

Bolting failure-free technology on to the offshore wind industry

Intellifast GmbH is a leading name in the ultrasonic load measurement business, launching on to the market in 2002 with a focus on – high quality bolts. Here, Managing Director Frank Scheuch talks to PES about the company, its expansion into the wind industry, and his vision for its future.

Intellifast was founded as PFW Technologies in 2002. The company acquired the Intelligent Fastener trademark in 2002 and based on that trademark changed its name to Intellifast in 2006 when its sister company, PFW GmbH changed its name to PFW Aerospace AG. The business was started with the acquisition of an ultrasonic load measurement technology, invented in 1993 and launching into the market in 1997 with a focus on the world's biggest bolt consumers – critical fasteners in the automobile industry.

The central technology is a thin film permanently-mounted transducer. Using high-vacuum technology, the transducer is deposited on to the bolt. The materials used are immune to the elements and are inert to their environment. To read the bolt load, the transducers are connected to an

ultrasonic measurement device. The measurement of the clamp load is accurate to +/- 3 %.

The patented digifast barcode technology provides ultrasonic fastener information on each bolt in addition to the serial number. The technology can store assembly-relevant data, such as target load, in addition to other customer specific information, e.g. the bolt supplier. Intellifast uses an open source 20-digit 2d code. A laser process is used to apply the permanent high-contrast code to the bolt. With this information stored on the bolt, any bolt can reliably be identified and precisely measured. The technology makes it possible to acquire bolt load measurement in any bolt at any time with any Intellifast load-measurement device. No previous documentation (reference readings) is required to use the ultrasonic measurement tool.

An inspection head, combining load measurement and bolt identification, provides instant bolt load measurement and documentation with no operator training or ultrasonic measurement technology background.

Intellifast adds cost to the fastener but, in industries where bolts are higher priced than in the automotive market, the technology is cost-beneficial and can be implemented in series production. The benefit is achieved when assembly and inspection times are figured into the total unit price. The ability to fully use the load carrying capability of the fastener also benefits safety and weight-reduction programmes. Thus, Intellifast actively works with industries like wind energy, large-size diesel engines, mining machinery, nuclear energy and aerospace. In other industries Intellifast products are becoming more and more



the standard for lifecycle simulation, bolt load monitoring in test rigs and prototype development where loss of bolt pre-load is checked under real operation conditions.

In a world where quality documentation is daily business and high-quality assembly has become a worldwide requirement, the possibility of target parameter (bolt pre-load) controlled tightening combined with 100% traceability and complete documentation becomes more and more the standard.

The biggest challenge Intellifast has is to become an accepted partner to the customer, providing support in their bolt assembly processes including necessary safety improvements and lifecycle cost savings. In almost every industry nuts and bolts are not looked on as big problems – until one fails – because they hold everything together.

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Ask the experts

PES: Wind turbine bolts are items OEMs want to touch once and then forget – how do you achieve this?

Frank Scheuch: All of the OEM designs have to meet regulatory stress requirements. Theory tells us that bolts assembled with a uniform and high pre-load don't turn loose and are more fatigue resistant than joints with lower uneven operational bolt loads. The bolts assembled in a joint using PMTS load measurement can be accurately controlled to the maximum preload. Because of the high cycle environment not seen in buildings the regulations require that the fasteners be inspected regularly. The critical variable in the operation of the turbine is continuing maintenance costs. Of course the operators want to lower total operating costs with lower inspection time, here the PMTS reduces inspection time with one-touch load measurement. It is our goal to assemble and maintain the design operational load in all critical fasteners to assure a failure-free design life.

PES: Bolts sit at a lot of critical interfaces with expensive equipment like large bearings and so on. Would bolt load measurement, verification and documentation be helpful discussing warranty cases with sub-suppliers?

FS: We definitely hear this from utility engineers as now more and more utilities become wind park operators. A large bearing is a very expensive piece of equipment and of course all suppliers of high-value equipment specify uniform bolt-preload and a certain load level to avoid any distortion as this has a negative impact on the lifetime. In a warranty case it is always difficult to prove that the specified pre-load status in the bolts was achieved and maintained over time.

PES: The projects get more and more spread out all over the world and as a consequence turbine assembly is executed by sub-suppliers – how satisfied are OEMs with actual assembly documentation?

FS: The value of a complete documentation of bolt assembly is continuously rising. The leading tool manufacturers are all offering assembly documentation systems to register tightening parameters like torque or pressure. However, those parameters cannot directly be translated into pre-load values by the nature of bolt assembly and after-tightening effects like embedding. We feel our complete pre-load documentation, where the pre-load is precisely determined by ultrasonic measurement – made available in standard computer operation system formats – gives OEMs and end users a good opportunity to independently control the quality of sub-supplier erection work.

PES: As the offshore industry starts playing a leading role in the overall wind market – have the OEMs and wind park operators already considered expanding existing monitoring systems with a remote bolt monitoring package?

FS: Access (travel and weather) to an offshore turbine dictates and can limit maintenance time. Expense of that offshore time is a real negative pressure on the operator. Bolt maintenance offshore is now more critical because the size and subsequent loads are larger. Real-time life monitoring of a critical system removes that system

from the maintenance timeline and from the access limitation. This allows the service crew to concentrate on components to be inspected and repaired that cannot be monitored or have been targeted by our monitoring systems. The Intellifast Bolt Condition Monitoring System, where a number of selected bolts in a flange serve as load monitors, fills the real-time system requirement. The system consists of several multi-channel systems sitting close to flanges which are connected with each other and a standard industry computer which again can easily be linked to the installed CMS. Germanischer Lloyd recently recommended our transducerised bolts for this application in one of their articles.

PES: Do actual weight-reduction programmes already touch bolts?

FS: We are working on weight-reduction programmes in other industries where weight reduction plays the dominant role in component design. However, we see that with rising material costs and steadily increasing production rates weight reduction will become an issue in the wind industry as well. Typically those programmes don't start with bolts but regulations require that accuracy certificates for load measurement in bolts are supplied. We also spotted at least one application – the fixation of rotor blades – where increasing operation loads and the wish to keep the flange diameter small (which saves expensive blade material and reduces blade weight) have led to a situation where low bolt design factors and the requirement of precise assembly already play a very important role.

PES: The bolts actually used are big and expensive – would 100% traceability and structural health monitoring be valuable for wind turbine OEMs?

FS: The steadily rising installed base of wind turbines and rapidly rising per year rate includes millions and millions of expensive bolts. Keeping track of this worldwide population of critical expensive fasteners with the ability to find bolts from any lot where quality and assembly process can instantly be recalled will become a value in its own right. We are also working on structural health monitoring developments with the aim of using permanent corrosion resistant transducers and ultrasonics to monitor bolt fatigue. For the operator, lowering long-term maintenance costs greatly increase long term profitability, selling points for an OEM. The results so far are promising. ▲



Frank Scheuch, Managing Director, Intellifast GmbH. For more information, visit: www.intellifast.de

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