NG Twelve-Five (33kW)

The NG Twelve-Five is a German designed wind turbine that was originally sold under the trade name of AEROMAN in 1984. The Twelve-Five turbines are completely rebuilt and customized for Midwest conditions. This system is available with a standard 50 foot tower, 80 foot and 100 foot towers are available as an option. The Twelve-Five uses a 12.5 meter (41 ft) diameter, variable pitch rotor. The variable pitch rotor, contrary to most fixed pitch turbines of comparable size, allows for precise adjustment and control of power output. This makes for a more reliable wind turbine with lower stresses on the drivetrain. The rotor drives an induction generator via a 3 stage step-up gearbox that increases the speed from 100 RPM at the blades to 1800 RPM at the generator. The induction generator makes the use of simplistic controls possible for connecting the Twelve-Five to the grid as well as providing high reliability and low maintenance costs. A spring loaded disc brake is located on the low speed shaft and is used in the event of an emergency situation or for stopping the rotor during normal scheduled maintenance. The wind tracking system, also known as the yaw system, is fully automated with an electric yaw motor which is controlled by the wind sensors and the Twelve-Five's controller. Automatic untwisting of the tower drop cables is made possible with this yaw system. The Twelve-Five's controller is a brand new state of the art UL listed wind turbine control that has been custom built for the Twelve-Five in particular. This control cabinet houses the PLC processor that monitors the turbines operation and makes adjustments to the various systems of the turbine accordingly. The PLC monitors power output and adjusts the blade pitch accordingly, monitors for grid irregularities in both voltage and frequency, controls the turbine during start-up and shut-down, and monitors for any malfunctions. The entire wind turbine and control system has been designed in a fail-safe configuration.

Advantages of the Twelve-Five:

- Fully Automatic Operation
- Easy to Assemble
- Easy to Maintain
- High Level of Reliability
- Thoroughly field tested
- Fail-Safe design
- Design Lifetime of 20 years

Safety Devices:

- Manual Activation of Disc Brake from the ground
- Mechanical and Electronic Overspeed Protection
- Vibration Detector
- Grid Failure Monitoring Relays

System Description

Figure 1 below lists the main components of your NGPS Twelve-Five wind turbine nacelle.

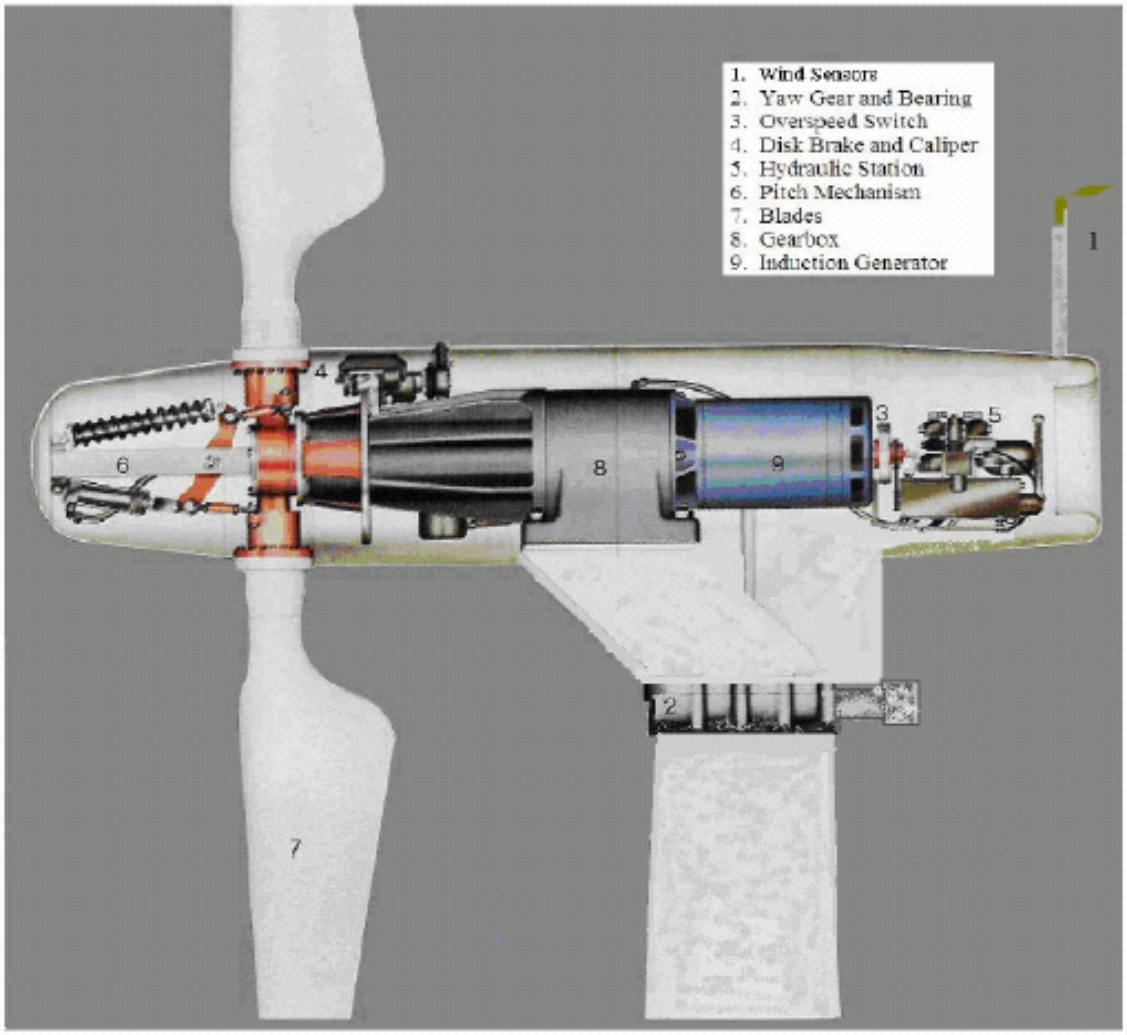


Figure 1

1. Wind Sensors

The wind sensors provide the proper signals to the Twelve-Five controller to orient itself into the wind. The wind sensors consist of a cup style anemometer for sensing windspeed and an electronic wind vane for sensing wind direction.

2. Yaw Gear and Bearing

The yaw gear and yaw bearing are the means by which the Twelve-Five is attached to the tower and allows full 360° rotation to track the wind.

3. Overspeed Switch

The overspeed switch is a safety device that will fully feather the blades and apply the disk brake (position #4) in the event of an emergency overspeed condition. This device must be reset manually at the tower top after engagement.

4. Disk Brake and Caliper

The disk brake is used in the event of the overspeed switch (position #3) engaging or can be activated manually at the tower base for maintenance purposes. The caliper is applied with spring tension and is released hydraulically via the hand pump on the hydraulic station (position #5).

5. Hydraulic Station

The hydraulic station houses all the hydraulic components used in the operation of the blade pitch mechanism (position #6) and the disk brake (position #4). It also houses a hand pump for releasing the Disk Brake (position #4) after engagement.

6. Pitch Mechanism

The pitch mechanism is used in varying the pitch angle of the blades under the varying operating wind conditions. The Twelve-Five's controller sends the appropriate signals to the hydraulic station (position #5) to change the blade pitch angle via the pitch mechanism.

7. Blades

The blades convert the winds energy into rotational forces used to drive the induction generator (position #9)

8. Gearbox

The gearbox is used to increase the rotational speed of the blades (position #7) to the appropriate speed for the induction generator (position #9).

9. Induction Generator

The induction generator uses the rotational forces created by the blades to produce electricity. It is flange mounted to the gearbox (position #8) and provides the mounting structure for the hydraulic station (position #5).

NG TWELVE-FIVE

Next Generation Power Systems, Inc.

TECHNICAL DATA – SINGLE PHASE 33 kW

Rotor
Number of blades…….…….. 2
Diameter…….……12.5 m
Speed (at rated power)……...……..100 rpm
Direction (looking downwind)……...counterclockwise
Location, relative to tower……...….upwind
Type of hub……...……...….rigid
Cone angle……..none
Tilt angle…….……0°
Swept area……...…….123 m²
Cρ max., rotor……..…… 0.44
Design tip speed ratio……...……9

Blades
Material…….……..….GFRP
Airfoil…….……...…NACA 4415-4424
Chord
tip…….……260 mm
root……560 mm

Transmission
Type……..……three-stage spur gear
Ratio…….……..…… 1:19,3

Generator (other types on request)
Grid-connected
Type……..…….…….induction generator
Rating…….……33 kW
Power factor…….(at rated power) 0.99
Voltage…….……...240 V
Frequency…….……..…. 60 Hz
Speed (at rated power)…….……..….1830 rpm

Control System
Principle……...electrohydraulic power and speed control by pitch adjustment
Overspeed control…….……centrifugal

Orientation Drive
Type…….…….mechanical yaw
Transmission ratio…….……. 1:4000

Performance
Grid-connected
Rated power……...…….…….33 kW
At rated windspeed……...13.4 m/s
Windspeeds (hub height)
Cut-in……. 3.7 m/s
Max. design speed (survival)…….… 50 m/s
Tower (other types on request)
Conical central steel pipe (octagonal)…..……. 15 m

Weight
Rotor blades…….…….. 110 kg
Nacelle……...…….....approx. 1180 kg
Tower (15 m) ……...…….. approx. 2660 kg
Total ……..... approx 3950 kg

Safety devices
- Manual cut-out by opening of the hydraulic circuit
- Electronic and mechanical overspeed shutdown
- Emergency cut-off and maintenance blocking by means of an integrated disk brake
- Whole system in accordance with the German Standards VDE and DIN
-Vibration sensor

Design lifetime ……...…… 20 years

TECHNICAL DATA – THREE PHASE 33 kW

Rotor
Number of blades…….…….…….. 2
Diameter…….…….……12.5 m
Speed (at rated power)……...….100 rpm
Direction (looking downwind)…….counter clock wise
Location, relative to tower……...….upwind
Type of hub……...……rigid
Cone angle……..none
Tilt angle…….……0°
Swept area……..….123 m²
Cρ max., rotor……..……...0.44
Design tip speed ratio……...……9

Blades
Material…….……..…….GFRP
Airfoil……..…….……NACA 4415-4424
Chord
tip…….……260 mm
root……560 mm

Transmission
Type……..……three-stage spur gear
Ratio……..……..…… 1:19,3

Generator (other types on request)
Grid-connected
Type……...…….induction generator
Rating……..……33 kW
Power factor…….….(at rated power) 0.95
Voltage…….……...240 V
Frequency…….……..…. 60 Hz
Speed (at rated power)…….…..….1830 rpm

Control System
Principle……...electrohydraulic power and speed control by pitch adjustment
Overspeed control…….……centrifugal

Orientation Drive
Type…….….mechanical yaw
Transmission ratio…….……. 1:4000

Performance
Grid-connected
Rated power……...……..…33 kW
At rated windspeed…….…..13.4 m/s
Windspeeds (hub height)
Cut-in……. 3.7 m/s
Max. design speed (survival)……..…... 50 m/s

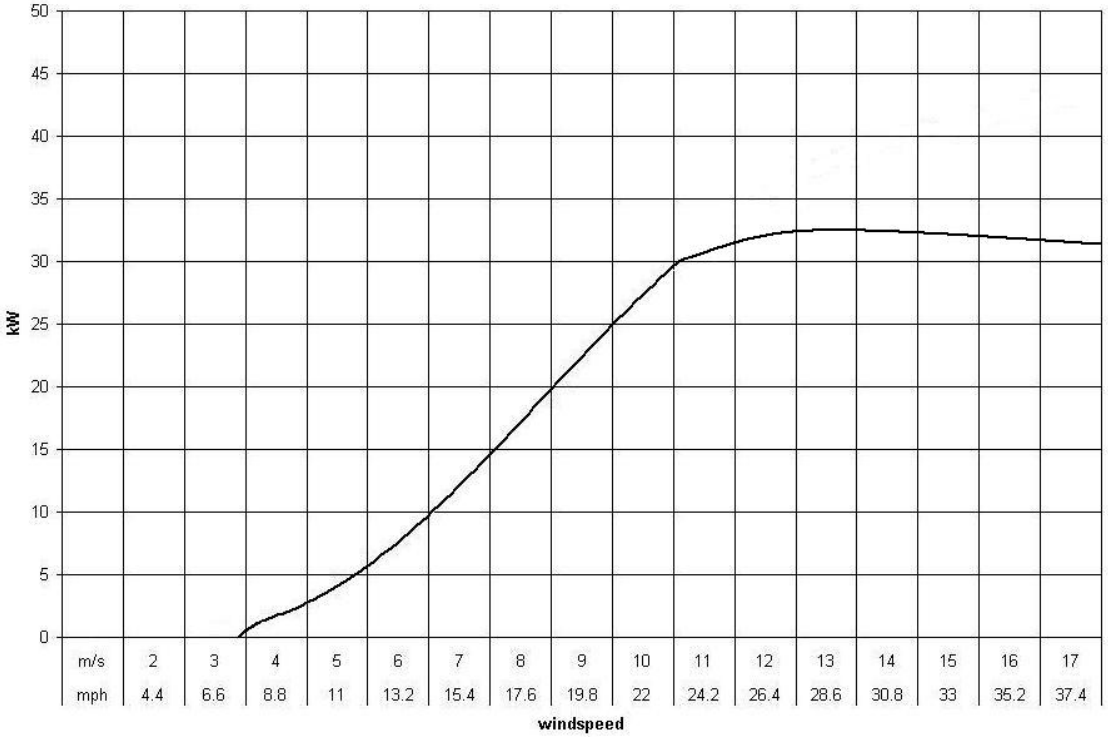
Tower (other types on request)
Conical central steel pipe (octagonal)……..…. 15 m

Weight
Rotor blades……..…..…….. 110 kg
Nacelle……..……..…approx. 1180 kg
Tower (15 m) ……...……..…… approx. 2660 kg
Total ……..... approx 3950 kg

Safety devices
- Manual cut-out by opening of the hydraulic circuit
- Electronic and mechanical overspeed shutdown
- Emergency cut-off and maintenance blocking by means of an integrated disk brake
- Whole system in accordance with the German Standards VDE and DIN
-Vibration sensor

Design lifetime ……..…… 20 years

Average Power



Estimated Annual Energy Production