

SmartBolts®

Visual Indication System

Accurately represents *tension* by measuring **Fastener Elongation Under Load**. Tension, not torque is the force that's holding your bolted joints together.

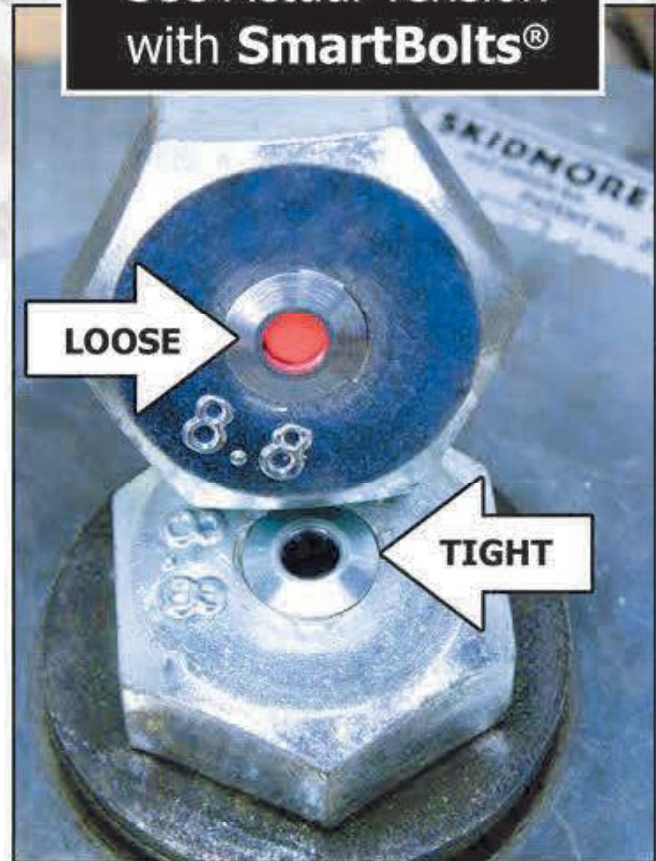
Built-in Visual Display allows for hands-free inspection at a distance.

Upgrade/Retrofit Standard Bolts with no need to modify your current design.

Provides **Application-Specific Indicating Tension** (See table on page 3)

Durable Design allows SmartBolts to maintain full functionality similar to the typical lifetime of any standard fastener.

See Actual Tension
with **SmartBolts®**



DTI **SmartBolts®** are fitted with a built-in visual indicator that gradually changes from red to black -- clearly showing whether your bolted joint is loose or tight.

The SmartBolts® Advantages

ACCURACY

SmartBolts technology is based on the most accurate principle used to measure fastener tension - actual fastener elongation under load. DTI SmartBolts are accurate to within 10% of design tension.

SAFETY

SmartBolts take the guesswork out of safety, giving you peace of mind because you know your bolts are *doing their job*, at installation and while in service.

RELIABILITY

Bolts fitted with our indicators can be used and re-used time and again for a reliable reading of joint clamping force. If used properly, SmartBolts can have a useful life of 20+ years.

ECONOMY

The cost of DTI SmartBolts is a fraction of that of strain-gaged bolts or other products performing an equivalent function. Costly instruments such as strain-gage bridges or readouts are not required.

How SmartBolts® Work

DTI SmartBolts are specialty fasteners with a built-in visual indicator that shows the tension developed as the bolt is installed. The indicator gradually darkens from bright red to black as the fastener is sufficiently tightened. See Figure at right.

Starting with a standard fastener, a special recess and hole is machined; a colored pin is inserted and fixed at the bottom of the hole. Our unique microindicator technology is then sandwiched between the pin and viewing lens. The assembly is then permanently installed into the bolt.

The indicator works on the most accurate principle for tension measurement – actual fastener elongation under load. As the bolt is stretched elastically, the minute displacement of the pin allows the microindicator to produce a continuous and completely reversible color change.

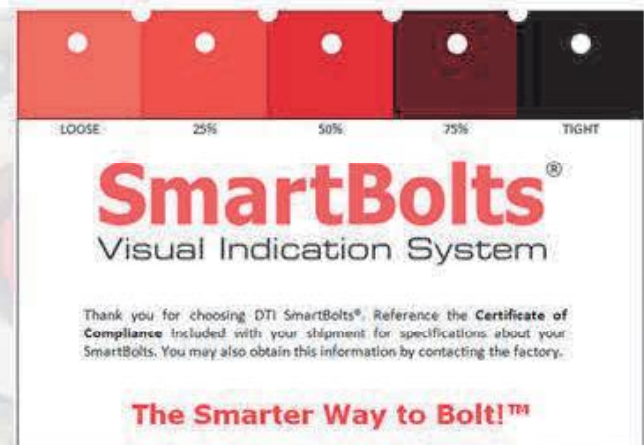
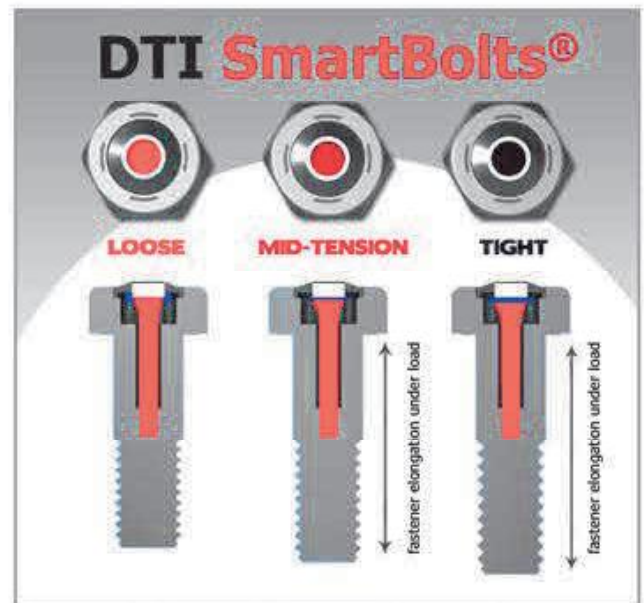
SmartBolts are customizable to indicate "Tight" at a specific tension (subject to proof load limits).

Why Tension, NOT Torque

The traditional method for tightening fasteners is to turn the head or nut using a torque measuring tool such as a torque wrench until a "torque spec" is reached. The tool may be very accurate, but measuring torque only measures how difficult it is to turn the head or nut. It provides little information on the force that is actually holding the joint together – Tension.

In some cases, 90% of the torque force applied to a fastener is used just to overcome friction. In those cases only 10% of the torque force is creating tension by elongating the bolt. Or in other cases the torque-tension relationship may be 50/50. Which case applies to your bolted joint? How can you know for sure?

The difference between the two cases depends on variations in the friction factor. The friction factor will vary due to changes in as many as 70 factors, according to some studies.



DTI SmartBolts® Verification Guide
For illustration purposes only

These factors include the amount of scale on the fastener and nut, the type of plating, what lubrication is used, if any, the amount of rust present, the characteristics of any washers used, whether the nut or the head is being turned, the number of times the joint has been tightened, among many other factors.

This makes the amount of torque needed to produce a desired tension very difficult to predict without extensive laboratory tests under highly specific conditions. It also makes it difficult, if not impossible, to determine whether a bolted joint is properly tensioned for a given application of torque.

On the other hand, direct tension indicators respond to fastener tension ONLY, ignoring torque inputs, providing a true measure of joint tightness. Tension, or clamp force, is the only factor that ensures that a bolted joint is "tight".

DTI SmartBolts®: Hex Head Cap Screw Characteristics

Size Ranges	7/16" (M10) to 1-1/2" (M36)
Length Range	1-1/4" (30mm) to 16" (400mm)
Available Grades	Grade 5, Grade 8, Class 8.8, Class 10.9 For others contact us
Available Finishes	Plain, clear zinc, yellow zinc For others contact us
Threading	Partial or full
Grip Lengths	Minimums apply to fully threaded bolts
Customized Design Tension Range	30-90% of Proof Load
Accuracy	+/- 10% of Design Tension
Operating Temperature Range	-20° C to 75° C / -4° F to 168° F
Strength Reduction as a Result of Modification	Only in smaller sizes or fully threaded bolts

Do You Have a Potential Application for SmartBolts®?

Current SmartBolts Applications Include:

Electrical Distribution	Heavy Equipment
Amusement Rides	Mining
Industrial Machinery	Radar Towers
Critical Structural	Press Dies
Materials Processing	Machining Fixtures

DTI SmartBolts At-A-Glance

- ⊙ Easy to use – visual indication speeds inspection
- ⊙ Measures tension – the critical factor to determine joint tightness.
- ⊙ Accurate to +/- 10% of design tension
- ⊙ Completely re-usable
- ⊙ No special tools or training required for installation or maintenance
- ⊙ Long service life - 20+ years, if used properly
- ⊙ Adaptable to a wide range of fastener sizes and indicating tensions.

SmartBolts are useful in a wide range of real world applications. We invite you to visit our website and try our Application Qualifier questionnaire to learn if your application is appropriate for the SmartBolts solution. You can also receive price quotes for testing and annual usage quantities.

Go to
www.smartbolts.com/aq
 to get started!

100% QUALITY TESTED

Every DTI SmartBolt is tested to assure indication at the proper tension before it leaves the assembly plant.

CERTIFIED

Each batch of DTI SmartBolts comes with a certificate of conformance and statistical results from our stringent quality tests.

MEETS THE TOUGHEST STANDARDS

Our fasteners have passed the highest scrutiny including tests by

- ✓ US Army
- ✓ UL for electrical busway
- ✓ Independent bolting experts

MADE IN



U. S. A.

The Smarter Way to Bolt!™

DTI SmartBolts® Provide SAVINGS at Every Stage of Your Business

Save on Design

Incorporating SmartBolts into product design may mean less of everything: number of fasteners, strength of fasteners and diameters of drilled openings, saving you and your customer time and money.

Save on Installation

SmartBolts unique design eliminates the need for special tools or wiring during installation. Simply tighten the bolt until the indicator turns the proper color and move to the next one. Using the SmartBolts system can reduce fastener installation times when compared to traditional methods.

Save on Maintenance

Visual indication is safer and it saves time and money. Maintenance personnel can simply look at bolts from several feet away for inspection, focusing on the loose bolts ONLY. In a typical two week maintenance cycle on an installation of 1,000 fasteners, SmartBolts can reduce maintenance time by 80% and costs by as much as 50%.



About the Company



We are the world's leading provider of visual tension indicating technology. Our technology, trademarked as the Visual Indication System™, measures tensile force by associating the elongation of a fastener with a distinct color spectrum.

We develop, manufacture and embed this technology with a wide range of fasteners, generating the SmartBolts® product line for industrial and OEM markets.



202 Perry Parkway, Suite 7
Gaithersburg, MD 20877 USA

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Distributed by P&C Mining Services

E-mail: sales@pandcmining.co.za Tel: 010 060 9833 / 0861 723 000
Unit 2 Protea Business Park, No 30, All Black Road, Anderbolt
Boksburg, Gauteng, South Africa

www.pandcmining.co.za