

# VERIFYING QUALITY AND RELIABILITY WITH FASTENER TESTING

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**Every day, we come in contact with equipment, buildings, vehicles and more that are held together with fasteners. In order for them to be safe and reliable, the fasteners need to perform to expectations and hold up to wear and tear such as stress, vibration, and environmental conditions.**

Many production errors can occur that result in substandard fasteners, including the use of poor quality raw material, application of inferior plating or heat treatment, incorrect machining, careless handling and more. Many of the inadequacies and defects that occur in fasteners, and the raw materials used to manufacture fasteners, are not visible to the naked eye and require testing and inspection techniques to ensure a quality end product.

The testing schedule or frequency and the types of testing required from company to company vary greatly and depend on factors such as:

- type of company;
- stage in the business life cycle;
- industries served;
- relationship with material suppliers;
- intended use of fasteners;
- applicable standards; and
- customer requirements.

Testing of raw materials and/or finished fasteners is a routine part of product development, manufacturing processes and purchasing decisions for many types of businesses, including material suppliers, fastener manufacturers, distributors, fabricators and end users. This key component of quality control measures whether or not a specified benchmark or standard has been met and is essential for any business to build strong sales, a positive reputation and long-term success. Most industrial fasteners are covered by standards for materials and properties, as well as dimensions and tolerances.

At times, samples from every lot of fasteners purchased for use in the assembly of certain products go through testing. Fasten-

ers that will be subjected to extreme wear or can be a safety concern are generally inspected regularly. Fasteners used under less severe conditions may undergo testing only when a material supplier or a manufacturing process is changed to verify that everything is in order. Still other businesses may test only when a customer requires that a certification be provided with the raw materials or fasteners they are selling.



Two 2-1/2" by 7-1/2" (8 threads per inch) bolts; one before testing and the other after the Yield Test and a Wedge Tensile Test

## Testing for a Range of Business Decisions

Testing can be performed throughout the product life cycle, from R&D and product development on through to fastener failure or disposal. Test methods are available to provide reliable information and answers for many business needs, including:

- confirming material content;
- comparing materials and suppliers;
- evaluating treatments and coatings;
- verifying production processes;
- performing quality control checks on finished fasteners;

- fulfilling industry or internal quality requirements;
- resolving a customer dispute; and
- analyzing a failure.

## Test Methods for Fasteners and Raw Materials

Broadly speaking, testing is either a destructive or nondestructive process. Destructive testing will damage the test sample, making it unfit for use, while nondestructive testing will not.

### NONDESTRUCTIVE TESTING: LOCATING FLAWS AND DEFECTS

For obvious reasons, finished fasteners generally undergo nondestructive testing and inspection to confirm the absence of surface or sub-surface indications, which suggest a defect or discontinuity. As a result, methods such as Magnetic Particle, Liquid Penetrant and Visual Inspections are routinely used to test samples from production runs and will detect seams, laps, cracks or tears open to the surface of fasteners. X-ray Inspection and Ultrasonic Testing can provide information on internal flaws.

### Verifying Dimensional Accuracy

Although Dimensional Inspection is not formally classified with these other methods as nondestructive testing (NDT), it is an inspection process that does not harm the fastener. Prototypes and finished fasteners undergo inspection to verify the measurement accuracy of internal and external threads, and surface features such as length, diameter, angle and surface finish. Inspection confirms compliance with design speci-

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fications and can be a critical step during product development or following production runs.

### DESTRUCTIVE TESTING

Many destructive methods are offered to analyze and test prototypes, failed fasteners and the materials used to manufacture fasteners.

### Evaluating Mechanical Properties

Before using a material to manufacture fasteners, it is important to know that its mechanical properties are suitable for the fastener's intended application. The various Mechanical Testing techniques test raw material specimens or finished fasteners for their properties in tension and compression at various temperatures. These tests include stress rupture, yield strength, axial tensile, wedge tensile, proof-load, cone strip, hydrogen embrittlement, hardness testing and more. Testing can also evaluate the effects of heat treatments on mechanical properties. After heat treating, tensile, yield and elongation testing can determine if intended improvements have been achieved.

### Assessing Material Characteristics and Structure

Chemical Analysis is very effective in determining material composition, finding impurities and identifying materials. Testing can be performed during material selection to compare raw materials or when changing suppliers to confirm a new material. There are also times when it is necessary to test samples from finished fasteners in order to verify the content, such as when a product is being reproduced and the original material is unknown or when a failure must be investigated.

Metallurgical Evaluation can also provide an in-depth assessment of a material sample or fastener using microscopic techniques to study the structure and properties or to detect defects. Optical magnification is used to obtain information about coating and plating thickness, decarburization, micro-hardness and microstructure.

The effects of environmental conditions on a material, such as salt spray and humidity, can also be assessed with testing.

### Determining Your Testing Needs

Some testing can be performed in-house with an investment in equipment and skilled technicians, but oftentimes, a certified test

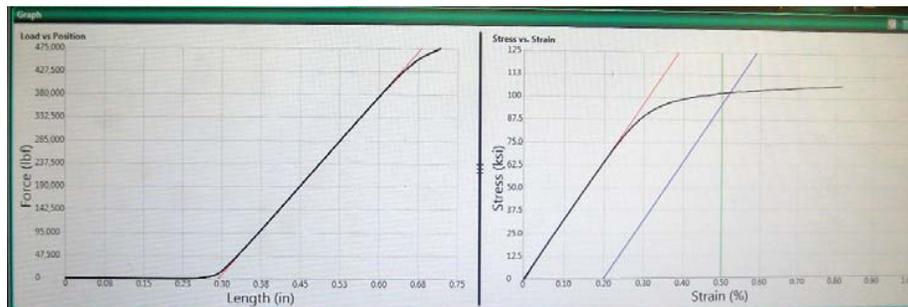


Chart recording showing the results of the Full-size Yield Test

report from an independent laboratory is mandatory to show conformance to industry specifications or stipulated requirements. These reports are usually required in industries such as aerospace, power generation, military, medical implant and more. The risk of liability for loss due to defective fasteners also brings many other manufacturers and

end users to independent laboratories for documentation of test results and conformance to standards for their own protection. Also, certified reports provide documented results that are frequently needed when lawsuits and insurance claims are investigated.

The experience, qualifications and capabilities of independent testing laboratories vary, so it can be a good practice to do some research before making a selection. The key is to know what you need, as well as what is available in the market.

Some labs are accredited and hold industry certifications. You may also need a lab with test procedures that conform to certain industry specifications such as AMS, ANSI, ASME, ASTM and MIL. The scope of testing, turnaround times and support services vary widely. First, determine what is required by your internal quality program and your customer, then consider your own expectations, so you'll know what to compare and can look for a good match.

### ABOUT LTI

Laboratory Testing Inc. (LTI) of Hatfield, Pennsylvania, is an independent materials testing lab specializing in destructive and nondestructive inspection and analysis of metals, alloys, and polymers. A broad range of materials testing, fastener testing, dimensional inspection and failure analysis capabilities are provided. In addition, LTI performs specimen machining and calibration services.

For more information, email [sales@labtesting.com](mailto:sales@labtesting.com), call 800.219.9095, or visit [www.labtesting.com](http://www.labtesting.com). ■



Setting up a Full-size Yield Test on a 600K Tensile Machine