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# Japanese Fastener Tech Trends: High-end Migration & Industry 4.0

The countries that measure up to Industry 4.0 are probably Germany, the U.S., and Japan. Here we are going to talk about Japan. Japan's fastener technology has migrated to the high-end level pretty early, but in the last two years, Industry 4.0 implementation has become more apparent because the leading corporations in Japan are the spearheads of this trend. Before moving on to the Japanese Industry 4.0, we have to know the R&D trends of Japanese fastener manufacturers.

## Trend 1: Anti-loosening

Anti-loosening is no doubt Japan's iconic and admirable technology in fastener development. There are so many, almost countless local companies developing anti-loosening fasteners and these fasteners are considered the "regular items" in Japanese fastener development. The Japanese people in nature have the momentum to innovate; and therefore, they can roll out improved anti-loosening fasteners every time. Even if some of the innovations are just a minor improvement over the previous products, "a few more percentages of anti-loosening improvement" means a head start for the Japanese fastener manufacturers who have to face a domestic population of 100 million people and thousands of domestic fastener competitors. Therefore, you can imagine the intensity of competition in this nation of creativity.

There are a few examples of anti-loosening fasteners if we look back at the past two years. The first example is "petal fastener," which out of the Japanese creativity is a petal-like structure comprising two triangle springs to lock the nut, thereby preventing the bolt from loosening and detaching from the nut. The second is a type of bolt, which claimed by its developer will not loosen or break. All the threads on this bolt generate a reaction force, and stress spreads across all the threads instead of just across the first 6 threads. The third is a self-tapping screw, which gains a significant torque from the difference between low fastening torque and high rupture strength. Utilizing the torque difference, the screw delivers stable fastening.

These are only a tip of an iceberg. It is not an overstatement to describe Japan as a major creator of anti-loosening fasteners.

## Trend 2: Materials and Structural Advancement

Japan is one of the pioneers in material development. When it comes to titanium screws, Taiwan is one of the manufacturing countries that started early. There are other competitors in Japan, who successfully developed titanium processing technology and rolled out expert-grade titanium screws. These screws possess the characteristics of pure titanium and the strength which is parallel to titanium alloys. They are colorable, and each of them weighs only 60% of a stainless steel screw.

Another company developed a technology to join different kinds of metal materials that are used for cold forging, including iron, stainless steel, copper, and aluminum, applying different material characteristics to a single screw. Yet, another company rolled out a 3-in-1 bolt, which integrates 3 patented designs, including a special head shape, materials, and threads. This composition achieves light-weighting, high strength and anti-loosening.

## Trend 3: Visualization

The Japanese people care a lot about shortening the operation of fastening and making it efficient, so from time to time they will roll out fasteners which users can visual check to determine the fastening state. The most common way is to inject a special dye to the fastener or put a special mark on it. The wider the dye spreads, or if the mark breaks apart further, the looser the bolt, nut, or washer is. In Japan there is a type of anchor with a black inspection ring attached to the washer portion. The anchor installation is complete when you see the inspection ring come up in sight.

## Trend 4: Industry 4.0, AI, Drones

This trend has just taken off in the past 3 years in Japan. An example is a leading telecommunication company in Japan, which rolled out a service utilizing drones to inspect structural bolts for rust, cracks and loosening. A top Japanese household appliance company is developing an AR-enabled bolt fastening system, through which the operator's head-mounted display shows the positions of fastened bolts for the operator to confirm if the bolts on the display are fastened with a proper force. Another Japanese company is developing a system to monitor wind turbine screws. Sensors installed on the screws collect data and check if the screws are degrading. Still another Japanese fastener company is working with a major watch company to develop IoT-enabled smart screws. The smart screws can collect critical signs on joining portions and visualize the time-lapse change of screw structure. Furthermore, the company will roll out an AI system to visualize the structural healthiness of infrastructure.

