

LOCTITE[®] 454[™]

 (TDS for new formulation of Loctite[®] 454[™]) February 2012

PRODUCT DESCRIPTION

LOCTITE[®] 454[™] provides the following product characteristics:

| | |
|----------------------|---|
| Technology | Cyanoacrylate |
| Chemical Type | Ethyl cyanoacrylate |
| Appearance (uncured) | Clear to slightly cloudy gel ^{LMS} |
| Components | One part - requires no mixing |
| Viscosity | High, thixotropic |
| Cure | Humidity |
| Application | Bonding |
| Key Substrates | Metals , Plastics and Elastomers |

This Technical Data Sheet is valid for LOCTITE[®] 454[™] manufactured from the dates outlined in the "Manufacturing Date Reference" section.

LOCTITE[®] 454[™] is designed for the assembly of difficult-to-bond materials which require uniform stress distribution and strong tension and/or shear strength. The product provides rapid bonding of a wide range of materials, including metals, plastics and elastomers. The gel consistency prevents adhesive flow even on vertical surfaces. LOCTITE[®] 454[™] is also suited for bonding porous materials such as wood, paper, leather and fabric.

NSF International

Registered to NSF Category P1 for use as a sealant where there is no possibility of food contact in and around food processing areas. **Note:** This is a regional approval. Please contact your local Technical Service Center for more information and clarification.

TYPICAL PROPERTIES OF UNCURED MATERIAL

| | |
|---|------------------------------------|
| Specific Gravity @ 25 °C | 1.1 |
| Flash Point - See SDS | |
| Casson Viscosity, 25 °C, mPa·s (cP): | |
| Cone and Plate Rheometer | 150 to 450 ^{LMS} |
| Viscosity, Brookfield - RVT, 25 °C, mPa·s (cP): | |
| Spindle TC, speed 2.5 rpm, Helipath | *100,000 to 300,000 ^{LMS} |
| Spindle TC, speed 20 rpm, Helipath | *18,000 to 40,000 ^{LMS} |

* Applies to material made in N. America

TYPICAL CURING PERFORMANCE

Under normal conditions, the atmospheric moisture initiates the curing process. Although full functional strength is developed in a relatively short time, curing continues for at least 24 hours before full chemical/solvent resistance is developed.

Cure Speed vs. Substrate

The rate of cure will depend on the substrate used. The table below shows the fixture time achieved on different materials at 22 °C / 50 % relative humidity. This is defined as the time to develop a shear strength of 0.1 N/mm².

Fixture Time, seconds:

| | |
|-----------------|----------|
| Steel | 30 to 60 |
| Aluminum | 2 to 10 |
| Neoprene | 10 to 15 |
| Rubber, nitrile | <5 |
| ABS | <5 |
| PVC | 5 to 10 |
| Polycarbonate | 10 to 15 |
| Phenolic | <5 |
| Wood (balsa) | <5 |
| Wood (oak) | 30 to 60 |
| Wood (pine) | 15 to 30 |
| Chipboard | 5 to 10 |
| Fabric | 10 to 20 |
| Leather | 5 to 15 |
| Paper | 5 to 10 |

Cure Speed vs. Bond Gap

The rate of cure will depend on the bondline gap. Thin bond lines result in high cure speeds, increasing the bond gap will decrease the rate of cure.

Cure Speed vs. Humidity

The rate of cure will depend on the ambient relative humidity. The best results are achieved when the relative humidity in the working environment is 40% to 60% at 22°C. Lower humidity leads to slower cure. Higher humidity accelerates it, but may impair the final strength of the bond.

Cure Speed vs. Activator

Where cure speed is unacceptably long due to large gaps, applying activator to the surface will improve cure speed. However, this can reduce ultimate strength of the bond and therefore testing is recommended to confirm effect.

TYPICAL PERFORMANCE OF CURED MATERIAL**Adhesive Properties**

Cured for 30 seconds @ 22 °C

Tensile Strength, ISO 6922:

| | | |
|--------|-------------------|---------------------|
| Buna-N | N/mm ² | ≥6.0 ^{LMS} |
| | (psi) | (≥870) |

Cured for 72 hours @ 22 °C

Tensile Strength, ISO 6922:

| | | |
|--------|-------------------|---------|
| Buna-N | N/mm ² | 15.1 |
| | (psi) | (2,190) |

Lap Shear Strength, ISO 4587:

| | | |
|----------------------|-------------------|---------|
| Steel (grit blasted) | N/mm ² | 20.9 |
| | (psi) | (3,030) |

| | | |
|-------------------|-------------------|---------|
| Aluminum (etched) | N/mm ² | 17.1 |
| | (psi) | (2,480) |

| | | |
|-----------------|-------------------|---------|
| Zinc dichromate | N/mm ² | 11.5 |
| | (psi) | (1,670) |

| | | |
|-----|---------------------|---------|
| ABS | * N/mm ² | 8.3 |
| | * (psi) | (1,200) |

| | | |
|-----|---------------------|---------|
| PVC | * N/mm ² | 7.1 |
| | * (psi) | (1,030) |

| | | |
|----------|---------------------|---------|
| Phenolic | * N/mm ² | 12.3 |
| | * (psi) | (1,780) |

| | | |
|---------------|-------------------|---------|
| Polycarbonate | N/mm ² | 7.7 |
| | (psi) | (1,120) |

| | | |
|---------|---------------------|-------|
| Nitrile | * N/mm ² | 1.3 |
| | * (psi) | (190) |

| | | |
|----------|---------------------|-------|
| Neoprene | * N/mm ² | 1.1 |
| | * (psi) | (160) |

Block Shear Strength, ISO 13445:

| | | |
|---------------|-------------------|---------|
| Polycarbonate | N/mm ² | 9.6 |
| | (psi) | (1,390) |

| | | |
|-----|-------------------|---------|
| ABS | N/mm ² | 23.3 |
| | (psi) | (3,380) |

| | | |
|-----|-------------------|-------|
| PVC | N/mm ² | 3.3 |
| | (psi) | (480) |

| | | |
|----------|---------------------|-------|
| Phenolic | * N/mm ² | 6.7 |
| | * (psi) | (970) |

* substrate failure

TYPICAL ENVIRONMENTAL RESISTANCE

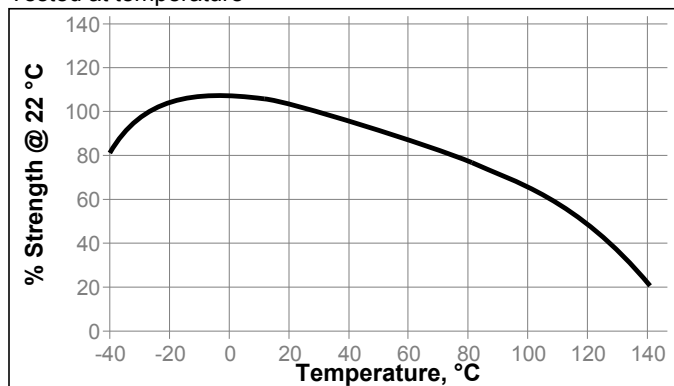
Cured for 1 week @ 22 °C

Lap Shear Strength, ISO 4587:

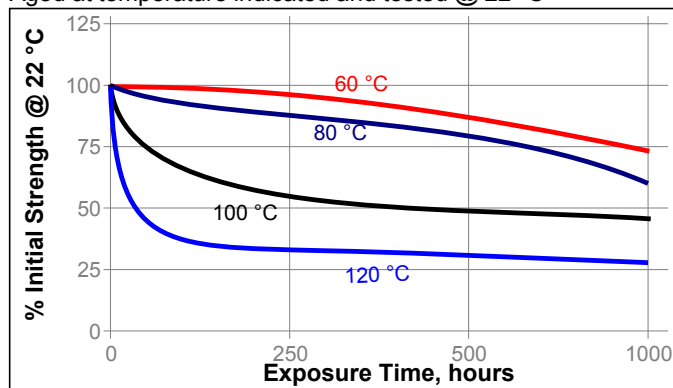
Steel (grit blasted)

Hot Strength

Tested at temperature

**Heat Aging**

Aged at temperature indicated and tested @ 22 °C

**Chemical/Solvent Resistance**

Aged under conditions indicated and tested @ 22 °C.

| Environment | °C | % of initial strength | | |
|-------------------|----|-----------------------|-------|--------|
| | | 100 h | 500 h | 1000 h |
| Motor oil | 40 | 105 | 85 | 80 |
| Unleaded gasoline | 22 | 95 | 120 | 125 |
| Water | 22 | 75 | 70 | 75 |
| Water/glycol | 22 | 90 | 85 | 85 |
| Ethanol | 22 | 120 | 125 | 120 |
| Isopropanol | 22 | 100 | 130 | 135 |
| 98% RH | 40 | 70 | 55 | 55 |

Chemical/Solvent Resistance

Aged under conditions indicated and tested @ 22 °C.

Lap Shear Strength, ISO 4587, Polycarbonate

| Environment | °C | % of initial strength | | |
|-------------|----|-----------------------|-------|--------|
| | | 100 h | 500 h | 1000 h |
| Air | 22 | 105 | 105 | 105 |
| 98% RH | 40 | 105 | 105 | 105 |

GENERAL INFORMATION

This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a sealant for chlorine or other strong oxidizing materials.

For safe handling information on this product, consult the Safety Data Sheet (SDS).

Directions for use:

1. Bond areas should be clean and free from grease. Clean all surfaces with a Loctite® cleaning solvent and allow to dry.
2. To improve bonding on low energy plastic surfaces, Loctite® Primer may be applied to the bond area. Avoid applying excess Primer. Allow the Primer to dry.
3. LOCTITE® Activator may be used if necessary. Apply it to one bond surface (do not apply activator to the primed surface where Primer is also used). Allow the Activator to dry.

4. Apply adhesive to one of the bond surfaces (do not apply the adhesive to the activated surface). Do not use items like tissue or a brush to spread the adhesive. Assemble the parts within a few seconds. The parts should be accurately located, as the short fixture time leaves little opportunity for adjustment.
5. LOCTITE® Activator can be used to cure fillets of product outside the bond area. Spray or drop the activator on the excess product.
6. Bonds should be held fixed or clamped until adhesive has fixtured.
7. Product should be allowed to develop full strength before subjecting to any service loads (typically 24 to 72 hours after assembly, depending on bond gap, materials and ambient conditions).

Loctite Material Specification^{LMS}

LMS dated December 22, 2011. Test reports for each batch are available for the indicated properties. LMS test reports include selected QC test parameters considered appropriate to specifications for customer use. Additionally, comprehensive controls are in place to assure product quality and consistency. Special customer specification requirements may be coordinated through Henkel Quality.

Storage

Store product in the unopened container in a dry location. Storage information may be indicated on the product container labeling.

Optimal Storage: 2 °C to 8 °C. Storage below 2 °C or greater than 8 °C can adversely affect product properties.

Material removed from containers may be contaminated during use. Do not return product to the original container. Henkel Corporation cannot assume responsibility for product which has been contaminated or stored under conditions other than those previously indicated. If additional information is required, please contact your local Technical Service Center or Customer Service Representative.

Conversions

$(^{\circ}\text{C} \times 1.8) + 32 = ^{\circ}\text{F}$
 $\text{kV/mm} \times 25.4 = \text{V/mil}$
 $\text{mm} / 25.4 = \text{inches}$
 $\mu\text{m} / 25.4 = \text{mil}$
 $\text{N} \times 0.225 = \text{lb}$
 $\text{N/mm} \times 5.71 = \text{lb/in}$
 $\text{N/mm}^2 \times 145 = \text{psi}$
 $\text{MPa} \times 145 = \text{psi}$
 $\text{N}\cdot\text{m} \times 8.851 = \text{lb}\cdot\text{in}$
 $\text{N}\cdot\text{m} \times 0.738 = \text{lb}\cdot\text{ft}$
 $\text{N}\cdot\text{mm} \times 0.142 = \text{oz}\cdot\text{in}$
 $\text{mPa}\cdot\text{s} = \text{cP}$

Manufacturing Date Reference

This Technical Data Sheet is valid for LOCTITE® 454™ manufactured from the dates below:

| <u>Made in:</u> | <u>First manufacturing date:</u> |
|-----------------|----------------------------------|
| EU | December 2011 |
| China | Pending |
| India | Pending |
| U.S.A. | March 2012 |
| Brazil | February 2013 |

The manufacturing date can be determined from the batch code on the pack. For assistance please contact your local Technical Service Center or Customer Service Representative.

Note:

The information provided in this Technical Data Sheet (TDS) including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this TDS. The product can have a variety of different applications as well as differing application and working conditions in your environment that are beyond our control. Henkel is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product.

Any liability in respect of the information in the Technical Data Sheet or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law.

In case products are delivered by Henkel Belgium NV, Henkel Electronic Materials NV, Henkel Nederland BV, Henkel Technologies France SAS and Henkel France SA please additionally note the following:

In case Henkel would be nevertheless held liable, on whatever legal ground, Henkel's liability will in no event exceed the amount of the concerned delivery.

In case products are delivered by Henkel Colombiana, S.A.S. the following disclaimer is applicable:

The information provided in this Technical Data Sheet (TDS) including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this TDS. Henkel is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product.

Any liability in respect of the information in the Technical Data Sheet or any other written or oral recommendation(s) regarding the concerned product is excluded, except if otherwise explicitly agreed and except in relation to death or personal injury caused by our negligence and any liability under any applicable mandatory product liability law.

In case products are delivered by Henkel Corporation, Resin Technology Group, Inc., or Henkel Canada Corporation, the following disclaimer is applicable:

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically disclaims any liability for consequential or incidental damages of any kind, including lost profits.** The discussion herein of various processes or compositions is not to be

interpreted as representation that they are free from domination of patents owned by others or as a license under any Henkel Corporation patents that may cover such processes or compositions. We recommend that each prospective user test his proposed application before repetitive use, using this data as a guide. This product may be covered by one or more United States or foreign patents or patent applications.

Trademark usage

Except as otherwise noted, all trademarks in this document are trademarks of Henkel Corporation in the U.S. and elsewhere. ® denotes a trademark registered in the U.S. Patent and Trademark Office.

Reference 2.7