

ASTM F1941/F1941M- An Important Revision to the Standard for Fastener Electroplating

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New Revision to an Important Standard

The fastener industry should be made aware of an important recent development in the realm of ASTM fastener standard specifications. ASTM F1941/F1941M-15, Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric was published in October 2015 and is available for purchase through ASTM. The revised standard is the product of a major revision under ASTM Committee F16 on Fasteners. This standard is designed specifically for electroplating fasteners. The new inch-metric standard is what is known as a “dual” standard and it supersedes two previous standards, F1941-10 and F1941M-07.

Background

ASTM F1941 was first published in 1999. It was developed as a fastener specific alternative to ASTM B633, a general, zinc electroplating standard. Until then, B633 was the default in the fastener industry. However, B633 is not well suited to the requirements, specifications and practices of the fastener industry. This fact was the main impetus for the development of ASTM F1941, which I had the honour of leading. In the drafting of ASTM F1941, two topics in particular were addressed: (i) coating accommodations and tolerances for threaded fasteners, and (ii) internal hydrogen embrittlement avoidance and baking requirements specific to fastener products.

Baking Requirement

ASTM F1941 reflects the standard practice of only mandating baking at specified hardness above 39 HRC. If requested, baking may be performed below 39 HRC; however it is not mandatory for the reason it is not beneficial. Parts with a specified hardness below 39 HRC are not susceptible to internal hydrogen embrittlement (IHE). This position is based on both scientific research and product test data; it is also reflected in industry practice. Research has shown the typical 4 hour bake at 200 °C is not sufficient to extract hydrogen from a zinc plated part. On the other hand, B633 requires that all parts with a tensile strength above 1000 MPa (~31 HRC) must be baked. This would include Grade 8 / PC10.9 and Grade 5 / PC 8.8. Although a proportion of Grade 8 / PC10.9 fasteners are baked, specifically in the automobile industry, Grade 5 / PC 8.8 are never baked. Given the long history of B633, it appears on many prints and is often invoked by default. The fastener industry must beware that unintentional use of B633 can lead to parts being found non-compliant with the standard, even though they may be perfectly fine in every respect. To mitigate the consequences of unintended use of B633, the scope of ASTM F1941/F1941M-15 now states: “This standard shall be used in place of ASTM B633 for mechanical fasteners.” At the same time the latest revision of B633-13 points the reader to F1941/F1941M for electroplating fasteners.

Baking requirements are now defined for parts with a specified hardness above 39 HRC. For example, the minimum baking requirement for parts with hardness over 39 and up to 44 HRC is 14 hours. Bake times may be altered for specific parts on the basis of product and process test methods. Finally, Appendix X4.2 has been updated to summarize the latest state of the art with respect to hydrogen embrittlement avoidance.

What Else is New in ASTM F1941/F1941M-15?

In this latest revision, ASTM F1941/F1941M-15 has been updated with an eye on current technology, specifically in relation to the use of trivalent, or non-hexavalent chromates, topcoats and their salt spray performance. Also, the latest revision covers non-threaded fasteners such as washers and pins. The reader should be aware that a similar revision is underway with the ISO equivalent, ISO 4042, Fasteners – electroplated coatings under the jurisdiction of ISO Technical Committee 2 on Fasteners. Collaboration between committee members of ASTM F16 and ISO TC2 will ensure that the standards remain consistent on key elements of content. ■

For more information on fastener hydrogen embrittlement see:

Fundamentals of Hydrogen Embrittlement in Steel Fasteners, S. Brahim, 2014. Available from the Industrial Fasteners Institute (IFI), www.indfast.org/info/free-technicalinfo.asp

ISO Technical Report ISO/TR 20491:2015, Fundamentals of Hydrogen Embrittlement in Steel Fasteners. (NOTE: currently undergoing final draft revision as ISO/DTR 20491:2015).