our customers ever-growing requirements so that we can always provide the ideal, future-oriented solution.

2 Reliable nacelle movement and yaw control (Azimuth)

When it comes to nacelle movement control, how much it should yaw during operation (Azimuth), leading vendors rely on Baumer encoders. For more than 20 years, Baumer has unerringly been counting on non-contact multiturn sensing methods. So far, more than 1 million encoders utilizing a non-contact sensing principle have been sold. The sensing system without any mechanical gears is extremely long-lasting, unaffected by frequent fluctuations in temperature and speed, and endures heavy impacts by shocks and vibrations.

3 Position feedback of slip ring and rotary limit switches

Baumer is the only manufacturer who offers such an unrivalled extensive technology and product portfolio to provide the perfect task-matching solution for every application. The portfolio encompasses optical, magnetic, incremental and absolute singleturn and multiturn encoders either with or without integral bearings as well as redundant encoder configurations in all their facets. Further expanding Baumer's proven portfolio of absolute and incremental encoders, the compact magnetic incremental encoder BRIV 30R is conceived especially for slip rings and features the most robust properties.



1 2 3

Absolute dependability by redundancy

(series *MAGRES* redundant)

- Top-grade reliability by virtue of redundant single and multiturn sensing (MTTF > 100 years)
- Integrated self-monitoring system
- For safety-relevant applications



3

Compact encoders

(series BRIV 30R / Serie GI356)

- Extremely robust magnetic respectively ultra-precise optical sensing technique
- Optionally available in corrosion-proof designs
- Stable ShaftLock construction unaffected by high shaft loads

Robust solutions for generator and rotor feedback.



4 Speed monitoring at the end of the generator shaft
Backed by more than 20 years of know-how in wind energy, the Baumer HeavyDuty encoders are attuned to the demanding requirements of this industry. The well-conceived design unmatched in terms of robustness and reliability ensures maximum service life in continuous operation. Numerous design benefits ease installation at all sites and conditions. Lightning protection and the EMS functionality prevent and reduce expensive downtimes. Integrated centrifugal switches protect the system against damage in case of turbine overspeed.

5 Speed monitoring at the generator shaft
Baumer was the world's first manufacturer of bearingless encoders specifically conceived for the large shafts of wind turbines. Available for shafts with a maximum 740 mm diameter, they are best-in-class and provide unique features that set new standards. Bearingless encoders are predestined for speed feedback straight at the drive shaft of the turbine. Large axial and radial tolerances ease installation and ensure reliable operation. Bearingless encoders provide maximum yield by their extremely long service life without mechanical wear.



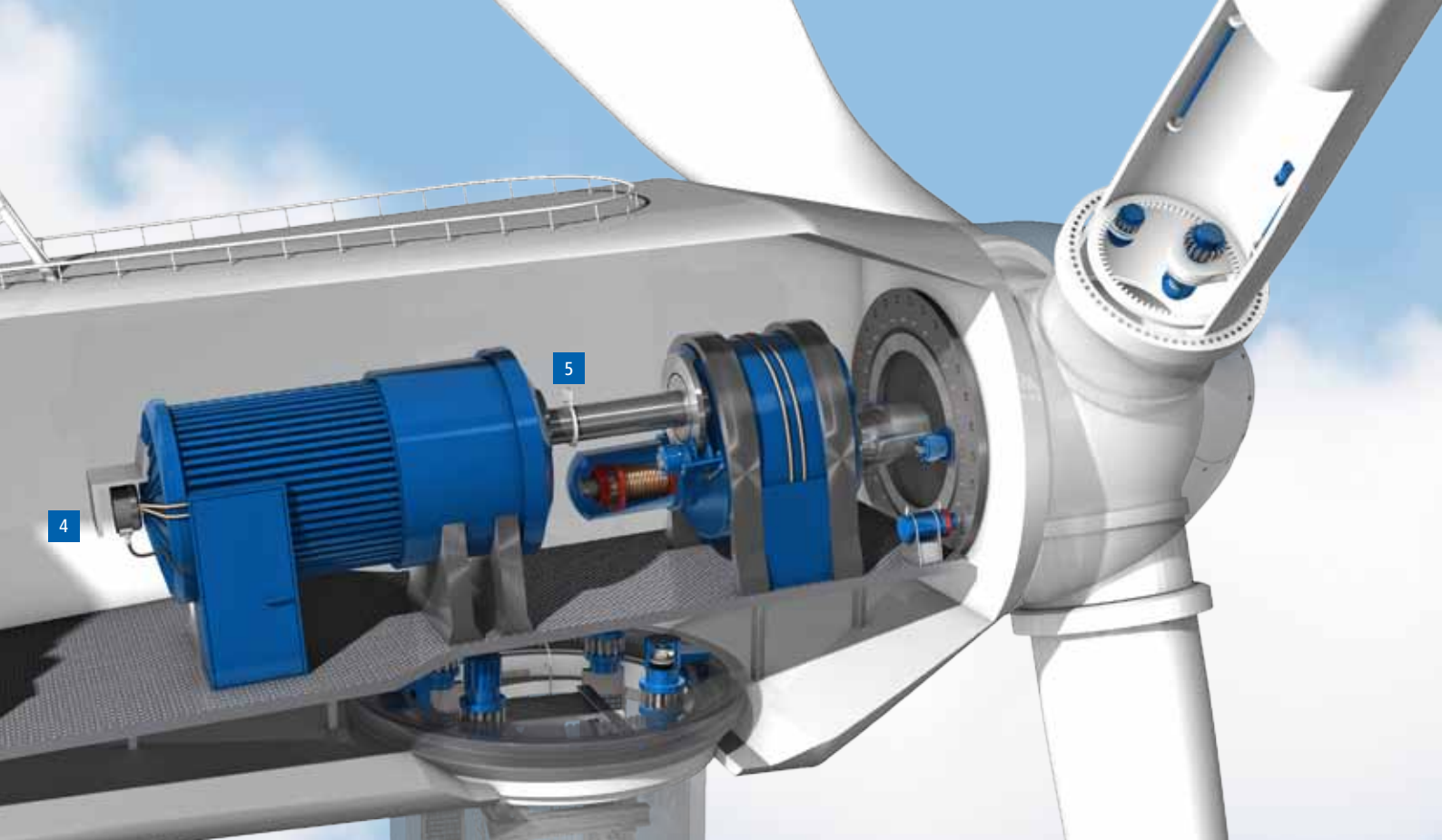
- 4**
- Incremental HeavyDuty encoder for most demanding requirements (series HOG 86)**
- Extreme longevity
 - Insensitive against environmental impacts
 - Proven sensing technique
 - Excellent signal quality up to 500 m cable length (TTL)
 - Quick commissioning and reduced downtime thanks to monitoring functionalities
 - More than 50 years of HeavDuty expertise in one product



- 4**
- Redundant HeavyDuty encoder (series HOG 86 M)**
- Twofold acquisition of speed and position
 - Two sensing units separated by galvanic insulation
 - Independent signal outputs
 - Flexible mounting options by two rotatable terminal boxes
 - Optionally with two integrated function monitoring systems EMS
 - Separated signal evaluation and enhanced error tracking



- 4**
- HeavyDuty encoder with fiber optic interface (series HOG 86 L / ML)**
- Reliable optical signal transmission with maximum availability
 - Insensitive against electromagnetic interference
 - Transmission distance up to 2200 m, two fiber optic cables opt.
 - Signal error tracking
 - Integrated function monitoring system EMS and redundant configurations



4

5

No. 1 in HeavyDuty.



4

The industry-proven HeavyDuty encoder (series HOG 9.2)

- Optionally with integrated function monitoring system EMS (Enhanced Monitoring System)
- Tried and tested mechanics
- Signal output driver for cable length up to 500 m (TTL)
- Insulation protection against inductive shaft currents

4

The universal HeavyDuty encoder (series HOG 10.2)

- Incorporating 20 years of expertise in wind energy
- Ultra-resilient housing
- Flexible mounting capabilities thanks to rotatable terminal box
- Enhanced longevity by hybrid bearings for protection against shaft currents
- Optionally with integrated function monitoring system EMS (Enhanced Monitoring System)

4

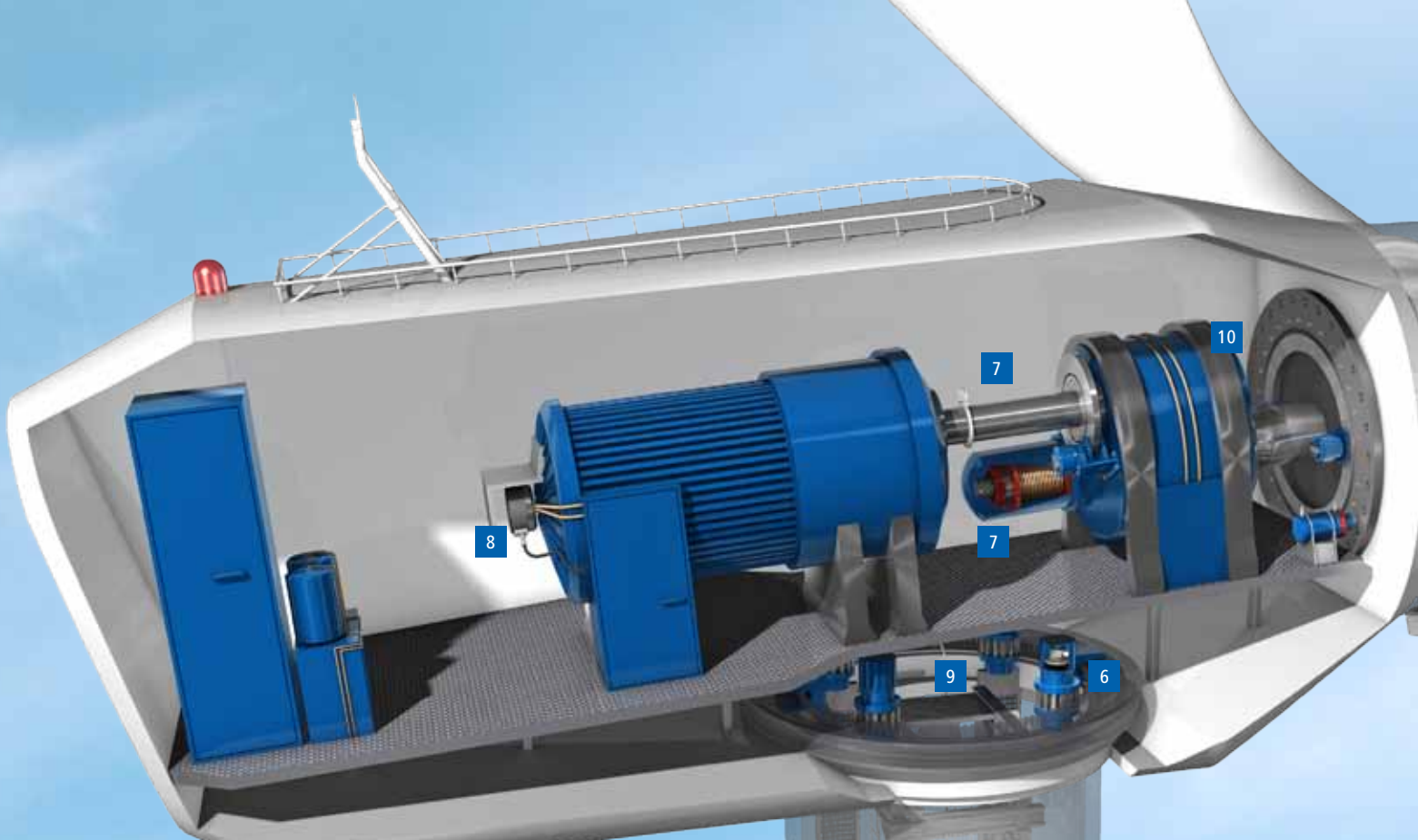
Precise optical encoders (series ITD 41 A4)

- Accurate generator feedback with a maximum resolution of 10'000 ppr
- Corrosion-proof stainless steel design
- Tried and trusted more than 10'000 times worldwide
- Interference-immune by virtue of electrically insulated shaft and torque support

5

High resolution and no integral bearings to fit large shaft diameters (series *HDmag*)

- Long-lasting and wear-free by non-contact sensing technique
- Incremental and absolute configurations
- Enhanced operational safety thanks to wide air gap
- Narrow, space-saving dimensions
- Easy to mount with flexible installation options
- High resolution for low speed



Our complete offshore portfolio.



6

The offshore absolute encoder (series GM400C / 401C)

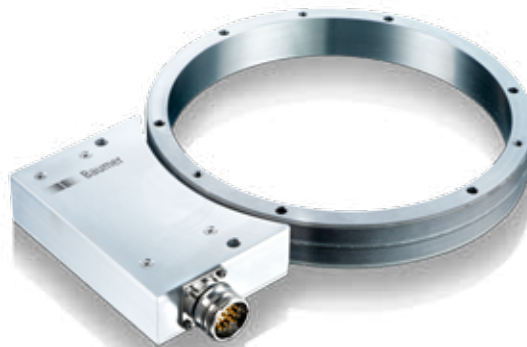
- Incorporating 20 years of expertise in wind energy
- Premium materials, perfected coating and sealing systems
- Non-contact and wear-free multiturn sensing technique
- Reliable and robust without gears
- Resilient ShaftLock feature to endure high shaft loads
- Corrosion-resistant according to C5M



6

The offshore incremental encoder (series GI355C / 356C)

- Corrosion-resistant up to C5M
- Clamping and synchro flange
- Resilient ShaftLock feature to endure high shaft loads



7

No integral bearings to fit large shaft diameters up to 740 mm (series *HDmag*)

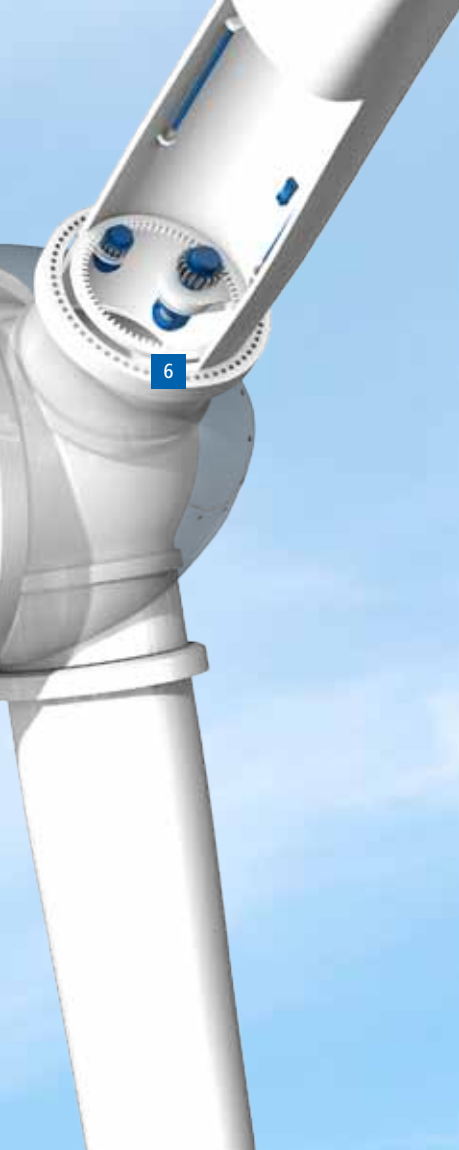
- Det Norske Veritas (DNV) certification (MHGE)
- Long-lasting and wear-free by non-contact sensing technique
- Enhanced operational safety by wide air gap
- Compact design with shallow installation depth
- Convenient installation and flexible mounting options



8

Offshore encoders proven in the field for more 10 years (series HOG 131)

- Housing with specialized surface protection
- Special shaft seals
- Integrated lightning protection
- Flexible mounting options thanks to large terminal box rotatable through 180°
- Extended service life by hybrid bearings for protection against shaft currents



Reliable solutions for azimuth, pitch and generator feedback.

6 Pitch and azimuth feedback

For more than 15 years, leading drive system manufacturers in wind power have been relying on the Baumer encoders as a result of their ultimate robustness, resilience and precision. Long tried and tested in many years of operation and appreciated for their longevity even under extreme conditions, these encoders are now also available in corrosion-proof designs.

7 Rotor speed monitoring at large hollow shafts

Backed by long-term expertise, Baumer is the first manufacturer to present bearingless encoders for offshore applications. These encoders are especially conceived for large hollow shafts up to 740 mm diameter and provide maximum corrosion protection by all high-class materials. Operating on the non-contact sensing principle, they ensure utmost endurance without mechanical wear.

8 Speed monitoring at the end of the generator shaft

20 years of experience in wind energy have attuned the Baumer HeavyDuty encoders to the demanding requirements of this industry. Lightning protection and the EMS monitoring functionality prevent and reduce expensive downtime. Integrated centrifugal switches protect the system against damage in case of turbine overspeed. Premium materials, perfected coatings and sealing systems together with an unrivalled rugged and well-conceived design ensure maximum service life in permanent offshore deployment.

9 Reliable and easy nacelle position feedback

The turbine nacelle must be constantly aligned to the prevailing wind to avoid extreme strain and loads and to provide maximum yield. The robust and dependable Baumer inductive sensors ensure easy and efficient nacelle yaw control.

10 Reliable and cost-effective speed feedback

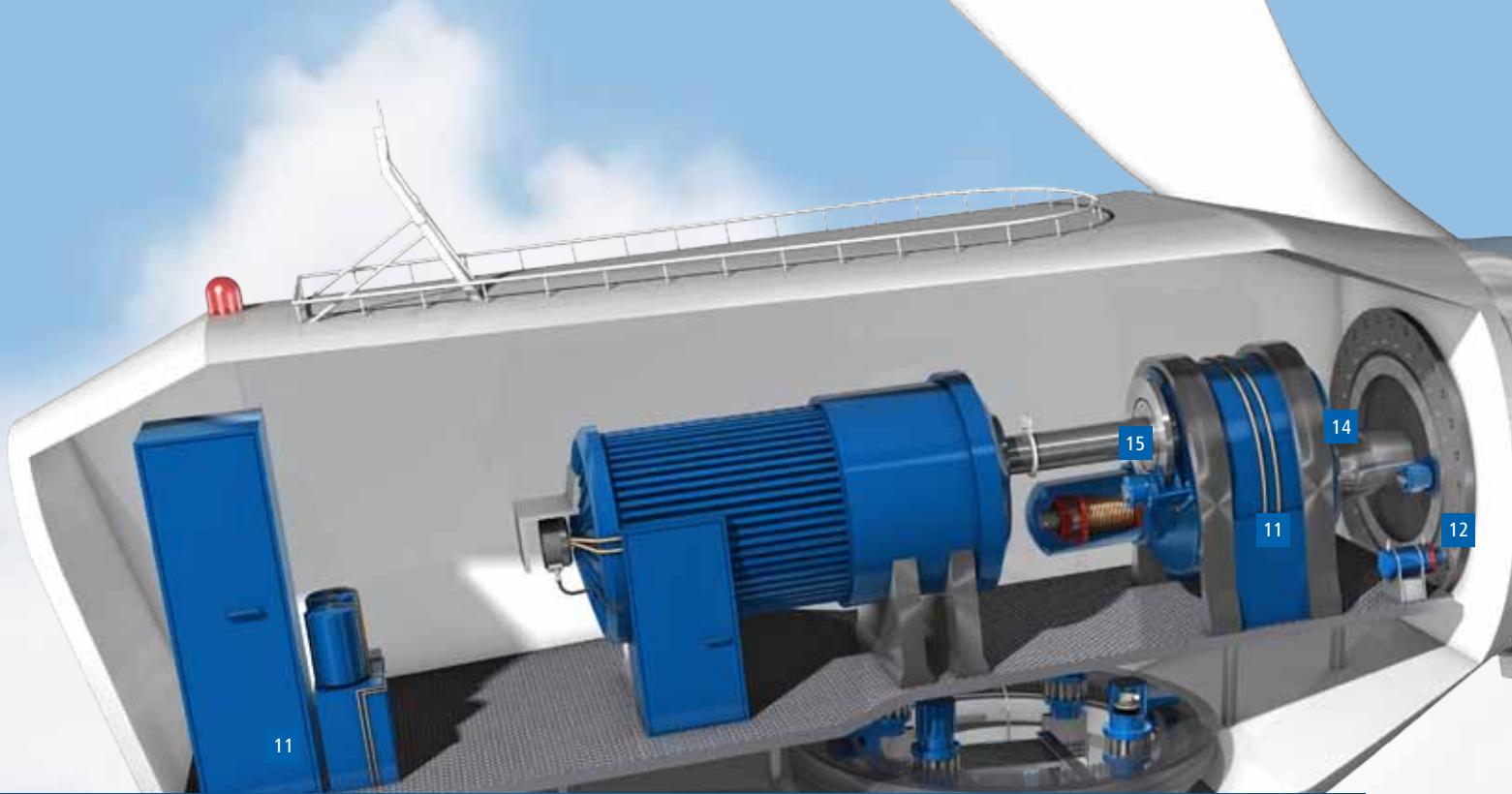
Inductive sensors master the task of rotor feedback by acquisition of the switching signals occurring at the gears. This very dependable and cost-efficient method is the solution to choose when the accuracy of an encoder is not required.



9 10

Robust inductive sensors for position and speed feedback (series IFRR)

- Robust and absolutely dependable – MTF > 100 years
- *protect+* – approved sealing even with frequent fluctuations in temperature
- Easy, quick and flexible installation thanks to the high switching distance up to 12 mm
- Corrosion-resistant according to C5M, the highest corrosiveness category



Pointing the way in terms of reliability and robustness.



11

Leakage sensing by photoelectric sensors (series FODK)

- The slightest leakage is recognized early on – even minute amounts of 1 ml fluid
- Smart installation clip made of PFA or PVC enables quick sensor attachment without any tools
- Integrated fail-safe behavior for detection of eventual cable break, etc



11

Gear oil level detection by CleverLevel switch (series LBFS)

- Safe operation by high switching point reproducibility
- Detects any fluid media
- Maintenance-free, robust design
- Quick and easy commissioning



11

Gear oil level detection by capacitive sensors (series CFAK)

- Easy and quick installation straight in the oil vessel
- Robust product design with IP67 protection, unaffected by gear oils
- Varied housing configurations provide the ideal solution for all sites and conditions



12

Detection of the piston position by high-pressure resistant inductive sensors (series IFRP)

- Capable of extreme environments with pressure up to 500 bar
- Absolutely reliable thanks to the stainless steel housing and active zirconium oxide surface
- Robust product design with IP68 protection, unaffected by hydraulic oils



Reliable level and leakage sensing and monitoring of air gap and brake system.

11 Enhanced process reliability by liquid level and leakage sensing

Baumer liquid level sensors are installed straight at the gearbox or oil vessel. Robust leakage sensors are attached to the base of the oil vessel and reliably detect even the smallest amount of fluids. The extensive Baumer technology portfolio allows for the ideal customer-configured solution for any gearbox or hydraulic system.

12 Monitoring of locking cylinders and stop positions of hydraulic pitch systems

If the plant's operation is to be interrupted, maybe for a maintenance cycle, the blades are turned out of the wind and brought to a halt. The temperature and high-pressure resistant Baumer inductive sensors reliably detect the piston position in the locking cylinder and the stop position of the hydraulic pitch system.

13 Cost-efficient and dependable blade monitoring

The blades are permanently exposed to enormous load impacts. Baumer *AlphaProx* inductive sensors constitute a reliable and economically viable solution for blade strain monitoring.

14 Enhanced efficiency and safety by air gap monitoring

The enormous load impacts on the blades are directly transmitted to the hub and consequently to the main bearing. In gearless plants, asymmetric strain may reduce the air gap between rotating shaft and nacelle. *AlphaProx* inductive sensors monitor the air gap tolerances at the respective critical points and allow for balancing the load.

15 Efficient brake maintenance thanks to continuous, dependable

Wind power plants employ disc brakes. Robust and accurate inductive sensors permanently monitor the disc pads and will give a warning early on prior to the pads having been consumed. This allows for predictive maintenance cycles that boost plant efficiency. Inductive distance sensors with analog interface employed in combination with inductive switching sensors additionally signal the limit values.



13 14 15

Inductive sensors *AlphaProx* with extended temperature range (series IWRR)

- The short response time of < 2 ms enables quick reactions to fluctuations in strain
- Easy and quick installation thanks to the high measuring distance up to 7 mm
- Smart product design in a stainless steel housing (V4A)
- Corrosion-resistant according to C5M, the highest corrosiveness category

Precise pressure and temperature measurement and load monitoring of blades and tower.

16 Quick and reliable strain measurement for improved operational safety and maximum yield by making the best possible use of the wind

Tower and blades of a wind power station are permanently exposed to heavy loads. The Baumer strain sensors, Vision Systems or *AlphaProx* inductive sensors monitor the loads on tower and blades and provide a cost-efficient long-term solution that allows for predictive and preventive maintenance techniques to reduce downtimes and optimize yield.

17 Precise acquisition of pressure and temperature in gearing and hydraulic components

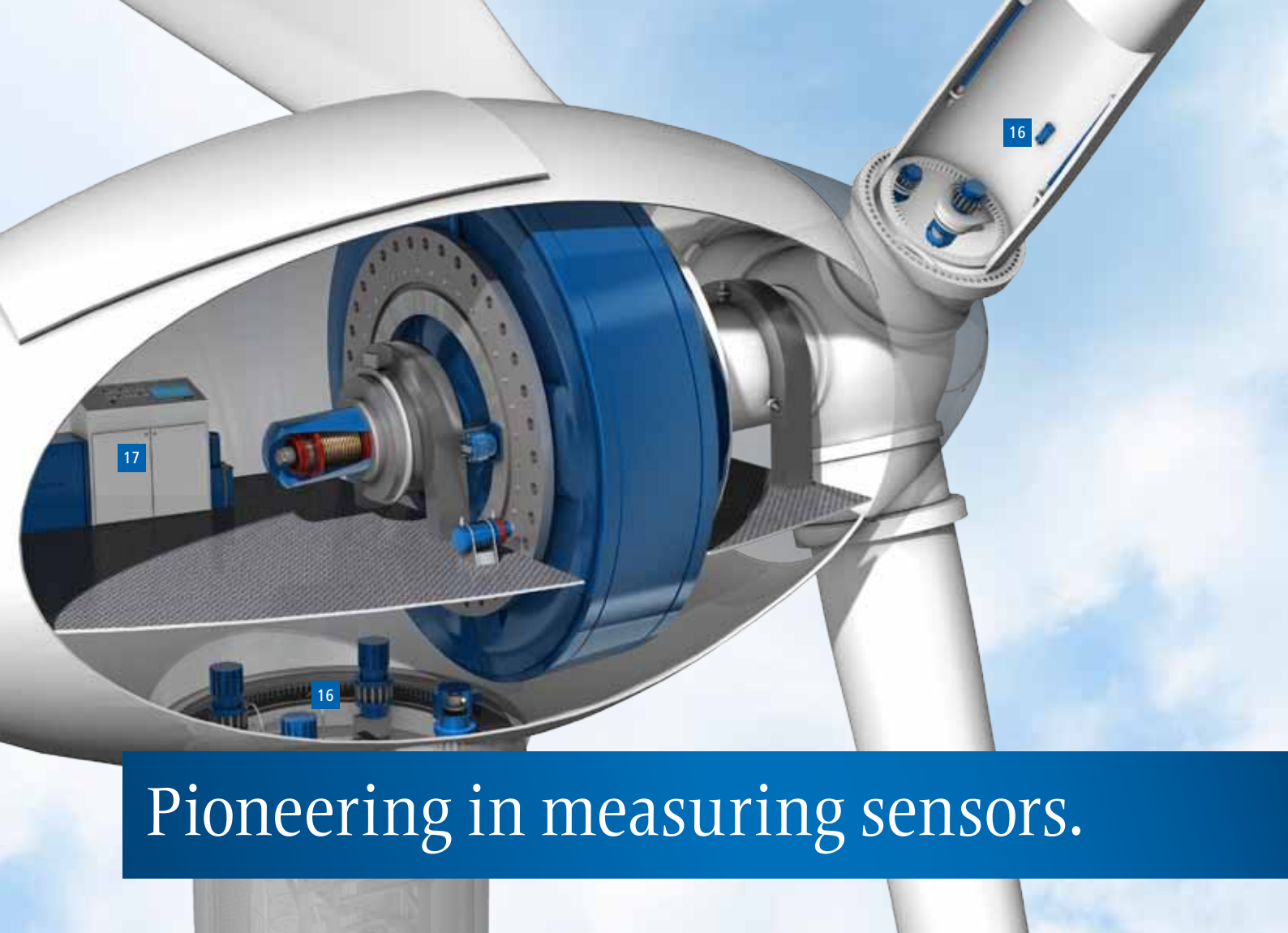
Gearbox, nacelle cooling and lubrication systems are monitored reliably and with utmost temperature stability by the Baumer temperature sensors. The well-conceived modular building block system meets all customer-specific requirements. Ultra-precise and overpressure-proof Baumer pressure sensors monitor the condition of hydraulic components.



16

New Vision system for top-grade precision in blade monitoring (series ZHDM)

- Precise blade deflection measurement flapwise and edgewise for individual pitch control
- Structural damage and ice accumulation are recognized early on
- Unique remote measuring position at the far edge of the blade without electrical cabling



Pioneering in measuring sensors.



16

Robust strain sensors based on DMS (series DSRT)

- Long-term stability and robustness in blade strain measurement by DMS technology
- High reproducibility
- Integrated electronics
- Overload protection by detecting the wind load
- Add-on sensor for CMS systems



17

Accurate detection of hydraulic pressure (series EW6)

- Reduces maintenance cycles thanks to excellent long-term stability
- Enhanced operational safety thanks to very high temperature stability
- For pressures ranging from 0 to 600 bar



17

Detection of hydraulic pressure in extreme environments (series PB)

- Excellent long-term stability
- Ultra-precise measured values over a wide temperature range
- Extremely robust thanks to the fully welded design without any sealing
- 100 mbar up to 1600 bar



17

Precise detection of the gear oil temperature (series TE2)

- Well-proven and long-lasting
- Precise signal transmission thanks to the short response time of the sensor
- Easy installation with DIN and M12 connector output

Worldwide presence.

We strive to be close to our customers all around the world. We listen to them, and then after understanding their needs, we provide the best solution. Worldwide customer service for us starts with on-the-spot personal discussions and qualified consultation. Our application engineers speak your language and strive from the start, through an interactive problem analysis, to offer comprehensive and user-compatible solutions. The worldwide Baumer sales organizations guarantee a high level of readiness to deliver.



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China
India
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Israel
Japan
Kuwait
Malaysia
Oman
Philippines
Qatar
Saudi Arabia
Singapore
South Korea
Taiwan
Thailand
UAE

Europe

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Belgium
Bulgaria
Croatia
Czech Republic
Denmark
Finland
France
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