On Galvanized Bolts and Nuts

BY CHRIS CURVEN

Three important aspects of using galvanized fasteners and how to avoid problems in the field.

WORKING WITH GALVANIZED FASTENERS brings its own set of concerns to the jobsite. *MSC* recently asked bolting industry specialist Chris Curven to share some of the insights he has gained over the years in working with designers, installers and inspectors to ensure successful bolted connections.

MSC: What's the most common problem you encounter when dealing with galvanized fasteners?

CURVEN: Probably the single thing that is most misunderstood is that the galvanized threaded portions of the fastener must be of the same coating process. There are two galvanizing processes—hot-dip and mechanical. Hot-dip is a thicker, messier coating because it's dipped then spun. And because it's a thicker coating, manufacturers tap the nut oversized after it has been galvanized, which makes room for the threaded portion of the bolt to fit into the nut.

Mechanically galvanized bolts and nuts have the coating pounded on with glass media, or beads. That results in a much thinner, prettier coating that is also more uniform. Because of that mechanically galvanized nuts are over-tapped before they are coated.

Chris Curven is a field bolting specialist with AISC-member firm Applied Bolting Technology, Inc., Bellows Falls, Vt. He can be contacted at ***chrisc@appliedbolting.com****.*

MSC: What is over-tapping and what is the difference between doing that before or after the galvanizing?

CURVEN: Over-tapping is when the fastener manufacturer makes the nut threads slightly larger to accommodate the slight dimensional increase in the bolt threads that results from the galvanizing. The hot-dip galvanizing is a little thicker and less uniform than the mechanical galvanizing, but it makes a difference when the nuts are over-tapped. So a hot-dipped galvanized bolt is too big for a mechanically galvanized nut, unless someone forces it jamming on the nut. Conversely, there isn't enough thread engagement when a mechanically galvanized bolt is used with a hot-dip galvanized nut, possibly causing the threads to strip as the nut is turned.

MSC: How important is that?

CURVEN: It's very important for two reasons. First, ASTM A325 states that the galvanizing must be the same on threaded portions of the fastener assembly. The rationale for that is explained in the Research Council on Structural Connections' *Specification for Structural Joints Using High-Strength Bolts*. The RCSC *Specification*, under Section 2.3.3. Commentary states, "Galvanized high-strength bolts and nuts must be considered as a manufactured fastener assembly… The purchase of galvanized high-strength bolts and galvanized nuts from separate suppliers is not in accordance with the intent of the ASTM Specifications because the control of over-tapping, the testing and application of lubricant and the supplier responsibility for the performance of the assembly would clearly not have been provided as required… In accordance with ASTM A325, all threaded components of the fastener assembly must be galvanized by the same process and the supplier's option is limited to one process per item with no mixed processes in a lot. Mixing high-strength bolts that are galvanized by one process with nuts that are galvanized by the other may result in an unworkable assembly."

A mixture of different colored galvanized nuts might be a sign that both types of galvanizing are present.

A connection using galvanized fasteners should show consistency in the color of nuts.

The second reason has to do with the "unworkable assembly" that the RCSC *Specification* mentions. Mixing hot-dipped and mechanically galvanized nuts and bolts can drastically increase the torque required to tighten a fastener. And because some installation guidelines reference torque as an indicator of bolt tension, you can end up with a nut that's "torqued," but the bolt has not actually been tensioned.

MSC: So how can the various parties involved in a project ensure that matched or compatible materials are installed on the jobsite?

CURVEN: To begin with, the engineer and the purchasing people need to be on the same page and mandate one type of coating and a visible dye lubricant on all the nuts. That makes it easy to confirm that the lubricant is there, but more importantly the ironworkers and inspectors can tell by eye when they're all the same or not.

And then the people in the field—the installers, preferably, because by the time it's inspected it's too late—need to understand that there is a reason for the color on the nuts, and if they see different colored nuts, they should pay attention to it. If you're the ironworker and you go to install blue nuts after working with green nuts all week, you should say, "Hey—what's going on here?" That could save possibly stuffing 5,000 hot-dipped nuts on mechanically galvanized bolts. And it's not the cost of the bolts that we're concerned with—maybe they are a couple of bucks each—but the labor involved in replacing 5,000 of those $2 bolts would be huge.

MSC: How can you tell what process was used to galvanize a bolt or nut?

CURVEN: You can check the label information on the shipping containers, but it is possible for fasteners to get mixed up. before they are shipped to the site. Therefore it's also important to be familiar with their appearance.

Hot-dip galvanizing has a bit of a shimmer to it, and looks a bit like the underside of aluminum foil. Mechanically galvanized fasteners often are a dull, flat gray color with a very smooth finish.

Another good indicator is the color of the visible dye lubricant on the nuts. Unfortunately there is no universal color-code system, but some manufacturers have adopted their own. For example, Nucor's mechanically galvanized nuts are blue and their hot-dip galvanized nuts are green.

It would be a lot easier for everyone if there were an industry standard, but as it is we always tell inspectors and ironworkers to look for uniformity in a connection. All the nuts should be the same—and the correct—color.

MSC: Are there other common problems?

CURVEN: One other common misconception is that galvanized fasteners do not rust. Galvanized fasteners, even wax-coated nuts, do rust. However, instead of being the typical red rust, galvanized fasteners oxidize, which leaves a white powder on them. That white rust causes the same friction and torque problems that red rust does.

Hole size also can be a problem. We've occasionally come across fabricators who use oversized holes to accommodate the thicker galvanized steel and fasteners when standard holes have been specified. In doing so they are making the pretensioned connection into a slip-critical connection. The same hole size should be used for galvanized fasteners as for uncoated fasteners unless a change is specifically approved by the engineer of record. MSC

Photos by Applied Bolting Technologies, Inc.

Mechanically galvanized fasteners (left) have a dull flat gray finish compared to the shiny appearance of hot-dip galvanized fasteners. For more photos, visit www.modernsteel.com/photos.