

Dr. Fastener: Interesting Facts About Locknuts

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1 What are basic Locknuts?

This article will focus on all metal and nylon insert style locknuts specified in ISO 2320 “Prevailing torque type steel hexagon nuts mechanical and performance properties”. These are nuts that are not free running on a mating externally threaded component (i.e., bolt) and have a self-contained prevailing torque feature, which provides a degree of resistance to rotation independent of clamping or compression forces. See Fig.1, Fig.2 and Fig.3.



Fig.1.
Stover all metal
locknut (side squeeze)



Fig.2.
All metal locknut
(top crimp)

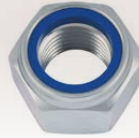


Fig.3.
Nylon insert locknut

2 What is prevailing torque?

This is the torque necessary to rotate the nut on its mating externally threaded component (i.e., bolt) without generating any clamp load. The all metal and nylon insert nuts discussed in this article have a feature that increases the nut’s resistance to loosening. These types of nuts are commonly called “prevailing torque” locknuts because they require the use of a wrench to assemble or disassemble. They are not “free-spinning” like a standard hex nut.

3 Can locknuts “lock” a joint together?

No. Locknuts do not lock. This is a misleading industry name that can confuse the user into thinking that the joint will not loosen after a locknut is installed. The names “all metal” and “nylon insert” locknuts created the impression that they actually lock, they do not. Depending on the amount of vibration in the application the parts may become loose. However, they will not come apart because of the friction that results between the locknut and the bolt threads.

4 How often can locknuts be reused?

Most industry standards have prevailing torque performance test from first installation and 5th removal. This provides a criterion for inspection and locknut manufacturing. Often within the user industry, the maximum recommended use of a locknut is 3 times. After three installations the prevailing torque performance is reduced and may not meet design intent. Often locknuts are replaced with new locknuts if the assembled joint is reprocessed and during service to avoid concerns about how often the nut has been reassembled.

5 Does the color of the nylon insert have a specific meaning?

Is there any significance to the color of the nylon inserts? If they conform to industry standards like ISO 2320, the color does not mean anything. Different manufacturers just use assorted colors of plastic. However, some users may use a distinct color nylon insert for internal quality and manufacturing controls such as differentiating between a fine and course threads.

6 What are the property class designations for locknuts?

Most locknuts conform to industry property class standards 5 up to and including 12. The most common are property class 8, 9, and 10. In general, nylon locknuts of a higher property class can replace nuts of a lower property class. However, it is not recommended for all metal nuts to be combined with a bolt of a lower property class. The aggressive top crimp may damage the mating lower hardness external thread during assembly. This can lead to galling and final assembly torque variation.





Fig.4.
Nylon insert
separation

7 What are some limiting conditions of nylon locknuts?

Many of the inserts are made of nylon 66 which is a hydroscopic material that can absorb moisture. When exposed to elevated temperatures and low humidity, the nylon will lose moisture, shrink slightly, and become brittle. These conditions are not relevant once the insert is installed, but if the nylon has become too dry prior to assembly, then we can see problems like in Fig.4.

8 Are there limits to external thread engagement rundown during assembly?

For all metal and nylon insert locknuts the preferred maximum thread engagement is between 4 – 7 thread pitches (M10 x 1.5 equals 6mm to 16.5mm). This is established as an industry test criterion noted within ISO 2320. However, nylon locknuts can be used on any application with a long run down (greater than 1.5 times the bolt diameter). For a M10 bolt this long rundown would be greater than 15mm.

9 Is there a minimum amount of thread engagement for the prevailing torque feature to work?

There should be full external thread engagement in the prevailing torque feature (metal crimp or nylon) contact area to fully optimize performance as per industry standards. To achieve this, the rule of thumb is to have a minimum of two threads protruding above the top of the nut. This is because the thread profile has a slight taper resulting from cold forming and thread rolling.

10 Are there any assembly torque adjustments because of the locking feature?

The rule of thumb is to add the amount of first on prevailing torque to the final assembly torque. This is because the prevailing torque does not contribute to generating clamp load in the joint. The prevailing torque feature (all metal or nylon insert) friction needs to be overcome. Please limit tool speed to 250 RPM on nylon locknuts to allow the plastic to flow around the mating external threads without pushing the nylon ring out from the top of the nut. See Fig.5.

11 Can a nylon insert nut provide a thread seal?

Yes, the locknut does provide a seal against gas and moisture.

12 What are the types of corrosion protection required?

All metal locknuts should be coated with lubrication to prevent galling and consistent torque tension performance. Many nylon locknuts have the nylon ring assembled after the corrosion coating. This removes the protective coating protection from the top of the nut. However, there are nylon locknuts that utilize a nylon ring which is compatible with the paint curing process of some dip-spin coatings. So, the assembly of the nylon ring is before the coating, producing a part with exceptional corrosion resistance.

13 Are there any temperature limitations?

For all metal locknuts (industry property class grades) the operating temperature range is from -50°C to + 300°C. For nylon insert type locknuts, the operating temperature range is from -50°C to + 120°C. However, there are non-metallic materials for higher service temperature properties that are unique, and specialty manufactured.

All metal locknuts made of stainless-steel metal are resistant to elevated temperatures and vibration. Use stainless steel alloy locknuts for extreme temperature applications. Consider locknuts made of 302, 304, 316 stainless steels. Also, 316 stainless is an excellent option for saltwater environments.

14 Can a bolt pilot point interfere with the performance of the prevailing torque?

The bolt pilot point outer diameter must be small enough to pass through the locknuts without interference. Avoid bolts with a paint cutter pilot point into a nylon insert locknut. This paint cutting point will remove the nylon instead of allowing the nylon to flow around the external thread thus reducing the prevailing torque performance. ■



Fig.5.
Fast assembly
speed nylon insert
separation.

