INDUSTRIAL FASTENERS INSTITUTE
6363 Oak Tree Boulevard • Independence, Ohio 44131 USA, www.indfast.org

ISO Fastener Standards Should Be Referenced for All Metric Fasteners

Metric fasteners are used throughout the world to assemble most products that are traded internationally. Unfortunately, there are currently three similar, yet slightly different metric fastener standard systems in use; ISO, US (ASME, ASTM, and SAE), and DIN. Maintaining three sets of standards that cover the same engineered components is poor engineering practice and results in poor economics. The designers, end users, and suppliers of metric fasteners need to move as quickly as possible to the adoption of ISO metric fastener standards, the only true international fastener standard system.

Before the 1970's there were many metric fastener standards in use. Many countries including Germany, France, Italy, Japan, and others had their own national standards. During the 1970's the ISO TC2 sub-committee on metric fasteners started publishing ISO International Standards and over the next 20 years the major industrial economies in the world, except the US, adopted the ISO fastener standards for the most commonly used fasteners and withdrew their own national standards.

The United States has sent delegates to the ISO TC2 meetings, but instead of adopting the ISO fastener standards it was decided that the US would create its own set of metric fastener standards through the American Society of Mechanical Engineers (ASME), the Society of Materials and Testing (ASTM), and SAE International.

The US delegates to ISO TC2 felt they could create a superior metric fastener system, called the Optimum Metric Fastener System (OMFS). The main goals of OMFS were:

1. Eliminating the recognition of all thread series except course threads to minimize the number of possible sizes to manage.
2. The addition of a new size, M6.3 X 1.0 to be sure American designers had a size closer to ¼-20 than M6 X1, yet not directly interchangeable with ¼-20.
3. The reduction of the across flats sizes on hex cap screws and hex nuts by 1 mm on sizes M10, M12, and M14 to save the material content in these part sizes.
4. The introduction of a new fixed limit thread gaging system to achieve higher fastener thread quality.
5. The introduction of an external 12-spline flange drive design intended to eventually replace the external hex drive and provide higher torque delivery capability.

Since the 1970s each of these goals has proven to be confusing, impractical, and non-beneficial. All of these except the across flats changes were either never adopted by users, or adopted for a relatively short time and later abandoned.

1. ISO metric fastener threads come in coarse, fine, and extra fine series just as do the US inch system threads always have. The usage of coarse to fine threads of ISO threads is about the same as in the inch threads. The overall usage is in the vicinity of 90% coarse, 9% fine, and 1% extra fine. OMFS had no impact on usage in the long run.
2. The size M6.3 X 1.0 was adopted by General Motors for a relatively short period of time and dropped, because it was found to be confusing and had no significant benefits over the original M6 X 1.0.
3. ISO TC2 did adopt the smaller across flats hex size for M10, M12, and M14. These have been employed around the world in some organizations, but many earlier designs were based on the larger across flat that are in the German DIN standard. As a result many users still specify DIN bolts and nuts. It is the author's opinion that had ISO stayed with the larger hex sizes the DIN standard would have been largely eliminated today. Some material was saved, but some confusion in metric fasteners was introduced and persists today.
4. The OMFS thread gaging systems was tried for a few years. The experience of those who tried it could not accept a lot of products with the new systems that were accepted by the old and no improvement in product performance was ever proven by the use of the new system. As a result, the OMFS thread gaging systems was quickly abandoned.
5. The 12-spline flange drive design was covered in ASME standards, but it is believed that products using this design were never produced because they were difficult to manufacture and higher potential torque delivery was never proven to be a significant benefit over the use of the external hex drive.

It is time for all suppliers and users to specify and use ISO fastener standards so US manufacturers of export goods are compatible with the rest of the world.

Recent reviews of the US created metric fastener standards have found that the ASME, ASTM, and SAE metric fastener standards have no technical superiority to the current ISO fastener standards. Based on that conclusion the ASME B18 and ASTM F16 committees have started withdrawing the US metric fastener standards they have issued since the 1970's and are encouraging users to move to the equivalent ISO standards. Following are the ASME metric fastener standards that have been withdrawn so far.

Metric Product	Withdrawn ASME Standard	Replacement Standard
Style 1 Hex Nut	B18.2.4.1M	ISO 4032
Style 2 Hex Nut	B18.2.4.2M	ISO 4033
Jam Nut	B18.2.4.5M	ISO4035
Heavy Hex Structural Nut	B18.2.4.6M	ASME B18.2.6M
Heavy Hex Structural Bolt	B18.2.3.7M	ASME B18.2.6M
Hex Cap Screw	B18.2.3.1M	ISO 4014 and ISO 4017
Square Head Bolt	B18.2.3.10M	NA (no commercial usage)
Hex Lag Screw	B18.2.3.8M	NA (no commercial usage)
Round Head Short Square Bolt	B18.5.2.1M	ISO 8678
Formed Hex Heads	B18.2.3.2M	NA (no commercial usage)
12-spline Flange Screw	B18.2.7.1M	NA (no commercial usage)

Last year ASTM F568M was withdrawn to encourage the adoption of ISO 898-1. In future action F16 will undertake the withdrawal of ASTM F738M and encourage the use of ISO 3506-1.

The SAE Fastener Committee will pursue the withdrawal of SAE J1199 it further encourage the use of ISO 898-1.

Some have asked, “What if we receive an order with one of these withdrawn standards specified?” Simple, first the user can be offered the equivalent ISO standard, which is the preferred resolution, or second the orders can be filled referencing the withdrawn standard as requested. There is no prohibition against the use of withdrawn standards. As a common example, withdrawn military standards are frequently used to create repair parts of old aircraft which are still in service.

Some have raised a concern that withdrawing the US metric standards might change the US Customs classification of some products like hex head cap screws. This is highly unlikely. Customs classifies fasteners from their physical characteristics and not by the description on the paperwork. If Customs classified products based on what the shipping paperwork called incoming products, there would be no duties ever collected because importers would simply call what they ship something that has a 0% duty rate assigned to it. In the case of cap screws verses bolts, Customs uses the washer face as a determinant characteristic. Bolts have no washer face (0% duty) and cap screws have washer faces (8.5% duty).

The question of any possible impact on the import duty classification of fasteners as a result of withdrawing these metric ASME, ASTM, and SAE fastener standards was taken to Kathy Campanelli, the fastener specialist, at US Customs. She replied that fastener classifications were established many years ago based on past guidance from various IFI fastener definitions and documents and that the withdrawal of specific standards would not affect their current classification process. Ms. Campanelli stated that the US Customs guide for fastener classification is “What Every Member of the Trade Community Should Know About: Fasteners of Heading 7318”, http://www.cbp.gov/linkhandler/cgov/trade/legal/informed_compliance_pubs/fasteners_head_7318.ctt/fasteners_head_7318.pdf.

Just because of historical purchases, many users of metric fasteners still call for DIN fasteners. DIN formally withdrew most of its fastener standards in April of 2001 when issuing DIN 918. This standard announces the withdrawal and indicates the ISO standards that should be used to replace the withdrawn DIN standards. Those wishing to receive a complete spreadsheet of the withdrawn DIN standards and the ISO replacements send an email request to techinfo@indfast.org.

The ISO metric fastener standards started development about 40 years ago. They are now used around the world to assemble internationally traded goods. It is time to move all metric fastener designs and requirements to the adoption of ISO fastener standard and abandon most, if not all, of the ASME, ASTM, SAE, and DIN metric fastener standards. It is good engineering practice and it makes good economic sense to maintain a single system for mechanical fasteners.