V120-4.5 MW
Offshore leadership

Prototype

Reliability and longevity

Employing OptiTip® and OptiSpeed®* – both proprietary Vestas technologies – the V120 constantly pitches its blades and varies the speed of its rotor to match the rough offshore conditions. This ensures optimal and constant power output at all times.

OptiTip® technology measures the position of each blade from two physically different perspectives, making it possible to keep all three blades in perfect alignment at all times. This minimises the loads on the turbine and ensures high reliability and longevity.

OptiSpeed® allows the rotor speed to vary within a range of approximately 60 per cent in relation to nominal rpm. Thus with OptiSpeed®, the rotor speed can vary by as much as 30 per cent above and below synchronous speed. This minimises both unwanted fluctuations in the output to the grid supply and the loads on the vital parts of the construction.

Reduced service needs

The V120 has gone through a radical process to reduce service requirements and to cut downtime due to maintenance. The V120 is equipped with a fully enclosed nacelle and an enclosed tower design. These features efficiently put a stop to salt damage to the vital parts of the wind turbine. Together with innovations such as automatic blade bearing lubrication, advanced lightning protection and the “once a year service programme”, these features help to cut personnel costs and reduce down-time due to service and maintenance.

Grid-friendly operation

The V120 complies with the strict grid demands of the offshore market, and can help stabilise the power quality of a weak grid. Furthermore, Vestas’ advanced SCADA technology allows remote monitoring of the V120 wind turbines in order to support offshore power operations and facilitate data acquisition and evaluation.

Proven performance

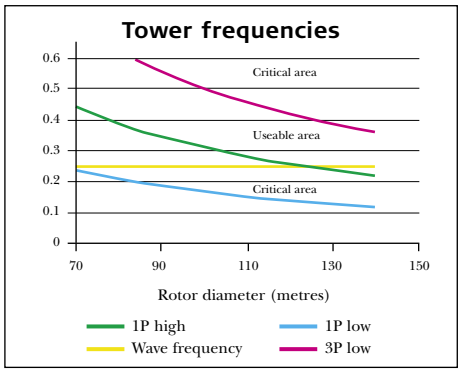
Wind power plants require substantial investments, and the process can be very complex. To assist in the evaluation and purchasing process, Vestas has identified four factors that are critical to wind turbine quality: energy production, operational availability, power quality and sound level.

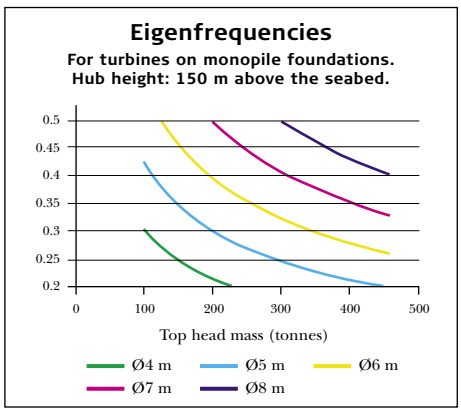
We spend months testing and documenting these performance areas for all Vestas turbines. When we are finally satisfied, we ask an independent testing organisation to verify the results – a practice we call Proven Performance. At Vestas we do not just talk about quality. We prove it.

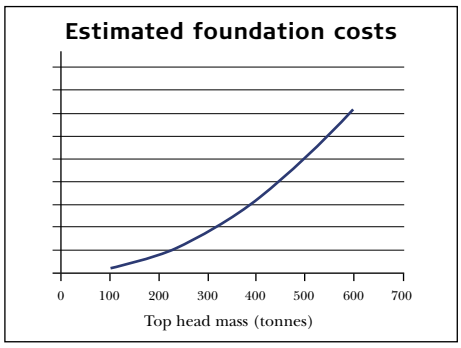
* Vestas OptiSpeed® is not available in the USA and Canada.

Technical specifications

1. Wind sensors and lightning conductors
2. Cooler for gearbox, generator and hydraulics
3. Converter cooler
4. Helihoist platform (Option)
5. Aviation light (Option)
6. VMP-Top controller with converter
7. OptiSpeed® generator
8. Composite disc coupling
9. Service crane
10. Mechanical disc brake
11. Gearbox
12. Machine foundation
13. Main shaft
14. Yaw gears
15. Main bearing
16. Blade bearing
17. Blade hub
18. Hub controller
19. Pitch cylinder
20. Blade







Top head mass has a major impact on costly offshore foundations

When installed offshore, large turbines face challenges with critical eigenfrequencies. As their diameters increase, large rotors have to rotate more slowly to keep the tip speed at a reasonable level. In order to obtain the most economical tower solution, the eigenfrequency for the tower has to be just above the 1p level over speed. When the frequency is below 0.25 Hz, the impact of the waves starts to dominate.

A lower limit on the frequency creates demands regarding tower stiffness or the stiffness of the complete tower and foundation system. In this context, top head mass is an important parameter as it affects the frequency. Taking as a theoretical example a cylindrical tower installed on monopile foundations and with a height of 150 m, the necessary diameter can be read from the figure on the basis of the mass and frequency required.

A low top head mass makes it possible to use a slimmer and less expensive tower and foundation. For wider towers, the impact from the waves becomes even greater through a sort of self-sustaining process. In addition, heavier towers are more expensive to install – which naturally drives up the total cost. Consequently, as shown by the figure, the estimated foundation costs increase exponentially as a function of the top head mass.

Design criteria

Approval:	IECS
Maximum average wind speed:	10 m/s
Maximum reference turbulence:	14%

Rotor

Diameter:	120 m
Area swept:	11,310 m²
Nominal revolutions (rated power):	12.4 rpm
Operational interval:	9.9-14.9 rpm
Number of blades:	3
Power regulation:	Pitch/OptiSpeed®
Air brake:	Full blade pitch by 3 separate pitch cylinders

Tower

Hub height:	90 m or site specific

Operational data

Cut-in wind speed:	4 m/s
Nominal wind speed (4.5 MW) according to IEC:	12 m/s
Cut-out wind speed:	25 m/s

Generator

Type:	Asynchronous with OptiSpeed®
Rated output:	4.5 MW
Operational data:	50 Hz 6,000 V

Gearbox

Type:	Two planetary and one parallel stage

Control

Type:	Microprocessor-based control of all the turbine functions with the option of remote monitoring and control. Output regulation and optimisation via OptiSpeed® and OptiTip® pitch regulation.

Weight (IEC IIB)

Hub height:	90 m*
Tower:	220 t
Nacelle:	145 t
Rotor:	65 t
Total:	430 t

t = metric tonnes

** Offshore conditions require site specific tower constructions.*

All specifications subject to change without notice.

Offshore leadership

The V120 is a full-blown offshore wind turbine specially designed to perform under the extremely tough conditions at sea and to comply with the requirements of large offshore projects. The flexible design of the V120 means that a range of installation methods can be applied so that the turbine can be installed on a variety of foundations and operate under different grid conditions. With an impressive 4.5 MW power rating, the number of turbines needed for a given output has once again been reduced – just as the "once a year service" design ensures that downtime, personnel and service costs are held at a minimum. This is naturally a very important factor when it comes to hard-to-reach offshore installations.

Extensive use of superior technologies – such as the light blade design based on wood carbon and new, stronger steel alloys – has made the V120 the lightest wind turbine in its class. The low weight cuts material consumption, reduces production and transport costs and allows for single-lift offshore installation. Most importantly of all, it keeps down the substantial cost of the foundations. And finally, when the turbines are installed, the lower weight means less wear and tear – thereby improving the overall economy of offshore projects.

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