

## USM – ULTRASONIC BOLT LOAD MEASUREMENT

Norbar's USM-3 is one of the most powerful tools ever to be made available to engineers concerned with bolted joint integrity. The USM-3 uses ultrasound to measure the change in length of bolts during and/or after the tightening process. Unlike indirect methods of tension control such as torque or torque and angle, ultrasonic measurement of bolt load or elongation bypasses the problems of friction and other variables resulting in significantly more accurate bolt tension. Issues such as vibration loosening, bolt yielding, embedment relaxation, and many others can be identified and addressed prior to failure; likewise, verification of residual stud tension after using hydraulic or mechanical tensioning systems or post-heating provides data that can be uploaded to a computer, saved as an Excel spreadsheet and printed for hardcopy documentation. The USM-3 has been laboratory and field proven to be the most accurate, reliable and cost effective solution to bolting failures which could lead to leaks, capital equipment damage and risks to workers.

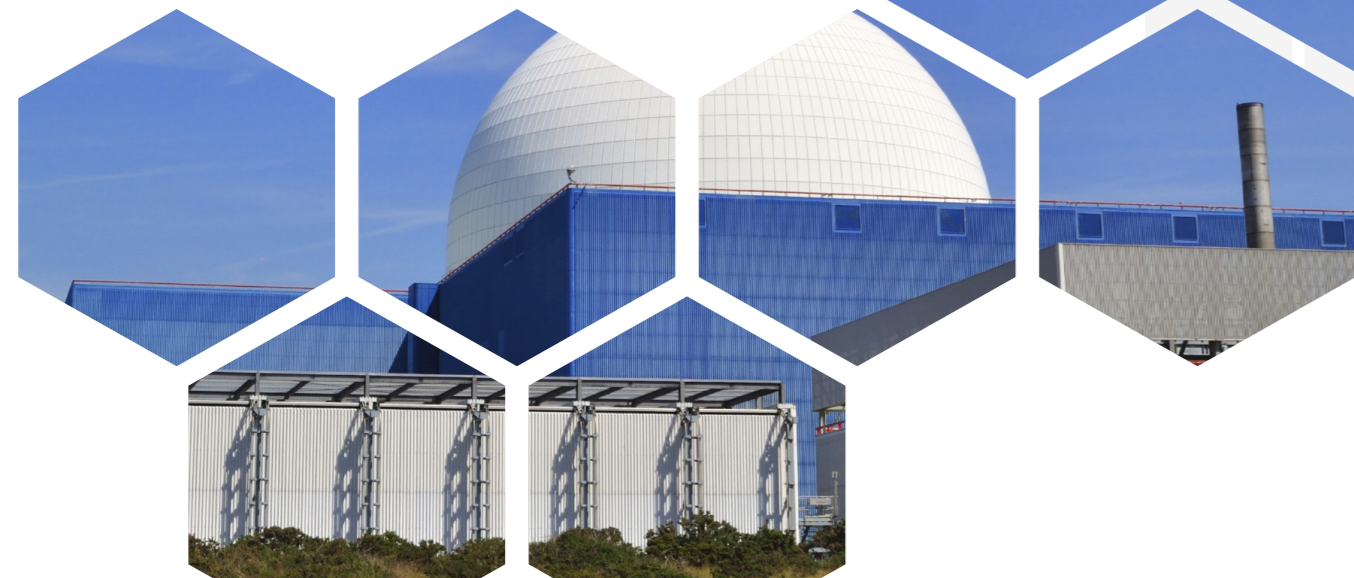
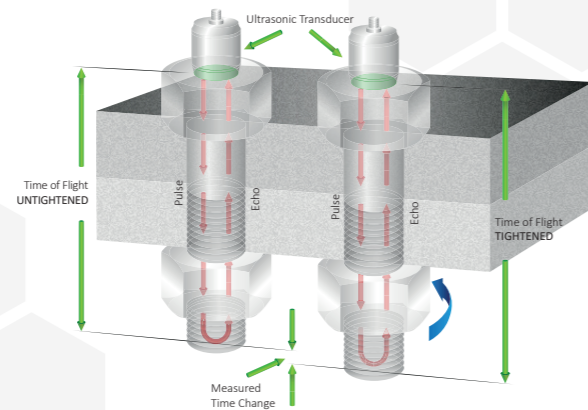
Regardless of whether the project is under construction, in fabrication or undergoing maintenance, the USM-3 excels at verification and long term monitoring of bolt tension and elongation. Norbar's USM instruments have been chosen by many of the largest bolting service companies as their preferred instrument for power generation maintenance work. Critical applications for fossil, nuclear and wind power have all been made surer and safer through implementation of bolt load and elongation verification. Common applications include: Steam turbine compressor rotors, inner and outer casings, coupling bolts, HP & LP blade rings, main steam inlet flanges, throttle valves, generator bearing brackets and generator through bolts. Nuclear Reactor coolant pumps, baffles, reactor pressure vessels, man-way covers, foundation bolts. Wind power foundation bolts, yaw bearing bolts, hub to blade, hub coupling, generator coupling and tower bolts.

## "SPECIAL" ENGINEER TO ORDER PRODUCT SERVICE

The diverse needs of the power generation industry, from nuclear to wind, mean that Norbar's standard range of products are not always suitable. This is particularly true with regard to difficult to reach bolts, for example, on wind turbines or where an even higher degree of accuracy and verification is required as in the nuclear industry. Norbar therefore offers an Engineer to Order service that spans a range from modified reaction arms through to completely one off tools or measurement systems.



USM-3 Ultrasonic Bolt Meter



## GLOBAL SERVICE

Norbar is the only torque equipment manufacturer capable of offering tool and instrument calibration services to the original factory standard on four continents.

Accredited laboratories in Australia, USA, Singapore, China and India operate the same equipment and procedures as the UKAS accredited laboratory within our headquarters in the UK.



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## NORBAR PRODUCT PORTFOLIO



Torque Screwdrivers



Torque Wrenches



Electronic Torque Wrenches



Manual Torque Multipliers



Pneumatic Torque Tools



Electronic Torque Tools



Torque Measurement Instruments



Torque Transducers

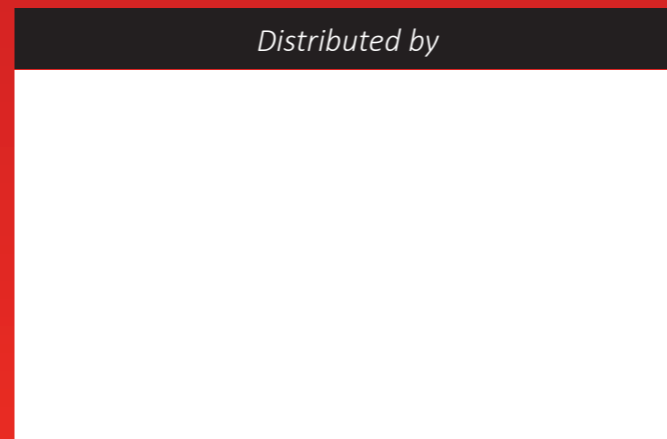


Ultrasonic Bolt Measurement

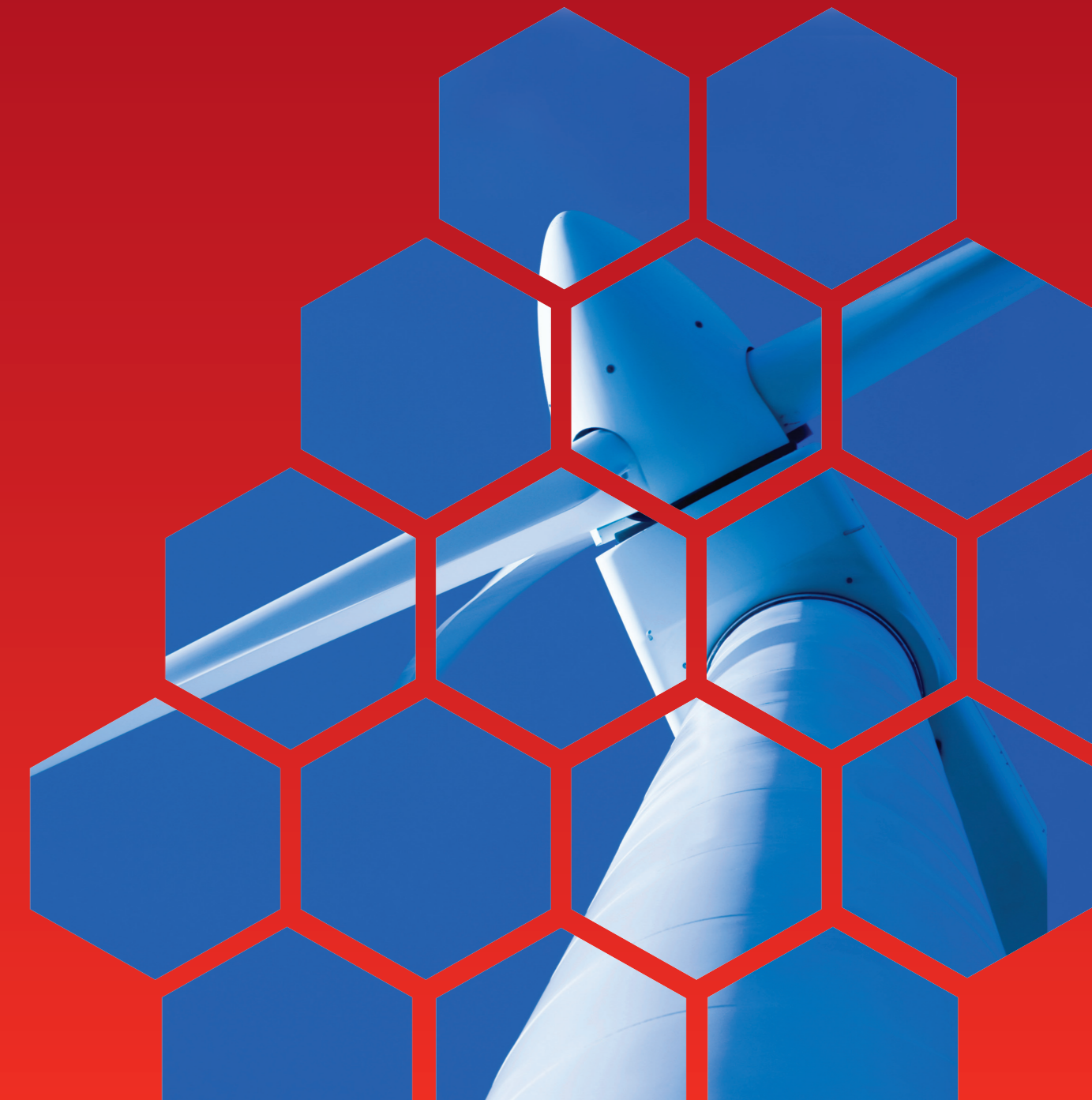


Calibration Services

Distributed by



# PRECISION TOOLS FOR THE ENERGY GENERATION INDUSTRY





Climate change and the need to find alternatives to depleting fossil fuels are issues forcing massive change onto the electrical power generation industry. As the industry changes, the need for torque tools and torque measuring systems is also changing.

Large scale power generation in fossil fuel or nuclear powered plants will form the bulk of our capacity for the foreseeable future but renewable energy, particularly wind energy, is where much of our attention is focused. Smaller scale plants such as a typical 3mW wind turbine presents new issues both in manufacture and maintenance, particularly since the plant often has to operate in extremely hostile environments, including off-shore. This smaller plant requires torque tools to be compact, light, accurate and extremely robust.

Throughout Norbar's 75 year history we have been closely involved with the power generation industry: from coal fuelled plant through to highly safety critical areas of nuclear plant and, more recently, extensive involvement in the wind energy industry. The use of Norbar's tools and instruments has helped make the power generation industry run more efficiently, reliably and cleaner.



Professional Torque Wrench range

### TORQUE WRENCHES

Norbar's hand torque wrenches range from screwdrivers with a minimum capacity of 0.3 N·m through to wrenches with a capacity of 2,000 N·m.

Norbar's torque wrenches have been used throughout the power generation industry from the equipment manufacturers producing the plant through to power generation sites and the electricity distribution infrastructure. The features making Norbar wrenches especially suitable for this industry include accuracy that exceeds the requirement of international standards, backed up with traceable documentation. Robust ratchets with a narrow engagement angle allow the use of wrenches in tight spaces. Users of Norbar's New Professional range wrenches in elevated positions such as wind turbine nacelles will particularly appreciate their light weight and compact dimensions.

Norbar offers a range of torque wrenches up to 2,000 N·m that can be split for storage and transportation. These wrenches are perfect for mobile maintenance crews as they are easily transported and assembled and disassembled in seconds.

Another innovation in the torque wrench range is the 3/8" and 1/2" drive, 1,000 Volt insulated torque wrenches, tested to IEC 60900:2004 and suitable for live line working (only where the operator is qualified to do so).



Split torque wrenches up to 2,000 N·m, ideal for carrying in maintenance vehicles



Insulated Torque Wrench

### MANUAL TORQUE MULTIPLIERS - HANDTORQUE®

Torque multipliers are geared devices that allow very high torques to be accurately applied from a compact tool package. Take for example Norbar's HT-52 multiplier which can apply 1,000 N·m from a package weight with a suitable torque wrench of around 3 kg – around half the weight of a typical 1,000 N·m torque wrench. Given the tight confines and difficult accessibility of most wind turbines, this low weight and the fact that this tool package utilises a wrench length of around 300mm will be a major advantage.

Norbar HandTorque® multipliers set the standard for power generation and other applications. These exceptionally well engineered tools offer outstanding robustness and torque multiplication accuracy. For applications where a torque readout is required for monitoring or data collection, Norbar multipliers can be fitted with torque transducers which measure the actual torque at the output drive.

### PNEUMATIC TORQUE TOOLS - PNEUTORQUE®

Norbar have over 50 years experience in the manufacture of PneuTorque® pneumatic torque tools and now offer an unparalleled range stretching from 100 N·m to 300,000 N·m. PneuTorque® tools offer accurate and quiet torque, almost free from vibration.

Although mostly used in bolting applications, the power generation industry has found other invaluable uses for the accurate, smooth power delivery of PneuTorque® tools. These include rotating hydro electric turbines under maintenance, valve actuation, opening and closing coal hopper doors and weld testing.

All PneuTorque® tools are optionally available with a torque transducer for accurate torque audit. Such a system has been used in the highly safety critical area of fastening the lids of nuclear waste flasks.

### ELECTRIC TORQUE TOOLS - EVOTORQUE®2

Norbar's EvoTorque®2, enables users to torque bolts accurately and reliably whilst generating a record to confirm the fact, providing complete traceability for Operations & Maintenance teams and their clients. Tools are factory calibrated to ±3% of reading. The unique 'intelligent joint sensing' technology continually measures the joint during tightening and when necessary, employs dynamic braking to avoid torque overshoot due to motor inertia. Consequently, EvoTorque®2 can apply torque accurately over a wide range of joint rates from hard (high torque rate) through to soft (low torque rate). All EvoTorque®2 tools are highly tolerant of supply voltage and frequency variation. When the tool runs, it will run accurately. If the supply voltage is outside of tolerance then, as a safety feature, the tool will be prevented from starting.

Furthermore, in independent tests and calibrations conducted across a number of Spanish wind farm sites; EvoTorque®2 achieved the OK/PAA/APPROVAL standard; making them the only electric multipliers permitted for use to perform final torque on a number of wind farm sites.

### HYDRAULIC TORQUE WRENCHES

Norbar offers both Square Drive Series "NSD" and Hex Link Series "NHCL" hydraulic torque wrenches, specifically designed for extremely low height access applications. Our robust and lightweight aluminium body completely encloses the drive train keeping the crucial lubricant inside the tool while significantly reducing the opportunity for contamination from the outside elements. The model range extends to 81,360 N·m in the Square Drive Series and 67,800 N·m in the Hex Link Series.

### TORQUE MEASUREMENT

For any environment – factory line-side, mobile or calibration laboratory – and any torque up to 300,000 N·m, Norbar offers a torque measurement solution. Many of Norbar's Professional Torque Testers (Pro-Test) can be found in service vehicles travelling to wind farms throughout the world. For outdoor use in all weathers, Norbar offers a comprehensive "Harsh Environment" range consisting of IP65/67 rated measurement instrument and a range of corrosion resistant, stainless steel transducers. These will provide reliable service even on vessels serving off-shore wind farms.

The importance of keeping torque controlled tools in peak calibration condition is well established and whatever torque tool you have, Norbar have a testing or calibration solution. The Hydraulic Torque Wrench Calibration Fixtures are a good example. With Calibration Fixtures available for hydraulic wrenches up to 80,000 N·m, these thoroughly engineered devices allow accurate and repeatable calibration from a robust yet relatively lightweight package.

All transducers up to 108,500 N·m are supplied as standard with a UKAS accredited calibration certificate from Norbar's in-house laboratory. Re-calibration and service of torque transducers and instruments can be performed at Norbar's own locations in UK, Australia, USA, Singapore, China and India. Other locations in the world are covered by a family of factory trained and equipped distributors.



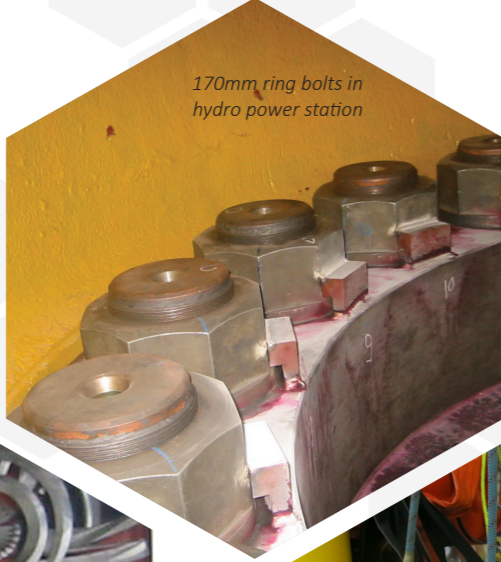
Gas turbine rotation with a PneuTorque®



7,000 N·m Hydraulic Torque Wrench Calibration Fixture with Norbar NSD Wrench



Valve actuation with a Remote Operated PneuTorque®



170mm ring bolts in hydro power station



EvoTorque®2 used on an offshore wind farm

