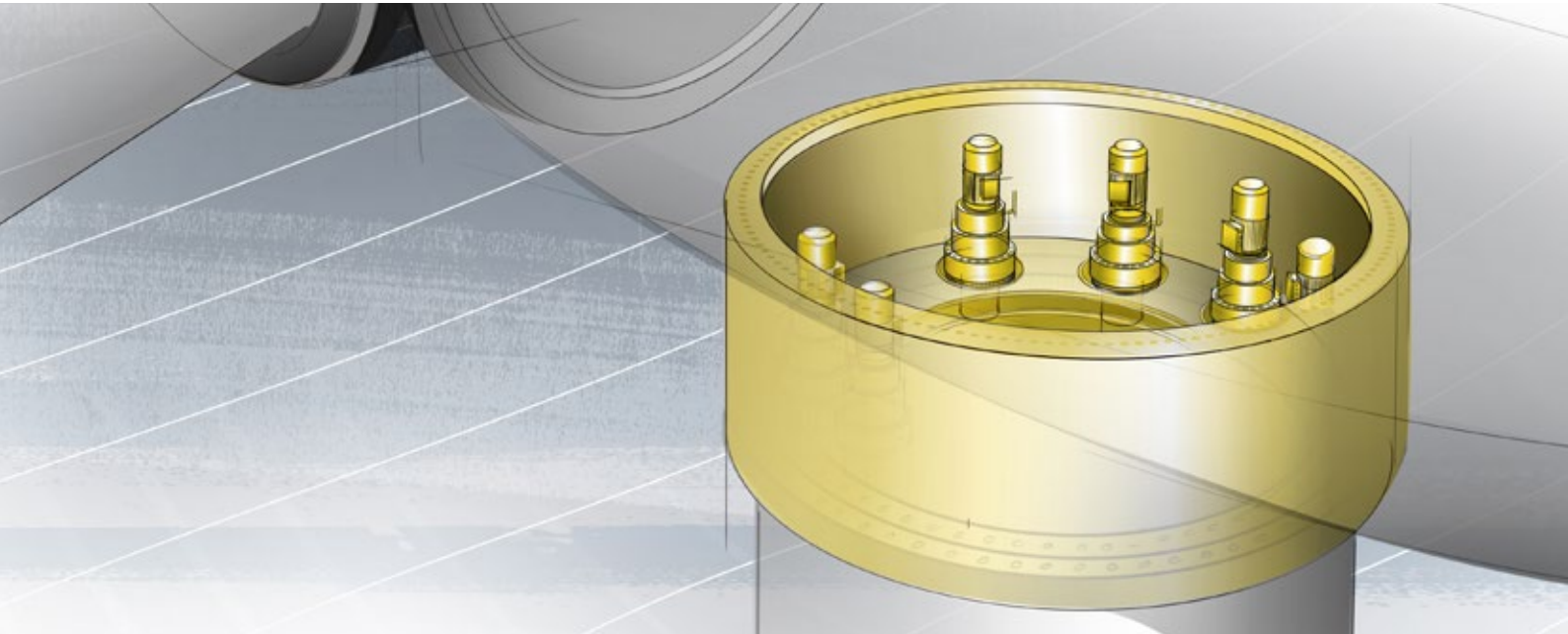
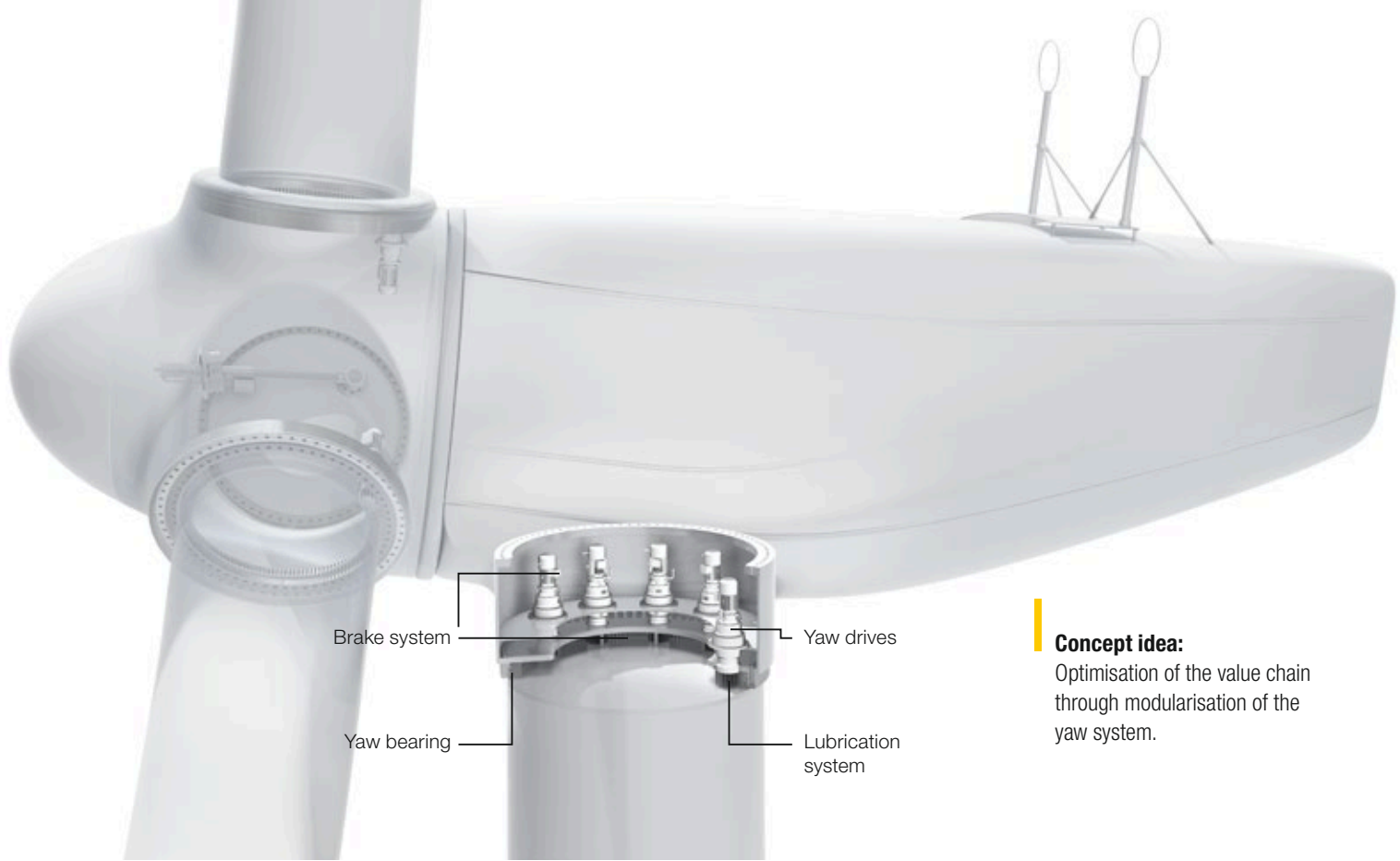


Flexibility on a new level

Yaw Module Concept Study



LIEBHERR



Concept idea:
Optimisation of the value chain through modularisation of the yaw system.

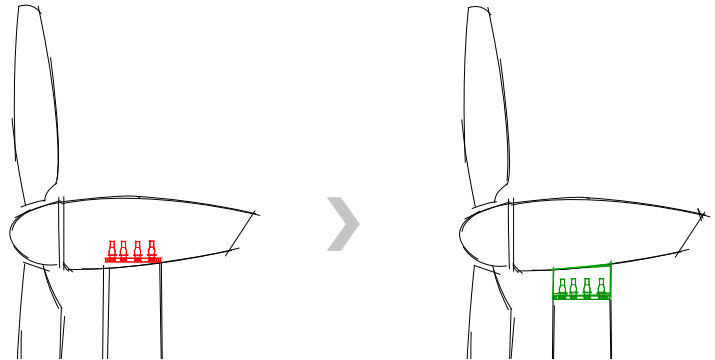
Yaw module concept study

For over 20 years now Liebherr has been supplying the wind industry with components for pitch- and yaw systems, mainly with large diameter bearings and drives. In this period the turbine manufacturers have expanded their product portfolios, which in turn has led to a greater variety of parts and higher complexity.

With this study Liebherr wants to show new ways of optimizing processes relating to the specification, part management and infrastructure of the yaw system to achieve a more flexible value chain setup. Liebherr's many years of experience in the development of components and systems provided a valuable basis for the development of this concept. The result is a module which integrates all functions of the yaw system in a ready-to-install unit.

Overview of benefits

- Modularisation based on standard components
 - Various configuration options
 - Optimised value chain
- Reduced Total Cost of Ownership

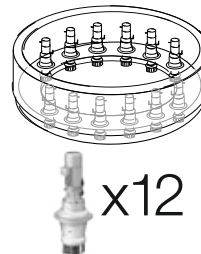
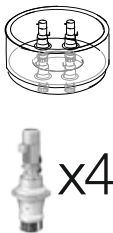
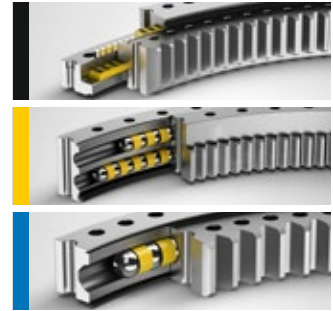
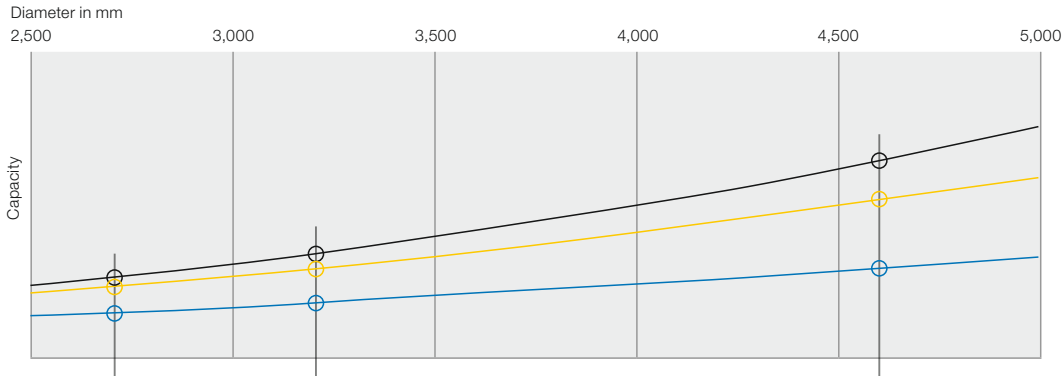


Modularisation based on standard components

The current concept of the yaw system can be easily scaled in terms of size and capacity and adapted to the different turbine platforms. For customers this means:

- Cost savings potential with the option of using standard components across all platforms.
- Option to implement modules in standard sizes, which can cover a large spectrum of operational requirements with different bearing and drive configurations.
- The yaw module makes it possible to select the most cost-effective solution in terms of size and number of drives, without considering the geometry of the turbine main frame and the positioning of the drives.

Configuration options of selected yaw modules



Additional functions and safety solutions

With the modular design various functions and safety solutions can be integrated in the yaw module depending on the customer's requirements without influencing the structure and design of the turbine main frame.

Integrated lubrication system:

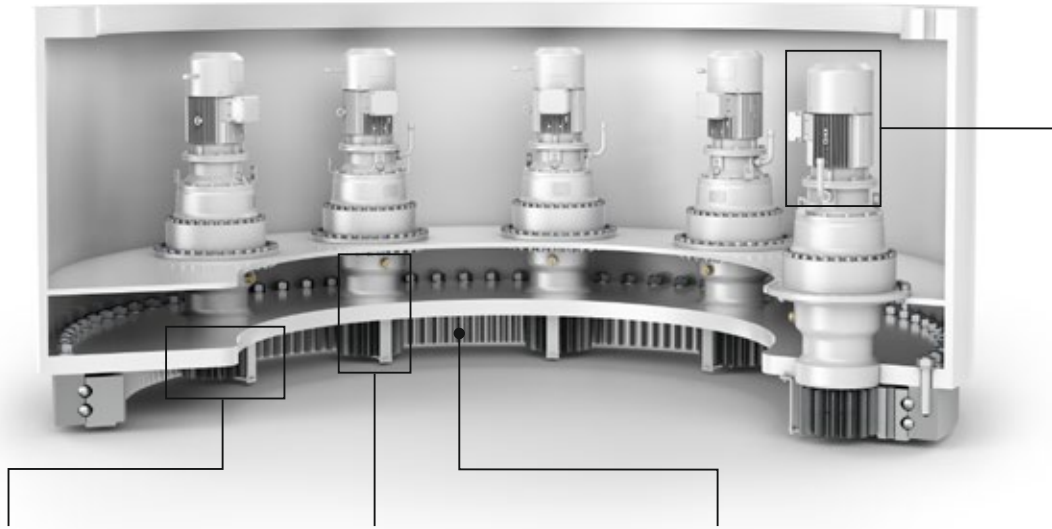
The in-the-drive-pinion integrated lubrication system reduces the risk of dry-running gearing by applying grease directly into the interface between drive pinion and gear of the bearing. As a result, less grease can be applied reducing maintenance and cleaning.

Tooth root safety geometry:

The drive pinion can be designed with a torque defined fracture point. This eliminates the risk of damaging the gearing of the yaw bearing in the case of a drive blockage, consequently eliminating considerable repair costs.

Hydraulic or electric brake system:

Depending on the specific customer wish, the yaw module can be equipped with hydraulic brakes or an electric brake system, which utilizes counter rotating drives to brake the nacelle.

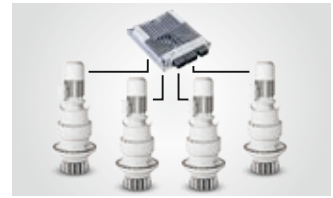
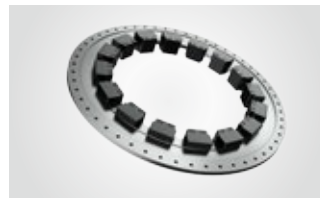
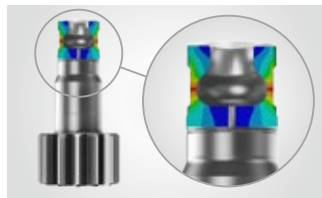


Integrated lubrication system

Tooth root safety geometry

Hydraulic brake system

Electric brake system



Optimised value chain

The implementation of the yaw system as a ready-to-install module makes it possible to simplify processes for the turbine manufacturer along the entire value chain:

- Definition of a sub-system specification instead of several individual component specifications
- Simplified parts management (Purchasing, storage, etc.)
- No specific assembly line for the yaw systems is required
- No specific investments needed for new yaw system assembly lines when new turbine platforms are implemented
- Implementation of functionality test on supplier side to guarantee readiness for installation
- Simplified logistic setup by having the yaw module delivered directly on site upon request
- One contact person for the entire yaw system
- The individual components can be easily serviced or replaced due to direct access to the drives
- In order to minimise risk of downtime for offshore turbines, redundancy drives can be installed

Specification



- One general sub-system specification instead of individual specifications for each component

Parts management



- Management of a single module instead of individual management of each integrated component

Infrastructure



- No specific production line required
- Functionality test is performed by Liebherr
- The module is delivered on site, ready for installation

Commissioning



- Easy access for service work
- One system – one contact person



We look forward to receiving your feedback.

Contact: components@liebherr.com

Liebherr Components



Gas engines



Diesel engines



Fuel injection systems



Axial piston hydraulics



Hydraulic cylinders



Large diameter bearings



Gearboxes and winches



Electric machines



Remanufacturing



Human machine interfaces



Control electronics



Power electronics



Switchgear



Software

From A to Z – the components division of the Liebherr Group offers a broad range of solutions in the area of mechanical, hydraulic, electric and electronic drive system and control technology. The efficient components and systems are produced at a total of ten production sites around the world to the highest standards of quality. Central contact persons for all product

lines are available to our customers at Liebherr-Components AG and the regional sales and distribution branches.

Liebherr is your partner for joint success: from the product idea to development, manufacture and commissioning right through to customer service solutions like remanufacturing.

components.liebherr.com

Sales worldwide
Liebherr-Components AG
P.O. Box 222,
CH-5415 Nussbaumen / AG
☎ +41 56 296 43 00
E-Mail: components@liebherr.com

Sales North America
Liebherr USA, Co.
1465 Woodland Drive, Saline,
MI 48176 USA
☎ +1 (734) 944 6334
E-Mail: components.usa@liebherr.com

Sales Russia
Liebherr-Russland 000
Office 2, Bolschoi Palaschewskij 13/2
121104 Moscow, Russia
☎ +7 (495) 280 18 94
E-Mail: components.russia@liebherr.com

Sales China
Liebherr Machinery Service (Shanghai) Co., Ltd.
Building No. 1, 88 Ma Ji Road,
200131, Shanghai Pilot Free Trade Zone, V.R. China
☎ +86 21 2893 8039
E-Mail: components.china@liebherr.com