

all required inspections of the fasteners indicate they are acceptable, but the fact remains that they are not working.

This problem is called "thread galling". According to the Industrial Fastener Institute's 6th Edition Standards Book (page B-28),

"Thread galling seems to be the most prevalent with fasteners made of stainless steel, aluminium, titanium and other alloys which self-generate an oxide surface film for corrosion protection. During fastener tightening, as pressure builds between the contacting and sliding, thread surfaces, protective oxides are broken, possibly wiped off, and interface metal high points shear or lock together. This cumulative clogging-shearing-locking action causes increasing adhesion. In the extreme, galling leads to seizing – the actual freezing together of threads. If tightening is continued, the fastener can be twisted off or its threads ripped out."

Carpenter Technologies, the fastener industry's largest supplier of stainless steel raw material, refers to this type of galling in their technical guide as "cold welding". Anyone who has seen a bolt and nut with this problem understands the graphic nature of this description.

The IFI and Carpenter Technologies give three suggestions for dealing with the problem of thread galling in the use of stainless steel fasteners:

- Slowing down the installation RPM speed will frequently reduce, or sometimes solve completely, the problem. As the

installation RPM increases the heat generated during tightening increases. As the heat increases, so does the tendency for the occurrence of thread galling.

- Lubricating the internal and/or external threads frequently eliminates thread galling. The suggested lubricants should contain substantial amounts of molybdenum disulfide (MoS₂), graphite, mica, or talc. Some proprietary, extreme pressure, waxes may also be effective. You must be aware of the end use for the fasteners before settling on a lubricant. Stainless steel is frequently used in food related applications which may make some lubricants unacceptable. Lubricants can be applied at the point of assembly or pre-applied as a batch process similar to plating. Several chemical companies offer anti-galling lubricants.

One such source, EM Corporation, suggests their Permaslik® RAC product for use at the point of assembly. They suggest Everlube® 620C for batch, pre-applying to stainless steel fasteners.

- Using different stainless alloy grades for the bolts and nut reduces galling. The key here is the mating of materials having different hardnesses. If one of the components is 316 and the other is 304 they are less likely to gall than if they are both of the same alloy grade. This is because the different alloys work harden at different rates.

Another factor affecting thread

galling in stainless steel fastener applications is thread roughness. The rougher the thread flanks, the greater the likelihood galling will occur. In an application where the bolt is galling with the internal thread, the bolt is usually presumed to be at fault, because it is the breaking component. Generally, it is the internal thread that is causing the problem instead of the bolt. This is because most bolt threads are smoother than most nut threads. Bolt threads are generally rolled, therefore, their thread flanks are relatively smooth. Internal threads are always cut, producing rougher thread flanks than those of the bolts they are mating with. The reason galling problems are inconsistent is probably due largely to the inconsistencies in the tapping operation. Rougher than normal internal threads may be the result of the use of dull taps or the tapping may have been done at inappropriately high RPM.

Fortunately, stainless steel bolt and nut galling problems do not occur everyday, but when they do it usually creates a customer crisis. Knowledge of why this occurs and how to remedy it can save the supplier much grief and many headaches.

Here are some questions that should be asked and the suggestions that should be made immediately when you are confronted with a customer's complaint about thread galling:

1. Are you using the same driver RPM you have used in the past to install these stainless fasteners?

If they say they are driving them faster than in the past or if they say this is a new application, suggested they immediately try slowing the driver RPM and see if the problem goes away. In general, a stainless bolt of a given size should be driven slower than a steel bolt of the same size.

2. Are the bolts and/or internal threads lubricated?

If they say "no", suggest they try lubricating the bolts and/or internal threads with one of the lubricants listed earlier in the article. If this eliminates the galling, you might want to batch lubricate the remainder of the order to eliminate the extra work of applying lubricant at the point of assembly.

In applications where galling is a repetitive problem, it is advisable to supply the fasteners with pre-applied lubrication to eliminate future problems.

3. Are you using the same grade of stainless steel for the bolts and nuts?

If the answer is "yes", you can suggest changing one or the other to a different grade.

Be sure the suggested grade meets their corrosion needs and changing the material does not cause a procurement problem.

When thread galling occurs in stainless steel bolt and nut applications, do not panic. Try the suggestions listed; one or a combination of these will probably resolve the problem immediately.