

CASE STUDY

Hansen Transmissions
Lommel, Belgium
Gearbox Testing

Belgium, Europe
PULSE
Wind Turbine Industry

With 30 years of experience in the production of gearboxes for wind turbines and over 85 years experience in the production of industrial gearboxes, Hansen Transmissions International is synonymous with quality, reliability, leading gear technology and innovation for numerous applications. It is among the top players in the gearbox sector and enjoys a leading position in multi-megawatt space. For more than 20 years Hansen Transmissions has worked with Brüel & Kjær. And since 2002 Hansen has used Brüel & Kjær's PULSE Data Acquisition and Analysis System platform for a range of applications from field measurements to R&D, Quality Control, Production Testing and Validation.

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The Wind Energy Market

Wind energy is one of the fastest growing power generation technologies. The level of annual installed capacity has grown at an average rate of 27.6% p.a. for the past five years. High fuel prices and increased focus on global warming and renewable energy resources have contrib-

uted to an increased investment in the development of wind technology over the last three decades. Today, wind energy is a proven technology and is already competing with gas and “new coal-fired” electricity. And the wind energy market is expected to continue to grow. Indeed, BTM Consult Aps (BTM) have forecasted growth in global cumulative installed wind power capacity from 93 106 MW at the end of 2007 to 203 151 MW at the end of 2011.

Hansen Transmissions – “In Gear for a Sustainable Future”

The fully integrated state-of-the-art dedicated wind turbine gearbox manufacturing facility in Lommel



Hansen Transmissions’ history can be traced back to the formation of “La Mécanique Générale” in 1923, a small workshop in Antwerp producing spare parts for numerous types of mechanical equipment. Gradually, the company’s activities shifted towards the production of customised gear units, mainly under the influence of a young engineer called David Hansen. In 1939, the company relocated to its present Headquarters in Edegem, offering a range of possibilities for future expansion.

Today, the company supplies gearboxes to the major manufacturers of gear-driven wind turbines globally – Vestas (Denmark), Siemens Wind (Denmark), Gamesa (Spain), Suzlon Energy (India) and REpower (Germany) – and provides durable gear drives for a wide range of industrial applications throughout the world. Hansen plans to increase its wind turbine gearbox manufacturing capabilities, from 3800 MW per annum in the financial year 2007 to 14300 MW, by financial year 2013.

In addition to its principal manufacturing facilities in Belgium – comprising a wind turbine and industrial gearbox plant in Edegem (Antwerp) and a fully integrated state-of-the-art dedicated wind turbine gearbox manufacturing facility in Lommel (Limburg) – Hansen has a +95000 m² production plant for wind turbine gearboxes in Coimbatore, India and started the construction, in September 2008, of a production plant for wind turbine gearboxes for the Chinese market on a 250000 m² site in the Beichen Hi-tech Industrial park in Tianjin.

Hansen has strong research and development operations to maintain its technological leadership and employs over 2400 people worldwide.

No. 1 in Megawatts Worldwide

Hansen Transmissions has produced over 20000 gearboxes over the last 30 years. With today’s technology they are producing approximately 3000 a year. Hansen Transmissions might only be No. 2 in the number of gearboxes produced, but when it comes to Megawatts they are the world’s No. 1 producing the largest gearboxes – up to 3 MW (serial production). However, future development plans are aiming at 6 MW gearboxes for offshore turbines.

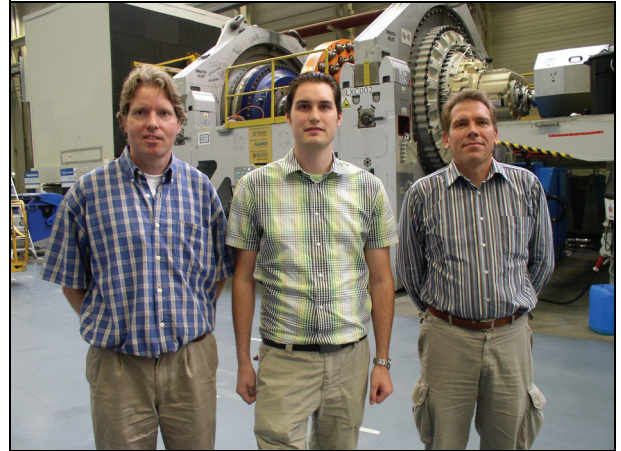
All Hansen gearboxes are custom made according to customer specifications and can be developed, manufactured and tested at the Lommel facility in Belgium. From specification to delivery takes about a year but plans for developing modular components should considerably reduce this.



Testing, Testing

From left to right: Rob de Vries, Rudy Pieters and Mario Desmit

The predicted outlook for wind energy is that it will, eventually, produce 98% of the world's energy. So wind turbine reliability is key. And it can be argued that the wind turbine's most critical and vital component is the gearbox. Quite simply, if the gearbox doesn't work the wind turbine doesn't turn and no energy is produced. Hansen Transmissions has always recognised the importance of high quality. As Mario Desmit, Marketing Communications Manager at Hansen Transmission says, "If you want to be No. 1 in wind turbine gearboxes then you need to be No. 1 in quality and reliability. Gearboxes turn constantly and they must be fully reliable. That's why initial testing and maintenance become more and more important. We design our gearboxes to run for 20 years". And to stay at the top of technology, Hansen re-invests 4% of its annual global turnover into R&D.



To ensure the highest quality possible, Hansen Transmissions produce everything themselves. The design of Hansen gears are unique and well-known and the in-house heat treatment, gear cutting and grinding and housing machining distinguish Hansen from its competitors.

Brüel & Kjær has supplied Hansen with some 30 PULSE Data Acquisition and Analysis Systems. PULSE is used at all facilities worldwide for:

- Core R&D development
- Production testing
- Visiting installations for on-site diagnostics and troubleshooting

Measuring sound intensity using the scanning method to determine the sound power of the gearbox. It takes 20 minutes to complete the measurement on each side



As well as PULSE, Brüel & Kjær also supply Hansen with Modular Precision Sound Analyzers Type 2260 for sound intensity measurements in the field and in the factory, Type 8341 piezoelectric accelerometers (with TEDS, initially developed especially for Hansen) and Type 4513-B DeltaTron[®] Accelerometers for each test bench.

When it comes to testing gearboxes, Hansen Transmissions are uncompromising and thorough. With an expected lifetime of 20 years running continuously, everything has to be tested – vibration, noise, temperature, cleanliness, pressure – against maximum limits and according to the testing specifications agreed with the customer. Rob de Vries, Validation Engineer, Research & Development explains, "PULSE is used to measure noise and vibration. At low speed, gearbox noise becomes more dominant so it's important for the gearbox to be as quiet as

possible. This is a key differentiator for us. Our gearboxes are unmatched in low-noise performance. Vibration is also important as excessive gearbox vibration can agitate and adversely affect other parts of the turbine". The testing process on each gearbox takes eight hours; a PULSE system monitors the vibration spectra from 24 Brüel & Kjær uniaxial accelerometers Type 8341 (with TEDS) and Type 4513-B which are strategically placed at critical locations.

For Hansen, one of the joys of the ongoing relationship with Brüel & Kjær is that they can buy solutions for both sound and vibration from one source covering the whole measurement chain. Brüel & Kjær's products are developed to work together and as a result the data format is the same for all assembly and testing worldwide. This is also a great advantage in the event of having to transmit raw data from, for example, an assembly plant back to Headquarters in Belgium

for analysis. Another key factor in choosing Brüel & Kjær is the good local support provided by ENMO, Brüel & Kjær's distributors in Belgium. Project Engineer Rudy Pieters adds, "Brüel & Kjær equipment is known for its high quality all over the world, so data accuracy is never questioned."

A 24-channel PULSE 3560-D at Lommel, Belgium

How the Brüel & Kjær Systems are Distributed

Having Brüel & Kjær products at all their facilities worldwide ensures uniformity of measurements and data. Here's how they're distributed and what they're used for:

Antwerp, Belgium

- 4 × PULSE systems – one for production quality, one for R&D, one mobile system for on-site testing and investigations and one spare system
- 2 × Modular Precision Sound Analyzers Type 2260 for sound intensity measurements in the field and in the factory

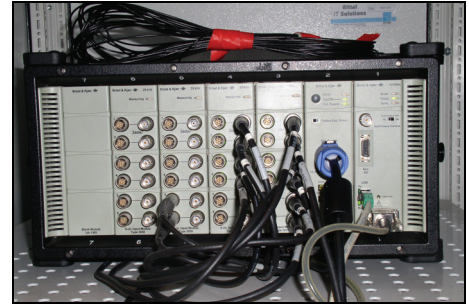
Lommel, Belgium

- 6 × PULSE 24-channel systems for production quality
- 6 × PULSE B-frames for sound intensity measurements
- Brüel & Kjær sound intensity probe

India and China

Each has:

- 3 × PULSE 24-channel systems
- 3 × PULSE B-frames
- 24 × Monitoring DeltaTron® Accelerometer Type 8341 and Type 4513-B for each test bench



The Future

Built with an eye to the future, Hansen's copycat facilities in India and China will increase their capacity and allow them to keep up with the huge growing demand for gearboxes. India will provide an increased capacity of 4300 MW a year by 2013 and China 3300 MW. When India and China are up and running, Hansen will then look at other markets where wind energy has a strong focus. After-sales Service is important to Hansen and is an area they are extending. A Service plant is planned for 2010 in North America, and preventive and predictive maintenance are being considered for the future and will include, for example, on-site repairs and on-line monitoring.

Gear technology and design improve efficiency and optimise component lifetime and continuous product innovation increases the speed with which products are brought to market. Rob de Vries believes that getting more knowledge to predict behaviour is one of the ways to achieve this. He says, "We already use simulation techniques to predict performance and the correlate with physical test so that our CAE model become increasingly more accurate. This combined with more ODS (Operating Deflection Shapes) analysis and modal analysis using shaker excitation will help us produce cost-effective designs faster but without compromising performance".



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Local representatives and service organisations worldwide

Brüel & Kjær 