Threadlocking
User’s Guide

What you need to know to ensure a reliable threaded assembly
Since the design of threaded fasteners, engineers have been searching for the solutions to vibrational loosening. Vibration loosening of fasteners creates reliability issues, unscheduled shutdown of equipment and additional costs.

Old Way

Mechanical Locking Devices
Mechanical locking devices (e.g. split washers, nylon nuts) were invented to solve the common problem of loosening that occurs in most threaded assemblies. Although they were made for this purpose, they have several shortcomings.

Shortcomings of Mechanical Locking Devices
- Loosen under vibration, thermal expansion and/or improper torque
- Do not seal threads
- Require extensive inventory of several shapes and sizes
- Prone to rust

Better Way

Loctite® Threadlockers
Invented fifty years ago by Loctite Corporation, now Henkel Corporation, this revolutionary method to lock and seal threaded fasteners with liquid anaerobic adhesives has found worldwide acceptance. Suited for a wide range of applications, from delicate electronic components to heavy industrial equipment, Loctite® threadlockers have dramatically increased the reliability of threaded assemblies.

Benefits of Loctite® Threadlockers
- Lock nuts and bolts against vibration and thermal expansion
- Seal against corrosion and leakage
- Reduce inventory costs
- Suitable for all shapes and sizes of fasteners
- Act as a thread lubricant
- Maintain critical adjustments of the assembly
- No on-torque adjustments needed
- High chemical resistance
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Threaded Fasteners

Functions of a threaded assembly

1. Create clamp force
2. Maintain clamp force
3. Allow disassembly

Why do threaded assemblies fail?

Clamp force is not maintained
Threaded assemblies loosen because of:

A. Gaps: In order to make the assembly possible, nuts and bolts must have some tolerance, which creates gaps between the threads.

B. Vibration & side-to-side movement: These gaps allow the parts to move from side-to-side when exposed to vibration.

C. Expansion/contraction & loosening: Expansion and contraction can also cause side-by-side movement. This, in addition to vibration, leads to loosening and ultimately disassembly of parts.

Disassembly is not always possible
This failure happens because, in certain conditions, a nut and a bolt can seize together. This seizing effect is caused by:

- Corrosion, rust, when dealing with:
  - Humidity
  - High temperatures
  - Assembly of different metals (galvanic corrosion)
- Galling (friction welding)
Loctite® Threadlocking Solutions

How does a Loctite® threadlocker work?

**Fill Gaps**
Loctite® threadlockers are single-component adhesives that cure in the absence of air and in contact with active metal to form a tough thermoset plastic. They completely fill all voids between the interfacing threads, which makes the assembly an unitized component, prevents any movement between threads, and ultimately prevents loosening.

**Seal Threads**
Another property of Loctite® threadlockers is thread sealing. This property is especially important when assembling through-bolts in an oil reservoir or cooling jacket in order to keep the fluids sealed in and corrosion out. Examples of this application are common but not limited, to gearboxes and internal combustion engines.

How do I use a Loctite® threadlocker?

**Application Options**

- **For through holes**
- **For blind holes**
- **For post assembly (using Loctite® 290)**
- **For overhead applications**

**IMPORTANT:** To achieve optimum performance all parts must be clean and free of contaminants (e.g. oil, grease).

**Dispensing Options**

- 250 ml and 50 ml Loctite® hand pumps
- Loctite® integrated semiautomatic dispenser, dispense valve, and stationary dispense valve

For maximum convenience and productivity, Loctite® threadlockers can be dispensed through Loctite® dispensing systems.
Why use Loctite® threadlockers?

<table>
<thead>
<tr>
<th>Conventional Method</th>
<th>Locknuts</th>
<th>Spring Washers</th>
<th>Nylon Inserts</th>
<th>Tab Washers / Split Pins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Double cost</td>
<td>• Ineffective locking</td>
<td>• On-torque needed</td>
<td>• Difficult production use</td>
<td></td>
</tr>
<tr>
<td>• Extra space</td>
<td>• Can damage contact faces</td>
<td>• Ineffective under severe vibration</td>
<td>• Expensive</td>
<td></td>
</tr>
<tr>
<td>• Re-torquing required</td>
<td>• Large inventory</td>
<td>• Require good access</td>
<td>• Designed mainly to prevent loss of loosened nuts &amp; bolts</td>
<td></td>
</tr>
<tr>
<td>• Seizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loctite® Solutions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lower cost</td>
<td>• Positive locking</td>
<td>• Low on-torque</td>
<td>• Easy application</td>
<td></td>
</tr>
<tr>
<td>• Space saving</td>
<td>• No damage, no corrosion</td>
<td>• Effective even under severe conditions</td>
<td>• Lower cost</td>
<td></td>
</tr>
<tr>
<td>• Seal against corrosion</td>
<td>• One bottle fits many sizes</td>
<td>• Easy to apply</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 100% contact, no loosening</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Loctite® Benefits

**Better Performance**

- **Reliable assembly**: Not only locks against vibration, shock and thermal cycling but also seals against corrosion and galling
- **Easy disassembly** using hand tools when low or medium grade formula is selected
- **Outperform locking devices**: better clamp load retention compared to all mechanical locking devices

**Cost Savings**

- **Failure**: Reliable threaded assemblies reduces costly downtimes
- **Inventory**: “One size fits all”, universally applicable for a wide range of fastener sizes
- **Processing**: Ease of automation reduces assembly costs and increases throughput
- **Material Cost**: Lower cost per unit compared to most locking devices

**Vibration loosening test**

- Standard bolt w/ Loctite® threadlocker
- Bolt w/ saw-toothed flange
- Nylon nut
- Bolt w/ DIN 6797 A tooth lock washer
- Bolt w/ DIN 127 A split ring washer
- Unsecured standard bolt

Note: Results from the Transverse Vibration Test (Junkers Machine) that assesses fasteners’ resistance to vibration loosening

**Cost per locking application**

<table>
<thead>
<tr>
<th>Typical Locking Device</th>
<th>Relative Cost per part on M10 Bolt &amp; Nut</th>
<th>Locks</th>
<th>Seals</th>
<th>Lubricates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanged Bolt (DIN6921 - M10 x 80)</td>
<td>12 X</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Nylon Insert Lock Nut (DIN985)</td>
<td>6 X</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Flanged Nut (DIN926)</td>
<td>5 X</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Additional Lock Nut (DIN934)</td>
<td>3 X</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Spring Lock Washer (DIN127A)</td>
<td>1 X</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td><strong>Loctite® Threadlocker</strong></td>
<td><strong>1 X</strong></td>
<td><strong>YES</strong></td>
<td><strong>YES</strong></td>
<td><strong>YES</strong></td>
</tr>
</tbody>
</table>

Note: Estimated costs based on purchase of 1000 pcs. from a fastener distributor.
Loctite® threadlocker key selection factors

Strength
- **Low strength**: Ideal for fasteners <M6. Easy disassembly using hand tools
- **Medium strength**: Designed to be removable with standard hand tools on M6 to M20 fasteners
- **High strength**: Designed to deliver high strength on M6 to M20 fasteners. For removal, it may require localized heat (>260°C), hand tools, and disassembly while hot

Application Methods
- **Pre-Dispensed**: Loctite® sticks semisolid formula can be applied beforehand on bolts that are waiting to be assembled
- **Pre-Assembly**: Most Loctite® liquid threadlockers are designed to be applied at the moment that parts will be assembled
- **Post-Assembly**: Wicking grade formula can be applied on parts that are already assembled

Materials Being Assembled
- **All Loctite® Threadlockers**: Metal-to-metal applications
- **Loctite® 425 Assure™**: Plastic-to-plastic, plastic-to-metal applications

Loctite® threadlockers are available in many grades to satisfy a wide range of applications. To make grade selection easy, the grades are now color-coded to help you identify one threadlocker from the other.

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**LOW STRENGTH THREADLOCKERS**
- Removable with hand tools
- Adjustment screws
- Calibration screws
- Meters and gauges
- Up to M6

**MEDIUM STRENGTH THREADLOCKERS**
- Removable with hand tools
- Machine tools and presses
- Pumps and compressors
- Mounting bolts
- Gear boxes
- Up to M20

**HIGH STRENGTH THREADLOCKERS**
- Permanently assembly
- Heavy equipment
- Suspension bolts
- Motor and pump mounts
- Bearing cap bolts and studs
- Up to M27 and larger diameters

**PENETRATING THREADLOCKERS**
- Removable with heat and hand tools
- Preassembled fasteners
- Instrumentation screws
- Electrical connectors
- Carburetors
- Up to M14
Loctite® Threadlocking Solutions

Selectors chart

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Product</th>
<th>Colour</th>
<th>Thread size upto</th>
<th>Operating temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core liquid line:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low strength</td>
<td>Loctite® 222</td>
<td>purple fluorescent</td>
<td>M14</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>Medium strength</td>
<td>Loctite® 243</td>
<td>blue fluorescent</td>
<td>M20</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>High-medium strength</td>
<td>Loctite® 262</td>
<td>red fluorescent</td>
<td>M27</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>High strength</td>
<td>Loctite® 270</td>
<td>green fluorescent</td>
<td>M27</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>Specialty liquid line:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passive surfaces</td>
<td>Loctite® 2701</td>
<td>green fluorescent</td>
<td>M27</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>High temperature</td>
<td>Loctite® 272</td>
<td>red-orange</td>
<td>M27+</td>
<td>-55°C to + 230°C</td>
</tr>
<tr>
<td>Wicking/Capillarity</td>
<td>Loctite® 290</td>
<td>red-orange</td>
<td>M14</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>Semi-solid line:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium strength</td>
<td>Loctite® 248</td>
<td>blue fluorescent</td>
<td>M20</td>
<td>-55°C to + 150°C</td>
</tr>
<tr>
<td>High Strength</td>
<td>Loctite® 268</td>
<td>red fluorescent</td>
<td>M20</td>
<td>-55°C to + 150°C</td>
</tr>
</tbody>
</table>

When should I use a Loctite® primer?

**Speed up cure**
Significantly speed up the cure time of Loctite® threadlockers when assembling metal parts that are cold, have large gaps or deep threads.

**Inactive metal assemblies***
When assembling metal parts with inactive surfaces, Loctite® primers are recommended to ensure proper performance of Loctite® threadlockers.

<table>
<thead>
<tr>
<th>*Inactive Metals (Primers Recommended)</th>
<th>Active Metals (Primers Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plated Parts</td>
<td>Magnetite Steel</td>
</tr>
<tr>
<td>Zinc</td>
<td>Iron</td>
</tr>
<tr>
<td>Anodized Aluminum</td>
<td>Inconel®</td>
</tr>
<tr>
<td>Pure Aluminum</td>
<td>Plain Steel</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Nickel</td>
</tr>
<tr>
<td>Titanium</td>
<td>Silver</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Copper</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>Gold</td>
</tr>
<tr>
<td>Brass</td>
<td>Manganese</td>
</tr>
<tr>
<td>Galvanized Steel</td>
<td>Monel®</td>
</tr>
<tr>
<td>Natural or Chemical</td>
<td>Brass</td>
</tr>
<tr>
<td>Black Oxide</td>
<td>Kovar®</td>
</tr>
</tbody>
</table>

Loctite® threadlockers cure in the absence of air and presence of metal ions. When assembling inactive metal parts, which are low in metal ions, the use of Loctite® primers are recommended to ensure proper performance of Loctite® threadlockers.
König + Neurath AG
Assemblies in seating furniture are subject to enormous forces of motion. König + Neurath AG uses threadlocking adhesives on various threaded joints in their products (seating furniture and workplace systems). Threadlockers Loctite® 242 and 270 are applied to ensure improved strength, to enhance stability and extend the service life of the furniture.

LEMKEN GmbH & Co. KG
Agricultural machinery for soil cultivation is exposed to severe vibrational loading. The notched hollow disc on the left is attached to the frame and secured with a nut. The bearing mounted disc is used for loosening and mixing of soil. As the disc rotates at a high peripheral speed, Loctite® threadlocker is applied to the locknut for additional protection to permanently resist self-loosening of the nut.

Stuttgarter Straßenbahnen AG
Thousands of passengers trust in the safety of SSB, the Stuttgart urban light rail transportation they use on a daily basis. SSB workshops are responsible for repair and maintenance of all vehicle components. To ensure reliable assemblies of axles, bogies, transmission and motor, numerous threaded fasteners are locked with Loctite® 243 or 262.

Gottwald Port Technology GmbH
Gottwald Port Technology GmbH builds a wide range of different cranes from railway and harbour cranes to fully automated stacking cranes. Particularly high loads are encountered during loading and unloading, and the hoisting gear of a crane must be capable of withstanding these loads. For reliable, permanent operational readiness the threaded fasteners used to assemble the electric motor to the transmission are secured with Loctite® 243.

SCHOTTEL GmbH
Threaded assemblies in ship propellers operate under severely adverse conditions, exposed to vibrations, water currents and corrosion processes. SCHOTTEL’s product line includes rudder propellers in the megawatt range. Such enormous dynamic loads require the use of Loctite® threadlockers to resist self-loosening. In addition, the assemblies are sealed for permanent corrosion protection. Loctite® products therefore contribute significantly to operational safety and extend the service life of underwater components.
Ehlebracht Slowakei s.r.o.
A large portion of LCD and plasma monitors are mounted on rotating holders before being fixed to the wall. Ehlebracht Slowakei s.r.o. manufactures these mounting devices for the electronics industry. As these holders are often subject to numerous load cycles there is a high risk of self-loosening of the nuts and bolts. To counteract this problem, wicking grade threadlocker Loctite® 290 is applied to the galvanized screw after assembly.

Professional Barrier Systems Ltd.
Professional Barrier Systems Ltd. manufactures the highly respected Extendor range of physical security devices for the protection of window and door openings. The systems feature retractable grilles which blend into door and window surrounds when they are not in use. From a security standpoint, preventing the barrier’s threaded locking mechanism from moving is a necessity. For this crucial task Loctite® 268 threadlocking stick is applied before assembling the parts.

Hiller GmbH
The decanter centrifuge has become a major processing tool in a wide range of applications, e.g. for the separation of waste water and rape seed. The environment is harsh and chemical resistance is needed for all parts of the centrifuge. For components such as the bowl, conveyor, base frame, housing and most of all the centrifuge drive it is very important to prevent loosening and corrosion of the fasteners to ensure reliability of the components. As a result, manufacturer Hiller GmbH uses Loctite® threadlockers in many of their assembly applications.
We trust in Loctite® Threadlocking Solutions
When you choose the Loctite® brand, you receive much more than a reliable assembly, you obtain a comprehensive solutions package:

- Wide product range
- Advanced training programs
- Engineering services
- Research and development
- Agency certification and approvals
- Local application assistance
- Global availability

Loctite® Solutions