Threadlocking
User’s Guide

What you need to know to ensure a reliable threaded assembly

www.useloctite.com
Loctite® – Finding a Better Way

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 50 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-to-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)

Corroded assemblies can be difficult to take apart... …which can lead to broken bolts.
Locking Methods

Shortcomings of locking devices

- **Split ring or spring washers**: Increased friction reduces clamp load; will not ensure reliable threadlocking under dynamic loads.
- **Tab washers, split pins, castle nuts**: Expensive and time-consuming methods, they often impose challenges to line up their components appropriately (i.e., tabs, cotter pins).
- **Tooth or ribbed flanged bolts**: Prevent self-loosening, but are expensive; need larger flange-bearing surfaces and may damage the surfaces.
- **Nylon nut**: More expensive than a standard nut, nylon inserts increase friction, which results in inaccurate torque.

Why use Loctite® threadlockers?

**Loctite® Benefits**

**Better Performance**
- **Reliable assembly**: Lock against vibration, shock and thermal cycling – plus seal 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 reduce 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

**Cost per locking application**

<table>
<thead>
<tr>
<th>Fastener Size</th>
<th>Split Ring Washer</th>
<th>Loctite® Threadlocker</th>
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</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>2¢</td>
<td>2¢</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>9¢</td>
<td>5¢</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>25¢</td>
<td>7¢</td>
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</tbody>
</table>

**Note**: Washer pricing based on 100 units purchased at an industrial distributor. Loctite® pricing based on 50 ml bottle price and number of drops required per application.
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 a unitized component 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
- For overhead applications
- For pre-applied applications

**Dispensing Options**
- 250 ml and 50 ml push-pull nozzle
- 250 ml and 50 ml Loctite® hand pumps
- Loctite® integrated semiautomatic dispenser, dispense valve and stationary dispense valve

**IMPORTANT**: To achieve optimum performance, all parts must be clean and free of contaminants (e.g., oil, grease).
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. Not required for primerless products.

**Inactive metal assemblies**
When assembling metal parts with inactive surfaces, Loctite® primers are recommended to ensure proper performance of Loctite® threadlockers. Not required for primerless products.

<table>
<thead>
<tr>
<th>Inactive Metals (Primers Recommended)</th>
<th>Active Metals (Primers Optional)</th>
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</thead>
<tbody>
<tr>
<td>Plated Parts</td>
<td>Iron</td>
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<tr>
<td>Zinc</td>
<td>Manganese</td>
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<tr>
<td>Anodized Aluminum</td>
<td>Plain Steel</td>
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<tr>
<td>Pure Aluminum</td>
<td>Monel®</td>
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<tr>
<td>Titanium</td>
<td>Copper</td>
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<tr>
<td>Cadmium</td>
<td>Kovar®</td>
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<tr>
<td>Stainless Steel</td>
<td>Magnesium</td>
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<tr>
<td>Magnesium</td>
<td>Silver</td>
</tr>
<tr>
<td>Galvanized Steel</td>
<td>Gold</td>
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<tr>
<td>Natural or Chemical Black Oxide</td>
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</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 is recommended to ensure proper performance of Loctite® threadlockers.*

**Loctite® threadlocker key selection factors**

**Strength**
- **Low Strength**: Ideal for fasteners <¼” (6 mm). Easy disassembly using hand tools.
- **Medium Strength**: Designed to be removable with standard hand tools on ¼” to ¾” fasteners.
- **High Strength**: Designed to deliver high strength on ¼” to ¾” (6 mm to 22 mm) fasteners. For removal, it may require localized heat (>550°F/260°C), hand tools, and disassembly while hot.

**Viscosity**
- **Liquid Formulas**: Everyday assembly; ideal for fine threads and blind holes
- **Semisolid Formulas**: Pocket-friendly, ideal for overhead applications
- **Tape Formula**: Pocket-friendly; controlled application; can be pre-applied several days before assembly.

**Application Methods**
- **Pre-Applied**: QuickTape™ threadlocker 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® Threadlocker Selection

## Are the parts being assembled metal or plastic?

<table>
<thead>
<tr>
<th>Plastic Assembly</th>
<th>Metal Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loctite® 425™ Assure</strong></td>
<td><strong>Loctite® 220™ Assure</strong></td>
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<tr>
<td><strong>Loctite® 290™ Assure</strong></td>
<td><strong>Loctite® 220™ Assure</strong></td>
</tr>
<tr>
<td><strong>Loctite® 2422™ Assure</strong></td>
<td><strong>Loctite® 2620™ Assure</strong></td>
</tr>
<tr>
<td><strong>Loctite® 2047™ Assure</strong></td>
<td><strong>Loctite® 2047™ Assure</strong></td>
</tr>
</tbody>
</table>

### Wicking Grade

<table>
<thead>
<tr>
<th>Low Strength</th>
<th>Medium Strength – Blue</th>
<th>Medium / High Strength – Green</th>
<th>High Strength – Red Paste</th>
<th>High Strength – Liquid</th>
</tr>
</thead>
</table>

### Solution

<table>
<thead>
<tr>
<th>Fastener Size</th>
<th>Liquid (in.-lbs.)</th>
<th>Temperature (°F/°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small fasteners</td>
<td>4 / 2</td>
<td>180°F (80°C)</td>
</tr>
<tr>
<td>Medium strength</td>
<td>85 / 170</td>
<td>300°F (150°C)</td>
</tr>
<tr>
<td>High strength</td>
<td>90 / 260</td>
<td>650°F (340°C)</td>
</tr>
<tr>
<td>High strength</td>
<td>650°F (340°C)</td>
<td>300°F (150°C)</td>
</tr>
</tbody>
</table>

### Product Details

- **Loctite® 425™ Assure® Instant Adhesive**
  - Low strength, fast surface-curing threadlocker for plastic fasteners. Can be used as a tamper-proofing agent for the head of screws. Can be applied before or after assembly.

- **Loctite® 220™ Assure® Threadlocker – Medium Strength / Wicking / Blue**
  - A low viscosity threadlocking adhesive that allows the product to wick along the threads of preassembled fasteners. Perfect for fasteners up to ¼” diameter (6 mm).

- **Loctite® 290™ Assure® Threadlocker – High Strength / Wicking / Green**
  - Recommended for locking pre-assembled fasteners, i.e., instrumentation screws, electrical connectors and set screws. Also seals porosities in welds and metal parts.

- **Loctite® 2422™ Assure® Threadlocker – High Strength / Medium Strength**
  - Recommended for locking fasteners that are exposed to temperatures up to 650°F (340°C). Removable with hand tools.

- **Loctite® 2620™ Assure® Threadlocker – High Temp / Medium Strength**
  - Recommended for locking fasteners that are exposed to temperatures up to 650°F (340°C). Recommended for locking fasteners permanently.

- **Loctite® 2047™ Assure® Threadlocker – High Lubricity / High Strength**
  - Recommended for fasteners over ¼” (22 mm). Formulated with increased lubricity to reduce friction and allow proper clamp load to be achieved. Ideal for locking fasteners permanently.

### Table Notes

- **Cure Time**: Fixture time in min./full strength in hrs. Typical value @ 70°F (21°C)
- **Torque**: Values in in.-lbs. (breakaway/prevailing torque)
- **Break Loose Value**
- **Temperature**: Resistance for continuous service

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**Are the parts already assembled?**
- Yes
- No

**Is the assembly exposed to extreme temperatures?**
- Yes
- No

**Are you assembling large fasteners?**
- Yes
- No

**What strength do you require?**

<table>
<thead>
<tr>
<th>Strength</th>
<th>Product</th>
<th>Primer</th>
<th>Temperature</th>
<th>Cure Time</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Strength</td>
<td>Purple</td>
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<tr>
<td>Medium Strength</td>
<td>Blue</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>High Strength</td>
<td>Red</td>
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</tbody>
</table>

**Loctite® 222™ Threadlocker – Low Strength**
- Recommended for low strength threadlocking of adjustment screws, countersunk head screws and set screws; on collars, pulleys, tool holders and controllers. Also for low strength metals such as aluminum or brass. Also available in Loctite® 222MS® version which carries MIL-Spec (5-45163A) Type II, Grade M, NSF P1.

**Loctite® 243™ Threadlocker – Medium Strength/Primerless**
- Versatile, medium strength liquid threadlocker. Reliably locks and seals metal fasteners up to ¼” (19 mm). Engineered to cure consistently on a variety of metals, despite minor surface contaminants. Works on steel, stainless steel and most plated fasteners. Tolerates thread lubrication, anti-corrosion and protection fluids. Rated for 360°F (180°C).

**Loctite® QuickTape™ 249™ Threadlocking Tape**
- The one and only threadlocker in a tape form. This revolutionary medium strength threadlocking adhesive is removable with hand tools, and offers the same reliability as traditional Loctite® removable grade threadlocking liquids. Convenient, durable package is a must for every toolbox. Loctite® QuickTape™ 249™ is easy to apply and can be preapplied for future assembly.

**Loctite® QuickStix™ 248™ Threadlocker – Medium Strength**
- Semisolid stick form is convenient, portable, and great for hard-to-reach applications. Loctite® QuickStix™ 248™ Threadlocker is the ideal general purpose threadlocker for all nut and bolt applications, especially fasteners between ¼” and ¼” (6 mm to 19 mm). Removable with hand tools.

**Loctite® 263™ Threadlocker – High Strength/Primerless**
- Versatile, high strength liquid threadlocker. Reliably locks and seals metal fasteners up to 1” (25 mm). Engineered to cure consistently on a variety of metals, despite minor surface contaminants. Works on steel, stainless steel and most plated fasteners. Tolerates thread lubrication, anti-corrosion and protection fluids. Rated for 360°F (180°C). Heat required for removal.

**Loctite® QuickStix™ 268™ Threadlocker – High Strength**
- This convenient semisolid stick form is portable and less messy. Its high strength prevents loosening of threaded fasteners. Well-suited for heavy-duty applications.

**Helpful Hints:**
- Clean part with Loctite® ODC-Free Cleaner & Degreaser before applying the adhesive.
- If the threadlocker will be applied below 40°F (4.4°C), pre-treat with Loctite® 7649™ Primer N™.
- Aqueous washing solutions and cutting fluids can leave a protective layer on the surface. Wash with hot water before use or use contaminant tolerant 243™ or 263™ Threadlocker.

**IMPORTANT!** See page 5 for more information on: 
- Primers and inactive metals
- Strength
- Application methods
Loctite® Innovations

**Tape and Semisolid Products – Versatility and Cleanliness**

**Loctite® QuickTape™ 249™ Threadlocking Tape**
The first threadlocker in a convenient, tape form. Easy to use with no mess and no waste, Loctite® QuickTape™ 249™ provides the same reliable performance as traditional Loctite® medium-strength threadlocking liquids and sticks. It can even be pre-applied for future assemblies. It’s a MUST HAVE for every toolbox!

**Loctite® QuickStix™ 248™ Medium Strength**
**Loctite® QuickStix™ 268™ High Strength**
**Loctite® QuickStix™ 7088™ Primer**
No mess, easy to apply and pocket-friendly. Ideal for overhead and pre-dispensed applications.

**Primerless Products – Speed and Performance**

**Loctite® 243™ Medium Strength and Loctite® 263™ High Strength Threadlockers**
The Loctite® 243™ Medium Strength and 263™ High Strength Threadlockers offer all of the performance properties of the original Loctite® 242® and 262® products, plus more, to meet the ever-changing, ever-demanding industrial environments of today and tomorrow. The new formulas offer:
- High temperature performance able to withstand temperatures up to 360°F (182°C)
- Improved cure performance on oil-contaminated surfaces
- Cure without primer, even on inactive surfaces such as stainless steel

**High Temperature Products – Performance and Convenience**

**Loctite® 2422™ Threadlocker, High Temp, Medium Strength**
**Loctite® 2620™ Threadlocker, High Temp, High Strength**
New paste formula does not run or migrate, and withstands continuous exposure to temperatures up to 650°F (340°C). These products are conveniently packaged in syringes for easy dispensing. Disassembling Loctite® 2620™ Threadlocker, High Temp, High Strength requires heating to above 650°F (340°C) and disassembling while hot.

**Large Fastener Product – High Lubricity and High Strength**

**Loctite® 2047™ Threadlocker, High Lubricity and High Strength**
Designed for applications on fasteners over 7/8” in diameter, this threadlocker and its formula with increased lubricity allow proper clamp load to be achieved by reducing friction. In addition, its high strength property will ensure that clamp load is maintained when exposed to vibration. Standard threadlockers may not have sufficient lubricity on large fasteners to achieve ultimate clamp load.
### Key Factors

**Factors**

- **SOLVENT-REMOVABLE STRENGTH**
  - **WICKING**
  - **PLASTIC**
- **MIL-SPEC**
  - **LESS STRENGTH**
- **Primers Properties Chart**
  - **Semisolid Stick**
  - **Lubricity Large**
- **High Strength**
  - **Low Viscosity**
  - **Temperature/Can contact**
- **Loctite® Strongest**
  - **Processing**
  - **Large Bolts**
  - **High Lubricity Large Bolts**
- **Removable Strength**
  - **Working**
  - **Removable**
  - **High Temperature/Oil Tolerant**
  - **Plastic Fasteners**
  - **Processing equipment that can contact food**
- **ML-G-63**
  - **ML-G-63c**
- **N-60**
  - **N-60c**

### Key Features

**Purpose**

- **Small Screws under 1/4”**
- **High Lubricity**
- **Loctite® Strongest**
- **Processing equipment that can contact food**
- **ML-G-63**
- **N-60**

### Product Information

<table>
<thead>
<tr>
<th>PRODUCT ITEM NO.</th>
<th>PACKAGE TYPE &amp; SIZE</th>
<th>COLOR</th>
<th>TYPICAL USE</th>
<th>VISCOSITY (cp°F)</th>
<th>TORQUE in.-lbs. (break/pre-load)</th>
<th>TEMPERATURE RANGE</th>
<th>CURE SPEED (Steel @ 25°C)</th>
<th>AGENCY APPROVALS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Loctite® Threadlocker Properties Chart</strong></td>
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<td><strong>MIL-SPEC</strong></td>
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<td><strong>N-60</strong></td>
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<td><strong>7471® Primer T</strong></td>
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<td><strong>7449® Primer N</strong></td>
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<td><strong>7090®</strong></td>
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<tr>
<td><strong>Loctite® QuickStix® 7088® Primer®</strong></td>
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### Top choice product

- **9**

### Break loose Value

- See TDS for spindle and speed test measurement

### New designs

- **Top choice product**

### World availability

- **9**
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

For your local Loctite® Adhesives and Sealants Specialist, the nearest authorized Loctite® products distributor, to place an order, to arrange an in-plant seminar or for technical product assistance, call 1.800.LOCTITE (562.8483) in the U.S.A, or call 1.800.263.5043 within Canada.

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