North American Fastener Standards

2025 Update

In 1841, the English engineer and inventor Joseph Whitworth presented his paper, " A Uniform System of Screw Threads" to Great Britain's Institution of Civil Engineers. This paper was a proposed solution to an Industrial Revolution problem vexing Great Britain and other western countries. Although it started with the burgeoning railroads, this problem was being experienced globally throughout all industries relying on newly developed mechanization. Specifically, when threaded fasteners failed or needed to be replaced, there was no uniformity among manufacturers. Without any confidence in interchangeability, replacing a broken part required going back to the original manufacturer, which often was inconvenient and sometimes impossible. Whitworth's uniform thread design solved this problem and was quickly adopted as a national standard, propelling it into the history books as the world's first industrial standard.

Today, there are thousands of fastener standards, including global standards like ISO, regional standards like JIS, ANSI, and DIN, and individual user standards like Boeing, Honda, and Bosch. Standards fall into one of two categories, Consensus Standards and Non-consensus Standards. Consensus Standards are generated by Consensus Standard's organizations, which means they are developed by a diverse and multi-talented group of experts using a formal set of procedures and rules that guarantee they reach consensus regarding the contents of the final standard. Non-consensus Standards are developed by individuals and individual organizations to best represent their specific interests.

Standards related to fasteners can be divided into several categories:

1. **Product Standards:** These standards provide all the requisite information to be able to produce a part or family of parts. Foremost they provide dimensional information but may have other information required to make or control the proper manufacture of parts as well.
2. **Material Standards:** This is a slightly broader range of standards, as it includes standards related to raw materials, performance (specifically mechanical performance), heat treating, plating and coatings, and testing.
3. **Testing Standards:** This is a small group of standards that are specifically written to detail one or more fastener test methods.
4. **Procurement Standards:** These are generally unique to aerospace and defense fasteners and provide requirements related to quality, performance, and procurement.
5. **System Standards:** These are broad standards that detail quality-related, business management systems, some are intended to encompass all industries and others are specific to fasteners.

In North America, there are several Consensus Standard's organizations that generate fastener standards. The primary ones include:

- American Society of Mechanical Engineering (ASME), predominantly providing product standards. Fastener-related standards come from two different technical committees, B18 (fasteners) and B1 (threads).
- American Society of Testing and Materials (ASTM), predominantly providing material and testing standards. Fastener-related standards come mostly from the Fastener Committee F16 although a number of them are derived from the steel committee A01.

- Society of Automotive Engineers (SAE), providing mostly material and a few product standards. Fastener-related standards come primarily from their Fastener Committee, although aerospace fastener material standards come from their Aerospace Material Division.
- National Aerospace Standards Committee (NASC), providing product, material, testing, and procurement standards for aerospace fasteners.
- International Organization for Standardization (ISO), providing product, material, and system standards. ISO is unique because it is a world organization and, thus, delegates to the fastener committee, TC2, represent different countries or regions.
- Research Council on Structural Connections (RCSC), exclusively focused on structural bolting.
- National Association of Corrosion Engineers (NACE), with several fastener standards, mostly focused on the oil and gas industry.
- American Petroleum Institute (API), with several material standards exclusively for oil and gas industry fasteners.

There is always debate over which standards, Consensus or Non-consensus are better. Good arguments can be made for both sides and, the best answer is, most likely, "it depends". For example, if you are an automotive OEM and have some specific requirements that you wish to maintain, a company proprietary, Non-consensus Standard is probably a better choice. One of the big advantages, however, of most of the Consensus Standards is that one of the rules of the Consensus Standard's organization is that standards must be kept up to date. Each organization has its own rules, but most require that the standard be reviewed and either updated or reapproved every five to seven years. This is good practice because it doesn't allow these standards to fall too far behind the state of the industry. Although this is really a necessity, it can often be frustrating because it means that these standards are continuously changing, and users must be continually attentive to recent and upcoming additions and revisions.

The following are some of the current activities of these fastener committees:

ASME:

The ASME fastener committee B18 meets twice a year. The last meeting was in September 2024 and the next meeting was held in April 2025 at the IFI headquarters in Cleveland Ohio. The following are highlights of some of the recent revisions and work of this committee.

- **ASME B18.6.3:** "Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series)". A new revision of this standard was published in the first half of 2024. Although it was a significant editorial update from the 2013 revision, technical changes include a reduction of the core hardness to not exceed HRC36 for case hardened tapping screws, revised guidance regarding the Hydrogen Embrittlement Test, and revised underhead thread rolling parameters on tapping screws to reduce the risk of rolling threads into the fillet radius.
- **ASME B1.1:** "Unified Inch Screw Threads". This standard was revised and published in May of 2024. It corrected and revised several issues from the 2019 revision.
- **ASME B18.3:** "Socket Cap, Shoulder, Set Screws, and Hex Keys (Inch Series)". The Subcommittee that is responsible for this standard is working on a major revision. Currently the only allowable material choice is to use ASTM A574. This ASTM standard provides only one strength grade, equivalent to 180,000 psi. Unfortunately, this strength level makes these specific parts susceptible to hydrogen embrittlement, especially when they receive a zinc electroplated surface finish. Although the standard recommends avoiding this practice, it does not outright disallow it, and thus, it gets commonly applied. Metric socket parts can also experience this issue, but the metric standard includes option for property classes lower than 12.9 (the metric equivalent of a 180,000 psi strength fastener). To correct this, a task group in this ASME subcommittee has been working on a revision that will include Grade 5 and 8 inch socket products. Work is proceeding but likely will not be completed until the latter half of 2025 or sometime in 2026.

ASTM:

The ASTM fastener committee F16 meets twice a year. The last meeting was in November 2024 and the next meeting is held in Toronto Canada in May 2025.

The following ASTM Standards were revised in 2024:

- **ASTM A193/A193M:** "Alloy Steel and Stainless-Steel Bolting for High-Temperature or High-Pressure Service and Other Special Purpose Applications"
- **ASTM A320/A320M:** "Alloy Steel and Stainless-Steel Bolting for Low-Temperature Service"
- **ASTM A394:** "Steel Transmission Tower Bolts, Zinc-Coated and Bare". This standard was not changed but was reaffirmed to the last revision in 2008.
- **ASTM A540/A540M:** "Alloy Steel Bolting for Special Applications"
- **ASTM A962/A962M:** "Common Requirements for Bolting Intended for Use at Any Temperature from Cryogenic to the Creep Range"
- **ASTM F880:** "Stainless Steel Socket, Square Head, and Slotted Headless Set Screws"
- **ASTM F593**: "Stainless Steel Bolts, Hex Cap Screws, and Studs"
- **ASTM F3148:** "High Strength Structural Bolt Assemblies, Steel and Alloy Steel, Heat Treated, 144KSI Minimum Tensile Strength, Inch Dimensions" This standard was not changed but was reaffirmed to the last revision in 2017.
- **ASTM A194/A194M:** "Carbon Steel, Alloy Steel, and Stainless-Steel Nuts for High Pressure or High Temperature Service or Both"
- **ASTM A563/A563M:** "Carbon and Alloy Steel Nuts (Inch and Metric)"
- **ASTM F467:** "Nonferrous Nuts for General Use"

- **ASTM C1513:** "Steel Tapping Screws for Cold-Formed Steel Framing Connections"
- **ASTM F436/F436M:** "Hardened Steel Washers Inch and Metric Dimensions"
- **ASTM F3393:** "Zinc Flake Coating Systems for Fasteners"
- **ASTM F606/606M:** "Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets"

So far, only the following ASTM Standard has been revised in 2025:

- **ASTM F3125/F3125M:** "High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120KSI, 144KSI,and 150 KSI Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength". This was a significant revision as it added the 144KSI strength grade for all styles and types of structural bolts.

Highlights of future activity include:

- Currently there are almost seventy work items open in the F16 Committee, impacting forty different fastener standards. Many of these are relatively simple, minor changes, but having so many open work items signifies that this committee is currently very busy, and many standards are likely to be revised in 2025 and 2026.
- A proposal is underway to provide a galvanizing option for A490 (high strength) structural bolts.
- A guideline for best practices regarding fastener test reporting has been in development for several years and may see completion in 2025 or 2026.

SAE:

The SAE Fastener Committee met in September 2024 and will have its next meeting in September 2025.

Highlights of recent activity include:

- **Combination of SAE J1701 and 1701M**- These standards are the inch and metric versions of "Torque-Tension Tightening for Inch Series (J1701) and Metric Series (J1701M) Fasteners". These have been combined into one standard that is expected to publish in early 2025.
- **SAE J995**- "Mechanical and Material Requirements for Steel Nuts"- There is currently a work project on this standard to clarify the usage of screw machining materials.
- **SAE J58-** "Flanged 12-Point Screws". There is currently a work project to revise and update this standard.
- **SAE J429:** "Mechanical and Material Requirements for Externally threaded Fasteners". There is a significant revision of this document currently being worked on by a task group. It was balloted in early 2024 but is currently on-hold pending the proposed addition of Grade 5 and 8 versions to ASME B18.3 Socket Products.

ISO:

The ISO Fastener Committee, TC2, is not a regional Consensus Standard organization, but rather the global activity of many regional fastener organizations. In the U.S., ISO fastener activities are primarily hosted by the ASME Fastener Committee B18, Subcommittee 4. As most metric fasteners worldwide are governed by the standards under the jurisdiction of this committee, it is a very important one.

Highlights of recent activity include revisions to the following standards:

- **ISO 15330**: "Preloading Test for the Detection of Hydrogen Embrittlement- Parallel Bearing Surface Method"
- **ISO 10684:** " Hot Dip Galvanized Coatings"
- **ISO 898-1:** " Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel- Part 1: Bolts, Screws and Studs with Specified Property Classes- Coarse Thread and Fine Pitch Thread"
- **ISO 13809:** "Hexalobular Socket Set Screws"
- **ISO 6157-1:** "Surface Discontinuities- Part 1: Bolts, Screws, and Studs for General Requirements"
- **ISO 6157-3:** "Surface Discontinuities- Part 3: Bolts, Screws and Studs for Special Requirements"

RCSC:

Unlike the other Consensus Standard's organizations listed above, which focus on a broad range of fastener topics, the Research Council on Structural Connections (RCSC), is singly focused on user guides for structural steel bolting. Its hallmark standard, the "Specification for Structural Joints Using High-Strength Bolts", is used worldwide by steel erectors and construction trades. This document has been undergoing a major overhaul and was expected to go out for its second ballot in the first quarter of 2025. Likely approval and publication will occur in the latter half of 2025.

Summary:

As is obvious above, standards are always changing. Consensus Standard's organizations incorporate rules within their procedures to make sure that their standards do not get stale and are evolving to incorporate the latest development and understanding in the industry. In fact, an estimated 20%-25% of all consensus standards are under review or revision at any point in time. This is a big advantage, since it helps industry stay abreast of a continuously changing environment. However, it also creates a challenge because with so many standards in use and so often changing, users must be prepared to keep abreast of the changes. That is not always as simple as one might think. Therefore, users are encouraged to find ways to stay abreast of changes and implement actions in their management systems that will keep them up to date. ■