

# Six INTO One

The consolidation of multiple ASTM structural bolt standards will help simplify bolt specification.

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## WE ALL KNOW CONSTRUCTION CAN BE COMPLICATED.

Schedule complexity, environmental compliance, design challenges and new technologies are just a few of the hurdles that exist beyond the physical acts of designing and building structures. There is also an enormous burden on producers, designers and users of construction materials to understand and comply with numerous standards. The standards, codes and specifications required to bring a simple project off the ground can number in the hundreds. As an industry we need to identify when standards or processes have become unnecessarily complex and seek out ways to improve them.

The ASTM F16 fastener committee has identified an opportunity to improve and simplify standards for structural bolts and has also begun the process of reviewing other F16 standards for ways to improve, simplify, combine or eliminate them if not in use.

The vast majority of fasteners in steel buildings, bridges and structures are produced to one of six ASTM fastener standards. Many provisions in these standards vary by grade and type, but many other provisions are similar or identical across all six standards.

In order to correct numerous problems with the existing standards, to simplify standards maintenance and to better meet the needs of the steel construction industry, the ASTM F16 Fastener Committee approved ASTM F3125, which replaces the six existing standards. The new standard is the culmination of significant work by the volunteer task group and the F16.02 subcommittee and was made possible with the support of ASTM F16 executive leadership and association representatives from AISC, the Research Council on Structural Connections (RCSC) and the Federal Highway Administration (FHWA).

With ASTM A325, A325M, A490, A490M, F1852 and F2280 now combined under one parent document, the differences between grades and types are more distinct, the similar provisions are better coordinated and many technical improvements have been implemented.

## Similar, Simpler Specification

ASTM F3125 provides new advantages for standards writers as well as for designers and users, and specifying these bolts is nearly the same as before: Simply indicate the grade (A325, A325M, A490, etc.) and type (1 or 3/weathering). Some particular advantages to note are as follows:

- An increase in minimum tensile strength, proof load and hardness of greater than 1-in.-diameter A325 and F1852 bolts, from 105 ksi



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to 120 ksi. This change corrects the following inconsistencies (note that this will also increase the pretension and slip resistance for large A325 and F1852 bolts):

- The RCSC *Specification* purposely neglects the decrease from 120 ksi to 105 ksi ultimate tensile strength for greater than 1-in.-diameter A325 and F1852 bolts when giving the permissible shear strength in Table 5.1, but recognizes the difference when it gives the minimum bolt pretension in Table 8.1.
  - The AISC *Specification* incorporates the difference in ultimate tensile strength when calculating the minimum bolt pretension for larger diameter bolts in Tables J3.1 and J3.1M, but purposely neglects it when presenting the permissible shear strength in Table J3.2.
  - A325, A325M and F1852 tensile requirements are now aligned with A325M (A325M has the same tensile requirement regardless of diameter).
  - The AASHTO *Specification* defines design strengths in terms of the bolt tensile strength, so bolt shear strength as well as slip critical strength will be higher for A325 and F1852 greater than 1 in. in diameter.
  - The addition of a more detailed and useful ASTM rotational capacity test:
    - The rotational capacity (RC) test is a common requirement for bridge construction or when galvanized fasteners are used, but is not used much in vertical construction or other construction when using plain fasteners. The test is meant ensure an assembly of a bolt, nut and washer will work harmoniously when being fully tensioned by the chosen tightening method. The test screens for excessively over-tapped nuts, bolt material with insufficient ductility and to assess for proper lubrication.
    - There is confusion in the industry because suppliers and users have different RC tests to reference: an ASTM inch series test, an ASTM metric series test an AASHTO test and a frequently called out, but no longer officially maintained, FHWA test. This new ASTM RC test is an attempt to find common ground and allow the industry to consolidate on a single test method. Additionally, because of the tensile strength increase of grade A325, all the various RC test methods will have to be revised. This test method will be presented to other industry organizations with the request to have it considered for use by them.
  - Creation of a coatings Annex and nut over-tap guidance for recently added fastener coatings:
    - The coatings Annex covers recently added coatings for 150 ksi fasteners and gives guidance on coating grade recommendations and nut over-tap guidelines.
    - The new table based format will allow for future changes to be made in a much simpler way and will do a better job of presenting coating options to users.
- Other improvements of ASTM F3125 include:
- Reduction in the total page count from 45 pages down to 13 pages
  - Reduction of the number of tables from 54 tables down to 7 tables
  - Elimination of 32 cross references
  - More specific requirements for lot traceability
  - Sectional reordering and renaming for improved continuity from scope to packaging
  - Layout changes using tables to more simply define requirements

- Corrected dimensional references to recently approved ASME dimensional standards
- Correction of inconsistent heat treatment requirements and language
- Addition of elongation and reduction of area requirements for twist off-type bolts
- Creation of a supplementary requirement for non-standard threads or dimensions
- Addition of alloy steel with boron in A325, A325M and F1852
- Modification and simplification of chemistry requirements and tables
- Addition of a “Type 3” chemistry based on the ASTM G101 corrosion index

Grades within ASTM F3125 will continue to be called what we are all familiar with. For example, an old ASTM A325 bolt will be designated as “Grade A325” and will simply reside within the combined standard. Head markings will also remain the same. For example, an ASTM F3125 Gr A325 Type 3 bolt will be marked A325, just like it was when it was supplied under ASTM A325.

In the future, the F16 committee will ballot removal of the six previous standards, removing the requirements of each but leaving a note that the standard has been superseded, sending users instead to ASTM F3125.

### On the Ballot

This new standard is currently in the balloting process for recognition in the 2016 AISC *Specification for Structural Steel Buildings*, and RCSC is in the process of considering revisions needed to adopt this standard. The ASTM F3125 standard is also being presented to AASHTO for possible consideration of the Subcommittee on Bridges and Structures in June 2016.

What does this mean for existing inventory, projects underway and future projects? In short, not much will change. There will be a difference in how the fasteners are called out, and in some cases minor differences in technical requirements, but no changes that will result in the need for connection redesign or immediate code changes. Users must simply understand that the old designations they are familiar with now reside under a parent standard as a grade. They should be cognizant that older inventories of greater than 1-in.-diameter ASTM A325 and F1852 bolts may be recertified to meet the new requirements of ASTM F3125 (specifically, the greater-than-1-in.-diameter ASTM A325 and F1852 bolts). Those designing according to AISC should consciously specify ASTM F3125 for A325 and F1852 sizes greater than 1 in. to ensure the ordered bolt meets the assumption of design.

Other sizes and grades should be considered interchangeable with the previous requirements of the older individual standards, and users should understand that there are millions of bolts in inventory to the previous standards that will be shipped alongside bolts produced to the new standard for years to come.

As with any new standard, there will be some early editorial and content changes that will need to address items that came up in the balloting and publication process, along with items of new business that were identified along the way. As a result, the document will continue to evolve and improve in the years to come to better meet the needs of the industry.

The new standard is available for purchase at [www.astm.org/Standards/F3125.htm](http://www.astm.org/Standards/F3125.htm). ■