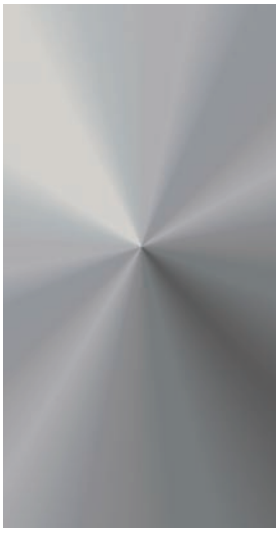
Overview of Stainless Steel & Non-standard Fastener Applications in U.S. Industries

by Shervin Shahidi Hamedani

Introduction

The world market for industrial fasteners represents a $67 billion industry divided between Asia (38.2%), Europe (25.3%), North America (21.9%) and the rest of the world (14.6%) as reported in the industrial fasteners institute annual report in 2012. Of this total, the Asian market is dominated by China (14.8%) and Japan (10.1%). Strong growth succeeds in the automotive, aerospace and energy sectors. The industry is expected to show sustained growth in the near future.



Although rapid global industrialization and rising demand for durable goods make brighter market for fasteners, loss to industries worldwide due to corrosion are huge. The estimated loss is about 50 billion dollars per year. Therefore, there is a combat against this loss, which is acquisition of strength through greater knowledge of corrosion and through the use of corrosion-resistant, stainless steel, fasteners and materials.

The use of such fasteners lengthens the life of equipment, decreases maintenance and repairs, and can avoid injury or death from product failure.

Stainless Steel and Non-standard Fasteners

Stainless steel, carbon steel, and alloy steel are the major steel fasteners used in industries. Automotive, construction, aerospace, military, oil & gas, marine, and replacement parts are just some of the examples of the different industries which fasteners are used extensively. Since corrosion resistance is an important aspect of product reliability, inherent in any attempt to prevent corrosion is the careful selection of fastener materials. A common practice in industry is to use fasteners made of metals or alloys that are more corrosion resistant than the materials they join.

Stainless steel labels a group of steels highly resistant to corrosion and oxidising, generally higher tensile strength than commercial low carbon steel, which comprise at least two separate elements alloyed together. The stainless features of these materials make them ideal fasteners for many architectural applications and suitable for atmospheric (indoor and outdoor) services.

Stainless steel is a family of iron-based alloys containing about 10.5% chromium or more, the chromium is chiefly responsible for corrosion and heat resistance; the other alloying elements are present in stainless steel to enhance corrosion resistance and to impart certain characteristics with respect to strength and fabricability. A total of 60 commercial stainless steel types were originally recognized by the American Iron and Steel Institute (AISI) as standard compositions. Stainless steel fasteners can be manufactured by either machining or cold heading. Machining is the oldest method of fastener production, and it is still specified for very large diameters and small production runs. They are fit for applications that need corrosion resistance, hardness, strength, and wear resistance.

Critical applications require the use of materials whose performance cover both normal-duty and extreme-duty demands. It is the latter that differentiates specialty fasteners and components from standard ones. There are many manufacturers who are specialised in non-standard and special fasteners. Manufacturers who have the capability to modify the existing standard fasteners and also manufacture special fasteners with specific design and requirement. Some of the non-standard fasteners can be produced by performing modification on an existing standard fastener, keeping costs and lead times to a minimum. On the other hand, there are many other fasteners which are not available as standard and they have very specific requirements with customised specifications on the size, materials, head styles, etc.

Nonstandard and specialised fasteners are those whose applications demand performance over cost and in most of the cases the quality is more important than the price. Mechanical, physical and metallurgical properties are more severe than those involving standard fasteners. Examples of equipment and industries that rely on specialty fasteners include power generation (e.g., gas turbines, offshore performance platforms), pulp and paper mills and electronic devices.

Stainless Steel and Non-standard Fasteners in US Industries

Fastener applications in the US are as diverse as the industries they service. Stainless steel and non-standard fasteners are extremely essential to nearly all of the industrial markets in US. When we take a look at automotive, construction, mining, marine, petrochemical, nuclear and specialized applications we could figure out how those fasteners are important in US industry. As reported in the industrial fasteners institute annual report in 2012, some 350 manufacturing plants in the U.S. produce more than 200 billion pieces of fasteners per year in this country alone.

The automotive industry alone is estimated to use between 25-35 billion pieces of fasteners. This manufacturing segment continues to see sales of greater than 14.5-15.5 million units of vehicles in North America. Steel and stainless steels, including duplex and austenitic grades, as well as plastic fasteners dominate the automotive landscape. Many fasteners are plated or coated for increased corrosion protection.

In the construction industry fasteners in general and stainless steel fasteners in specific are the critical link in the load path of a building structure. They provide structural integrity and are a major point of energy dissipation under seismic and wind loads. Construction fasteners are generally classified as those fasteners that are used to secure building materials. Those fasteners are not just commodity (standard) fasteners, but also non-standard and task-specific fasteners.

The marine industry is factually seized together by non-standard and stainless steel fasteners designed to survive the extremely severe and corrosive environments to which they are exposed. Bolts, screws, washers, locking washers, wing nuts, split rings and slating nails are just some of the many marine construction fasteners used on docks and ramps, ships, tanks, winches and for underwater construction projects.

The applications of special and nonstandard fasteners in US aerospace industry comprise aircraft (manned and unmanned, fixed and flex wing), rotorcraft (helicopters, gyrocopters) and space vehicles (shuttles, space stations, satellites). In aerospace (aircraft, rotorcraft, space) applications, specialty and nonstandard fasteners are used are on exteriors, interiors, avionics and flight systems (e.g., landing gear) as critical components used in all of these applications, which are required to meet the most demanding performance characteristics. According to The Boeing Company, the 747 includes over six million parts, half of which are fasteners.

At present, the Americas dominates the aerospace fasteners market with many attractive investments contributing to its growth. The mergers of major airlines in the US are one of the main reasons driving the growth of the market as these airlines are investing in advanced technology and upgrading special fasteners to enhance their flight safety and operations, thus having a positive impact on the fastener market.

References:

Global Aerospace Fasteners Market Share Report 2020: Radiant Insights

Industrial Heating; Fastener Industry Overview: Applications, Materials, Equipment