Fastener Testing to Ensure Product Safety & Performance

by:
Sharon M. Bentzley
Marketing Manager
Laboratory Testing Inc. (LTI)
2331 Topaz Drive
Hatfield, PA 19440 USA
www.labtesting.com

Detecting and preventing production and subsequent use of defective fasteners has led many manufacturers to independent testing laboratories.

Fastener quality has long been a topic of discussion and concern, leading to the Fastener Quality Act of 1990. Although the past decade has seen many advances in the fastener industry and the magnitude of problems with fasteners has declined, many companies still rely on raw material or fastener testing to ensure product safety and performance.

The manufacture of substandard fasteners that lead to fastener failures can result from poor quality materials, an error in the manufacturing process, negligence and more. Even under the best of conditions, defects can occur and may not be visible to the naked eye. To detect these flaws and ensure a quality end product, more sophisticated testing and inspection of finished fasteners is recommended as a safeguard.

Additionally, for the sake of reputation and future sales growth, or to meet industry specifications and customer requirements, many companies have made testing of fasteners and raw materials a routine part of their manufacturing process. Testing can occur at any stage in the process—at the mills supplying raw materials, at the fastener manufacturers or at the companies purchasing the raw materials and fasteners.

The frequency of testing can vary from company to company. Certain industries require their suppliers to test samples from every lot of fasteners purchased for use in the manufacture of their products. Some businesses may test only when a customer requires that a certification be provided with the materials or fasteners they are selling. Other companies will test when they make a change in their manufacturing process or begin purchasing from a new raw material or fastener supplier to verify that everything is in order.

Determining Your Testing Needs

Once you are ready to begin testing, your answers to the following questions will assist you in your selection of a qualified laboratory:

- Which testing methods will provide the answers you need?
- Are laboratory accreditations or testing to industry standards necessary?
- Do you have turnaround, pricing or service requirements?

Testing Capabilities. A wide array of testing and inspection services is available to provide information on material properties, characteristics, defects and weaknesses. The testing services provided by laboratories vary, so you may need to shop around. Some larger labs offer a wide range of testing services and test specimen machining at one location, a convenience if you will be using multiple services. If you are unsure which testing methods will give you the information you require, check with laboratories that offer a variety of services for recommendations.

- *Dimensional inspection* will examine a wide range of features, including multiple diameter and angle measurements, surface finish, threads and other characteristics.
- *Nondestructive testing*, most often magnetic particle and liquid penetrant inspections, will detect seams, laps, cracks or tears on the surface of fasteners. X-ray and ultrasonic inspections provide information on internal flaws.
- *Mechanical testing*, including hardness, axial tensile, wedge tensile, proof-load, cone strip, hydrogen embrittlement and stress durability testing are performed on fasteners or machined specimens to test durability and strength. After heat treating, tensile, yield and elongation testing determine if the fastener meets specified requirements or if any weakening of material has occurred (see **Figure 1**).
- *Metallography* looks at a section of a fastener or raw material after it is mounted and polished to detect small flaws and defects. Optical magnification is used to obtain infor-

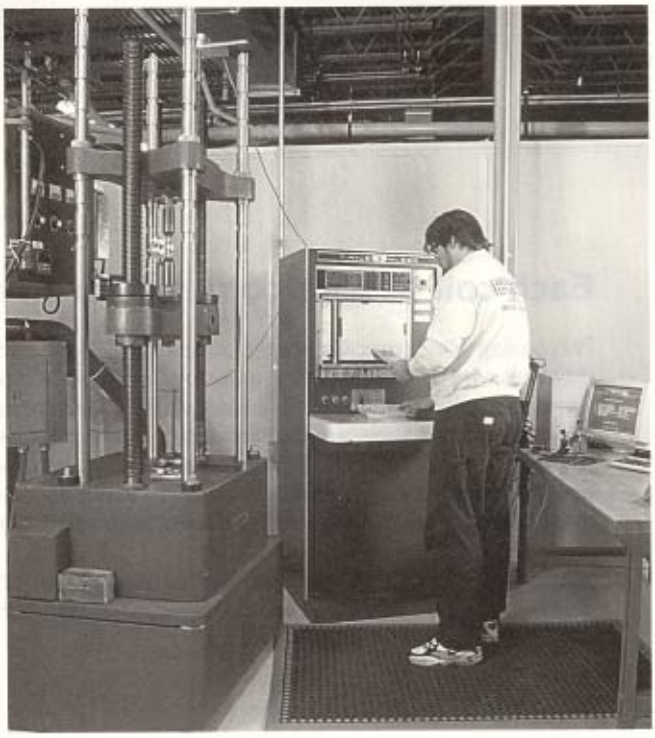

Fig. 1 — 60,000 lb (266,893 N) capacity tensile machine.

mation relating to coating/plating thickness, decarburization, micro-hardness and microstructure (**Figure 2**).

- *Chemistry* identifies the composition of a sample cut from raw material or a fastener.

Accreditations & Standards. Accreditation ensures all testing is done according to strict procedures that are regulated and audited by the governing organization. If your testing must be performed by an accredited laboratory, such as **A2LA** for the automotive and commercial industries or **NADCAP** for aerospace, the accrediting association can tell you which labs have met their requirements. Listings of members are often included on the associations' web sites.

If test procedures must conform to industry specs such as **ASTM**, **AMS**, **ASME**, **ANSI** and **MIL**, talk to the labs to find out which ones will follow the required standards. Some nondestructive testing must be performed by certified technicians, so verify that certifications are current.

Turnaround. Testing labs generally have standard turnaround times for the services they provide. Determine exactly when a laboratory needs your materials to guarantee completion by your due date. Be sure to clarify if turnaround time includes the completion of testing only, or also the preparation and mailing of certification documents. If you frequently operate under tight deadlines, you may need a lab that offers expedited delivery capabilities.

Pricing. Know your testing budget and what you need to accomplish with the allocated funds. There is wide variation in pricing among test facilities. Some labs include added services such as pickup, delivery, special handling or shipping costs in their quoted prices, while others charge separately.

You also may find that you only get what you pay for on your certifications. Some laboratories simply list test results, while others include a full interpretation of the data. If you do not want to evaluate the results yourself, look for a lab that includes this information.

Location. Decide how important location is to your choice of a laboratory. The size, weight and frequency of your orders, plus your budget, will help determine if shipping is an option. If not, some labs offer free pickup and delivery near their facility. If your materials will be shipped or delivered directly from a supplier to the laboratory or from the lab to your customer after testing is completed, the locations of these businesses must be taken into consideration.

Choosing a Quality Lab to Meet Your Needs

Just as you will see variation in services, capabilities and pricing among labs, the level of quality can vary and impact the reliability of test results. It is recommended that customers conduct an onsite audit or make a personal visit to any facility they consider using for testing services. Also ask if the lab has an open door policy allowing you to observe your company's testing at any time.

A wide variety of information should be available for review to familiarize you with the lab's qualifications and capabilities. Documented procedures should cover testing requirements, equipment calibration procedures and records, personnel qualifications and certifications, material preparation and acceptance criteria and tolerances. The laboratory's quality system should also specify material handling procedures to protect the quality of all materials undergoing testing. Generally, the procedures will cover steps to prevent the commingling of material types and heat lots, and to maintain traceability throughout the laboratory.

Fig. 2 — Digital imaging system.

The depth of information included in certifications is another key indicator of a quality laboratory. If you want your certification to state whether your test results are in conformance with a specified standard or meet your requirements, be sure your lab will include this information with the results.

Investigating Failures When They Occur

On those occasions when a product failure may involve a fastener, manufacturers will need to know whether their process or a substandard fastener is at fault and may want to consult with a materials engineer at a testing laboratory to avoid similar failures in the future. During the investigation, some of the same testing described earlier, in addition to other methods like electron microscopy, will be used to aid in identifying the root cause of the failure. If the failure leads to a legal claim of damage or injury, these test results may be used in litigation. It is beneficial to evaluate the background and qualifications of the laboratory being considered to conduct the investigation, just as you would to determine the suitability of a lab to perform standard testing, as discussed above.

Conclusion

The liability and risk of using defective fasteners in the construction industry and product manufacturing, where flaws could lead to product damage and personal injury, bring many manufacturers to independent laboratories for testing. Finding a testing vendor that is suited to your requirements can be a big project, but one well worth the effort.

The key is knowing what you need as well as what is available in the market so you will have the knowledge to ask the right questions when comparing laboratories. Referrals from other customers of testing labs can be an excellent source of valuable information, and can provide insight into the advantages of working with their vendors.

For more information on the services offered by Laboratory Testing Inc., contact the author or **Circle 204.** FTI

Company Profile...Laboratory Testing Inc. (LTI) *of Hatfield, PA, USA, is an independent materials testing laboratory that specializes in the inspection and analysis of metals and alloys found in fasteners, tubular products, plates and castings. In addition, LTI provides calibration services, specimen machining, failure analysis, lifetime prediction, materials engineering and materials selection services.*