FASTENERFACTS

An Informational Series From All-Pro Fasteners

Locknuts

A Review of a Versatile Fastener

INTRODUCTION

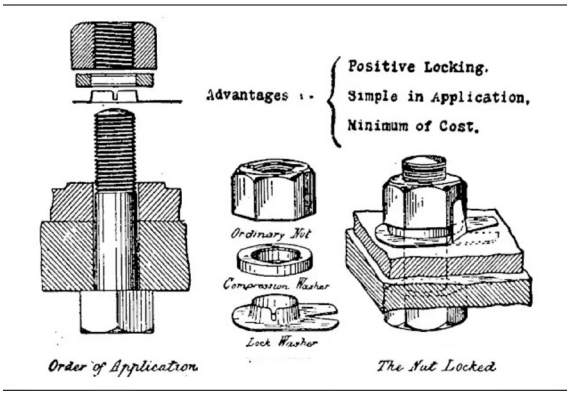
Locknuts are a fastener type designed for a specific purpose – the prevention of unintended loosening due to vibration. These fasteners are engineered with internal locking threads or other mechanisms that allow them to avoid loosening in response to vibrational forces and maintain their integrity even in high-vibration environments. With a history that stretches back over a century, locknuts are widely used in a broad range of industries and applications.

Over the years, locknuts have been called by a number of names, including locking nuts, self-locking nuts, prevailing torque nuts, stiff nuts, and elastic stop nuts. Although called by many names, these fasteners share one critical characteristic – the ability to withstand the effects of vibration in demanding joining applications.

Locknuts are commonly found in a number of Imperial sizes, including 1/4", 5/16", 3/8", 1/2", 9/16", 5/8", 7/8", 1", 1-1/4", and more. Metric sizes, ranging from M3 to M20, are also available for standard applications, while larger sizes like M25, M50, M60, and even M90 are offered to meet specialized requirements.

This whitepaper will provide a comprehensive exploration of locknuts, including their historical development and the principles governing their functionality. Other, related subjects will include typical applications, locknut advantages, and an overview of the many locknut designs currently available.

THE HISTORY OF LOCKNUTS



The first locknut used on a regular basis was the “Shekleton Nutlock.” This fastener was officially invented and patented by an Australian entrepreneur by the name of Jim Hardgrave Shekleton. However, many believe that the real inventor of the first locknut was a Scotsman, named Tom Davidson, who lived east of Perth in the Western Australian outback. Of interest is the fact that Mr. Davidson committed suicide after spending an evening of drinking at Mr. Shekleton’s pub. It was thought by many that Shekleton somehow acquired the design from Davidson prior to the Scotsman’s death. In 1915, Shekleton formed the company, ‘Shekleton Locknut Limited,” which marketed and sold the initial locknut design throughout Australia, New Zealand, Europe, and the United States. This initial locknut design was refined in the early 1930s, with the first nylon insert being added in 1931.

In the past, manufacturers would often use two nuts in tandem for high- vibration applications, with one nut forcibly tightened into the other. This use of two nuts was sometimes effective in preventing vibration-related loosening. However, it was neither operationally efficient nor cost-effective for large-scale production operations. Fastener costs were doubled, and assembly time was significantly increased. By comparison, locknuts provided the security of a non-loosening joint required for high-vibration applications, along with the simplicity and efficiency of a “one-nut” installation.

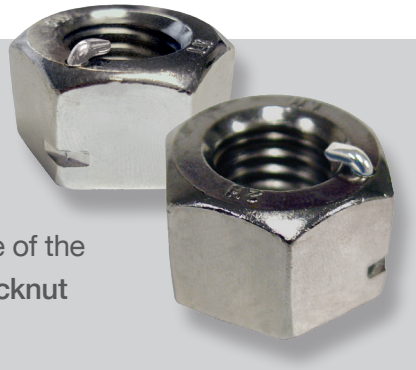
HOW LOCKNUTS WORK

Locknuts are similar to conventional fasteners when they are being installed on the shaft of a bolt. The difference is that they will not back off once tightened down, resisting the effects of vibration. Basically, all locknuts protect against loosening by utilizing a choice of design elements that cause the nut to “lock” into the bolt’s threads and provide the necessary resistance to the loosening effects of vibration.

Some locknuts are designed for increased friction, using pitted or flanged grooves to provide the necessary element of friction. Other designs employ a pin-type locking device or similar mechanism built into the nut. Another group of metal locknuts employ a crowned top that is crimped into the bolt in order to secure the nut in place.

By contrast, nylon locknuts feature a layer of nylon material covering the interior threading of the nut. When a nylon locknut is threaded onto a bolt, the nylon fibers expand to grip the threads of the bolt, providing the "lock" that permanently secures the nut.

BENEFITS OF LOCKNUTS



There is a reason that locknuts have been used for so many years in a broad range of applications – they work. For many tasks, locknuts deliver reliable, non-loosening joints for the life of the product being assembled at a reasonable cost. **A listing of locknut benefits includes:**

- Inexpensive, especially when compared with multiple fasteners or lockbolts
- Highly vibration resistant
- A number of fastener types available, allowing for the best match of locknut to the application
- No special tools required for installation, saving time and money
- No deformation or damage to bolt integrity
- Can be counted on in high-temperature and high-corrosive environments

TYPES OF LOCKNUTS

Over the years, various types of locknuts have been developed to address the unique requirements of a number of joining applications. While locknuts have been historically categorized as either Free-Spinning or Prevailing Torque, the ANCO® PN-LOC® cannot be characterized as either. Instead, the design and operation of the ANCO PN-LOC, and its many applications, place it in a category of its own.

ANCO® PN-LOC®

The ANCO® PN-LOC® is an all-metal, self-locking nut featuring a stainless steel ratchet pin. Coupled with a unique controlled lock indention, this non-breakable ratchet pin limits damage to bolt threads and the removal of galvanizing during installation, while ensuring consistent locking torque. This premium locknut is available in a wide range of American Standard and Metric sizes; Hex finished and heavy nuts.

Materials: Steel grade 2-5-8, 2H/DH and stainless steel

Finish: Plain, zinc, cadmium, hot dip galvanized, and Xylan/Teflon, as well as other platings and coatings

PREVAILING TORQUE LOCKNUTS

Often simply referred to as “locknuts,” these specialized nuts are designed to prevent unintended loosening of fasteners due to vibration, changes in temperatures, or other external forces. These nuts incorporate a unique feature that provides resistance against rotation, thus helping to maintain a secure and stable joint.

Prevailing torque locknuts typically feature the use of a deformable material or a special design in the interior of the nut to achieve a “lock.” When a prevailing torque locknut is initially threaded onto a bolt or screw, it requires increased torque to turn. As it is tightened, this increased resistance creates friction between the threads of the nut and the fastener. This frictional force serves to “lock” the nut in place, allowing it to handle vibration without loosening.

Prevailing torque locknuts are commonly used in applications where vibration and loosening are concerns, and there is no need to be able to loosen and retighten the nut. Typical applications for these locknuts include automotive and aerospace assembly, construction, and heavy machinery manufacturing.

Some typical prevailing torque locknut types include:

DURA-FLEX — an all-metal locknut with a slotted collar. When tightened, this locknut creates six flex locking elements along its top collar, which are deformed into the receiving bolt’s threads. Available in American Standard and Metric; Hex finished, jam, heavy, and Hi nuts.
Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, and stainless steel
Finish: plain, zinc, and cadmium, as well as other platings and coatings

C-LOCK (Collar) — an oval locking collar on top of this nut creates frictional thread interference between it and a screw or bolt. Available in American tandard and Metric sizes; Hex finished, jam, heavy, and Hi nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, and stainless steel

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other plating and coatings

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HEX-LOC (Reversible) — available in two- and one-punch configurations, this all-metal locknut features deflected threads at its center, which deform into the bolt threads to create a two-way locking mechanism. Available in American Standard and Metric sizes; Hex finished, jam, heavy, Hi, square, acorn, weld, track, and flange nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys, and stainless steel

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other platings and coatings

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TRI-LOC — this all-metal locknut features three locking elements, which deflect the threads in the top of the nut into the bolt's threads. Available in American Standard and Metric sizes; Hex finished, jam, heavy, Hi, coupling, flange, wing, weld, and track nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys,and stainless steel

Finish: plain, zinc, cadmium, hot dip galvanized, and mechanical galvanized, as well as other platings and coatings.

DOME-LOC — this locknut, designed for automated installation, features a top or oval lock feature. Available in American Standard and Metric sizes; Hex finished, jam, heavy, and Hi nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys, and stainless

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other platings and coatings

360-LOC (Special Reversible) — this locknut's 360° locking element creates frictional thread interference from the top all the way to the bearing surface of this two-way top locknut, providing for a secure joint. Available in American Standard and Metric sizes; Hex finished, jam, and heavy nuts.

Materials: Steel grade 2-5-8, Monel, brass, bronze, and stainless steel

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other platings and coatings

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O-LOC (Oval) — an oval-shaped locking feature on two sides at the top of this nut helps to create frictional thread interference with joining bolt's threads and a secure locking mechanism. Available in American Standard and Metric sizes; Hex finished, jam, heavy, Hi, and square nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys, and stainless steel

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other platings and coatings

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COLUMBIAN — the positioning of the slotted locking element on the side of this locknut creates frictional thread interference where it is most needed on the receiving bolt's threads for a secure locking mechanism. Available in American Standard and Metric sizes; Hex finished, jam, heavy, Hi, square, and flange nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys, and stainless steel

Finish: plain, zinc, and cadmium, as well as other platings and coatings

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PEL-LOC (Nylon Pellet) — a nylon pellet that extends throughout the wall at the center of this two-way nut creates frictional thread interference with the bolt's thread, providing for a secure locking mechanism. Available in American Standard and Metric sizes; Hex finished, jam, heavy, Hi, square, acorn, and flange nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloys, and stainless steel

Finish: plain, zinc, cadmium, and mechanical galvanized, as well as other platings and coatings

FLANGE TRI-LOC — this all-metal locknut features three locking elements, which deflect the threads in the top of the nut into the receiving bolt's threads for a secure connection. Available in American Standard and Metric sizes; large and regular flange.

Materials: Steel grade 2-5-8 and stainless steel

Finish: plain, zinc, hot dip galvanized, and cadmium, as well as other platings and coatings

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N-LOC (Nylon Insert) — available in large sizes up to 6 inches in diameter, this locknut features a nylon insert locking element which deforms around the thread of the bolt, providing a reliable locking mechanism. Available in American Standard and Metric sizes; Hex finished, jam, heavy, and Hi nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, stainless steel and a range of exotic metals

Finish: plain, zinc, cadmium, hot dip galvanized, and Xylan/Teflon, as well as other platings and coatings

FREE-SPINNING LOCKNUTS

Free-spinning locknuts turn freely on a bolt until they are seated against a base. Unlike prevailing torque locknuts, most free-spinning designs can be loosened and retightened several time before losing their vibration resistance.

These popular locknuts are designed with a unique feature that allows them to rotate freely on a threaded screw or bolt without engaging and tightening onto the threads. Unlike prevailing torque locknuts, which provide resistance to vibration-induced loosening by deformation of the nut's and/or bolt's threads, a free-spinning locknut turns freely onto a bolt until seated against a base of the bolt. Further tightening of the nut is then required to produce the locking action. This feature can be advantageous in applications where ease of installation and adjustment are required, as the nut can be quickly positioned by hand before other locking or securing methods are applied.

Some typical free-spinning locknut types include:

DBL-LOC — complete with a polyurethane, Teflon, or nylon insert recessed into the bottom of the nut, this sealing locknut creates a thread locking seal when tightened against the bearing surface. Available in American Standard and Metric sizes; Hex finished, heavy, and Hi nuts.

Materials: Steel grade 2-5-8, 2H/DH, Stainless steel, and other materials

Finish: plain, zinc, and cadmium, as well as other platings and coatings

DRAKE — this locknut is an all-metal, two-piece self-locking nut which operates by hand threading the bottom section of the assembly in place and then installing the top section in place as the locking mechanism. Available in American Standard and Metric sizes; Hex finished and heavy nuts.

Materials: Steel grade 2-5-8, 2H/DH, Monel, brass, bronze, aluminum alloy, and stainless steel

Finish: plain, zinc, and cadmium, as well as other platings and coatings

MAR-LOC (Marsden Type) — this all-metal locknut is deformed into the threads of the bolt once it is seated at the bolt's base and tightened. Available in American Standard and Metric sizes; Hex finished and heavy nuts.

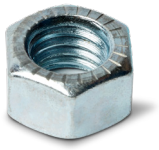
Materials: Steel grade 8, alloys, and stainless steel

Finish: plain, zinc, and cadmium, as well as other platings and coatings

SPN-LOC TWIN SPIN SERRATED — two options are offered for this locknut – with the serrated locking elements on either the bearing surface only, or on both nut faces. Available in American Standard and Metric sizes; Machine screw, hex finished, and jam nuts.

Materials: Steel grade 2-5-8, Monel, brass, bronze, aluminum alloys, and stainless steel

Finish: plain, zinc, and cadmium, as well as other platings and coatings



LOCKNUT APPLICATIONS

For more than 100 years, locknuts have been successfully used in a wide range of industries for any application where fasteners cannot be allowed to loosen. The specialized nuts are often found in the following industries:

- Aerospace / Aviation
- Turbine Engines
- Automotive
- Military Applications
- High Temperature Applications
- High Vibration Applications
- Ship Building/Marine Applications
- Oil & Gas Applications
- Medical

CONCLUSION

Locknuts are inexpensive, easy to use, and proven reliable through years of use in high-vibration environments. These proven fasteners have also evolved into a number of different types and styles to meet varied joining applications, each designed to achieve loosen-free fastening. Today, the versatility of locknuts continues to ensure their value over a wide range of fabrication, construction, and manufacturing applications.

ABOUT ALL-PRO FASTENERS

All-Pro Fasteners supplies high-quality fastener products to meet a number of industrial, manufacturing, and fabrication applications. The company offers a broad range of supply solutions – global sourcing, manufacturing, customized inventory management, kitting, custom shipping, and more — all designed to better meet customer's fastening requirements.

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