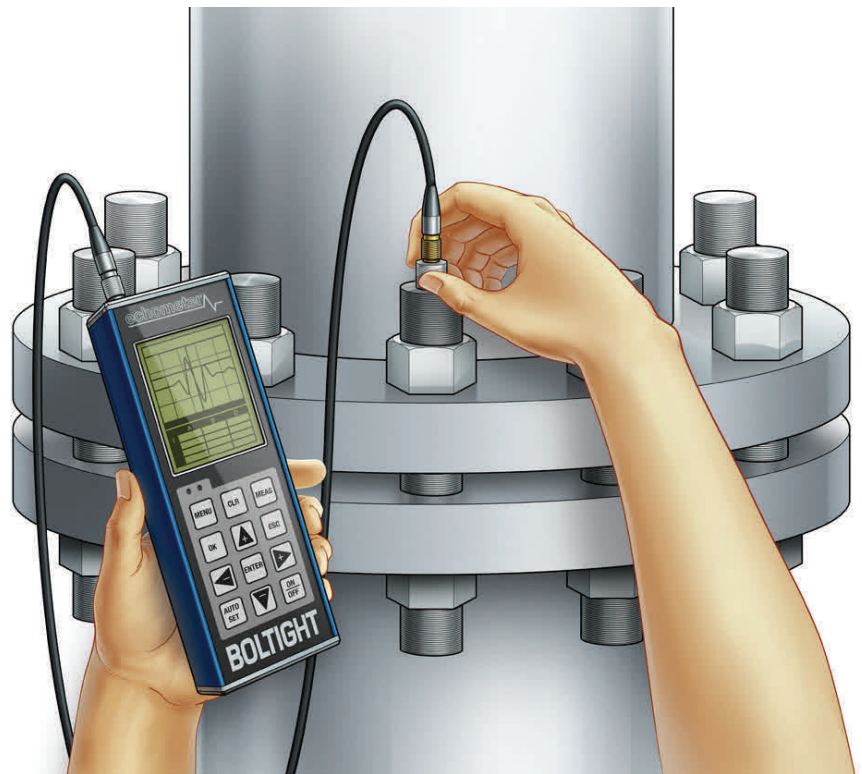




Introduction to Ultrasonic Bolt Load Measurement

BOLTIGHT[®]
echometer



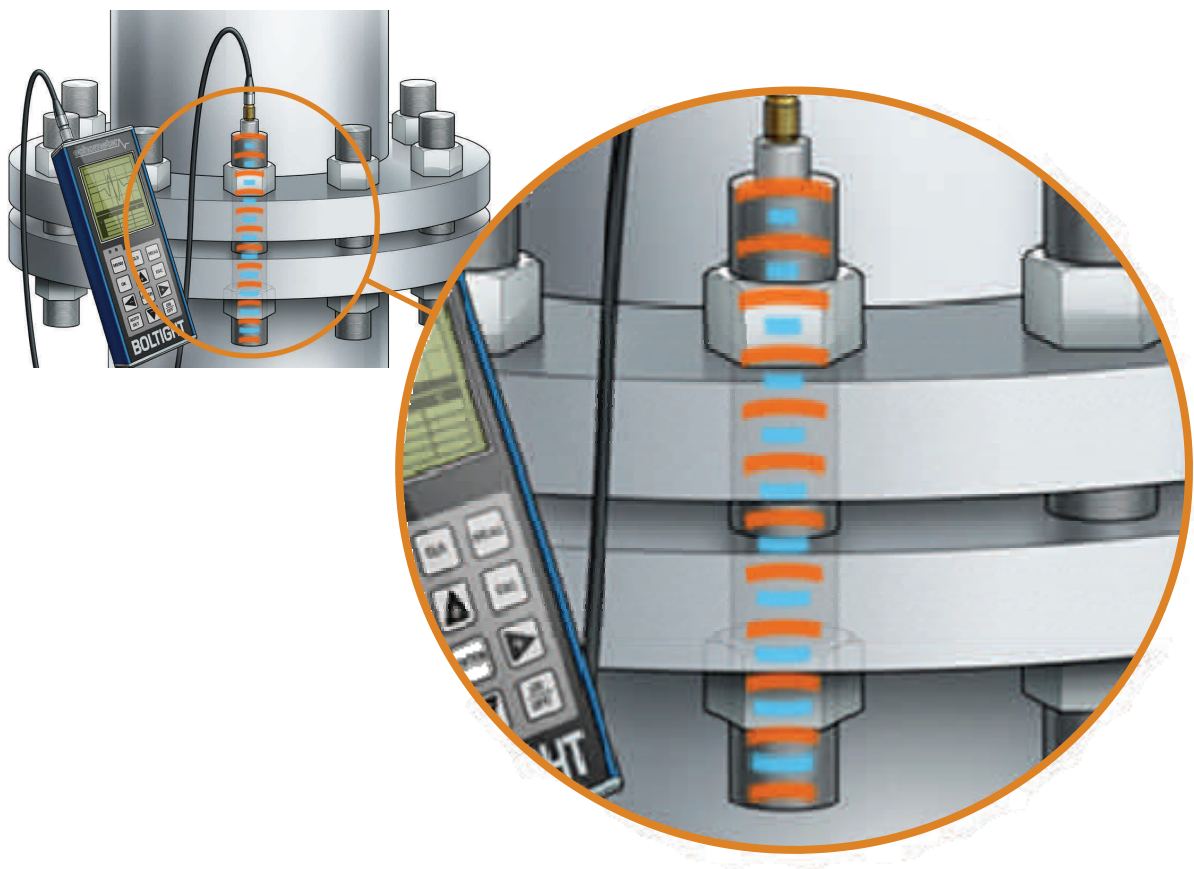
BOLTIGHT[®]
HYDRAULIC BOLT TENSIONING

Boltight Limited, Unit 2, Junction 10 Business Park, Bentley Mill Way, Walsall,
West Midlands, WS2 0LE, United Kingdom.
Tel: +44 (0)845 500 5556 Fax: +44 (0)845 500 5557
email: sales@boltight.com www.boltight.com

ULTRASONIC BOLT MEASUREMENT

The Echometer measures the time of flight of a shock wave as it travels through a fastener.

A shock wave is created when an electrical pulse is applied to a piezoelectric element inside the transducer.



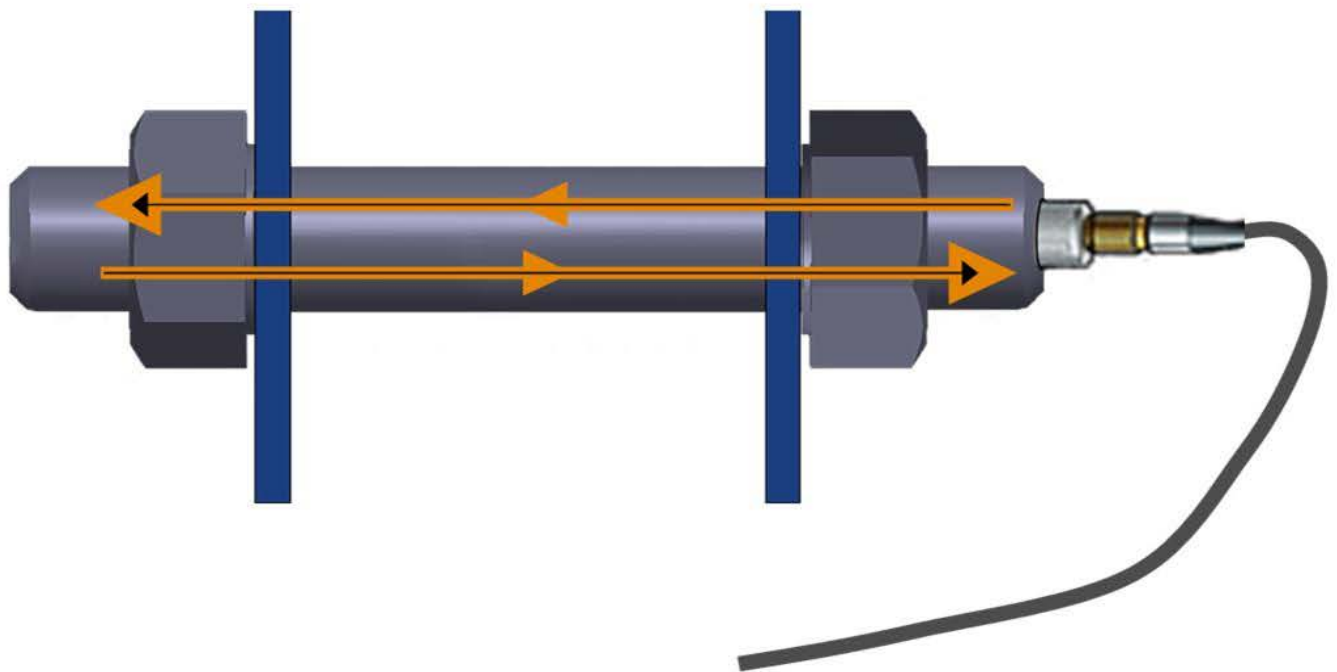
When the ultrasonic wave encounters an abrupt change in density, such as the end of the fastener, the wave reflects. This reflection travels back through the length of the fastener and back into the transducer.

ULTRASONIC BOLT MEASUREMENT

When the shock wave enters the piezoelectric element, a small electrical signal is produced. The signal is used to stop the timing counter.

Ultrasound travels in a fastener at a constant speed (the acoustic velocity) determined by the material type.

Therefore the time divided by 2 and multiplied by the acoustic velocity of the material gives the acoustic length of the bolt.



ULTRASONIC BOLT MEASUREMENT

A measurement is taken before the bolt is tightened, and then after the bolt is tightened.

The difference between the readings is the bolt elongation.

The Echometer can be calibrated to also read in units of Load, Stress and Strain.

EXAMPLE:

Before: 112.35mm

After: 113.45mm

Difference: 1.1mm

Therefore the bolt has stretched 1.1mm.



ULTRASONIC BOLT MEASUREMENT

The Ultrasonic method gives several benefits, including:

- Speed of taking measurements,
- Accuracy,
- Permanent electronic record,
- In service monitoring,
- Difficult access bolts.



Most fasteners are suitable for ultrasound. There are a few requirements:

- Flat ends - the bolt ends must be flat and parallel,
- Surface finish - the bolt ends must have a reasonable surface finish,
- Material must conduct ultrasound - not a problem for typical bolting steels,
- Significant stretch - bolts with very short effective lengths are not suitable.
- Difficult access bolts

