Galling

Thread Galling

Thread galling is a common, yet seldom understood problem with threaded fasteners. Galling, often referred to as a cold-welding process, can occur when the surfaces of male and female threads are placed under heavy pressure. The frustrating aspect of fastener galling is that galled nuts and bolts may pass all required inspections (threads, material, mechanical, etc.), yet they still fail to function together.

Stainless steel fasteners are particularly susceptible to thread galling, although it also occurs in other alloys that self-generate an oxide surface film, such as aluminum and titanium. During the tightening of the fastener, pressure builds between the contacting thread surfaces and breaks down the protective oxide coatings. With the absence of the oxide coating, the metal high points of the threads are exposed to one another, which increases friction. The combination of these two events can generate enough heat to fuse and seize the nut and bolt together.

Minor galling may cause only slight damage to the thread surface and the installer may still be able to remove the fastener. However, in severe cases galling can completely weld the nut and bolt together and prevent removal of the fastener. If the tightening process is continued once galling begins, the fastener may be twisted off or have its threads stripped.

Unfortunately, even with an understanding of the mechanism of galling, little is known on how to successfully control it. However, galling can be minimized with the following measures:

- Thread lubrication is one of the most effective measures to decrease the potential for galling. The lubricant reduces friction, which is a key element in thread galling. Certain environments preclude the use of some lubricants (such as stainless steel fasteners used in food processing equipment). Also, the operator must be aware that the torque-tension relationship will be altered with the use of lubrication.

  There are some outstanding **PTFE** based coatings that can be applied to stainless steel fasteners. They are able to drastically reduce the frictional coefficient. Fastenal has performed extensive research and testing and found a number of coatings that significantly reduce the galling potential. For further information on these coatings, please contact the Fastenal Engineering and Design Support group.

- Use coarse threads with a 2A-2B fit instead of fine threads. Coarse threads have a larger thread allowance and are more tolerant to abuse during handling.

- Heat contributes significantly to thread galling. Fastener installation alone generates friction and therefore heat. An increase in speed during installation increases the friction (heat) between the threads. Lowering the wrench speed during installation and removal can help avoid galling.

Stainless steel prevailing torque locknuts are particularly susceptible to galling due to the friction caused during installation.

- Avoid prevailing torque locknuts. Prevailing torque locknuts function by adding resistance to the threads, which in turn creates friction and heat. If a prevailing torque locknut must be used, ensure a minimal amount of threads are protruding beyond the nut. The most common stainless steel galling issue occurs with nylon insert lock nuts. The added friction that the nylon insert produces between the mating threads increases the potential for galling significantly. As a precaution, Fastenal typically adds a wax coating to stainless steel nylon insert locknuts nuts to reduce the friction. Although wax is a good lubricant it is affected by heat and can dissipate over time.

- Mating parts of the same alloy have a greater tendency to gall than those of dissimilar alloys. However, not all combinations of stainless steel act the same. For instance, a 400 series stainless steel nut can work well on a 316 series bolt, but this will cause a reduction in the overall corrosion resistance of the assembly.

- A smoother surface texture will lead to less frictional resistance. Rolled threads usually offer smoother surfaces than cut threads. As previously mentioned, friction increases the possibility of galling.

- Proper installation torque. If the fastener is over tightened, the threads can begin to yield which will induce friction between the mating surfaces.