

Thread Galling

By Mike McGuire

“Thread galling” or “cold welding” as the term is often called occurs during the installation of bolts & nuts where the bolts are twisting off and/or the bolt’s threads are seizing to the nut’s threads. Thread galling seems to be most prevalent with fasteners made of stainless steel, aluminum, titanium and other alloys which self-generate an oxide surface film for corrosion protection. During the tightening of the fastener, pressure builds between the sliding contacting thread surfaces and breaks down the protective oxide coatings. Possibly the coatings are wiped off and interface metal high points shear, friction increases and the fasteners lock together. This cumulative clogging-shearing-locking action causes increasing adhesion. Galling leads to fusing and seizing – the actual freezing together of threads because of the heat generated. If tightening is continued, the fastener can be twisted off or its threads stripped out.

Four suggestions to minimize thread galling in stainless steel fasteners:

1. Use coarse threads with 2A-2B fit instead of fine threads. UNC coarse threads have a greater thread allowance than UNF fine threads and are more tolerant to abuse during handling.
2. Slowing down the installation RPM speed will frequently reduce or sometimes completely solve the problem. As heat from friction increases during installation with too rapid RPM, so does the tendency for occurrence of threads galling. In general, a stainless steel bolt of a given size should be driven slower than a steel bolt of the same size. Slow down the wrench speed!
3. Lubricating the internal and/or external threads frequently eliminates thread galling. Suggested lubricants should contain substantial amounts of molybdenum disulfide (moly), graphite, mica or talc. Some proprietary extreme pressure waxes may also be effective. However you must be aware of the end use of the fasteners before settling on a lubricant. Stainless steel in certain environments precludes the use of some lubricants; for example the food processing equipment industry. In application, if the problem is repetitive, try to supply fasteners with a pre-applied lubrication to eliminate future galling problems. Also note; that the use of lubricants will change the torque-tension relationship.

4. Using different stainless alloy grades for the bolt and nut reduces thread galling. The key here is the mating of materials having different hardness's' numbers. Different stainless steel alloys work-harden at different rates. Try using type 316 stainless and 304 stainless for your components and increase the likelihood of eliminating thread galling in the application.

Thread roughness is another factor affecting thread galling in stainless steel fastener applications. Rolled threads offer a smoother surface than cut threads. The rougher the threads flanks, the greater the likelihood of thread galling. Although it may seem the bolt is the problem because it is breaking and the cause of the problem; in reality it is the internal threaded fastener, the nut. This is because the bolt has smooth rolled threads from the rolled threading process. Internal threads are always cut threads, producing rougher thread flanks than the bolts they mate with. The reason thread 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 operation may have been done at an inappropriately high RPM.

Knowledge of knowing why thread galling occurs and how to remedy it can save you a customer. Don't panic, try the suggestions from above. One, or a combination of these, will most likely solve the problem.