About the Author/BARNABY MYHRUM

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Lessons From the Field: If Your Squirter™ DTI Doesn't Squirt, You Have a Problem!

One of my favorite testimonials about Squirters™ came from a crusty old ironworker — let's say his name was Gus. Gus had seen it all and done it all with the old stuff — Turn of Nut, Calibrated Wrench — for over 30 years. After being introduced to Squirters in our field training and calibration exercise, he said, "Heck, that's like cheating!" He was hooked on Squirters, and practically all first time users are.

He learned that "Drive it 'till it Squirts" makes bolt installation and inspection easier and more accurate. That's why over 50 million Squirters have been sold around the world. But in addition to ease and accuracy, experienced users will tell you that Squirters also provide a higher level of quality assurance than other installation techniques. Squirters will tell you if something is wrong with your installation. **If the Squirter didn't squirt, you have a problem.**

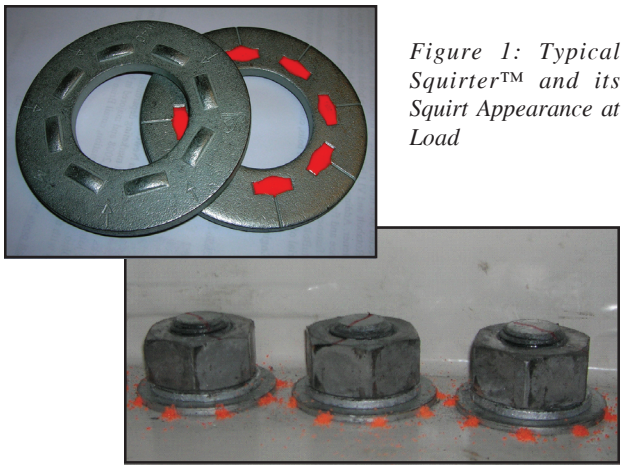


Figure 1: Typical Squirter™ and its Squirt Appearance at Load

Occasionally we get calls from the field stating that the Squirter didn't squirt, or that the squirt was weak or uneven. We know there's a problem, and we love solving problems. We use structured problem solving to determine the root cause of the problem, and 99.9 percent of the time we find that the root cause of the problem is unrelated to the Squirter. The root cause is usually related to one of the four M's: Material, Machine, Method, or Man.

The Four M's

The four M's relate to an approach to problem solving developed by Japanese scientist Karuo Ishikawa. He advocated a structured approach to cause and effect analysis. The Ishikawa diagram, also known as the Fishbone diagram, is a great structured problem solving tool. The diagram, shown in figure 2, resembles a fish. The head of the fish is the problem statement, and the bones are the four main root cause categories: Man, Machine, Material, and Method. While other categories can be added in unique situations, experienced users of this technique will testify that most root causes will fall into one of the "4 M's." A popular fifth "M" is Mother Nature, to be considered when natural elements cause problems. This particular diagram identifies potential root causes of the "no squirt/uneven squirt" problem.

The possible root causes are identified by asking "why?" five (or enough) times to identify the true root cause(s) of a problem. For a no squirt situation, the "five why" scenario might look like this:

Problem: The Squirter™ didn't squirt.

- Why? The silicone wasn't compressed.
- Why? The bumps weren't compressed.
- Why? They embedded into the flat washer.
- Why? The flat washer was too soft.
- Why? The supplier sent the wrong washers.

Root Cause: soft washers. Countermeasure: Use proper washers (F436).

It's a Good Thing You Had Squirters

This problem would not have been revealed by any other torquing/tensioning technique. Suppose, for instance, that standard non-squirting DTIs were being used. With standard DTIs, feeler gages are used to determine the tension in the fastener assembly. In this case, the bumps are embedded in the flat washer instead of being compressed. Therefore, the standard feeler gage test used with non-squirting DTIs would have been inaccurate. This would mislead the installers and

inspectors into thinking that the assemblies were tensioned properly.

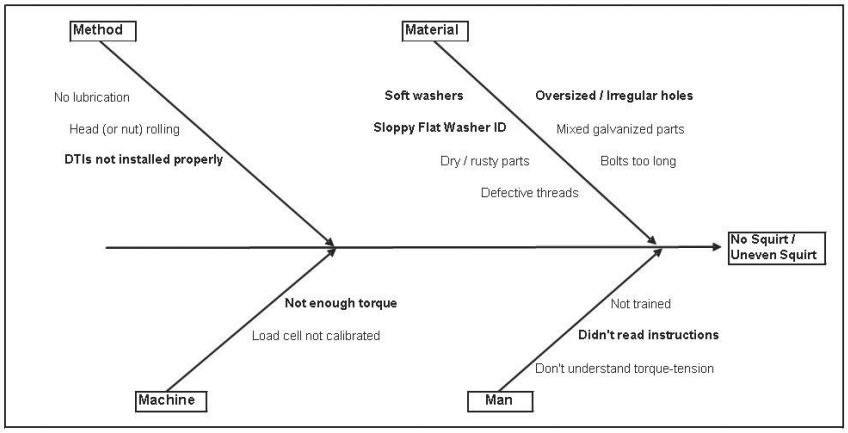
There is no chance that the other tightening techniques — Turn of Nut or Calibrated Wrench — would have identified this problem. If Squirters weren't on the job, the soft washers would likely have remained in the structure, and the assemblies would be in violation of RCSC standards. That's why we say with confidence that Squirters provide an additional level of quality assurance.

Squirters Can Identify Other Problems

Soft flat washers aren't the only thing that can go wrong in structural connections. The fishbone diagram in figure 2 lists the usual root causes we identify when a good squirt doesn't appear. The most frequent root causes are listed in bold text.

Defective Threads

Figure 2: Cause and Effect Diagram for "No Squirt/Uneven Squirt"



Sometimes we see fastener assemblies that have defective threads, or excessive coating buildup. This can lead to asymmetrical tensioning of the bolt or excessive thread friction. If you see an uneven squirt, it may be caused by a poorly manufactured nut or bolt which would cause uneven bump compression, and therefore uneven squirt. Excessive friction can cause torsion failure of the assembly prior to achieving proper tension. Unlike other techniques, the Squirter will tell you if this situation exists.

Not Enough Torque

Occasionally we run into this issue with larger bolt diameters. I wrote about a specific case in my last Link article. An erector was blaming the Squirter for increasing the torque required to tension the bolts. The problem was he didn't have enough torque in the first place. It was taking longer than 10 seconds to tension the bolt using an aged impact wrench. If you hammer on a bolt longer then 10 seconds, you can damage the threads, resulting in the situation described above. The Squirter told him that he wasn't achieving the proper tension with that gun, and we proved it by using our more powerful electric gun.

Oversized/Irregular Holes

RCSC specifications state that if you have oversized or slotted holes, you must cover the hole with a hardened washer of the appropriate thickness. We have seen situations where the fabricator intentionally made the hole oversized under the assumption that galvanizing would bring the hole size back into tolerance. This is an erroneous assumption. When a Squirter is installed in this case, some of the bumps can collapse into the hole rather than being properly compressed. Consequently, required tension is not achieved in the assembly. The Squirter can alert you to this problem because the squirt media will escape inboard instead of outboard. So if you see an uneven squirt, it may be caused by an oversized hole.

Sloppy Flat Washer ID

In this case, individual bumps may not be entirely engaged by the flat washer. Consequently you may see an uneven squirt pattern. This situation is apt to occur with larger diameter bolts where F436 ID tolerances increase. So while the assembly is in specification, one squirt may be a little weaker than the others. That's why we say that if you have "n" bumps, make sure you get at least "n-1" squirts. Our preference with larger bolts is to use hardened SAE washers which have tighter IDs.

While this is not an exhaustive list of possible root causes, it covers the likely culprits. Sometimes there are situations where the Squirters were installed upside-down or without a flat washer between the turned element and the Squirter. That situation is more easily resolved by politely reminding the users to read the instructions.

It's a Good Thing We Were Using Squirters…Coincidentally, as I was writing this article, one of my favorite customers contacted me. They were breaking bolts, in some cases before the squirt had developed. This guy knows his stuff when it comes to bolting and, though relatively new to Squirters, he's a huge fan. The problem was that some of his fastener assemblies were failing during installation by thread deformation. We discussed the symptoms: sometimes there was no squirt or only a partial squirt. When the failed assemblies were removed, he found that only half the Squirter bumps had been properly compressed. Digging deeper he discovered that, sure enough, the nut threads were asymmetrical and they had coating issues. The Squirter helped identify the problem, providing additional quality assurance.