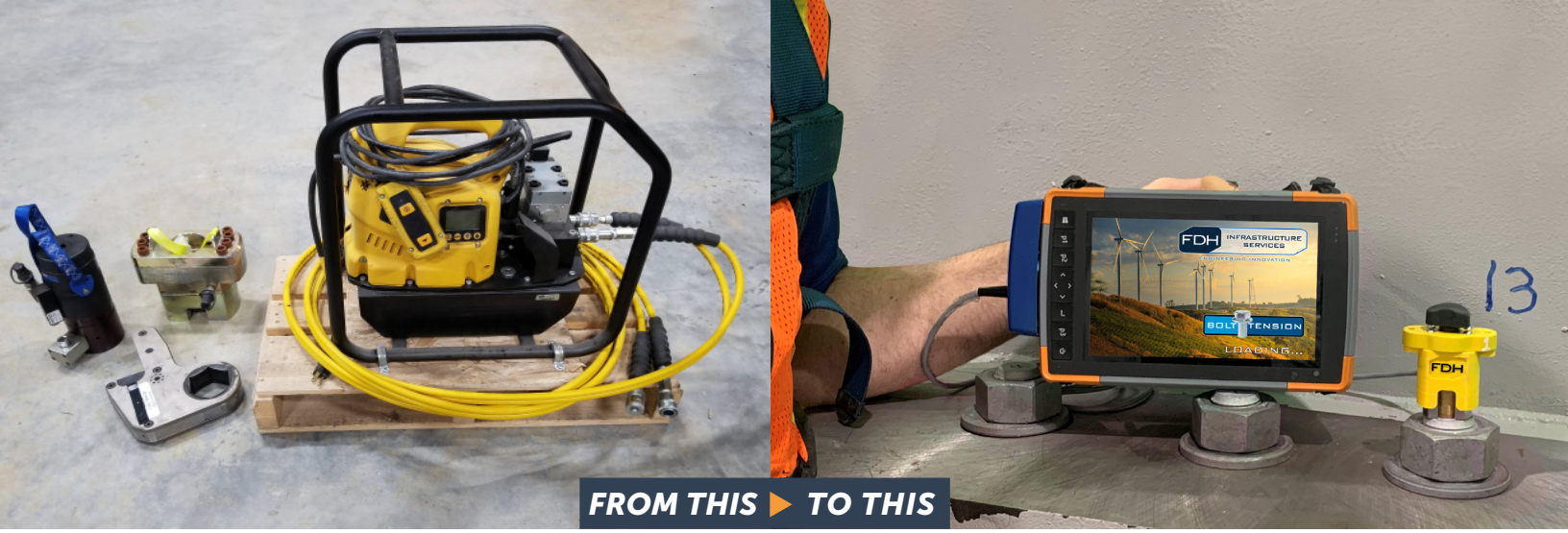


SOLUTION BRIEF: BOLTS iQ™

A Faster, More Accurate, and Intelligent Method for Measuring Tension in Bolted Joints

OPERATIONS AND MAINTENANCE CHALLENGE

Measuring and maintaining the tension of bolted joints is critical in cyclic loading applications, such as those found in large wind turbine structures. Traditional tensioning methods are inherently inaccurate, inefficient, and unwieldy to use, resulting in increased costs associated with bolted joint installations and inspections, as well as more operational downtime.

Traditional approach:

- Hydraulic torque wrench and tensioner systems are typically used.
- Torque methods are highly inaccurate. Errors as high as +/-30% are not unusual.
- Heavy, bulky, hydraulic pump-based systems require a winch to access workspace.
- Lower efficiency, increased maintenance costs, and safety concerns.

FDH APPROACH: BOLTS iQ INNOVATION

- Direct tension measurement achieved from patent-pending ultrasonic technology
- Confirmed accuracy within +/-10% over prescribed temperature range
- Faster, more accurate, and portable system
- IoT solution enables cloud-based maintenance planning, reporting, alerts, and analytics

Volume 2, Number 1

FDH INFRASTRUCTURE SERVICES®
ENGINEERING INNOVATION

FDH INFRASTRUCTURE SERVICES
ENGINEERING INNOVATION

BOLTS iQ INNOVATION

Key Features	Bolt Tension Measurement Systems	
	Bolts iQ	Traditional
Direct Tension Measurement	✓	✗[1]
Accuracy <+/-10%	✓	✗
Speed, Ease of Use (<1min/bolt)	✓	✗
Portable, Small, Fast	✓	✗[2]
Cloud-Connected Data	✓	✓✗[3]
No Bolt Pre-Condition Length	✓	✓
Works on Different Bolt Sizes	✓	✓

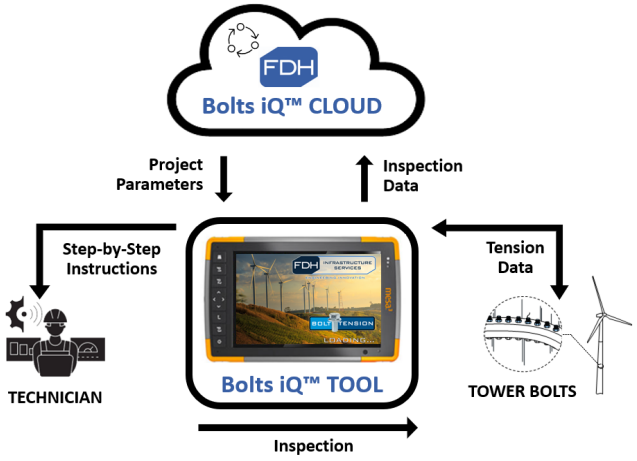
[1] Hydraulic pressure, torque required | [2] Hydraulic pump required
[3] Most systems do not offer cloud connectivity for bolt tension measurements

ACCURACY, EFFICIENCY, REPEATABILITY

» Enables wind turbine owners, operators, and independent service providers to increase inspection efficiency and maintain data integrity with a safer, easier-to-use, handheld IoT tool.

» Enables wind turbine owners, original equipment manufacturers, and engineering, procurement and construction firms to streamline build, maintenance, and operations processes, using a more accurate, reliable, and cost-efficient digital bolt tension measurement system.

BOLT TENSION MEASUREMENT SYSTEM with BOLTS iQ TECHNOLOGY



» Direct bolt tension. Patent-pending nondestructive sensing in a protected, compact, integrated, handheld device.

» Integrated sensing unit. Instant bolt tension measurement, interactive test and configuration display, and expert system guidance.

» Asset bolt data reporting. Cloud connectivity ensures test data is secure for remote access and future processing and asset management analytics.

» Project management interface. Plan, initialize, and track inspection projects and activities from any location.

SAFELY, ACCURATELY MEASURE BOLT TENSION IN SECONDS

Construction and O&M procedures specify measuring torque to determine bolt tension. Traditional measuring devices are heavy, inaccurate, and pose safety risks to field technicians. Responding to industry need, FDH has developed a nondestructive testing device that will measure bolt tension directly, safely, in under 30 seconds.

FROM FIELD TESTING TO DNV CERTIFICATION

Verifying that products are designed and built to accepted industry standards ensures high quality, stable operation, and sound risk management. For its novel measurement system, FDH has received a *Statement of Feasibility* and is undergoing *Technology Qualification* from DNV, an accredited certification body globally recognized for independent qualification of new technologies and products in renewable energy.

FDH Infrastructure Services, LLC, develops innovative products that assess and monitor critical infrastructure. Let's talk.

6521 Meridien Drive, Raleigh, NC 27616
(919) 755-1012
www.fdh-is.com/products
BoltsiQ@fdh-is.com