

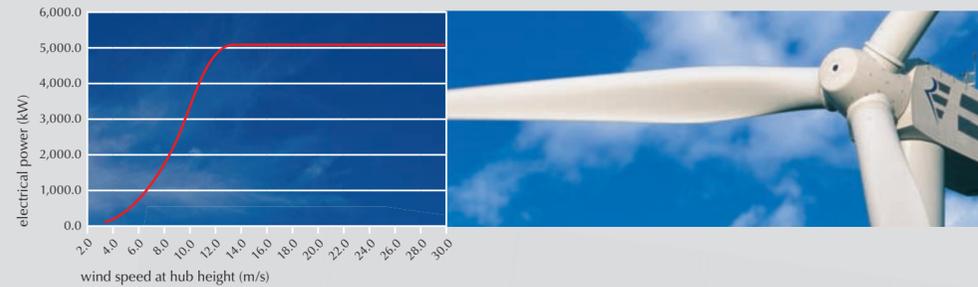
Proven technology in a new dimension

The REpower 5M takes our internationally renowned technology to a new dimension. Its innovative, detailed design reinforces our leadership in the provision of technical solutions. With a rated power of 5 megawatt and a rotor diameter of 126 metres, the 5M is one of the largest and most powerful wind turbines in the world. The 5M sets new standards for the economic viability of windfarms, especially in offshore installations.

Windfarms with turbines of this size achieve outputs similar to conventional power plants. This in turn puts high demands on the control and regulation system because optimised integration into the power grid is essential. In the 5M, REpower has once again shown how compatibility with the grid can be optimised. The 5M can be easily integrated into the grid, just like any other power plant of its size.

Due to its modular structure and logistical flexibility, the 5M is suitable for onshore and offshore installation. The offshore version is specifically designed to withstand extreme environmental conditions. This includes, for example, redundancy of key components to guarantee maximum availability, effective protection against corrosion and a permanent monitoring system.

Our comprehensive and efficient service ensures reliable and cost-effective operation of the 5M over its entire service life.



Powerful, economical, reliable

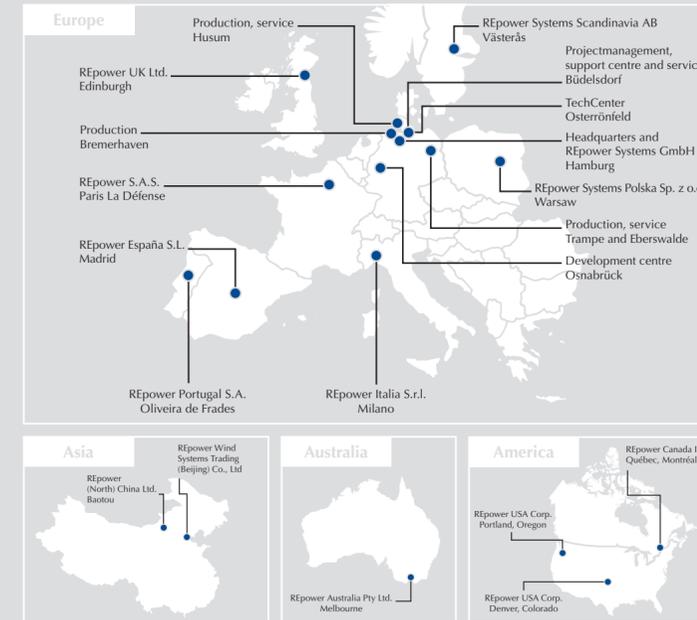
By choosing REpower turbines, you are selecting power plant technology of the highest quality. To ensure that your investment retains its value, we offer comprehensive after-sales service.

Our permanent system monitors your power plants 24 hours a day, 365 days a year ensuring the quickest possible response times of our local service teams. We also offer integrated service packages (ISP-onshore and OSP-offshore) that allow you to calculate your long-term operating costs.

We are constantly upgrading our services to meet the increasingly stringent requirements of monitoring, documenting and optimising the operational behaviour of windfarms. With our „REguard“ package, we offer a comprehensive modular windfarm management system that can be flexibly configured to suit local factors, ensuring efficient operation of your plant at all times.

For more information, please refer to our brochures or contact our sales team.

The REpower sales teams are always there for you.



Please visit our website: at www.repower.de ► **Company** ► **REpower Germany** or **REpower International** you can find the addresses of all our company sites.

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	MM82	MM92	MM100	3.4M104	3.2M114	5M	6M
Rated power	2,050 kW	2,050 kW	1,800 kW	3,370 kW	3,170 kW	5,075 kW	6,150 kW
Rotor diameter	82.0 m	92.5 m	100.0 m	104.0 m	114.0 m	126.0 m	126.0 m

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The 5-megawatt power plant with 126 metre rotor diameter



Technical data

Design data
 Rated power 5,075 kW
 Cut-in speed 3.5 m/s
 Rated wind speed 14.0 m/s
 Cut-out speed 25.0 m/s onshore
 30.0 m/s offshore

Type class
 Offshore IEC IB, REpower S-Classes
 Onshore IEC IB, IEC IIA

Rotor
 Diameter 126.0 m
 Rotor area 12,469 m²
 Rotor speed 7.7–12.1 rpm (+15.0 %)

Rotor blade
 Length 61.5 m
 Type GFRP shell construction, pre-bent

Yaw system
 Type Externally geared four-point bearing
 Drive system Gear motors with multi-disc brakes
 Stabilisation Disc brake with hydraulically operated brake shoes

Gear system
 Type Two helical planetary stage and one spur gear stage
 i = approx. 97

Electrical system
 Generator type Double-fed asynchronous generator, 6-pole
 Rated power 5,075 kW
 Rated rotor voltage 660 V
 Rated stator voltage 950 V
 Rated speed 750–1,170 rpm (+15.0 %)
 Generator protection class IP 54
 Converter type Pulse-modulated IGBTs

Power control
 Principle Electrical blade angle adjustment – pitch and speed control

Tower
 Type Steel tube tower
 Hub height 117 m onshore
 approx. 85–95 m offshore (depending on site conditions)

Foundation
 Onshore Reinforced concrete foundation, depending on site conditions
 Offshore Substructure suitable for actual site

Safety system
 ■ Individually adjustable blades (electrically controlled) – fail-safe system
 ■ Extensive temperature and speed sensing system including builtin redundancy
 ■ Fully integrated lightning protection
 ■ Automatic fire protection system
 ■ Shielded cables protecting people and machinery
 ■ Rotor holding brake with soft-brake function



Rotor bearing and shaft

- Double-supported distributed drive train with clear functional separation
- Bearing consisting of one movable bearing (CARB™) and one fixed bearing (spherical roller bearing) with optimised bearing housing and automatic for-life lubrication, ensuring excellent antifriction properties and prolonged service life
- The use of CARB™ bearings allows for axial shifts and inclination of the rotor shaft without causing damage



Rotor hub

- Extremely low deformation due to compact design adjusted to power flow, with optimised integrated external pitch drives
- Generously dimensioned spinner allowing access to the hub in all weather directly from the nacelle
- Elastomer bearings of the battery boxes prevent damage due to acceleration peaks



Pitch system

- Virtually maintenance-free electronic system
- High-quality double-row blade bearing with hardened gears and automatic lubrication of track and gearing
- Protected against the elements by means of integrated deflector in the spinner
- Maximum reliability due to redundant blade angle detection by means of two separate measuring systems
- Fail-safe design with separate control and regulation systems for each rotor blade
- High-quality batteries in heated battery boxes; charge and status permanently monitored depending on the actual temperature



Rotor blade

- Load-optimised GFRP construction
- Lightning protection with multi-receptor system, including drain receptor in the blade tip
- Optional load and blade status monitoring system



Fire protection

- Fully automated fire protection system with active signals (for smoke and aerosols) and smoke detection in the nacelle, the switch cabinets and the transformer room (for early fire detection)
- Automatic nitrogen multi-point fire extinguishing equipment protecting the electrical components
- Carbon dioxide and ABC fire extinguishers for manual fire-fighting in the tower and nacelle



Electrical system

- Optimised integration of the complete system into the nacelle
- Reliable protection against humidity and salt through cooling with air to air heat exchangers
- Low transmission loss as components are located close to each other
- Components mounted on elastomer bearings, reducing structure-born sound and vibration



Tube Tower

- Characteristic frequency of the tower is above rotating frequency of the rotor (rigid design) and ensures minimum stress in tower and machine
- No restrictions regarding speed range of unit, as there is no risk of frequency interference
- Excellent component safety due to T- and L-flanges and load-optimised door opening



Gear system

- Two helical planetary stages and a double helical spur gear stage
- Net torque transmission via slip-on gear design Dimensioned according to REpower gear regulations, meeting the most stringent requirements regarding service life and smooth running
- Optimised efficiency
- Elastomer bearing of torque multiplier for effective structure-borne sound insulation and gear-protecting compensation of peak loads
- Low temperature level due to efficient oil cooling system with oil/air heat exchanger
- Electric and mechanical system for optimised lubrication during normal and idle operation
- Excellent oil quality due to reliable filtering with minimum mesh size of 6 µm with triple-stage oil filtering system



Lightning protection

- Lightning protection concept based on zones, meeting the stringent requirements of IEC lightning protection class I and the GL regulations, with internal and external lightning protection
- Outer lightning protection by means of multiple receptors located in the rotor blades and the lightning rod at the weather mast
- Reliable protection of bearings due to defined lightning conduits
- GFC coupling for the galvanic insulation of the generator system from the gear system
- Overvoltage arrester protecting the electric system
- Reliable protection of the generator by means of insulated bearing bushings



Environment

- No leakage of lubricants at hub or nacelle, due to
 - labyrinth packing in spinner
 - grease and oil collecting pans integrated in nacelle
 - coaming edges in nacelle panelling and
 - oil pan below azimuth gearing
- Closed central lubrication system of blade bearings
- Shielding of all relevant cables to protect workers and machine
- Very low noise level



On-board crane

- Fully hydraulic marine crane
- All necessary maintenance work can be completed with on-board equipment due to:
 - unrestricted swivel range
 - great each
 - high load capacity
 - great lifting heights
- Flexible operation with remote control
- Option for transport of people with caged platform



Holding brake

- Secure holding of rotor via generously dimensioned disc brake
- Soft-brake function with delayed hydraulic actuation protects the gear system



Transformer

- Use of cast resin and dry-type transformers with excellent ecological properties
- Fully enclosed assembly with air to air heat exchanger
- Reduced weight and fire risk
- Output voltage adjustable between 20 and 33 kV



Converter

- Low conversion loss and high total efficiency as converter output is limited to maximum 20% of the overall output
- Redundant system with 4 modules aligned in pairs allows for continuous operation even in the event of a module failure
- Optimised frame construction minimizes vibration and oscillation



Generator

- Yield-optimised variable speed range
- Fully enclosed generator with air/air heat exchanger
- Optimised temperature level in generator, even at high outside temperatures
- Low-voltage operation allows for the use of tried and tested series components without the need of additional switching equipment
- Excellent safety as insulation is dimensioned for 20 kV



Corrosion prevention

- Special multi-layer coating according to DIN EN ISO 12944
- Highly effective additional coating of the tower and foundation area
- Protected installation of all electrical components in nacelle
- Cooling and ventilation of components through heat exchangers
- No intake of humid or salty air into the nacelle



Azimuth/Yaw system

- Externally geared four-point bearing, driven by generously dimensioned high-quality gear motors with multi-disc brakes
- Hydraulic holding brakes relieve the drives when idle and stabilise the nacelle
- Minimum load on drives due to low friction at four-point bearing and minimum brake pressure during tracking



Serviceability

- Ample space in nacelle for ergonomically optimised and reliable service
- Hub easily accessible in all weather conditions without having to leave the nacelle
- Excellent accessibility of all components
- Guards mounted over all rotating components ensure safe servicing
- If necessary, the unit can be easily and safely dismantled as drive train components are flange-mounted and the electric connections are equipped with plug-type connectors
- Easy handling of heavy components due to sturdy folding crane located in the nacelle
- Permanent status monitoring and reliable early detection system combined with optimised maintenance schedule based on condition monitoring system
- Helicopter descent platform for offshore installations ensure accessibility to the unit even in adverse weather conditions

