Predictant

An Introduction to Bolt iQ

Introducing Bolt iQ

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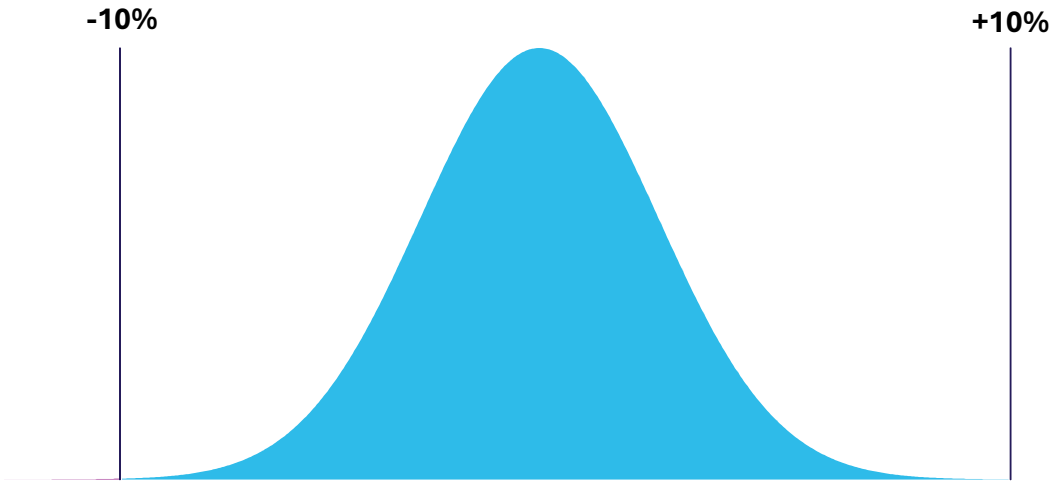
Bolt iQ is the first AI-powered bolt tension measurement tool for the global wind industry. It measures tension directly and accurately in seconds, without device calibrations or reliance on proxies such as elongation or torque.

Fast Facts

1. Bolt iQ tested 100 bolts in 30 mins during field trials, reducing maintenance inspection time by >90%
2. DNV certified methodology & accuracy[1]
3. 95% of measurements accurate to 5.5% of yield stress
4. Works on bolts in-situ without individual baseline measurements for each bolt
5. Weighs approx. 1.5Kgs/3.3lbs
6. Multiple forms of connectivity

[1] DNV Statement No: 80QT-DNV-SE-0160-07114-0 Issued: 2025-01-24

Distribution of Tension Measurements from DNV Qualification



N = 402
Error of ± 5.00% of Yield Stress (940MPa) with 93.32% CI
Error of ± 8.00% of Yield Stress (940MPa) with 99.73% CI

Includes data from different bolt/stud lengths, diameters, temperatures, tensioning methods, clamp lengths, head/tail end, and up to 4° of bending.

+/-5.5% **Accurate with a CI of 95%**

DNV **Verified by DNV**

How it Works

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Bolt iQ is lightweight, fast, accurate and easy to use. It has multiple forms of connectivity, providing full traceability for every test result in near real-time.

The Bolt iQ System

How it Works – In less than 30 seconds per test

1. Select the bolt to be measured in the device's software (can be done by scanning a QR code)
2. Place the solid couplant on the head of the bolt
3. Place the transducer in the centre of the bolt and twist the magnetic clamp to fix it in place. The alignment device can be used if required
4. Initiate the test. The device will take 1-2s to generate the measurement
5. Confirm the result, which will then synchronise with the cloud platform

No field calibrations of the device, transducer, or bolt are required at any point

The Benefits of Bolt iQ

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Bolt iQ has several key benefits vs. hydraulic equipment and elongation-based devices. It is faster, more accurate, easier to use, has full traceability, and can be used on the installed base with equal efficiency.

	Benefits	Tensioner or Torque Wrench	Elongation Device	Bolt iQ	Bolt iQ Notes
Technical	Accuracy	✗	~[1]	✓	+/- 5.5% with a C.I. of 95%
	Measurement speed	✗	~[2]	✓	Seconds vs minutes
	Usable on in situ bolts	✓	✗	✓	No pre-install measurements needed
Operational	Safe and lightweight	✗	✓	✓	Bolt iQ weighs around 1.5kgs
	Ease of use	✗	✗	✓	Minutes of non-specialist training only
	Clean handling	✗	~[3]	✓	No mess solid couplant
	Automated set up/reporting	✗	✗	✓	Eliminates error and time
	In-field calibration	✓	✓	✗	Not required
	Baseline bolt measurements	✗	✓	✗	Not required

1. Elongation tools typically claim +/- 10% accuracy, but this usually refers to measurement of the elongation of the bolt rather than actual tension, and numerous factors (Young's modulus, bending, temperature etc.) can further impact the accuracy of the conversion from one to the other
2. Once elongation devices are set up and working, they are significantly quicker than torque wrenches. However, this assessment of them vs. Bolt iQ includes the requirement for multiple, relatively complex calibrations that must be conducted in the field (e.g. system zero, transducer to device, stress-factor compensation, length, etc.)
3. Elongation devices do not involve the same risks of oil leakage etc. that torque wrenches do, however, they do require the use of liquid couplant. Bolt iQ functions with a proprietary, reusable, solid couplant that can be transferred easily from bolt to bolt and replaced when required, removing the need for any fluids or gels

Use Cases

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Bolt iQ can add value wherever fast and accurate bolt tension readings are required throughout the lifecycle of a wind turbine.

Turbine Lifecycle Use Cases

Bolt iQ can add value at multiple stages of the turbine life cycle:

- Manufacturing
- Installation
- 'Break-in' maintenance post-installation
- Scheduled services
- Unscheduled services
- Part replacements and reworks
- Root cause analysis
- Life extension and repowering

Use Case Highlights

Installation

- Bolt iQ means technicians can ensure that bolts are installed at the correct tension rather than relying on less accurate torquing alone
- Maximising the precision of bolt tension at installation reduces failures and excessive wearing as well as the number of bolts that require retorquing in future

'Break-in' Maintenance Checks After Installation

- Bolt iQ can drastically reduce the time required for break-in maintenance checks by cutting the time required to test each bolt
- Identifying which bolts actually require retorquing minimises the time spent moving, setting up and using cumbersome torquing equipment

Scheduled Bolt Maintenance

- Typically, only a small portion of bolts (c.5%) will need retorquing in a given maintenance cycle, so using heavy hydraulic equipment to check every bolt is highly inefficient
- Bolt iQ can be used to check many of the most time-consuming bolts in the tower flanges, hub and blades in a matter of hours
- Quickly identifying bolts that require retorquing in advance minimises the time spent moving, setting up and using cumbersome torquing equipment

Technical Overview

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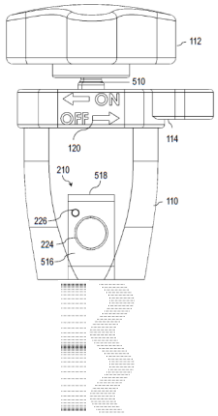
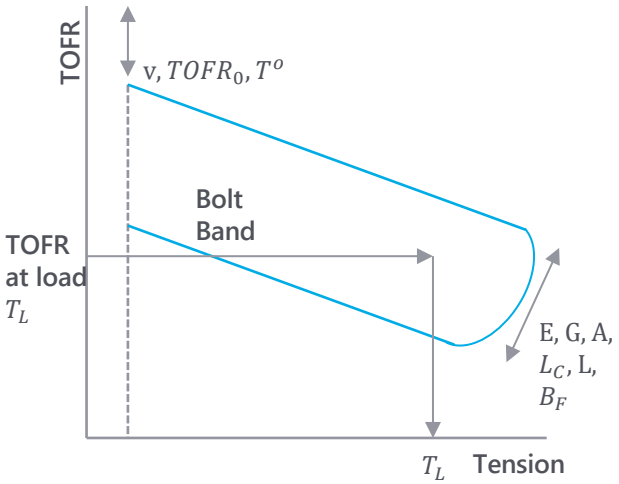
Bolt iQ combines proprietary hardware, software and deep learning to measure tension directly and to a high degree of accuracy.

1. Proprietary Hardware



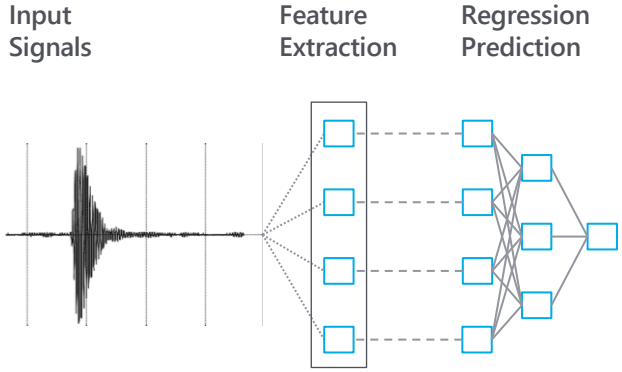
- Predictant's proprietary transducer generates both longitudinal and shear waves

2. Time-of-Flight Ratio Calculation



- Tension is measured using the time-of-flight ratio between longitudinal and shear waves
- Tension also depends on other factors (diameter, clamp length, Young's modulus, temperature etc.) but the system adjusts for all of these variables

3. Proprietary Software



- Predictant's proprietary model analyses the wave forms, extracts the relevant features, and produces an accurate reading which is displayed on the tablet and uploaded to a cloud-based platform for viewing, analysis and reporting

Contact Us

The Bolt iQ B100 system including bespoke hardware, software, and accessories is available now.

Get in touch to see how Bolt iQ could benefit your operations.

Contact Us

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