
# Gearbox full Load testing - full speed, full load, fully proven

During October 2015 Moventas Gears, the wind turbine gearbox specialist headquartered in Finland, made an investment decision, which now supports customers all around the UK and central Europe. The 3.6MW Full Load Test Bench & Final Assembly workshop was commissioned in Huddersfield, in August 2016. Supported by the UK government, the Huddersfield upgrade was part of a Regional Growth Fund initiative.

All gearboxes serviced at Moventas go through a proven test run process regardless off the gear type or size. This is a Moventas internal and essential quality standard and usually also a customer requirement. Refurbished gearboxes that have gone through partial load or spin test can also have the option to be full load tested; if there has been major component change or modifications in the design, the full load test is a must. Moventas has a range of test benches dedicated to the serial production and service workshop requirements covering kW and MW drive trains.

### The difference between full load test and partial load or spin test

The main purpose for the traditional full load test run is to guarantee successful component manufacturing, refurbishment and assembly process. The test run itself is not to improve quality – it is a quality assurance process.

A commonly used procedure for full or partial load test is two gearboxes mounted back to back and applied with nominal turbine load. With the spin test the basic principal of testing is to mount the gearbox and spin it with a motor coupling to the high-speed pinion.

During full load test the new or refurbished gearing will "wear in'', generating micro particles into the oil. This is a normal feature. Regardless of the testing method used, a customised fine filtering system is used to meet the required oil cleanliness. The ''Wear in'' feature will not occur during the partial load or spin test so it is essential to have offline filtering installed to the gear when taking it into the operation.

### First test bench in the UK

Wind gear services globally are facing logistics challenge; transporting gearboxes to factories creates costs and makes lead times long. The new 3.6MW Full Load Test Bench in Huddersfield was designed in-house by the gearbox engineering team building on the experience and references from the test benches already in use through Moventas factories in Finland and in the USA.

The main component supplier for the UK test bench was a Swedish-Swiss corporation that specialize in electrical switchgear, control & automation equipment. It took approximately six months to build & commission the test bench and MW Final Assembly workshop.

The provision of the Full Load Test Bench within the Huddersfield MW Final Assembly workshop offers full MW servicing and gives customers the ability to witness their gearbox on the test bench, engage with local Moventas operations and engineering teams and ensure pain free, reliable and efficient installation up-tower thereafter.

"I am proud to say that the UK wind industry can really benefit from our highly qualified service team, experienced in the service and repair of gearboxes for all makes of MMW wind turbines", comments Chairman of the Moventas Board, Jim McColl of Clyde Blowers.

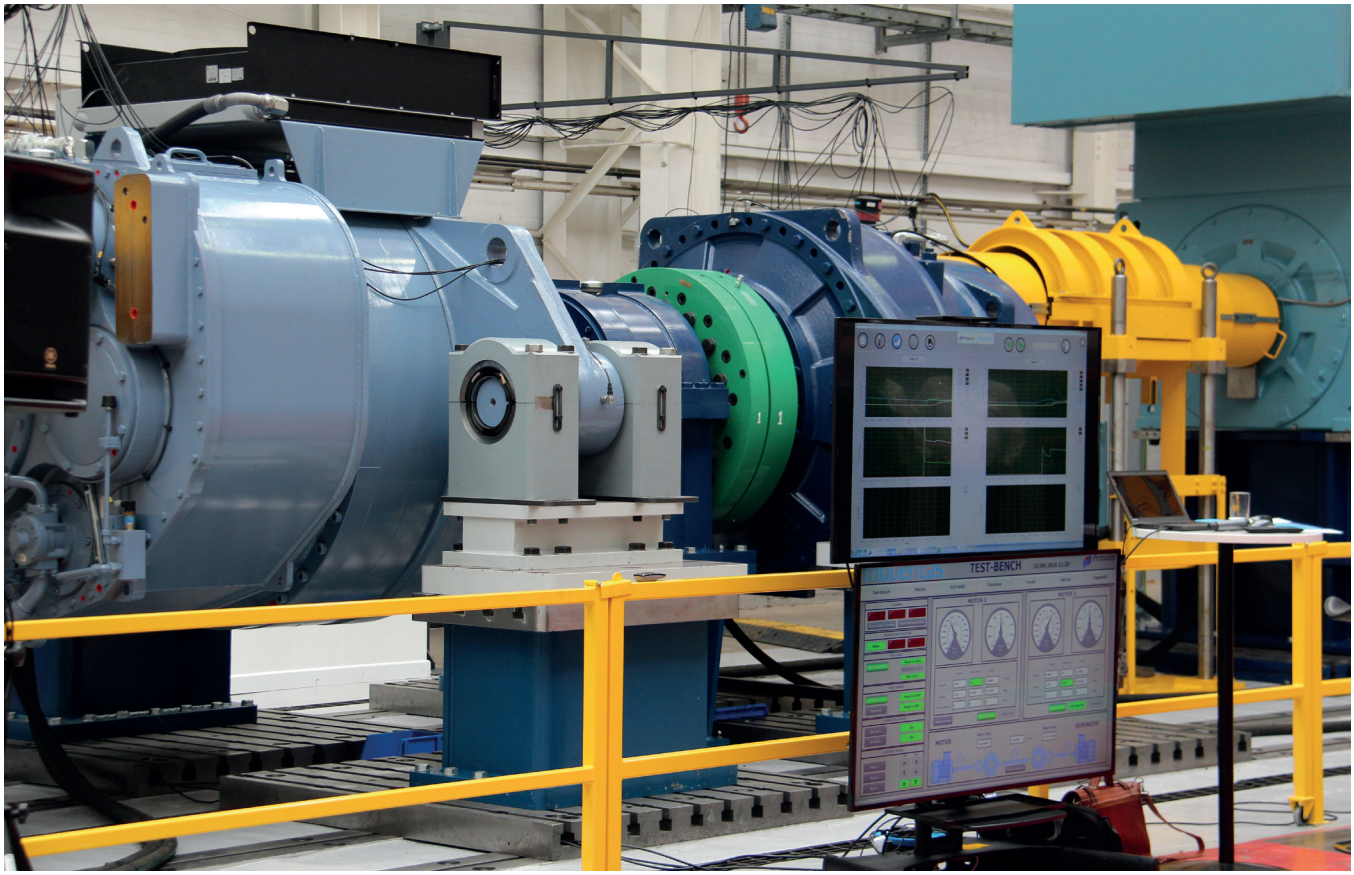
Moventas is pleased with the demand from both local UK and continental European markets and the range of units already serviced and load tested at Huddersfield. Recent references include Senvion MM82 & MM92 platforms, Siemens SWT-2.3 platform and the Nordex N80/N90 platform. The Vestas 2MW platform gearboxes are planned in due course followed by the SWT-3.6 gearboxes in line with market demand.

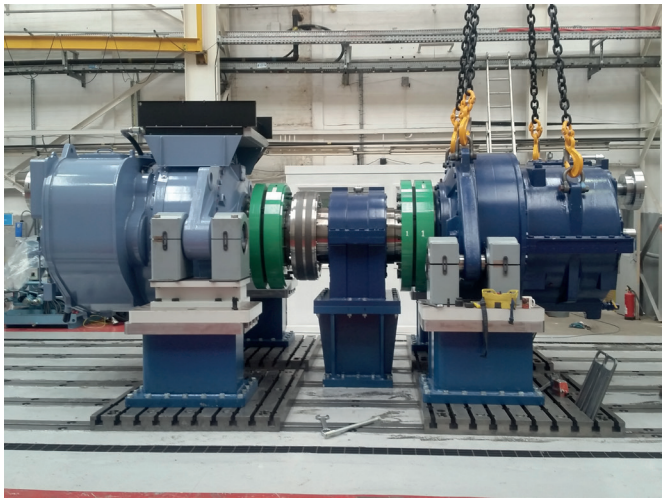
### Test bench design is based on vast experience

Moventas Technology Center in Jyväskylä, Finland, researches the dynamic behaviour of gearbox components and enables testing of a wind turbine gearbox up to 10 MW. Prototype units are tested under all load conditions to qualify their noise and vibration performance.

The engineers also perform extensive modal impact testing to ensure that resonances of a gearbox do not match the excitation frequencies of the surrounding structure or gear mesh frequencies. Detailed prototype test runs are always verified by type testing. Tests are conducted to improve product reliability, but also to comply with ever stricter demands from today's wind turbine manufactures and regulatory agencies.

As gearboxes are specifically designed to withstand the most extreme weather





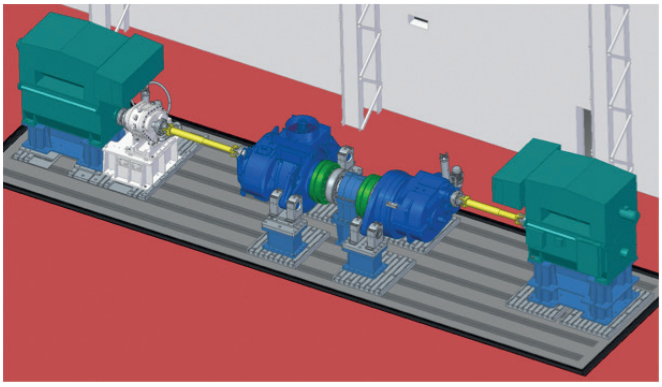


Photo of 3D model of the new 3.6MW Full Load Test Bench in Huddersfield, UK, designed by Moventas.

Moventas is the first gearbox service partner in the UK to provide multi-megawatt full load testing, which is an essential part of most gearbox service operations. From now on, serviced gearboxes no longer need to be sent to mainland Europe for testing, which minimises logistics costs and the carbon footprint.

conditions, in addition to wind gears' conventional prototype testing, Moventas provides gearbox qualification with a reliability test under severe ambient conditions in the climate chamber (-45 to +80°C) on both sub-system and component levels. This includes simulation of extreme conditions as well as an accelerated endurance test at elevated loads.

## Quality control measurements are the key

Dedicated Condition Monitoring Systems (CMS) are installed on all test benches to monitor, report and allow analysis of hundreds of signals and overall gearbox performance. Gearbox OEM test protocols in addition to Moventas' enhanced testing regimes ensure that the units on test by far exceed minimum IEC standards levels and are fully prepared for installation up-tower.

Key features and parameters during the full load testing:

- Vibration levels
- Sound power levels
- Oil cleanliness
- Temperatures
  - o Lubrication system
  - o Bearings
- Lubrication
  - o Pressures
  - o Functionality
- Possible leakages
- Gear Contact Patterns

Similarly, to test bench CMS, the Moventas CMaS Condition Management System is used world-wide to provide 24/7 performance monitoring and asset management across its own portfolio of gearboxes and the multi-brand drive trains. Moventas UK's field service team routinely performs a wide range of up-tower inspection and service repairs and upgrades. Moventas' objective is to extend gearbox life on existing fleets, innovate with new gearbox technology for next generation turbines and drive down O&M costs to reduce the total cost of ownership.

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Moventas is a new energy technology expert and service provider. Moventas' technology strives to lower the cost of energy across the lifecycle of renewable energy generation, from superior gearbox design and manufacture to extensive after sales service for most gearbox brands. Moventas is part of Clyde Blowers Capital.