Fastener Standards Today: Improving Quality

Dick Seidl, Global Applications Engineering Director, Stanley Engineered Fastening

This article first appeared in IMPO's September 2013 *[1] issue.*

Fasteners are essential to modern life, however, it is easy to forget just what an important role the small fastener plays in the integrity and safety of the end product. Automakers have reported that the majority of their warranty costs arise from fastener related issues – ranging from the simple rattle in the dashboard coming from a loose tapping screw to a major recall resulting from mis-torqued high strength fasteners in the steering system. Many problems relate back to the not-so-simple fastener.

Fastener Quality Act

In the 1980s, there were a series of product failures that were attributed to counterfeit or substandard threaded fasteners. Fasteners were being offered for sale that were mismarked in material and heat treatment or were dimensionally nonconforming to the appropriate standards. The most common of these counterfeits was the intentional mismarking of low-carbon boron steel Grade 8.2 bolts as alloy steel Grade 8.0. The mismarked low-carbon boron steel bolts have the potential for long term stress relaxation failures under certain conditions. After a number of product failures were publicized, Congress decided to protect the public from the dangers related to substandard fasteners and in 1990, the Fastener Quality Act (FQA) was passed into law. Since that time, several amendments to the FQA have been implemented.

The law, as passed in 1990, was never implemented in its original form. The intent of law was to assure that all ‘critical’ fasteners were properly marked for identification and properly tested to assure quality. The initial law contained requirements that virtually all quality inspections were to be based on sampling and testing of product. This was going to take the place of in-process controls and SPC, which most manufactures considered to be a step back rather than forward in quality. The law also required the use of NIST-accredited laboratories for all testing. The requirement for sampling negated the advantages gained by the use of modern process control methodologies and added significantly to cost and lead time, without improving resultant quality compared to properly conducted SPC. The NIST lab accreditation requirement mandated that all in-house labs that did any test on a part needed accreditation, meaning thousands of manufacturer and distributor labs suddenly needed accreditation, resulting in a log jam of applications.

Prior to implementation of the FQA act, it was amended in 1997. The most significant change created by this amendment was a provision to allow the use of SPC and process control systems to show conformance to the FQA. Companies that

could show certification that they were operating under an accredited Quality Assurance System (ISO 9000, AS 9100, etc) were declared provisionally compliant with the FQA.

In 1999, another amendment to the FQA was signed by the president. This amendment included significant changes to both the scope and implementation of the FQA:

- Limited the scope of covered fasteners to those fasteners that are both through hardened and grade marked.
- Eliminated the requirement for NIST approval of lab accreditations.
- Exempted manufacturers using quality management systems based on ISO 9000, ISO 9001, ISO 9002, or ISO/TS16949 from the FQA regulations.
- Allowed electronic storage and transmittal of records if they had effective systems to prevent alteration.

The current focus of the FQA is to prevent the fraud that was occurring during the late ‘80s with mismarking and falsified certifications. There were individuals and organizations who sought to take advantage of the situation by fraudulently selling product at a higher than normal margin. The FQA has reduced but certainly not eliminated this.

Quality Fasteners

The biggest impact on fastener quality during the past 20 years has been the adoption of process control methodology. This has both improved quality through the use of statistical and predictive controls and also reduced cost through the reduction in associated scrap and rework. The use of processes like SPC has allowed producers and users to better communicate processes and quality standards using a common language. End users should be careful to add SPC controls to those characteristics where such control will enhance resulting product quality – thread pitch diameter and hardness are two key ones.

Most fastener products now are controlled by customer drawings and mechanical requirements (ISO 898-1, ASTM A354, etc) or consensus dimensional standards and mechanical requirements. Few end users have the support staff available to generate and properly maintain their own fastener standards, so there is an increase in the use of consensus standards rather than proprietary standards at many companies. The use of consensus standards for mechanical properties helps assure the correct alloys and requirements are utilized, while allowing specific dimensional requirements to be easily addressed on a drawing by drawing basis.

During the past decade, there have been a number of evolutionary changes to the fastener specifications to match revised material and testing/inspection specifications to the appropriate fastener specifications. One of the areas where utilization of consensus standards by a company is a tremendous help is during the revision of these associated specifications such as raw material or testing protocols.

If a company maintains their own specifications, they need to have an engineer reviewing each and every one of the linked specifications to see how any revisions will affect their manufacturing and inspection processes. By utilizing consensus standards, the consensus specification body takes care of this process for the user.

The Right Choice

The vast majority of fastener related problems have nothing to do with fastener quality problems, rather they relate back to improper selection or installation of the fastener. As companies have become more aware that the hardware cost of the fasteners accounts for only 15-35 percent of the in-place cost of the fastener, they have become more interested in exploring ways to reduce the installation costs. This has led to significant growth in the area of engineered fastener designs, fasteners designed for use in a particular application.

The development of engineered fasteners allows the use of products like high performance thread forming screws that, in addition to eliminating the tapping operation, simultaneously eliminate cross threading while providing vibration resistance that meets locking screw standards. Not only is there a reduction in the cost of preparation and installation, there is also an increase in joint quality and integrity.

The increasing use of engineering grade plastics has also created fastening challenges. The key is to work with an experienced fastener application engineer to assure that the design is sound prior to making the final production mold for the plastic part. The application engineer can help do this by molding and testing trial bosses to help validate the design

Fastener professionals can make fastening suggestions that can result in major cost savings over the life of the product, while providing increased product quality and integrity.

Links:
[1] http://digital.impomag.com/impo/september_2013#pg1