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What Is a Retaining Compound?

Retaining Compounds are adhesives used to secure bearings, bushings, gears and cylindrical parts onto housings or shafts. The first retaining compound was introduced in 1963. Throughout the years, as technical advancements were made, manufacturing and maintenance engineers discovered and adopted LOCTITE® anaerobic retaining technology to replace conventional mechanical retaining methods.

Why Use a LOCTITE® Retaining Compound?

LOCTITE® Retaining Compounds, when cured, fill the inner space between components to provide a physical and chemical barrier that enables the elimination of fretting corrosion, oxidation and galvanic corrosion. By filling surface irregularities and clearance gaps with a very hard resin, the area of surface contact is increased while the distribution of stress is improved.

LOCTITE® Retaining Compounds also increase the reliability of the joint regardless of the machining tolerances and cure to form a strong precision assembly. They help achieve maximum load transmission capability and uniform stress distribution. In addition, equipment downtime is reduced and part life is increased.

Applied as a liquid or paste, they form 100% contact between mating metal surfaces, eliminating the need for time-consuming machining, the use of mechanical fastening methods or expensive replacement parts.
Retaining Compounds vs. Mechanical Retainers

LOCTITE® Retaining Compounds offer many distinct advantages over conventional assembly methods:

- High-strength products can carry high loads.
- Because there is 100% contact, load and stress is distributed evenly over the joint.
- All voids are filled, which prevents corrosion and fretting.

When used in combination with interference fits, LOCTITE® Retaining Compounds allow:

- Higher load transmission and better performance with existing designs and geometry.
- Equal performance with relaxed tolerances.
- Reductions in the size and weight of an assembly.

LOCTITE® Retaining Compounds are Superior to Conventional Assembly Methods, including:

Interference fits (press fits or shrink fits) and taper fits

These rely on friction alone to transmit torque; therefore, they are limited by material, surfaces and design. Close tolerances are needed to obtain specific load capacities, leading to higher production costs. Interference fitting creates stresses in the components that can lead to failure, particularly when combined with operational stresses.

Keyway and spline assemblies

These cause high stresses due to the “notch effect” that occurs. Splines can also result in high machining costs and backlash between drive and overrun.

Welding and soldering

Only compatible metals can be joined, and the parts can be distorted by the high temperatures required. Heating of the material can lead to residual stresses and structural degradation and distortion. Disassembly can also be difficult or impossible.
**Cost Benefits**

**LOCTITE® Retaining Compounds:**
- Reduce or eliminate expensive machining operations.
- Eliminate some surface finishing requirements.
- Prolong equipment life through better fatigue and corrosion resistance.
- Fill gaps so machining tolerances can be widened.
- Help lower overall assembly and maintenance costs.
- Simplify assemblies by reducing use of circlips, keys, dowels or threads.
- Can eliminate the need for mechanical retainers.
- Minimize machine downtime ensuring an earlier return to service.

**Performance Benefits**

**LOCTITE® Retaining Compounds:**
- Increase assembly reliability.
- Produce more accurate, rigid assemblies.
- Eliminate backlash in keys and splines.
- Prevent small diameter shaft distortion.
- Increase strength of heavy press fits.
- Eliminate fretting corrosion.
- Seal against environmental corrosion.
- Eliminate high assembly stresses.
- Reduce variations in load transmission.
- Allow dissimilar materials to be assembled more easily.

**Relative Production Costs**

<table>
<thead>
<tr>
<th></th>
<th>Cost Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonded</td>
<td>0.8</td>
</tr>
<tr>
<td>Bonded Interference*</td>
<td>0.9</td>
</tr>
<tr>
<td>Interference Fit</td>
<td>1.0</td>
</tr>
<tr>
<td>Keyed Fit</td>
<td>3.7</td>
</tr>
<tr>
<td>Splined Shaft</td>
<td>5.0</td>
</tr>
</tbody>
</table>

* Bonded Interference takes advantage of wider tolerances and relaxed surface roughness.

Cost is always an essential part of the selection process. When LOCTITE® Retaining Compounds are used, considerable cost benefits result.

Typical interference fit has 30% metal-to-metal contact.

LOCTITE® Retaining Compounds fill air voids, resulting in unitized, more reliable assembly.
### Engineering Considerations

#### Comparing Assembly Methods

**Interference fit (press fit or shrink fit)**

**Limitations:**
- Requires finely finished surfaces.
- Closer tolerances.
- Stronger and more resistant material.
- Oversize ring.

**Bonded with LOCTITE® Retaining Compound**

**Limitations:**
- Clearance fit does not guarantee alignment.
- Temperature limits may apply.

**Keyway**

**Limitations:**
- Requires finely finished surfaces.
- Closer tolerances.
- Axial connection.
- Keyway in shaft and key.
- Oversized shaft.

**Splined Assembly**

**Limitations:**
- Requires finely finished surfaces.
- Closer tolerances.
- Axial connection.
- Surface heat treatment (case hardening).
- Machining of multiple splines.

#### Performance Improvements

**Shrink fit improvement.**

**Press fit improvement.**
A bonded slip fit replaced an interference fit of a brushless motor. The new design enhances overall strength of the assembly, while allowing relaxed tolerances, reducing part costs, simplifying alignment and reducing stress.

Surface finish is an important cost factor in time and material (grinding). LOCTITE® products do not need a highly finished surface as they wet and fill irregularities.

The cost of machining decreases rapidly when tolerances are widened; these examples refer to a shaft and its bore. LOCTITE® products are effective over a very wide range of fits.
Calculation of Bonded Slip Fits and Press or Shrink Fits Augmented with Adhesive Bonding.

Henkel has developed an extensive library of data on the adhesive performance of retaining compounds. This data has been consolidated to provide predictive tools that can be used to estimate the load capacity of bonded slip fit and press or shrink-fit joints augmented with adhesive bonding.

These calculations can be performed by trained Henkel staff using our proprietary RetCalc+ software, created specifically for retaining applications. The following explains these calculations and applies them to a practical example.

The strength of a bonded joint and the torque that can be transmitted are calculated with the following equations. The strength of a press or shrink fit, augmented with adhesive bonding, is the sum of the strength calculated for the bonded joint plus the strength value of the press or shrink-fit joint without adhesive bonding.

Axial Load = \( \frac{\pi \times \text{diameter} \times \text{length} \times \text{RC strength} \times f_{\text{total}}}{1000} \) (in N)

Torque = \( \frac{\pi \times \text{diameter}^2 \times \text{length} \times \text{RC strength} \times f_{\text{total}}}{2000} \) (in N-m)

Key

RC strength is the compressive shear strength of the retaining compound in N/mm² measured in accordance with ISO 10123. This value is reported on the Technical Data Sheet for each retaining compound.

\( f_{\text{total}} \) represents the sum of these Joint Design and Retaining Compound factors.

Joint Design Factors

- \( f_1 \) = Type of joint
- \( f_2 \) = Materials
- \( f_3 \) = Clearance
- \( f_4 \) = Surface finish
- \( f_5 \) = Engagement ratio
- \( f_6 \) = Load

Retaining Compound Factors

- \( f_7 \) = Cure method
- \( f_8 \) = Operating temperature
- \( f_9 \) = Operating environment
Fitting a Gear to a Clutch Plate

This assembly is made in two parts in order to permit cutting of the gear teeth. The original design required positioning three dowels equally spaced on the joint between the two contacting surfaces to transmit the torque, since the wall thickness was too small to accommodate a keyway. The gear wheel has helicoidal teeth, and is subjected to different tangential and axial loads, depending on the direction of rotation, but the torque load never exceeds 18 N·m (159 in.-lb.). As torque transmission was the driving design factor, calculations only concern this load.

The dowels used present many disadvantages, causing distortion and rejected assemblies due to the thinness of the parts. LOCTITE® 648™ was suggested to replace the dowel pins, to simplify the assembly process and improve quality.

Dimensions of the bonded surface between the steel gear and the cast iron clutch:

Component Factors
Diameter = 32 mm
Engagement length = 15 mm
RC Strength = LOCTITE® 648™ has a strength of 29 N/mm²

Joint Design Factors
f₁ = 1.0 for bonded slip fit
f₂ = 0.8 for cast iron
f₃ = 1.0 for a clearance of 0.025 mm
f₄ = 1.0 for surface finish
f₅ = 0.7 for a L/D ratio of 0.5 and a shaft diameter of 32 mm
f₆ = 0.5 for alternating movement

Adhesive Design Factors
f₇ = 1.0 for room temperature cure (no activator)
f₈ = 1.3 for 150°C operating temperature
f₉ = 1.0 for ambient air operating environment

The sum of the joint design and adhesive design factors is

\[ f_{\text{total}} = f₁ \times f₂ \times f₃ \times f₄ \times f₅ \times f₆ \times f₇ \times f₈ \times f₉ = 0.36 \]

Substituting these values in the formula:

\[ T = \frac{\pi \times \text{diameter}^2 \times \text{length} \times \text{RC strength} \times f_{\text{total}}}{2000} \]

\[ T = \frac{\pi \times (32)^2 \times 15 \times 29 \times 0.36}{2000} = 252 \, \text{N·m} \, (2230 \, \text{in.-lbs.}) \]
Joint Design

Type of Joint

FACTOR 1

This factor accounts for the joint configuration. The RC strength reported on the Technical Data Sheet is representative of a bonded slip-fit joint. This factor accounts for the effective strength contribution for press and shrink-fit joints.

Materials

FACTOR 2

The shear strength given for LOCTITE® Retaining Compounds are measured using steel pins and collars. The $f_2$ factor varies with other metals, alloys and coatings as shown in this table. When dissimilar materials are joined, use the lower number in the equation.

Clearance

FACTOR 3

The best performance for slip fits is achieved using clearances between 0.025 mm and 0.075 mm (0.001 in. and 0.003 in.), or with interference fits. Performance is reduced as the clearance is increased.

Bonded slip fit replaces the costly, time-consuming, brazing process on industrial radiator heat exchanger tubes. Once the tubes are inserted using a slip fit, LOCTITE® Retaining Compound is applied to their outer diameter, and they are expanded into the tube sheet. The new process is more reliable, faster, and does not require specialized labor.
Surface Finish

FACTOR 4

Retaining compounds benefit from a certain degree of surface roughness 1.6 to 3.2 μm Ra. Smoother surfaces will lower adhesive performance and rougher surfaces have the risk of misalignment when assembled. Note that the $f_4$ factor only applies to axial loads and not torque. Use 1.0 for torque calculation.

Ratio of Engagement

FACTOR 5

The adhesive strength of a retaining compound gains limited benefit from increases in engagement length. As illustrated in the adjacent chart, this correction factor is more pronounced in smaller shafts and becomes negligible in shafts greater than 100 mm (4 in.) in diameter.

Load

FACTOR 6

As with any cylindrical assembly, the retaining compounds are affected by the magnitude and severity of alternating loads. The adjacent table illustrates the effect that different reversing loads can have on the adhesive strength.

To offer unquestionable safety and reliability, the bearings and bushings on the Prosthetic Moto Knee and Versa Foot must stay in place. With no seats or shoulders to stop bushings from sliding in and out, LOCTITE® Retaining Compound secures the bushings and keeps the stainless steel bearings in place, while evenly distributing load and stress. Retaining compound seals the bearing seats, prevents corrosion and erosion of the fit and locks the components in place.
**Cure Method**

**FACTOR 7**

The compressive shear strength reported for each retaining compound is determined from test specimens cured at room temperature (22°C). Activators can be used to accelerate the adhesive cure. The effect of the activator on cure speed and ultimate strength is reported on the Technical Data Sheet (TDS) for each retaining compound. For illustration, the factor in this chart relates to the TDS for LOCTITE® Retaining Compound 648™.

<table>
<thead>
<tr>
<th>Cure Method</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room Temperature Cure (no activator)</td>
<td>1.0</td>
</tr>
<tr>
<td>LOCTITE® 7649™ Activator</td>
<td>0.4</td>
</tr>
<tr>
<td>LOCTITE® 7471™ Activator</td>
<td>0.8</td>
</tr>
<tr>
<td>LOCTITE® 7091™ Activator</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**Operating Temperature**

**FACTOR 8**

Anaerobic adhesives cure to form a thermoset polymer. Increases in temperature will have a measurable effect on the strength of the polymer. It is important to select a product that is suitable for the service temperature of the application. These “Heat Aging” effects are reported on the TDS for each retaining compound. For illustration, this chart is an extract of Heat Aging values reported on the TDS for several products.

<table>
<thead>
<tr>
<th>Operating Temperature (in °C)</th>
<th>22</th>
<th>120</th>
<th>150</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCTITE® 620™</td>
<td>1.0</td>
<td>2.0</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>LOCTITE® 638™</td>
<td>1.0</td>
<td>1.7</td>
<td>1.2</td>
<td>0.4</td>
</tr>
<tr>
<td>LOCTITE® 641™</td>
<td>1.0</td>
<td>0.7</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>LOCTITE® 648™</td>
<td>1.0</td>
<td>1.4</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>LOCTITE® 660™</td>
<td>1.0</td>
<td>1.5</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>LOCTITE® 680™</td>
<td>1.0</td>
<td>1.6</td>
<td>1.5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**Operating Environment**

**FACTOR 9**

The compressive shear strength reported for each retaining compound is determined from test specimens exposed to ambient air. The effect of chemical and solvent immersion on strength is reported on the TDS for each retaining compound. For illustration, the “Chemical/Solvent Resistance” values in this chart were extracted from the TDS for LOCTITE® Retaining Compound 648™.

<table>
<thead>
<tr>
<th>Operating Environment</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetone</td>
<td>1.0</td>
</tr>
<tr>
<td>Ambient Air</td>
<td>1.0</td>
</tr>
<tr>
<td>B100 Bio-Diesel</td>
<td>1.0</td>
</tr>
<tr>
<td>Brake fluid</td>
<td>1.2</td>
</tr>
<tr>
<td>DEF</td>
<td>1.0</td>
</tr>
<tr>
<td>Ethanol</td>
<td>1.2</td>
</tr>
<tr>
<td>Motor Oil</td>
<td>1.4</td>
</tr>
<tr>
<td>Phosphoric Acid 10%</td>
<td>0.3</td>
</tr>
<tr>
<td>Sodium Hydroxide 20%</td>
<td>0.9</td>
</tr>
<tr>
<td>Unleaded fuel</td>
<td>1.0</td>
</tr>
<tr>
<td>Water 50%/glycol 50%</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Fitting Bearings

The performance provided by LOCTITE® Retaining Compounds makes them particularly suitable for fitting bearings. LOCTITE® Retaining Compounds have very high compression strength, and prevent fretting corrosion. Retaining compounds are available in removable strengths for easier assembly.

- Locking rings and circlips can be removed, eliminating costly shaft grooving and difficult assembly.
- Stepped diameters can be reduced by eliminating the need for shoulders to locate bearings.
- Improved bearing alignment can be achieved by compensating for surface imperfections.
- The assembly is sealed against the environment, eliminating fretting and galvanic corrosion.
- Assembly can be simplified by the easing of tolerances.

Wear Parts, Self-Lubricating Bushings and Inserts

Wear rings, liners, shrink rings (of any thickness), tubular connectors, inserts, plugs and self-lubricating sintered bushings can be assembled using retaining compounds such as LOCTITE® 638™ or LOCTITE® 648™. Choice of retaining compound will depend upon operating conditions and whether the assembly must be dismantled.

In many cases — engine cylinder liners, pump, drill and bronze bushings — a press is used to fit bushings, a procedure that requires additional machining due to the elastic deformation of the parts. In addition to increasing costs, if too much rework is done, there is a risk of weakening the quality of the fit. Also, by reducing wall thickness, stress and the risk of potential assembly failure is increased. These problems can be eliminated by assembling bushings and liners using a bonded slip-fit.

Fitting Non-Metallic Parts

Many parts made from molded materials are now used in assemblies for various reasons: cost reduction, appearance, improved resistance to wear or to achieve increased flexibility. Examples include: handles, hand-wheels, control buttons, nylon rings and bushings, gears and friction washers. LOCTITE® Retaining Compounds can be used to assemble these items to metal parts or to strengthen assemblies which are often weak due to their flexibility or fragility. LOCTITE® Retaining Compounds can also be used where it may be difficult to obtain a sufficiently accurate fit.

LOCTITE® Retaining Compounds cure in the absence of air and by the catalytic effect of the metal. To improve cure time with non-metallic parts, LOCTITE® Activator may be used to treat the surfaces before applying the adhesive. Plastic components need to be tested to ensure retaining compound or activator does not stress crack the component.
Get the most from LOCTITE® Retaining Compounds

From single repairs to daily production line use, these guidelines will help you maximize the benefits of using LOCTITE® Retaining Compounds:

Surface Cleanliness: Optimal performance is achieved when parts are clean and free of grease, oil, rust preventative or other contaminants. LOCTITE® ODC Free Cleaner & Degreaser is one of the recommended cleaners that will effectively remove contaminants without leaving a residue. LOCTITE® Retaining Compounds 638™, 648™ and 680™ are oil tolerant. They are robust enough to bond through contaminants including oils, and cutting and corrosion protecting fluids.

Surface Finish: One component of joint strength is dependent on a mechanical interlock with the roughness of the metal surfaces. A surface roughness of 1.6 to 3.2 μmRa, equivalent to a steel surface abraded with emery cloth, is recommended. A smoother finish will reduce mechanical interlock and correspondingly reduce the maximum achievable strength of the bonded joint.

Materials: LOCTITE® Retaining Compounds are designed for bonding cylindrical metal components. They are also used to assemble cylindrical metal and plastic component combinations. Plastic components need to be tested to ensure retaining compound or activator does not stress crack the component.

Joint Gap: LOCTITE® Retaining Compounds are versatile. They are recommended for gaps ranging from zero (interference fit) to 0.5 mm (0.02 in.) diametrical. Optimal bond strength is typically achieved at a diametrical bond gap of 0.075 mm (0.003 in.) or less. Total strength decreases as diametrical gap is increased.

Application Process: Use an application method that ensures the bond-line is filled. Excess material should be avoided because it could migrate. Several proven methods to control the amount applied, ranging from manual to automated:

- Roll bearing on a synthetic sponge saturated with LOCTITE® Retaining Compound to apply a consistent thin film.
- Manually apply LOCTITE® Retaining Compound with a LOCTITE® Hand Pump. Each squeeze of the trigger dispenses a metered amount of adhesive to the parts prior to assembly.
- Use the LOCTITE® Semiautomatic applicator to dispense a metered amount of adhesive to a predefined dispoint point.
- Use the LOCTITE® RotoSpray™ applicator to automatically dispense a precise band of adhesive to the bore of a circular component.

The LOCTITE® RotoSpray™ applicator automatically dispenses a perfect bead of retaining compound within the bore of circular components.
**Cure Process:** LOCTITE® Retaining Compounds have an anaerobic cure system. Anaerobic means it cures in the absence of air and in the presence of metal ions. This is why the resin remains liquid until it is confined between metal parts. Cure speed is influenced by:

- **Gap:** The thinner the gap the faster the cure.
- **Temperature:** Lower temperature slows cure speed. Higher temperature accelerates cure speed.
- **Materials:** Cure is faster when one or both metals oxidize, like steel and copper, and slower on metal surfaces that don’t oxidize, like chrome plate or stainless steel.
- **Product history:** Older products cure slower than newer products. Consult the Product’s Technical Data Sheet for detailed speed of cure curves.

**Bond Strength:** Cure speed can be accelerated with the application of LOCTITE® Activator before parts are assembled, or by applying heat up to 120°C (248°F). Heat will usually increase the ultimate bond strength. Activator will usually decrease the ultimate bond strength.

**Disassembly:** Bearings assembled with LOCTITE® Retaining Compound can be disassembled with industry standard bearing disassembly tools and techniques, including bearing pullers and hydraulic presses. Another technique is to heat the parts well above the service temperature [to 250°C (482°F) for most products] and disassemble while the parts are hot.

**Application Notes**

**On large air bearings, steel inserts are bonded to the steel bearing surface using LOCTITE® Retaining Compound. Bonding eliminates spot welding and the extra cleaning step to remove oxides from the surface, making the assembly process simpler, faster, and safer, lowering overall production costs.**

**Using a bearing puller to remove old bearings helps prevent shaft damage, e.g. gouging. Retaining compounds, however, will fill any scratches or gaps between mating surfaces.**
# Choosing a LOCTITE® Retaining Compound

## Solution

- Increase the shear strength of cylindrical, non-threaded assemblies
- An industry standard for assembling press- and slip-fitted parts
- Fill the “inner space” between components and cure to form a strong precision assembly
- Formulated in a variety of viscosities, gap fills, flexibility and strength characteristics
- Can be applied with automated process equipment or dispensed manually

## Your Application

- **Is Assembly Badly Worn?**
  - Yes: Gaps up to 0.5 mm (0.020 in.) with Activator
  - No: Gaps up to 0.25 mm (0.010 in.)

- **What Strength is Required?**
  - High
  - Medium

- **What Service Temperature is Required?**
  - Up to 180°C (355°F)
  - Up to 230°C (450°F)

- **Gap 0.15 mm (0.006 in.)**
- **Gap 0.25 mm (0.010 in.)**
- **Gap 0.5 mm (0.020 in.)**

## Product Description

### NEW LOCTITE® 648™ Retaining Compound

**General Purpose/High Strength/Rapid Cure**

Best performance for clearance or interference fit parts. Excellent performance for dynamic, axial and radial loads. Bonds through contaminants including oils, cutting and corrosion protection fluids. Cures on metals without an activator. Globally available product. NSF/ANSI 61-Certified

**P/N** | **Package Size**
---|---
1844699 | 0.5 ml capsule
1835822 | 10 ml bottle
1835820 | 50 ml bottle
1835818 | 250 ml bottle
1865917 | 1 liter bottle

### NEW LOCTITE® 638™ Retaining Compound

**Slip Fit/High Strength**

Recommended for slip fit parts with larger gaps. Excellent performance for dynamic, axial and radial loads. Bonds through contaminants including oils, cutting and corrosion protection fluids. Cures on metals without an activator. Globally available product. NSF P1-Certified

**P/N** | **Package Size**
---|---
1835937 | 10 ml bottle
1835936 | 50 ml bottle
1835925 | 250 ml bottle
1835924 | 1 liter bottle

### LOCTITE® 620™ Retaining Compound

**Slip Fit/High Temperature**

Recommended for high temperature retaining of parts with a clearance or interference fit, i.e., retaining bushings, bearings, seals, fans and liners. Requires heat cure to achieve temperature resistance. ABS-Approved.

**P/N** | **Package Size**
---|---
62005 | 0.5 ml bottle
62015 | 10 ml bottle
62040 | 50 ml bottle
62070 | 250 ml bottle
62085 | 1 liter bottle

### LOCTITE® 641™ Retaining Compound

A controlled-strength retaining compound that is ideal for cylindrical parts that require disassembly. CFIA-Approved.

**P/N** | **Package Size**
---|---
66010 | 6 ml tube
66040 | 60 ml tube

### LOCTITE® 660™ Retaining Compound

Used for repairing worn coaxial parts without remachining; enables reuse of worn bearing seats, keys, splines, tapers or for retaining shims. CFIA-Approved.
## Retaining Compounds

<table>
<thead>
<tr>
<th>LOCTITE® PRODUCT</th>
<th>Item Number</th>
<th>Package Type &amp; Size</th>
<th>Typical Use</th>
<th>Color</th>
<th>Maximum Gap Fill Diameter (mm)</th>
<th>Viscosity (CP)</th>
<th>Shear Strength Steel/Steel (psi)</th>
<th>Temperature Range</th>
<th>Cure Speed*</th>
<th>Recommended Activator</th>
<th>Agency Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>609™ NEW 648**</td>
<td>60905</td>
<td>0.5 ml capsule</td>
<td>Augments press fit parts</td>
<td>Green</td>
<td>0.15 mm (0.006&quot;)</td>
<td>125</td>
<td>-54°C to 150°C (-65°F to 300°F)</td>
<td>Fixture – 10 min. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>MIL-R-46082B for existing designs, ASTM D-5363**, CFIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60921</td>
<td>10 ml bottle</td>
<td>High strength, primerless; oil tolerant, general purpose</td>
<td>Green</td>
<td>0.15 mm (0.006&quot;)</td>
<td>500</td>
<td>-54°C to 180°C (-65°F to 355°F)</td>
<td>Fixture – 3 min. Full – 24 hrs.</td>
<td>Not required</td>
<td>NSF/ANSI 61, CFIA</td>
<td></td>
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<tr>
<td></td>
<td>60931</td>
<td>50 ml bottle</td>
<td>High strength, primerless, oil tolerant, for slip-fitted parts</td>
<td>Green</td>
<td>0.25 mm (0.010&quot;)</td>
<td>2,500</td>
<td>-54°C to 180°C (-65°F to 355°F)</td>
<td>Fixture – 4 min. Full – 24 hrs.</td>
<td>Not required</td>
<td>NSF P1, CFIA</td>
<td></td>
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<td></td>
<td>60941</td>
<td>250 ml bottle</td>
<td>High strength, primerless, oil tolerant, for slip-fitted parts</td>
<td>Green</td>
<td>0.38 mm (0.015&quot;)</td>
<td>1,250</td>
<td>-54°C to 180°C (-65°F to 355°F)</td>
<td>Fixture – 4 min. Full – 24 hrs.</td>
<td>Not required</td>
<td>NSF/ANSI 61, ABS, CFIA</td>
<td></td>
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<td>60943</td>
<td>1 liter bottle</td>
<td>High strength, primerless, oil tolerant, for slip-fitted parts</td>
<td>Green</td>
<td>0.2 mm (0.008&quot;)</td>
<td>5,800</td>
<td>-54°C to 230°C (-65°F to 450°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA, ABS</td>
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<tr>
<td>620™ NEW 638**</td>
<td>62005</td>
<td>0.5 ml capsule</td>
<td>For high temperature applications</td>
<td>Green</td>
<td>0.2 mm (0.008&quot;)</td>
<td>8,500</td>
<td>-54°C to 230°C (-65°F to 450°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA, ABS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62015</td>
<td>10 ml bottle</td>
<td>Medium strength for easier disassembly</td>
<td>Yellow</td>
<td>0.2 mm (0.008&quot;)</td>
<td>525/1,950</td>
<td>Thixotropic</td>
<td>Fixture – 20 min. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62040</td>
<td>50 ml bottle</td>
<td>For repair of worn machinery parts</td>
<td>Silver</td>
<td>0.5 mm (0.020&quot;)</td>
<td>250,000/1,500,000</td>
<td>Thixotropic</td>
<td>Fixture – 20 min. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62070</td>
<td>250 ml bottle</td>
<td>Slow cure for heavy press fit</td>
<td>Brown</td>
<td>0.36 mm (0.015&quot;)</td>
<td>5,000</td>
<td>-54°C to 150°C (-65°F to 300°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>62085</td>
<td>1 liter bottle</td>
<td>Slow cure for long assembly time</td>
<td>Green</td>
<td>0.1 mm (0.004&quot;)</td>
<td>600</td>
<td>-54°C to 175°C (-65°F to 355°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™ or 7471™</td>
<td>MIL-R-46082B, ASTM D-5363</td>
<td></td>
</tr>
<tr>
<td>641™ NEW 680**</td>
<td>28802</td>
<td>10 ml bottle</td>
<td>Medium strength for easier disassembly</td>
<td>Yellow</td>
<td>0.2 mm (0.008&quot;)</td>
<td>1,700</td>
<td>-54°C to 150°C (-65°F to 300°F)</td>
<td>Fixture – 20 min. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21458</td>
<td>50 ml bottle</td>
<td>For repair of worn machinery parts</td>
<td>Silver</td>
<td>0.5 mm (0.020&quot;)</td>
<td>250,000/1,500,000</td>
<td>Thixotropic</td>
<td>Fixture – 20 min. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>CFIA</td>
<td></td>
</tr>
<tr>
<td>660™ NEW 661™</td>
<td>66010</td>
<td>6 ml tube</td>
<td>Slow cure for heavy press fit</td>
<td>Brown</td>
<td>0.36 mm (0.015&quot;)</td>
<td>5,000</td>
<td>-54°C to 150°C (-65°F to 300°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™, 7649™ or 7471™</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>66040</td>
<td>50 ml tube</td>
<td>Slow cure for long assembly time</td>
<td>Green</td>
<td>0.1 mm (0.004&quot;)</td>
<td>600</td>
<td>-54°C to 175°C (-65°F to 355°F)</td>
<td>Fixture – 1 hr. Full – 24 hrs.</td>
<td>7088™ or 7471™</td>
<td>MIL-R-46082B, ASTM D-5363</td>
<td></td>
</tr>
<tr>
<td>661™ SLOW ON UV CURE</td>
<td>234921</td>
<td>250 ml bottle</td>
<td>UV light cures exposed adhesive</td>
<td>Yellow</td>
<td>0.15 mm (0.006&quot;)</td>
<td>500</td>
<td>-54°C to 175°C (-65°F to 355°F)</td>
<td>Fixture – 4 min. Full – 24 hrs.</td>
<td>7649™ or 7471™</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

## Activators

<table>
<thead>
<tr>
<th>LOCTITE® PRODUCT</th>
<th>Item Number</th>
<th>Package Type &amp; Size</th>
<th>Color</th>
<th>Viscosity (CP)</th>
<th>Base</th>
<th>On-Part Life</th>
<th>Dry Time</th>
<th>Application</th>
<th>Agency Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>7088™ PRIMER</td>
<td>1069258</td>
<td>17 g stick</td>
<td>Teal</td>
<td>Semisolid</td>
<td>No solvent</td>
<td>30 days</td>
<td>None</td>
<td>Anaerobics</td>
<td>N/A</td>
</tr>
<tr>
<td>7090™ PRIMER</td>
<td>1936812965</td>
<td>1 fl. oz bottle</td>
<td>Dark Blue</td>
<td>17.5</td>
<td>No solvent</td>
<td>1 hour</td>
<td>&lt;10 minutes</td>
<td>Anaerobics</td>
<td>N/A</td>
</tr>
<tr>
<td>7471™ PRIMER T</td>
<td>192672247719266</td>
<td>1.75 fl. oz bottle</td>
<td>Amber</td>
<td>2</td>
<td>Acetone/isopropanol</td>
<td>7 days</td>
<td>30 to 70 seconds</td>
<td>Anaerobics</td>
<td>MIL-S-22473E for existing designs, ASTM D-5363* for new designs</td>
</tr>
<tr>
<td>7648™ PRIMER N</td>
<td>213472134819266</td>
<td>1.75 fl. oz glass bottle</td>
<td>Clear/Green</td>
<td>2</td>
<td>Acetone</td>
<td>30 days</td>
<td>30 to 70 seconds</td>
<td>Anaerobics</td>
<td>MIL-S-22473E for new designs, ASTM D-5363, NSF P1, CFIA</td>
</tr>
</tbody>
</table>

## Cleaner & Degreaser

<table>
<thead>
<tr>
<th>LOCTITE® PRODUCT</th>
<th>Item Number</th>
<th>Package Type &amp; Size</th>
<th>Drying Time</th>
<th>Residue/Tinsability</th>
<th>Odor</th>
<th>Agency Approvals</th>
</tr>
</thead>
<tbody>
<tr>
<td>ODG-FREE CLEANER &amp; DEGREASER</td>
<td>2235520162</td>
<td>15 oz. net wt. aerosol 16 fl. oz. pump spray</td>
<td>Equivalent to the evaporation rate of water. Wiping or blowers will accelerate dry time.</td>
<td>No rinse and no residue</td>
<td>Mild Citrus</td>
<td>NSF K1</td>
</tr>
</tbody>
</table>

*Varies with substrates. **For new designs.
Dispensing Equipment

Dispensing equipment for retaining compounds includes applicators, controllers, reservoirs, pumps, valves, tips and monitoring devices. Contact your Henkel sales representative, authorized distributor, call 1.800.LOCTITE (562.8483), or visit www.equipment.loctite.com for help optimizing your dispense system.

**PRECISION BORE COATING APPLICATOR**

**LOCTITE® RotoSpray™ Applicator**

The LOCTITE® RotoSpray™ Applicator is electro-pneumatically powered to apply 360° beads of retaining compound on bore IDs. LOCTITE® RotoSpray™ applicators are used in conjunction with the LOCTITE® Positive Displacement Pump and LOCTITE® Dual-Channel Automatic Controller.

**HANDHELD MANUAL APPLICATORS**

**LOCTITE® Hand Pumps**

Handheld manual applicators allow retaining compounds to be dispensed directly from the original package. Applicators thread directly onto bottle tops and accept a variety of dispense tips.

**HANDHELD PNEUMATIC DISPENSING**

**LOCTITE® Bond-A-Matic® 3000 Dispenser**

A reliable, low-cost pneumatic dispenser with an adjustable pressure regulator. The system is “ready to go, right out of the box” and includes a LOCTITE® Vari-Drop™ Applicator Kit and dispensing-tip assortment. Available with low-level sensing for automated process lines.

* All system components and accessories are sold separately. For more information check with your Henkel representative or visit www.equipment.loctite.com
DUAL CHANNEL DISPENSING

LOCTITE® Dual Channel Integrated Semiautomatic Dispenser
A superior dispensing system for cost-effective operation in high-volume applications. It controls two manual or two automatic dispense valves, or one dispense-valve and one advancing slide. Includes integrated fluid reservoir and dispense valve timing controls. Interface with PLC reservoir allows "low level" sensing and "cycle complete" signaling.

EQUIPMENT FOR PRIMERS

LOCTITE® Spray Valve/Spray Valve Controller
The LOCTITE® Spray Valve and LOCTITE® Spray Valve Controller provide an effective solution for automatic spraying of low-viscosity primers up to 1,200 cP.

DISPENSE MONITORING

LOCTITE® High Precision Monitoring System
This advanced dispense monitoring system is designed for integration with other LOCTITE® dispensing systems and controllers. Pressure changes due to air entrapment, broken or blocked nozzles or substrate contact can be monitored. Out-of-tolerance dispense cycles are displayed as error messages.

DISPENSE ACCESSORIES

Needles and Tips
Henkel offers a complete line of LOCTITE® dispense needles and tips from 1/4" to 11/4", including 45°- and 90°-angled tips in a variety of gauges.