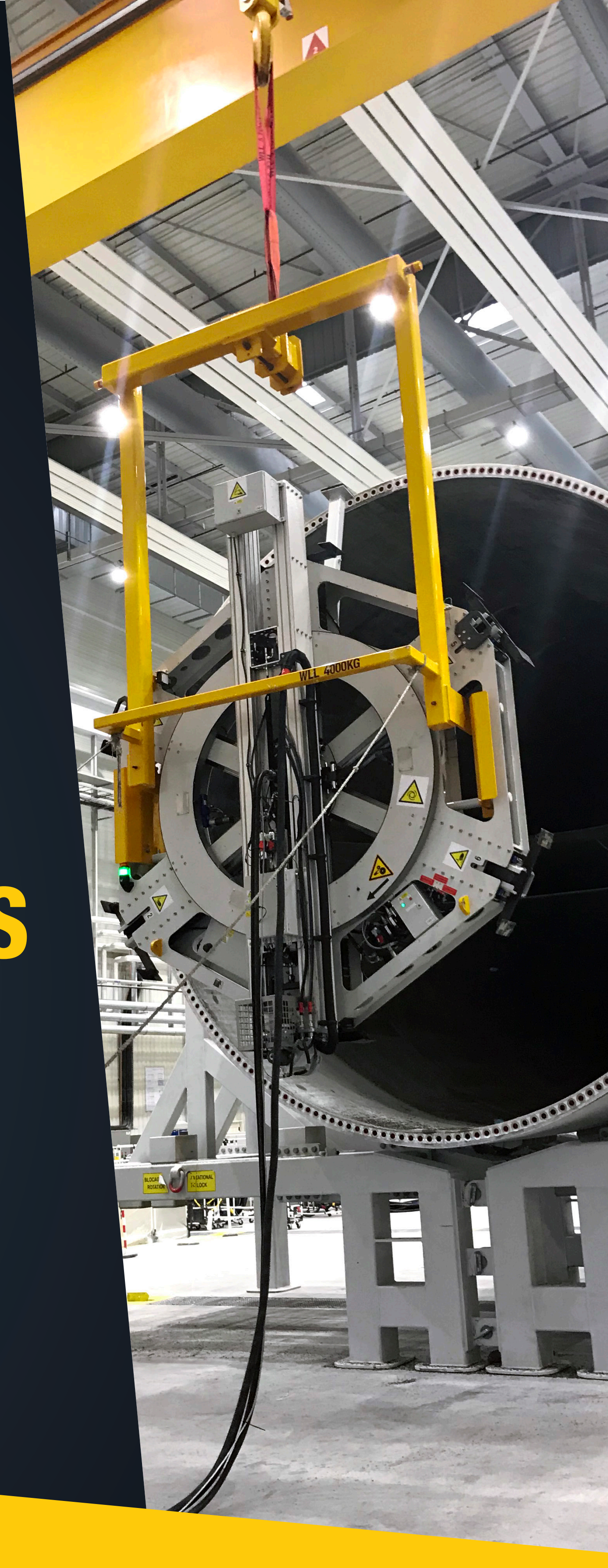
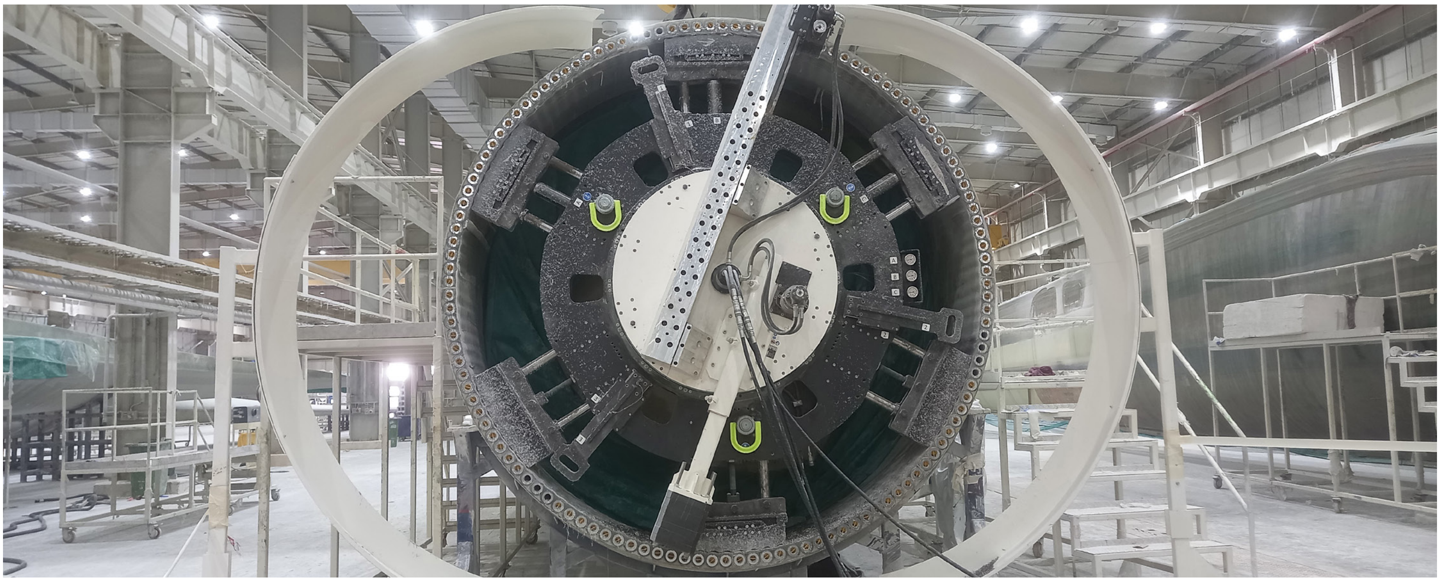
ENERPAC

MACHINING SOLUTIONS
FOR WIND TURBINE MANUFACTURERS



THE RIGHT TOOL MAKES ALL THE DIFFERENCE

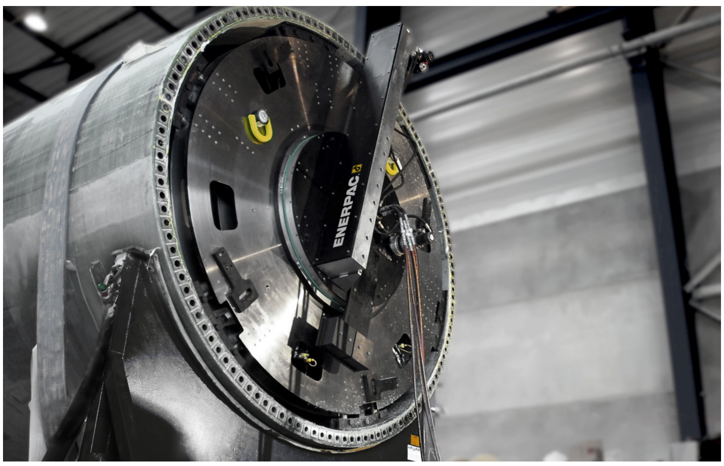
WINDS OF CHANGE: MEETING THE CHALLENGES OF INCREASED WIND TURBINE PRODUCTION



As the demand for wind turbines grows, manufacturers face the challenge of scaling up production while maintaining cost efficiency. Achieving economies of scale while preserving quality standards and cost-effectiveness is a constant balancing act within the industry.

For wind turbine components, quality and accuracy are paramount. Even the smallest inaccuracies at the root end of a turbine blade, tower flange, or transition piece can impact the structural integrity and performance of a turbine, ultimately resulting in reduced output and increasing operating costs.

The need for efficient repeatable production while meeting safety and environmental requirements is not an easy challenge, but manufacturers who stay at the forefront of technology and use the right equipment will be able to strike the right balance.



MACHINING TURBINE BLADES

The connection between the blade and the wind turbine hub is established at the root end of the blade, making it a crucial zone. Ensuring a smooth finish within specified industry tolerances is imperative, and to achieve this, manufacturers can overcome numerous challenges by using an orbital milling machine.

MACHINING COMPOSITE MATERIALS

The root end of the blade is typically constructed from composite materials including fiberglass and threaded metal inserts that accept the fixing bolts or studs. Creating a smooth and level surface using alternative methods, such as grinding, or hand tools would be far too labor intensive, inaccurate, and time-consuming.

TIGHT TOLERANCES

The blade root end must meet strict tolerances to ensure proper fit and alignment with the turbine hub. Achieving these tight tolerances consistently is a significant challenge in the machining process but these can be achieved using an orbital milling machine. These purpose-designed machines can achieve global industry flatness requirements of +/-0.15mm across large diameters. (Note that flatness requirements can fluctuate relative to the root diameter).

MANOEUVRABILITY FOR REPEATABLE PRECISION

The large size of turbine blades makes them hard to move around a factory, which means any machining equipment needs to be easily moved to root end. Orbital milling machines meet this challenge by mounting them to a detachable wheeled trolley that also holds the base, hydraulic power pack, and ancillaries such as hydraulic hoses.

Setting up the machine inside a turbine blade is a straightforward operation, with the height easily adjusted using a hydraulic lifting cylinder, and the machine base clamped into the blade's root using the hydraulic jaws.

DUST MANAGEMENT

The machining process inevitably creates a large amount of swarf and dust which needs to be managed to keep the facility clean and safe to work within. Compared to a grinding head that generates dust and other hot material moving at a fast velocity, an orbital milling machine allows the debris produced to be captured with be an optional vacuum system.

WORKING PROCEDURE OF A WP ORBITAL MILLING MACHINE

1. Machine attached to the purpose-designed trolley is moved to the blade.

2. Hydraulic clamping mechanism is actuated, jaws expand to clamp inside the root end of the blade.

3. The trolley is detached and moved clear of the blade.

4. Flange high point is found to set the milling head starting position.

5. The machine is controlled by the remote pendant attached to a hydraulic power pack.

6. The milling head works its way around the root end and takes the first rough cut.

7. The second smooth and final cut is carried out.

8. The trolley returns to the machine and is reattached

9. Hydraulic clamping is released and the trolley moves to the next blade

CUSTOM SOLUTIONS

Our Wind Power and Milling Machinery technologies have evolved to deliver an optimal combination of precision, productivity, and safety. As the wind industry's demands evolve, it necessitates more innovation and collaboration.
If you require a customized machining solution, we're interested in hearing from you, we're always available to discuss your challenges and offer our expertise.

MACHINING TOWER FLANGES AND TRANSITION PIECES

Tower sections and transition pieces are typically manufactured in a different facility to a blade manufacturing. Fabricators of these huge steel tower sections are also expected to deliver repeatable precision but also face different challenges to blade manufacturers.

A wind turbine tower is constructed from sections bolted together via flanges inside the turbine. The taper featured on a tower means these flange diameters vary, so machining equipment is needed to accommodate the different diameters. To give an example, an Enerpac OM8000 Orbital Milling Machine can be configured to machine diameters from 138 -315” (3.5 - 8m).

An orbital milling machine for this purpose shares many similarities to the turbine blade type. The working principle of a milling head rotating around a central hub is the same, but they’re generally simpler versatile machines, heavier, and instead of using trolley they’re inserted into the work piece using an overhead crane.

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