

## NORBAR ULTRASONIC INSTRUMENT SHOWS NEW REAL TIME MEASUREMENT CAPABILITIES



Foundation bolts on wind tower

A chance experiment on a wind farm in Texas has demonstrated an example of the non-traditional applications that can be carried out by Norbar's portable USM-3 ultrasonic bolt meter, which provides precise measurements for the elongation (resolution to 0.0001 mm) and load in threaded fasteners. It is known to be incredibly versatile, being able to undertake measurements for fasteners measuring from 25mm to over 15m long. What was not widely appreciated before is how it can provide precise real-time measurements of forces affecting a bolted joint, in this case a 2m long foundation bolt on a wind turbine tower.

The foundation bolt had already been installed and it was not possible to determine its actual elongation or tension without first loosening the bolt. However, for the purposes of demonstration, the initial length of the bolt was recorded using the USM-3 meter and a magnetic transducer which was placed onto the bolt end. After a while, the wind farm engineer commented that the elongation measurement did not seem to be stable since the value was constantly drifting.

While reviewing the data, Norbar's ultrasonic specialist, Gregory Young, realised what was happening. *"The tower base foundation bolt was located at a 160° angle from the wind direction. As the wind increased, it pushed the tower in the general direction of the foundation bolt, the joint was compressed slightly and the elongation decreased. As the wind decreased the tower rebounded and the bolt's*

*elongation increased as the compressive forces on the joint decreased. This ability to read minute fluctuations in the bolt tension, real time, can be of value to many companies dealing with bolted joint issues. Many sectors such as the automotive industry will also be interested, since real time changes in bolt tension are highly important in automotive engineering.”*

Ultrasonic measurement performed by the USM-3 works on a “time-of-flight” principle, similar to sonar, with a small transducer placed on the head or stud end of the fastener sending an ultrasonic sound wave through the length of the bolt and back again. After recording the initial bolt length with no load on the fastener, subsequent changes in the time of flight are converted by the USM-3 utilising material constants to eliminate the effect of stress and temperature variations on sound velocity, providing an accurate elongation or load measurement.

Measurements are shown on the USM-3’s large LCD display, providing easy to read data. The USM-3 incorporates digital signal processing and graphic displays of signal analysis and waveforms to make this a truly user-friendly instrument, thereby ensuring a high level of confidence in the measurements obtained.

In 2010, Norbar’s USM-3 won a gold medal at the MetrolExpo show in Moscow, a leading event for metrology (the science of measurement). The award was presented “for high quality accuracy of measurement, ease of use, storage and retrieval of data.” This ability to record real time fluctuations in bolt tension makes the USM-3 even more relevant for companies dealing with bolted joints that experience changes in dynamic loads during the tightening process and throughout the life of the joint.

Norbar Torque Tools is the world’s leading specialist in the design, development and production of torque tightening and measuring equipment. Norbar has established branches in the USA, Australia, New Zealand, China, Singapore and has recently launched a new branch in India.