



# Wind turbines

Your independent partner  
Installation – Operation – Maintenance

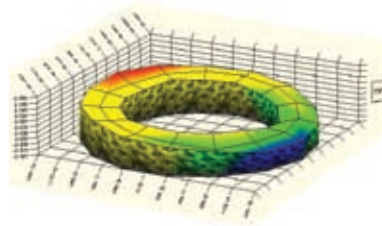


## Measurement of flatness and levelness

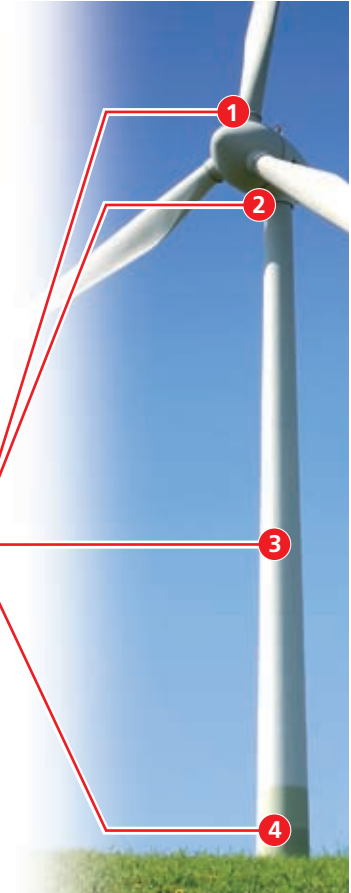
### Wind turbine installation

Wind turbines consist of four large main components: a foundation unit, a tower, a nacelle (turbine housing) and a rotor. The assembly of a wind turbine requires precision measurement for optimum operation. The exact levelness of the foundation plays a decisive role in the plumbness of the whole tower, whose segments must be flat and parallel on opposite sides to ensure proper assembly. After erection of the tower, the large cam wheel mounted on top of the tower is checked for flatness to make certain the nacelle sits atop the tower

appropriately and the rotor turns into wind. Flatness measurement is performed to guarantee the rotor blades mount to the hub precisely. LEVALIGN® laser measurement system is used to measure any surface. The high precision electronic inclinometer INCLINEO® is suited for horizontal surfaces. With these two systems, PRÜFTECHNIK provides the better solution for all flange-related precision measurement.



- 1 Hub
- 2 Cam wheel
- 3 Tower segments
- 4 Foundations



### Using LEVALIGN® to check flange surface flatness

Flanged surfaces are found in major wind turbine components. Tower segments are joined together by flanges, while the nacelle-hub assembly possesses several flanged surfaces. LEVALIGN® laser is used to determine the profile of these surfaces. By positioning a sensor at different points of the surface, the height of each single point is measured, providing surface profile flatness. Vertical mounting is the most appropriate in the case of nacelle side flange for mounting blades as well as for its counterpart – the blade base itself.



## Alignment of rotating machinery for optimal operation



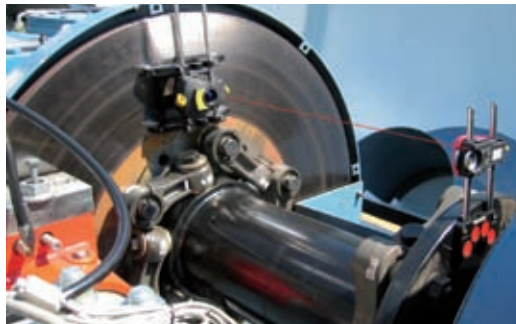
ROTALIGN® Ultra

OPTALIGN® smart



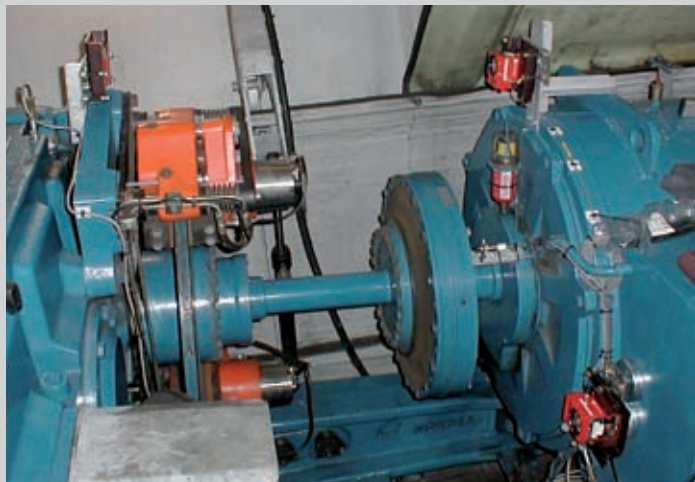
### Reliability starts with precision gearbox-generator shaft alignment

Accurate shaft alignment is an important factor towards preventing premature damage in rotating machinery. It increases the operating lifespan of such machinery. Shaft alignment systems from PRÜFTECHNIK take hundreds of readings, making it possible to perform the measurement under space constraints with the highest accuracy. PRÜFTECHNIK Alignment Systems offers a complete product range for mastering any alignment task.



### Determine the right target

The drive train in a wind turbine exhibits highly variable alignment conditions between the flexibly mounted generator and gearbox. Large parallel offsets cause greater restoring forces inducing stronger vibrations and premature wear. However, it is not desirable to align flexibly mounted drive trains to 'zero', as the alignment changes with new operating conditions. PERMALIGN® monitoring system measures displacements continuously in user-defined intervals, determining the change to be entered as a target when aligning the machines with PRÜFTECHNIK laser measurement systems.



## Predictive and preventive maintenance solutions

The economic viability of wind turbines is influenced by the following factors: sufficient wind, availability, reliability and serviceable life of the turbines. Important sections of wind turbines where PRÜFTECHNIK measurement technology is put to use include:

- ▶ Rotor components
- ▶ Nacelle components
- ▶ Tower components
- ▶ Foundation

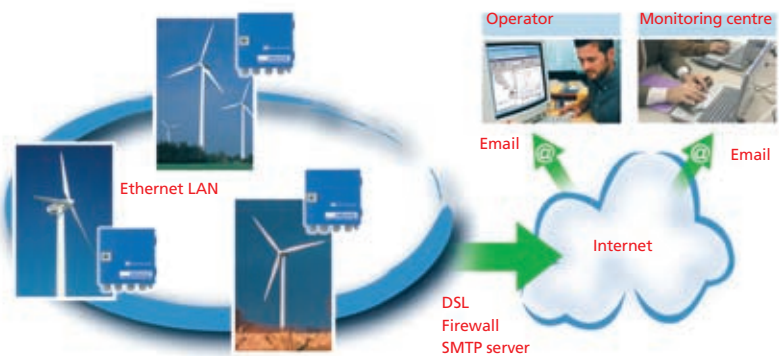
### Laser alignment

Laser measurement systems from PRÜFTECHNIK are applied in the alignment of drivelines, measurement of tower flanges and in permanent or temporary monitoring of machinery positional changes.



### No unplanned shutdowns

- ▶ Avoidance of crane rental
- ▶ Increase MTBR
- ▶ Avoid catastrophic failure of gearbox/drive train
- ▶ Better alignment reduces bearing failure, coupling wear, noise, vibration and downtime



### Online monitoring systems

Autonomous online systems (VIBROWEB XP, VIBNODE) are able to detect both mechanical and electrical faults at an early stage. In many cases, defects are identified while the component is still operational. This facilitates scheduling shutdowns for maintenance and repair, avoiding breakdowns that call for instant repair work. This strategy plays an important role in reducing downtime and maintenance costs of wind turbines.

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