



## Lagerway 80kW

### [re]manufactured wind turbine LAGERWAY 18/80KW an alternative energy power supply.

The LAGERWAY 18/80 is a two bladed, high performance, reliable 80 kW midsize wind turbine with a rotor diameter of 18 meters. The mechanical part of the LAGERWAY 18/80 is based on the original proven design from 1983. For the electrical part, power conversion and control, the latest technology is used. The LAGERWAY 18/80 is also available as Hybrid Wind/diesel system.

Discover the LAGERWAY 18/80 and harness the most advanced technology in its simplest form to create solutions for your renewable energy needs.

Originally developed and designed for on-grid, rural areas, farms and hybrid sites, the Lagerway 80 puts reliability at a premium regular and cheaper maintenance was an option for applications located in remote regions—let alone your farm, school, or business. all turbines capture wind.

#### Advanced Technology

The Lagerway systems team was driven to create state-of-the-art wind turbines with smart designs than conventional turbines. By minimizing wearing parts in the load path and maximizing efficiency over the full range of operating conditions. What this means for your application is more energy, less maintenance, and higher reliability!

#### 24/7 Monitoring

REPOWERING has created an advanced and responsive 24/7 network operations center to monitor our turbine installations around the globe. our engineers stand ready to support the safe and reliable operation of our turbines through our unique, web-based monitoring platform, which provides us nearly unlimited access to the turbine control system. in addition, Repowering continuously conducts preventative maintenance diagnostics on our fleet of turbines to identify opportunities for even more proactive service and support.

#### Fleet Availability

Repowering's expertise, advanced technology platforms and support infrastructure combine to provide an unprecedented level of service in the community-scale wind market. what that means for our customers is that when the wind is blowing, our turbines are available to start producing clean, domestic power.

#### Service and support

•As with every wind application, we are committed to being with you every step of the way. Some of the ways we do this are:

- Project planning and development advice
- Technical support for installation
- Ongoing maintenance support and advice
- Remote turbine monitoring and support

#### Wind Power for Farms

Many of the uncertainties faced by farmers – drought, storms, and disease – are unique to agriculture. But the volatile energy landscape forces farms to strive for energy independence and control costs as well. Although the team at REPOWERING SOLUTIONS can't help farmers control the weather, our state-of-the-art turbines can harness the wind and take the unpredictability out of your electrical costs. With a LAGERWAY 80KW wind turbine, you can safeguard your agricultural or dairy operations against rising utility bills and make your farm operations leaner and more profitable businesses.

Green economy: Your wind turbine project – and each new installation it fosters – will bring high-value jobs to your community.

#### Distributed energy

The benefits of distributed wind DO matter: Bringing distributed wind power directly to energy users and their communities brings huge benefits to a wide array of stakeholders. This is why it's one of the fastest-growing segments in the wind power industry today.



## Rebuilt Solutions

REPOWERING SOLUTIONS are the Europe's leading supplier of remanufactured wind turbines, specialising in turbines originally produced by Lagerway, Bonus & Vestas. They have been manufacturing turbines for 4 years. All turbines comes with a standard 2 year parts warranty and an expected life of 20yrs+

REPOWERING SOLUTIONS is committed to the production of clean affordable energy with these remanufactured and upgraded wind turbines.

REPOWERING SOLUTIONS works in partnership with site owners, financiers, suppliers and other stakeholders to guide projects through the process and beyond.

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## ROTOR

The rotor of the LAGERWEY 18/80 (LW 18/80) is provided with two blades and is characterised by the flexible (hinged) way of mounting the blades and the passive blade-angle adjustment. The possibility that the blades can hinge over a small angle has the advantage that the load on the construction in its entirety will be less. This way of mounting the blades is similar to the titting hub construction but has the advantage that the blades can hinge independently. This allows a lighter construction.

## BLADES

The blades are constructed from carbon-fibre reinforced epoxy. Due to this material composition the blades are light, strong and flexible. They have a taperwise form and a slightly twisted chord. The length is 7.8 metre. The blades are mounted by means of mounting plates and bolted to the pitch-shafts. This design has been tested thoroughly both under static and dynamic loads.

Inside the blades is a copper wire netting provided which will protect the blades in case of a lightning attack.

## HUB-FRAME

The hub-frame is the connection point of the blades to the main shaft. In the frame the synchronisation mechanism and the blade-hinges for flexible mounting of the blades are located. By means of a flanged connection the hub-frame is mounted to the main shaft; being the low speed shaft of the gearbox.

## GEARBOX

The gearbox increases the rotorspeed. In two stages a ratio of 1:20 is obtained between the rotorspeed and the out-coming shaft from the gearbox. Therefore the out-coming shaft, and consequently the generator, will have an effective working range between approximately 1200 and 2400 rounds per minute. The gearbox is provided with a low speed shaft and bearings. A built-in radial bearing and an attached radial/axial bearing allow the rotor to be mounted directly to the gearbox.

The high-speed shaft is connected to the generator by means of a flexible coupling. Further, the gearbox is equipped with a brake which prevents the rotor from turning backwards. When the turbine is yawed 1200 out of the wind, the rotor will have the intention to rotate backward. The above mentioned brake will be activated and the rotor will stand still. This same procedure is followed during a shut down the turbine.

## PARKING BRAKE

For maintenance reasons it is required that the rotor can be blocked. After having yawed the turbine out of the wind, the high-speed shaft can be blocked.

## GENERATOR

The generator is a 4-pole asynchronous generator. The generator is totally enclosed fan cooled; the fan is directly mounted on the shaft. The bearings are provided with nipples for re-greasing. The reactive current, which is needed to allow the generator to built up a magnetic field, is obtained by a capacitor package (Please refer to the Electro-technical description of the LW 18/80).

## YAW-SYSTEM

The yaw-system turns the position of the nacelle in order to place the rotor in the right position; in the wind or, if required, out of the wind. Contactors control the yaw-system. In case of a grid failure, which causes malfunctioning of the installation, the yaw-motor is directly connected to the generator. The turbine will yaw out of the wind all by itself. In order to avoid that the moments and forces of the rotor, which are passed through to the nacelle, are projected on the yaw-system four friction brakes are mounted.

Furthermore a flexible coupling is mounted between the worm-wheel reduction and the pinion in view of it's dampening and shock-absorbing properties.

## NACELLE

The nacelle is that part of the turbine that is placed on top of the tower. A yaw bearing allows the nacelle to turn along the horizontal plane. The baseplate of the nacelle is made of hot dip galvanised steel, on which the gearbox, generator, yaw-system and a part of the control equipment is mounted.

To reduce the sound from the operation of the turbine, optional (not included in standard equipment configuration) fittings such as vibration absorbing mounting pads and sound dampening insulation can be used.

## TOWER

The tower consists of three cylindrical parts, mounted to each other by means of a flanged connection.

The standard total height of the tower is 30 metre (as an option a 40 meter tower is also available. The tower has an external ascent, and is provided with the following safety measures: Two resting platforms and a steel cable parallel to the ladder in order to connect the fall- protection gear of the maintenance engineer. The tower is made of hot dip galvanised steel.

## FOUNDATION

The detailed design of the foundation depends on the local situation with regard to the strength and composition of the soil. In case of insufficient support, the foundation should be piled. In all cases an anchor or anchor-bolts is bedded into the concrete. The electrical- and control cables are led away through a pipe which goes from the centre of the anchor to one of the sides of the foundation. Besides a concrete foundation is a one-pole-foundation possible in cases that the local soil this will allow. A one-pole-foundation exist of a steel tube which is piled into the soil.

## ELECTRICAL SYSTEM

The grid connection is achieved by the AC/DC/AC principle. This means that the generated three phase alternating current is transformed first to a direct current. This direct current is converted to an alternating current which is synchronous to the grid. The advantage of this system is that the generator frequency is completely independent of the grid conditions and grid fluctuations. Herewith the rotor speed can be variable. The produced power is related to the rotorspeed by means of a fully variable mutator system. This means that the produced power is optimum adjusted to the actual windspeed. Since the generator builds up the voltage smoothly, rough starting currents do not occur. This is not only an advantage for the electrical components, but the loads on mechanical parts are also reduced. During normal operation the turbine is connected to the grid continuously; power supply to the grid depends on the rotor-speed and the wind speed.

## CONTROLLER

The control of the LAGERWEY 18/80 is done by a microprocessor. On the microprocessor is a terminal located for friendly user interface. The microprocessor shows the actual windspeed, wind direction, rotor-speed and the generating power. It provides also the cumulative kWh production and the history data of the above mentioned parameters. The controller and the electrical system are 'fail-safe' designed, which means that in case of a failure the turbine goes in a safe position, depending on the kind of failure. The microprocessor shows detailed information about the failure and will record this. A system for the remote monitoring and remote control of the turbine is available as an optional



# TECHNICAL DATA OF THE LAGERWEY 18/80 WINDTURBINE

## GENERAL

Type:	LAGERWAY 18design according to NEN 6096
Grid frequency:	50 Hz/ 60Hz
Hub height:	30 m / 40 m
Type of tower construction:	tubular galvanised steel
Rotor diameter:	18 m

## OPERATING DATA

Cut in windspeed:	3 m/sec.
Nom. windspeed:	12 m/sec.
Cut out operating windspeed:	25 m/sec.
Max. survive windspeed:	60 m/sec.
Specific power:	315 W/m <sup>2</sup>
Calculated lifetime:	min. 20 years

## ROTOR & BLADES

Number of blades:	2
Rotor position:	upwind
Angle of the main shaft:	70 with horizon
Diameter:	18 m
Swept area:	254 m <sup>2</sup>
Speed variable:	60 -120 rotations per minute
Power regulation passive:	blade-angle adjustment
Blade length:	7,8 m
Material:	carbon fibre reinforced epoxy

## GEARBOX & GENERATOR

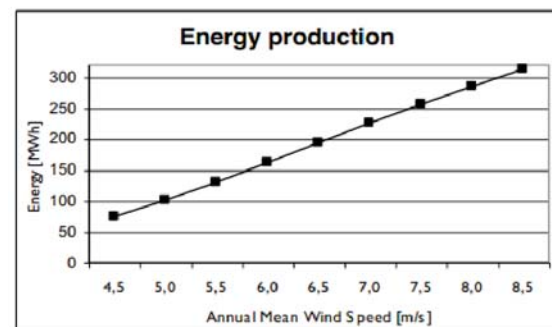
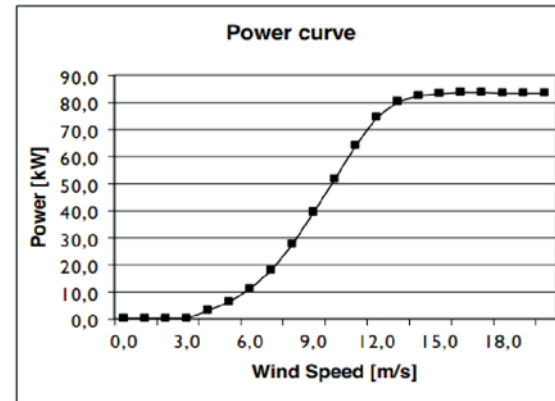
Number of stages:	2
Ratio:	1:20
Nominaal torque:	8050 Nm
Manufacturer:	Flender, Germany
Type generator:	asynchrony
Nominal power:	80 kW
Number of poles:	4
Nominal voltage:	400 volt
Frequency variable:	40 - 80 Hz.
Protection:	IP 55
Manufacturer:	ABB or equal quality

## GRID-CONNECTION

Converter principle:	AC - DC - AC
Powersupply:	400 V / 3 fase / 50/60 Hz.

## YAW-SYSTEM

System:	active
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Wind speed [m/s]	Energy [MWh]
4,5	74
5,0	101
5,5	130
6,0	161
6,5	193
7,0	225
7,5	256
8,0	285
8,5	313



#### Diesel grid owners/operators turning to wind power

Whether you are an electric coop utility or business located in a remote area, if you generate power through a diesel grid you share the concerns of an unstable future. Your business model's long-term efficacy is challenged on a daily basis by rising fuel costs, fuel transportation and storage issues, and diesel generator maintenance. At the same time, you—and the community you serve—have environmental considerations that drive you to seek clean, renewable alternatives. Until recently, wind power has been overlooked because of concerns about grid stability. With the advent of new technology found in the Lagerway 80kW wind turbine, diesel grid owner/operators can safely and effectively add wind power to their grid without complex system design enhancements.

#### Diesel grid owner/operators benefit from wind power

**Lower Costs and Greater Profitability** Adding a wind turbine to your diesel grid safeguards you against volatile diesel prices and the expense involved in its transportation.

**Improved Diesel Generator Operation** By demanding less of your generators over time, you can save on maintenance and operational costs.

**Increased Energy Security and Independence** By reducing your dependence on refined crude oil, you can stabilize your daily operations and maximize energy drawn from the wind in your area.

**Reduced Emissions** Burning less diesel fuel will cut emissions—a benefit to the communities you serve, your neighbors, and the global community.

**Marketing Opportunities** By “greening” your operations, you will spark renewed interest from your community and the media.

#### Cut your power costs:

- >> Industry, factory.
- >> Remote villages
- >> Island communities
- >> Farms, agricultural

#### Cost savings could equal:

- >> Facility improvements
- >> Increased profitability
- >> Lower rates for rate-payers
- >> Improved quality of life for local residents
- >> Increased economic viability for remote communities



REPOWERING Solutions help you to grow your business with best-in-class remanufactured wind turbines. We define new classes of wind turbines more economical. We can stand alongside you every step of the way – from sketching out the big picture to tightening the very last bolt



Through its Repowering Solutions, provides the conceptual and works detailed for remanufactured wind turbine and a full scope of services, including supply chain development, localization and volume remanufacturing support services and employee training. Our solutions also include advanced remanufactured wind turbine solutions. All of this will enable you to achieve business success.

We ensure your solution is right for your business and for the markets you are targeting. We provide a competitive edge. We make sure that investment costs are right for the size of the opportunity while helping reduce your production costs and increase sales. Ultimately, we lower the cost of wind energy, providing you with a competitive edge and a measurable ROI.

Our remanufactured wind turbine solutions make sure that the maximum amount of energy is extracted from the wind – turning energy into profit.

We deliver the skills, designs, technology and wind industry network to succeed in this growing market. Our solutions get you to market faster and reduce the time it takes to realize a return on investment, and ensuring that you have the right solution in place for now and for the future. Profit from our partnership

Our goal is to form decades-long relationships with our partners. We work alongside you to grow your business and overcome new challenges.

#### Profit from our innovation

The world leader in our field, we are constantly developing new solutions for our partners and opening up new market opportunities.

And that we will be there beside you – every step of the way..

Our goal is working with reconditioned turbines where we can provide a competitive solution. Those turbines sometimes are not older than 5 or 10 years and the technology is reliable and compliant with all legislation. As reconditioned we can provide full warranty and the cost usually drops to a half or less than new turbines. This advantage makes a cash flow turn to positive faster and healthier than using new turbines so we are now receiving many request for developing wind projects.

Additionally we can provide a GLGH power curve for the warranty. This second option requires an extra expenditure but we are offering this service as per client requests. Note that we can offer warranty on failure and breakdown same as Energy Yield Warranty.

#### REPOWERING SOLUTIONS provide bespoke guarantee cover for remanufactured wind turbines.

The following covers can be provided –

All Risks Cover – Damage to the turbine including ancillary parts, cabling, substations etc

Breakdown Cover – Cover against breakdown including parts & labour

Loss of Revenue – Protection against loss of revenue e.g. government tariffs

Public Liability – Cover against damage to third party property or injury to third parties

#### Others covers we can provide -

Wind Turbine Insurance/Wind Farm Insurance :  
Construction/Installation Phase

Employers Liability Insurance  
Public Liability Insurance  
Professional Indemnity Insurance  
Contractors All Risks insurance inc Contract Works  
Delay in Start Up/Advanced Profits Insurance  
Goods in Transit Insurance/Marine Insurance

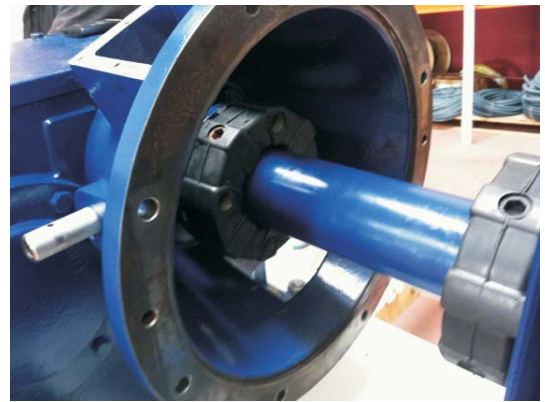
#### [RE]MANUFACTURING PROCESS

- All components are removed for cleaning and inspection.
- Any component not meeting OEM manufacturer specifications is repaired or replaced.
- The nacelle frame is inspected for cracks and overall structural integrity. Any deficiencies are repaired and tested.
- The machine base and frame are stripped of all paint, cleaned of dirt and lubricant, and repainted.
- All critical rotating components (cylinders, rollers, etc.) are inspected for run-out. Any component not meeting OEM manufacturer specifications are repaired or replaced.
- All bearings (roller or plain) are repaired or replaced with new.
- All belting is repaired or replaced with new.
- All rubber hydraulic lines are repaired or replaced with new.
- All polymer couplings are repaired or replaced with new.
- All hardware is repaired or replaced with new.
- All gear boxes are cleaned, inspected, and new seals installed. Gears are inspected and repaired or replaced if needed.
- All generators are cleaned, inspected, and 100% rewind.
- Brake calipers are rebuilt, including new brake rotor and brake pads.
- Bull (Yaw) gear is repaired or replaced with new having a wider face than the OEM gearing.
- Pinion gear is repaired or replaced with new having a wider face than the OEM gearing.
- All Oil on wear blocks are replaced with new.
- All blades are inspected for defects, including wear, cracks, and blemishes. Deficiencies are repaired and the surface profiles returned to OEM manufacturer specifications.
- All blades are protected with a new covering of gel coat.
- All blades are weighed, balanced, and matched.
- Blade over-speed mechanisms are inspected. Any component not meeting OEM manufacturer specifications are repaired or replaced.
- All electrical wiring and components are new and upgraded above and beyond original manufacturer specifications.
- The main control system is repaired or replaced for new.
- Wind vane and anemometer are repaired or replaced with new.

Option:

- New PANEL CONTROL AND FULL POWER CONVERTER

# Wind turbine remanufacturing report Lagerway





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