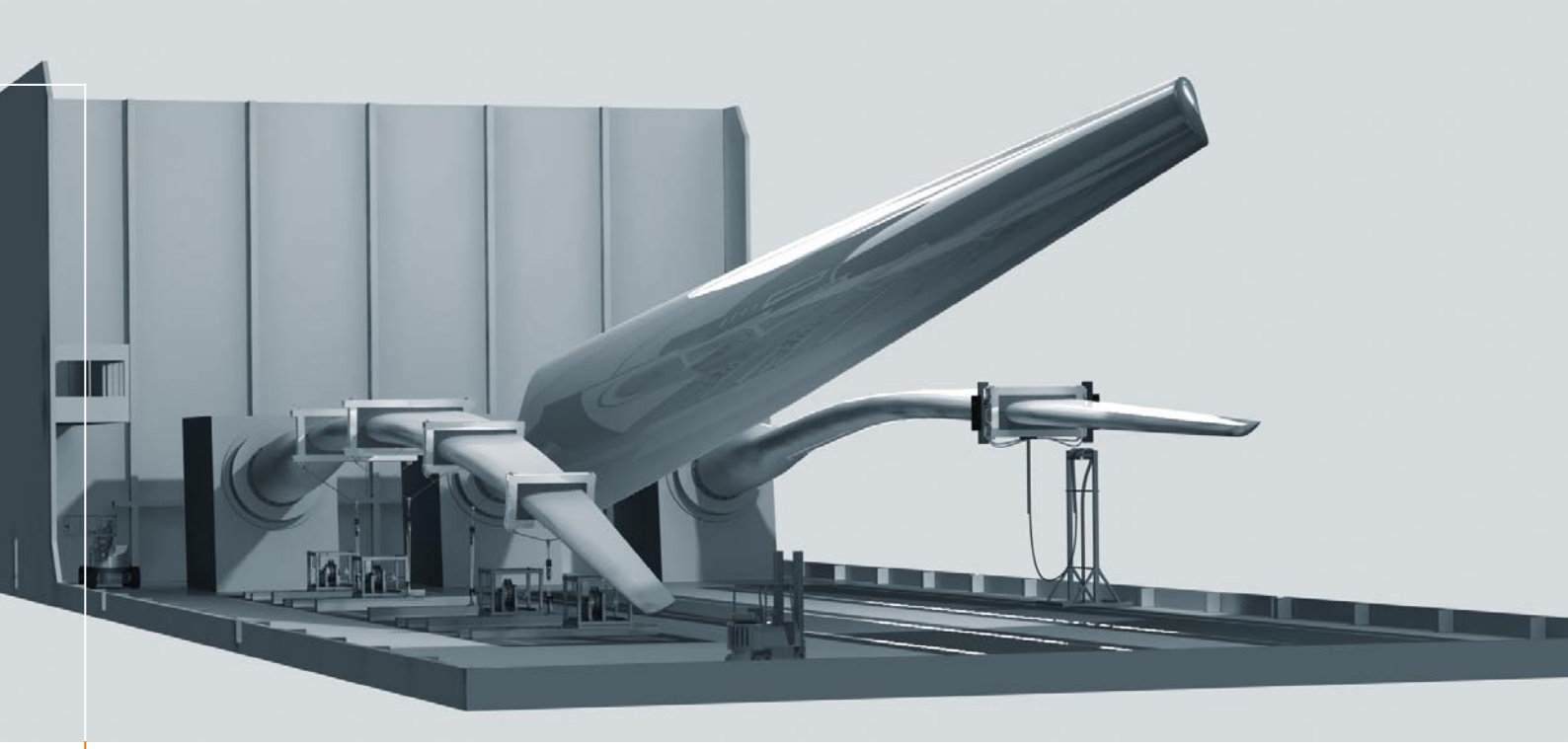

WIND ENERGY TECHNOLOGY CENTRE

FULL-SCALE TESTING OF ROTOR BLADES

RISK AND RELIABILTY

Proving the reliability of ever longer rotor blades is essential. Not only are blades delicate structures, consisting of combined materials with critical connections between subcomponents. Also during their operational life blades are subjected to highly demanding loads, both extreme and cyclic in nature.

Blade failures can have severe impact on safety, turbine downtime and public exposure. In case a retrofit is needed to a turbine fleet, significant costs arise. To minimise the risks from design flaws and manufacturing defects, a thorough validation of the blade through full-scale testing is indispensable.

BLADE TESTING AT SGS-WETC

The Wind Energy Technology Centre (WETC) provides a complete set of full-scale testing capabilities. Equipped with state-of-the-art technology the test centre can perform static and fatigue tests for various purposes

- Certification testing
- Blade design validation
- Manufacturing quality testing
- Validation of repairs and design changes

Consultancy is provided for determining a targeted test plan and specification.

Besides full-scale tests WETC offers the following services

- Testing of material coupons
- Advanced NDT methods specifically developed for Rotor Blades

STANDARDS AND PRINCIPLES

Tests are performed with great precision in load application and measurements. Along with detailed measurements, visual inspections are performed and NDT methods are used to monitor the condition of the blade.

Execution and reporting of the tests is done according to IEC-61400-23 with optional accredited witnessing.

Key principles with testing at SGS are

- Independence as third party test centre
- Safety with blade handling and test execution
- Intellectual property protection

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SGS

STRUCTURAL TESTING TO VALIDATE ROTOR BLADE LIFE

TEST METHODS

EIGENFREQUENCY DETERMINATION

Blade is mounted to the test stand and is excited manually into its eigenfrequency. Blade displacement is measured and eigenfrequencies of the blade are analysed using FFT. Test is done for edgewise, flapwise and torsional frequencies.

STATIC TESTING

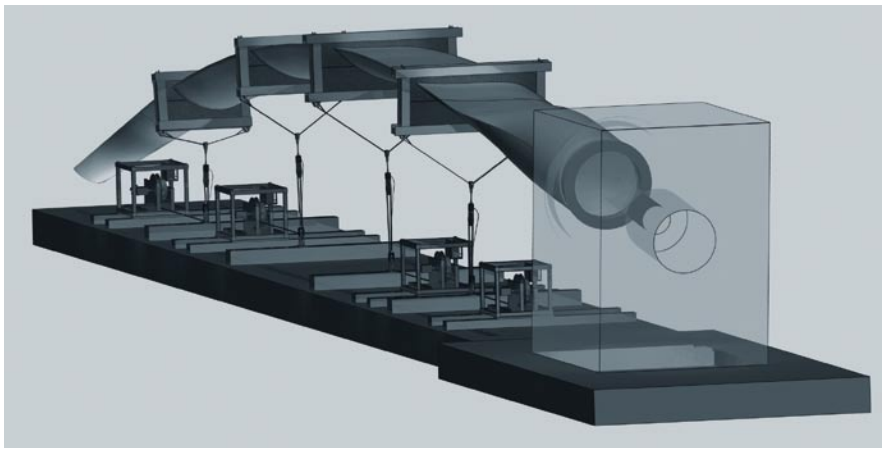
Along the blade a maximum of 6 saddles is mounted. Hydraulic winches are connected to the saddles via pulleys (see picture at right). Pulling loads are applied towards the floor and kept for a specified duration. Blade deflection and strains are measured at predetermined locations. Test is repeated for all required loading directions.

FATIGUE TESTING

An exciter saddle with linear masses is mounted to blade (see picture below). The dynamic load distribution and amplitude are adjusted to represent 20 years of cyclic field loads. Fatigue test runs until the equivalent number of cycles is obtained, with continuous signal monitoring and periodic inspection. Fatigue test is done separately for edgewise and flapwise direction.

ULTIMATE TESTING

Static testing until ultimate failure is available for blade lengths up to 60 m.



Static test set-up with four load saddles

TEST CENTRE SPECIFICATIONS

GEOMETRY

- Number of test rigs: 3
- Maximum blade length: 70 m
- Blade root fixture
  - Max. bolt circle diameter: 3.9 m
  - Default tilt angle: 7 °
  - Distance from root centre to floor: 4.5 m
  - Distance between root centres: 9 m

BLADE HANDLING

Two independent 32 ton overhead cranes

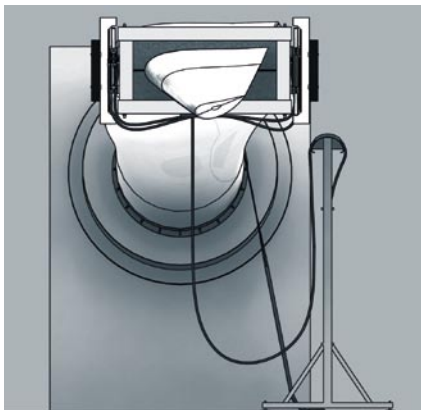
STATIC TESTING

- Load Capacity
  - Max. bending moment: 45 MNm
- Hydraulic winch capacities
  - 4 winches of 200 kN
  - 2 winches of 100 kN
- Max. blade tip displacement
  - 18 m vertical displacement

DYNAMIC TESTING

- Load capacity
  - Maximum fatigue bending moment: 30 MNm
- Dynamic excitation
  - Excitation saddle is mounted to blade with hydraulic cylinders at each side of blade
  - Adjustable moving masses with maximum of 1200 kg
- Max. blade tip displacement
  - 19 m peak-to-peak in fatigue

The Wind Energy Technology Centre (WETC) is located on Xinxing Road, West District, TEDA, Tianjin, China.



Fatigue test system with hydraulic excitation of linear masses

SGS COMPETENCE CENTRE
WIND ENERGY
Raboisen 28
D-20095 Hamburg
Germany
T +49 40 30101 236
F +49 89 1250 4068 236
wind@sgs.com
www.sgs.com/wind

WHEN YOU NEED TO BE SURE

SGS