



Threadlocking User's Guide

What You Need to Know to Ensure a Reliable Threaded Assembly



Excellence is our Passion

LOCTITE® Threadlocking Guide

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LOCTITE® THREADLOCKING INNOVATIONS

LOCTITE® THREADLOCKER PROPERTIES CHART



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.

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

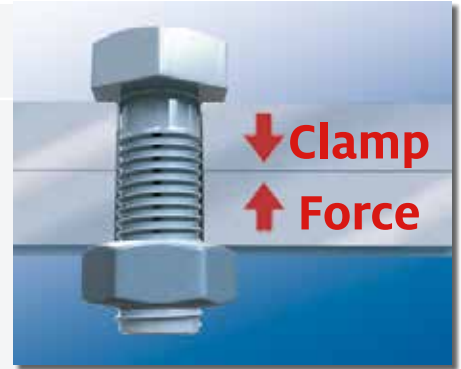
- Lock nuts and bolts against vibration and thermal expansion
- Seal against corrosion and leakage
- Reduce inventory costs
- Suitable for all shapes and sizes of fasteners
- Act as a thread lubricant
- Maintain critical adjustments of the assembly
- No on-torque adjustments needed
- High chemical resistance



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.



Parts tolerance.

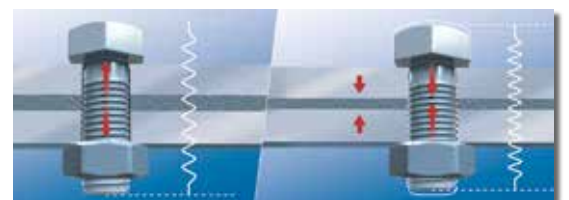
B. Vibration and side-to-side movement: These gaps allow the parts to move from side-to-side when exposed to vibration.



Vibration and loosening.

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.



Stretching of the bolt beyond its yield point and thermal expansion/contraction of parts lead to lack of structural rigidity and relaxation 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.



Tooth or ribbed flanged bolts

Prevent self-loosening, but are expensive; need larger flange-bearing surfaces and may damage the surfaces.



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).



Nylon nut

More expensive than a standard nut, nylon inserts increase friction, which results in inaccurate torque.

Why use LOCTITE® threadlockers?

LOCTITE® Benefits

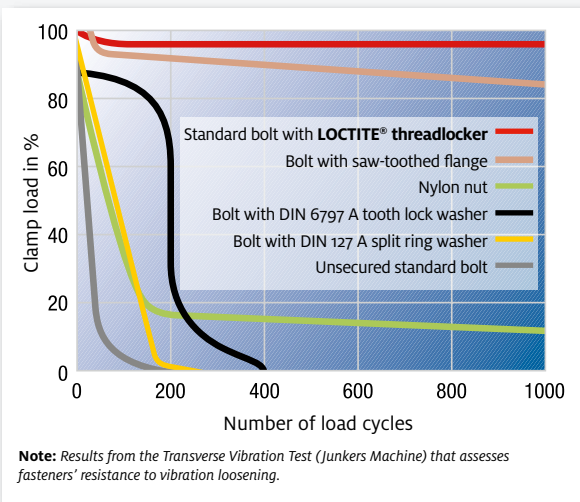
Better Performance

- **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

Fastener Size	Split Ring Washer 	LOCTITE® Threadlocker 
3/8"	2¢	2¢
5/8"	9¢	5¢
7/8"	25¢	7¢

Note: Washer pricing is based on 100 units purchased at an industrial distributor. LOCTITE® pricing is based on the price of a 50 ml bottle and the number of drops required per application.

LOCTITE® THREADLOCKING SOLUTIONS

How does a LOCTITE® threadlocker work?

Fill Gaps

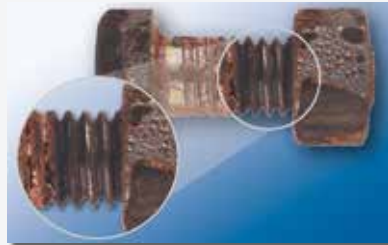
LOCTITE® threadlockers are single-component adhesives that cure in the absence of air and in contact with active metal to form a tough thermoset plastic. They completely fill all voids between the interfacing threads, which makes the assembly a unitized component and ultimately prevents loosening.



LOCTITE® threadlocker between the interfacing threads.

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.



Engagement area of rusty bolt that did NOT have LOCTITE® threadlocker applied.



Engagement area of rusty bolt that DID have LOCTITE® threadlocker applied.

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.

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 push-pull nozzle.



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. For more information, visit www.equipment.loctite.com.

LOCTITE® THREADLOCKING SOLUTIONS

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.



LOCTITE® 7088™ Primer Stick.

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.**



*Inactive Metals (Primers Recommended)			Active Metals (Primers Optional)	
Plated Parts	Zinc	Magnetite Steel	Iron	Manganese
Anodized Aluminum	Pure Aluminum	Inconel™	Plain Steel	Monel™
Titanium	Cadmium	Silver	Copper	Kovar™
Stainless Steel	Magnesium	Gold	Brass	
Galvanized Steel	Natural or Chemical Black Oxide		Bronze	

*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 $\lt; \frac{1}{4}$" (6 mm). Easy disassembly using hand tools.
- **Medium Strength:** Designed to be removable with standard hand tools on $\frac{1}{4}$ " to $\frac{3}{4}$ " fasteners.
- **High Strength:** Designed to deliver high strength on $\frac{1}{4}$ " to $\frac{3}{4}$ " (6 mm to 22 mm) fasteners. For removal, it may require localized heat (>550°F/260°C), hand tools and disassembly while hot.



Easy disassembly with hand tools when using low- and medium-strength formulas.

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.



Liquid.

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.



Semi-Solid.

Materials Being Assembled

- **All LOCTITE® threadlockers:** Metal-to-metal applications.
- **LOCTITE® 425™ Assure™:** Plastic-to-plastic, plastic-to-metal applications.



QuickTape®: pre-applied application.

HOW TO SELECT THE RIGHT LOCTITE® THREADLOCKER

Are the parts being assembled made from metal or plastic?

Plastic Assembly

Metal Assembly

Wicking Grade

Low Strength

What strength do you require?

What strength do you require?

High Lubricity – Black

Liquid Product

Low Strength – Blue

Medium / High Strength – Green

Medium Strength – Blue Paste

High Strength – Red Paste

High Strength – Liquid

Solution	LOCTITE® 425™ Assure™	LOCTITE® 220™ Threadlocker	LOCTITE® 290™ Threadlocker	LOCTITE® 2422™ Threadlocker	LOCTITE® 2620™ Threadlocker	LOCTITE® 2047™ Threadlocker
Fastener Size	Small fasteners	up to ¼"	#2 to ½"	½" to ¾"	½" to ¾"	> 7/8"
Cure Time ^a	1.5 min. / 24 hrs.	6 min. / 24 hrs.	20 min. / 24 hrs.	90 min. / 24 hrs.	30 min. / 24 hrs.	90 min. / 24 hrs.
Torque ^b (break/prevail)	4 / 2	85 / 170	90 / 260	102 / 12	161 / 10	204 ^{b1} / 35
Temp. ^c	180°F (80°C)	300°F (150°C)	300°F (150°C)	650°F (340°C)	650°F (340°C)	300°F (150°C)



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™ Threadlocker – Low 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™ 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™ Threadlocker – High Temp / Medium Strength

Recommended for locking fasteners that are exposed to temperatures up to 650°F (340°C). Removable with hand tools.

LOCTITE® 2620™ Threadlocker – High Temp / High Strength

Recommended for locking fasteners that are exposed to temperatures up to 650°F (340°C). Recommended for locking fasteners permanently.

LOCTITE® 2047™ Threadlocker – High Lubricity / High Strength

Recommended for fasteners over 7/8" (22 mm). Formulated with increased lubricity to reduce friction and allow proper clamp load to be achieved. Ideal for locking fasteners permanently.

^a CURE TIME (fixture time in min./full strength in hrs). Typical value @ 70°F (21°C) ^b TORQUE values in in.-lbs. (breakaway/prevaling torque) ^{b1} BREAKLOOSE VALUE ^c TEMPERATURE resistance for continuous service

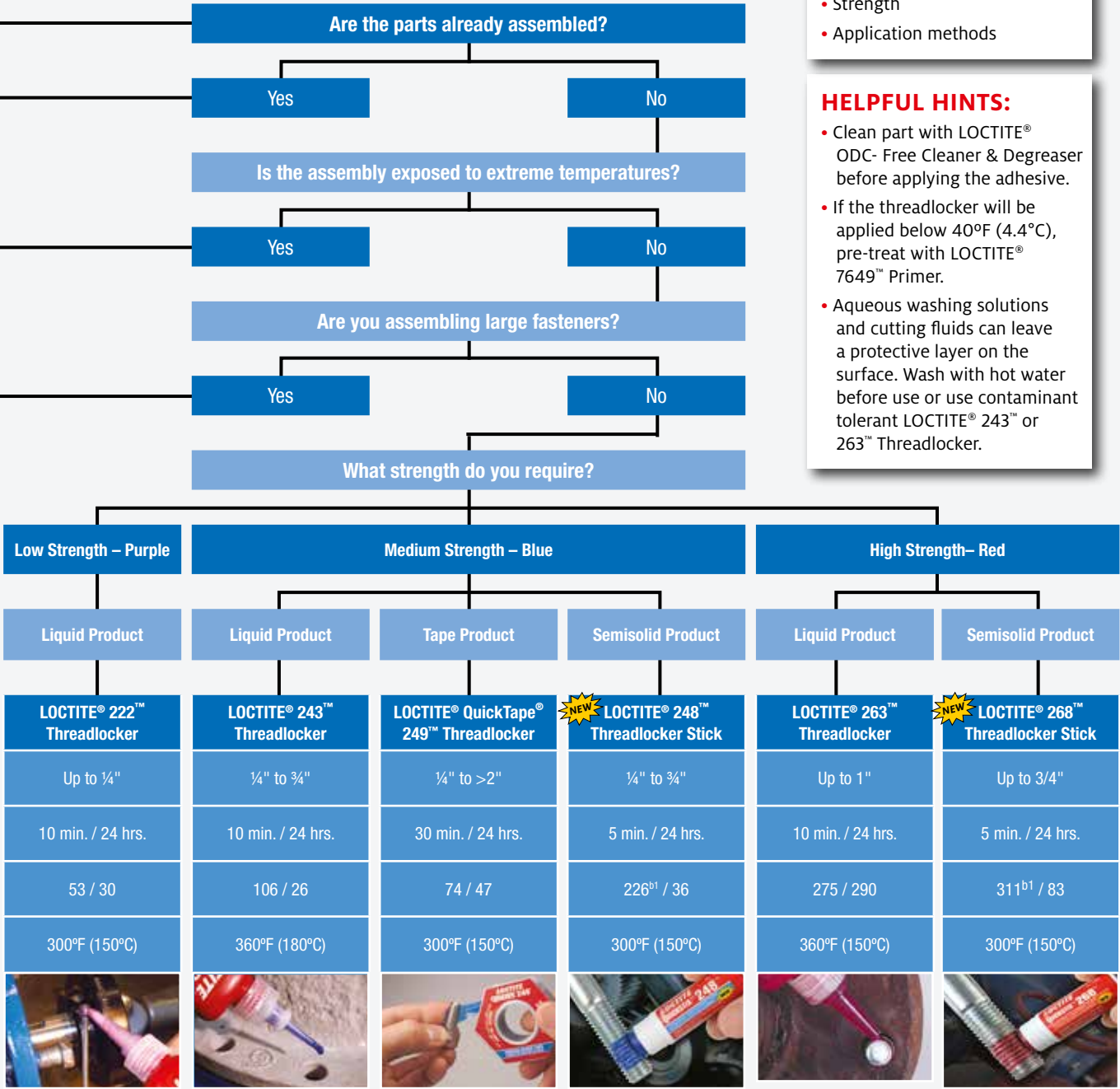
HOW TO SELECT THE RIGHT LOCTITE® THREADLOCKER

IMPORTANT! See page 6 for more information on:

- Primers and inactive metals
- Strength
- Application methods

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.
- Aqueous washing solutions and cutting fluids can leave a protective layer on the surface. Wash with hot water before use or use contaminant tolerant LOCTITE® 243™ or 263™ Threadlocker.



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 (S-46163A) 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 3/4" (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 reapplied for future assembly.

LOCTITE® 248™ Threadlocker Stick – Medium Strength/ Primerless
 Semisolid stick form is convenient, portable and great for hard-to-reach applications. General purpose threadlocker for fasteners between 1/4" and 3/4" (6mm to 19mm). New formula bonds through contaminants and cures on metal without primer. 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, anticorrosion and protection fluids. Rated for 360°F (180°C). Heat required for removal.

LOCTITE® 268™ Threadlocker Stick – High Strength/ Primerless
 Semisolid stick form is convenient, portable and great for hard-to-reach applications. Its high strength makes it well-suited for heavy-duty applications of threaded fasteners up to 3/4" (19mm). New formula bonds through contaminants and cures on metal without primer. Heat required for removal.

LOCTITE® THREADLOCKING INNOVATIONS

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. These 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



Semisolid and Tape Products – Versatility and Cleanliness

LOCTITE® 248™ Medium Strength Stick ★ NEW LOCTITE® 268™ High Strength Stick ★ NEW

No mess, easy to apply and pocket-friendly. Ideal for overhead and pre-dispensed applications. Upgraded formula to provide enhanced performance properties, just like the advanced LOCTITE® 243™ and 263™ products:

- Improved cure performance on oil-contaminated surfaces
- Cure without primer, even on inactive surfaces such as stainless steel



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!



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" (22 mm) 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.



LOCTITE® THREADLOCKER PROPERTIES CHART

KEY FACTORS	KEY FEATURES	PRODUCT	ITEM NUMBER	PACKAGE TYPE & SIZE	COLOR	TYPICAL USE	VISCOSITY (cP)†	TORQUE‡ in.-lbs. (break/prevail)	TEMP. RANGE	CURE SPEED (STEEL @ 25°C)	AGENCY APPROVALS				
LOW STRENGTH	Small Fasteners	222™	21463	10 ml bottle	Purple	Small screws under 1/4"	1,200/5,000 Thixotropic	53/30	-65°F to 300°F	Fixture – 10 min. Full – 24 hrs.	N/A				
			21464	50 ml bottle											
REMOVABLE STRENGTH	General Purpose/Primerless	243™	1330255	0.5 ml capsule	Blue	1/4" to 3/4" bolts, primerless, medium strength	1,300/3,000 Thixotropic	106/26	-65°F to 360°F	Fixture – 10 min. Full – 24 hrs.	NSF™/ANSI 61, CFIA Listed				
			1329837	10 ml bottle											
			1329467	50 ml bottle											
			1329505	250 ml bottle											
			1330333	1 liter bottle											
REMOVABLE STRENGTH	General Purpose Tape	QuickTape® 249™	1372603	260" Roll	Blue	Removable strength, 1/4" to > 2", pre-applied	Tape	74/47	-65°F to 300°F	Fixture – 30 min. Full – 24 hrs.	CFIA				
			General Purpose Semisolid Stick	248™								37684	9 g stick		
												37087	19 g stick		
												High Temperature	246™	29513	10 ml bottle
														29514	50 ml bottle
29515	250 ml bottle														
Ultra-High Temperature	2422™	1134601	30 g syringe												
		1134602	300 g cartridge												
HIGH STRENGTH	General Purpose/Primerless	263™	1330582	0.5 ml capsule	Red	Primerless, high strength	400/600	275/290	-65°F to 360°F	Fixture – 10 min. Full – 24 hrs.	NSF™/ANSI 61, CFIA				
			1330583	10 ml bottle											
			1330585	50 ml bottle											
			1330335	250 ml bottle											
			1330334	1 liter bottle											
			HIGH STRENGTH	General Purpose Semisolid Stick								268™	37685	9 g stick	
37686	19 g stick														
High Temperature	272™	27240			50 ml bottle										
		27270			250 ml bottle										
27285	1 liter bottle														
Ultra-High Temperature	2620™	1138282	30 g syringe												
HIGH STRENGTH	Large Bolts	277™	21434	10 ml bottle											
			27731	50 ml bottle											
			27741	250 ml bottle											
27743	1 liter bottle														
HIGH STRENGTH	High Lubricity Large Bolts	2047™	1134607	50 ml bottle	Black	Large bolts > 7/8". High lubricity allows proper clamp load to be achieved	2,000/12,000 Thixotropic	375/80	300°F	Fixture – 90 min. Full – 24 hrs.	N/A				
WICKING	Low Strength	220™	37388	10 ml bottle	Blue	Wicking grade for small, pre-assembled fasteners under 1/4"	20	85/170	-65°F to 300°F	Fixture – 6 min. Full – 24 hrs.	MIL-S-46163A for existing designs, ASTM D-5363**, CFIA				
			39186	50 ml bottle											
22041	250 ml bottle														
WICKING	General Purpose	290™	29005	0.5 ml capsule	Green	Medium/high strength. Wicking grade for pre-assembled parts	25/55	90/260	-65°F to 300°F	Fixture – 20 min. Full – 24 hrs.	MIL-S-46163A for existing designs, ASTM D-5363**, NSF™/ANSI 61, NSF™ P1, CFIA				
			29021	10 ml bottle											
			29031	50 ml bottle											
			29041	250 ml bottle											
			29043	1 liter bottle											
PLASTIC	Plastic Fasteners	425™ Assure™	42540	20 g bottle	Blue	For small metal and plastic fasteners and tamper-proofing	80	4/2	-65°F to 180°F	Fixture – 1.5 min. Full – 24 hrs.	N/A				
42561	1 lb. bottle														
FOOD COMPLIANT	Processing Equipment That Can Contact Food	2046™	1186840	12 ml syringe	Blue	Strengthening/coupling agent for joints on equipment			-65°F to 400°F	Fixture – 90 min. Full Cure – 24 hrs.	FDA 21 C.F.R. 175.300				
LOW HALOGEN/LOW SULFUR	Use in nuclear facilities	2432	25523	50 ml bottle	Blue	For use on sensitive metals, like titanium	300	150/53 (black oxide steel nuts/bolts)	-65°F to 300°F	Fixture – 30 min. Full – 24 hrs.	N/A				
ENHANCED HEALTH & SAFETY	Removable Strength	2400 NA	1526121	50 ml bottle	Blue	General-purpose for 1/4" to 3/4" bolts	3,070 Thixotropic	160/20	-65°F to 300°F	Fixture – 5 min. Full – 24 hrs.	N/A				
			1526122	250 ml bottle											
ENHANCED HEALTH & SAFETY	High Strength	2700 NA	1526123	50 ml bottle	Red	High strength up to 3/4" bolts	5,000 Thixotropic	300/265	-65°F to 300°F	Fixture – 5 min. Full – 24 hrs.	N/A				
			1526565	250 ml bottle											
MIL-SPEC	Small Fasteners	222MS™	22205	0.5 ml capsule	Purple	Low Strength, small screws under 1/4"	1,200/5,000 Thixotropic	53/30	-65°F to 300°F	Fixture – 10 min. Full – 24 hrs.	MIL-S-46163A for existing designs. ASTM D-5363**, NSF™ P1, CFIA				
			22221	10 ml bottle											
			22231	50 ml bottle											
			22241	250 ml bottle											
MIL-SPEC	Removable Strength	242®	24205	0.5 ml capsule	Blue	Medium Strength, 1/4" to 3/4" bolts	1,200/5,000 Thixotropic	110/43	-65°F to 300°F	Fixture – 5 min. Full – 24 hrs.	MIL-S-46163A for existing designs. ASTM D-5363**, NSF™ P1, ABS™, CFIA NSF™/ANSI 61				
			24221	10 ml bottle											
			24231	50 ml bottle											
			24241	250 ml bottle											
MIL-SPEC	High Strength	262™	26205	0.5 ml capsule	Red	High Strength, up to 3/4" bolts	1,800/5,000 Thixotropic	189/275	-65°F to 300°F	Fixture – 10 min. Full – 24 hrs.	MIL-S-46163A for existing designs. ASTM D-5363**, NSF™ P1, ABS™, CFIA				
			26221	10 ml bottle											
			26231	50 ml bottle											
			26241	250 ml bottle											
MIL-SPEC	Low Viscosity	271™	27105	0.5 ml capsule	Red	High strength for fasteners up to 1" diameter	500	250/275	-65°F to 300°F	Fixture – 10 min. Full – 24 hrs.	MIL-S-46163A for existing designs. ASTM D-5363**, UL™ Classified for U.S., CFIA				
			27121	10 ml bottle											
			27131	50 ml bottle											
			27141	250 ml bottle											

*Breakloose value †See TDS for spindle and speed test measurement **For new designs Top choice product

LOCTITE® Primers Properties Chart

‡M10 and/or 3/8 x 16 steel fasteners Worldwide availability

	PRODUCT	ITEM NO.	PACKAGE TYPE & SIZE	PHYSICAL PROPERTY	ON-PART LIFE	DRY TIME	AGENCY APPROVALS
SOLVENT-BASED	7649™ Primer	19269 38402 21347 21348 19266	1.75 fl. oz. glass bottle 1.75 fl. oz. aluminum bottle 25 g net wt. aerosol can 4.5 oz. net wt. aerosol can 1 gallon can	Liquid	30 days	30 to 70 seconds	MIL-S-22473E for existing designs, ASTM D-5363 for new designs, NSF™/ANSI 61, NSF™ P1, CFIA
SOLVENT-LESS	7088™ Primer Stick	1069258	17 g stick	Semisolid	30 days	–	–



U.S.A.

Henkel Corporation
One Henkel Way
Rocky Hill, CT 06067
Tel: 866.781.4601
Tel: 860.571.5100
henkelna.com/industrial

Canada

Henkel Canada Corporation
2515 Meadowpine Blvd.
Mississauga, Ontario L5N 6C3
Tel: 1.800.263.5043 (within Canada)
Tel: 905.814.6511
Fax: 905.814.5391

www.henkelna.com/threadlockers