G87-2.0 MW

Maximum output at minimum cost per kWh for medium and low wind sites

Advantages

- Up to 20% more energy output than the G80-2.0 MW for medium and low wind sites
- Optimum price-quality ratio provided by Gamesa's vertically integrated supply structure
- State-of-the-art blade manufacturing technology using carbon fibre and pre-preg technology for a lighter rotor design
- IEC II/WZII classes with the largest swept area
- Exceptional service facility through an independent drive train
- Reduced sound level for standard power level and different low-noise level versions
- Gamesa Technology with a proven track-record in complex terrains: active yaw, optimised control, fast pitch dynamics

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Rotor

Diameter	86.6 m.
Swept area	5,890 m^2
Rotational speed, rotor	9.0 - 19.0 r.p.m.
Rotational direction	Clockwise (frontal view)

Blades

Number of blades	3
Length	42.3 m
Airfoils	DU (Delft University) + FFA-W3
Material	Preimpregnated epoxy glass fibre + carbon fibre
Total blade weight	Aprox. 6,500 kg

Gearbox G87-2.0 MW

Type	1-stage planetary / 2-stage helical
Ratio	50 Hz 1:100.5 60 Hz 1:120.515
Cooling	Oil pump with heat exchanger
Oil heater	2.2 kW

2.0 MW Generator

Type	Doubly fed generator
Rated power	2.0 MW
Voltage	690 V ac
Frequency	50 Hz / 60 Hz
Protection class	IP 54
Number of poles	4
Rotation speed	900:1,900 r.p.m. (rated/ 1,680 r.p.m.)
Rated current	
Stator	1,500 A @ 690 V
Rated power factor, default	1.0
Power factor range	0.98 CAP - 0.96 IND (option)

Weights

Class	IEC IIA Dibt WZ II	IEC IIA Dibt WZII	IEC IIA
Tower height	67 m	78 m	100 m
Tower (tubular)	153 T	200 T	286 T
Nacelle	65 T	65 T	65 T
Rotor (incl. hub)	38 T	38 T	38 T
TOTAL	256 T	303 T	389 T

Control System

The Generator is a doubly fed machine (DFM), whose speed and power is controlled through IGBT converters and PWM (Pulse Width Modulation) electronic control.
Advantages:

- Active and reactive power control.
- Low harmonics content and minimum losses.
- Increased efficiency and production.
- Prolonged working life of the turbine.

Remote Control System

A remote control system that ensures real-time monitoring of the machines' parameters as well communication with the weather masts and the electrical sub-station from a central or remote site. Ability for controlling active and reactive power.

Predictive Maintenance System SMP-8C

Predictive Maintenance System for the early detection of wear and faults in the wind turbine's main components.
Advantages:

- Capacity for signal processing and detection of alarms within the equipment.
- Integration within the control system.
- Reduction in major corrective measures.
- Increase in the availability and working life of the machine.
- Preferential terms in negotiations with insurance companies.

Grid Code Compliance

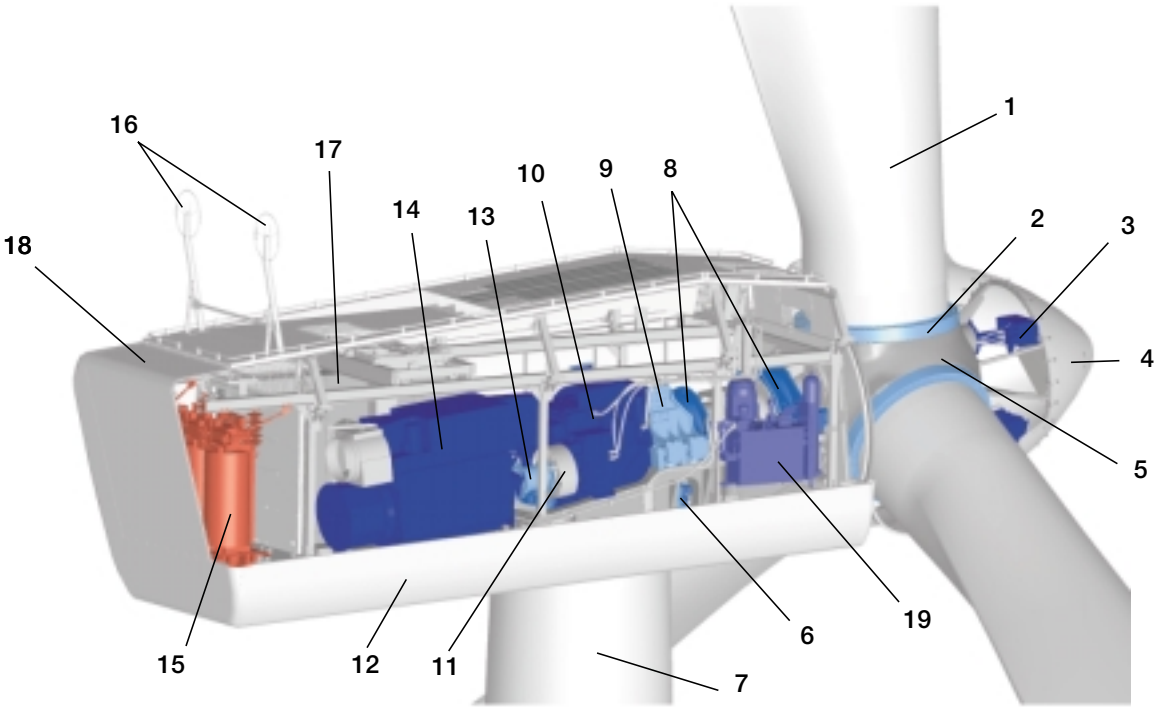
The dynamic regulation of active and reactive power in order to contribute to the stability of the grid and overcome voltage dips by means of a device that ensures grid code compliance.
The wind turbine is equipped with an active crowbar system that maintains connection during voltage dips in the supply system.

Brake

Aerodynamic primary brake by feathering of blades. In addition, mechanical emergency disc brake hydraulically activated and mounted on the gearbox's high-speed shaft.

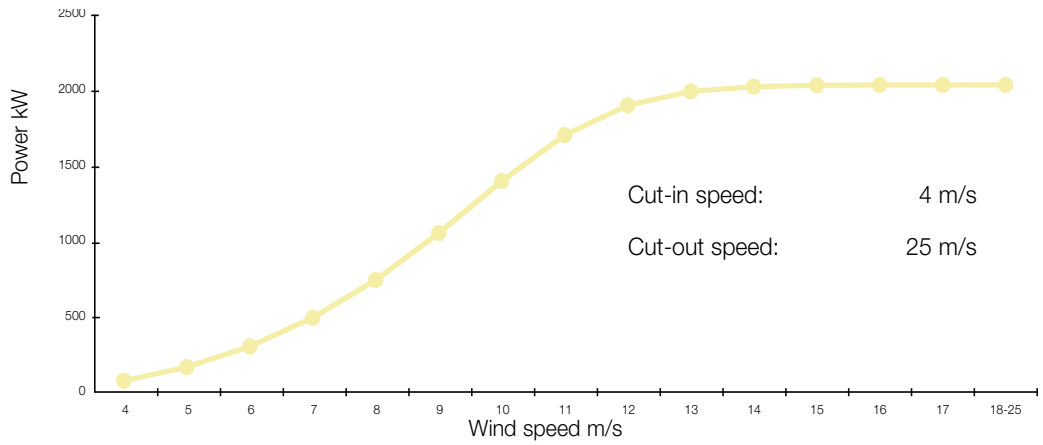
Lightning protection

The G87 wind turbine generator uses the "total lightning protection" system, according to IEC 1024-1 standard. This system conducts the lightning from both sides of the blade tip down to the root joint and from there to the nacelle, tower and earthing system. Therefore, the blade is protected and electrical component damage is avoided.



1. Blade
2. Blade bearing
3. Hydraulic pitch actuator
4. Hub cover
5. Hub
6. Active yaw control
7. Tower
8. Main bearing house
9. Gear tie rod
10. Gearbox
11. Main disc brake
12. Nacelle support frame
13. Cardan or composite shaft
14. Doubly fed generator
15. Transformer
16. Anemometer and wind vane
17. Top controller
18. Nacelle cover
19. Hydraulic unit

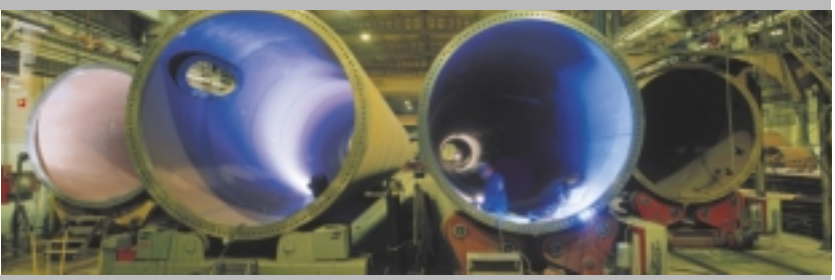
Power curve G87-2.0 MW (for an air density of 1,225 kg/m³ and a sound level of 105.3 dB(A))



Power curve calculation based on DU (Delft University) and FFA-W3 airfoil data.

Calculation parameters: 50 Hz grid frequency; pitch regulated tip angle (pitch control), a 10% turbulence intensity and a variable rotor speed ranging from 9.0 – 19.0 r.p.m.

Reduced sound level versions. The G87-2.0 MW wind turbine is supplied in different low-noise versions: 104 dB(A), 103dB(A), 102dB(A), 101dB(A).



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