# LOCTITE® 416™

January 2010

## PRODUCT DESCRIPTION

LOCTITE® 416™ provides the following product characteristics:

| | |
|---|---|
| **Technology** | Cyanoacrylate |
| Chemical Type | Ethyl cyanoacrylate |
| Appearance (uncured) | Transparent clear liquid[LMS] |
| Components | One part - requires no mixing |
| Viscosity | High |
| **Cure** | Humidity |
| **Application** | Bonding |
| Key Substrates | Plastics, Rubbers and Metals |

LOCTITE® 416™ is a general purpose cyanoacrylate instant adhesive.

### Mil-A-46050C

LOCTITE® 416™ is tested to the lot requirements of Military Specification Mil-A-46050C. **Note:** This is a regional approval. Please contact your local Technical Service Center for more information and clarification.

### Commercial Item Description A-A-3097:

LOCTITE® 416™ has been qualified to Commercial Item Description A-A-3097. **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 | 1.05 |
| Viscosity, Cone & Plate, mPa·s (cP): | |
| Temperature: 25 °C, Shear Rate: 100 $s^{-1}$ | 900 to 1,500[LMS] |
| Viscosity, Brookfield - LVF, 25 °C, mPa·s (cP): | |
| Spindle 2, speed 12 rpm | 1,150 to 1,500 |
| Vapour Pressure, hPa | <1 |
| Flash Point - See MSDS | |

## 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 .

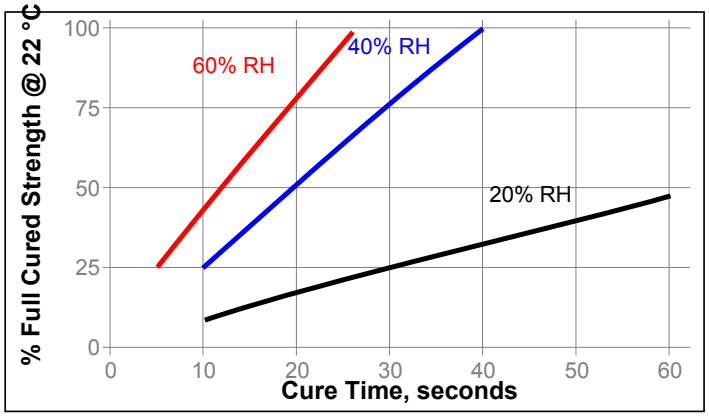
| | |
|---|---|
| Fixture Time, seconds: | |
| Mild Steel (degreased) | 20 to 50 |
| Aluminum | 10 to 30 |
| Zinc dichromate | 40 to 100 |
| Neoprene | <5 |
| Rubber, nitrile | <5 |
| ABS | 15 to 40 |
| PVC | 20 to 50 |
| Polycarbonate | 30 to 70 |
| Phenolic | 10 to 40 |

### 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 following graph shows the tensile strength developed with time on Buna N rubber at different levels of humidity.




### 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 PROPERTIES OF CURED MATERIAL

After 24 hours @ 22 °C

**Physical Properties**:

| | |
|---|---|
| Coefficient of Thermal Expansion, ISO 11359-2, $K^{-1}$ | $100\times10^{-6}$ |
| Coefficient of Thermal Conductivity, ISO 8302, W/(m·K) | 0.1 |
| Softening Point, DIN EN 1427, °C | 165 |

**Electrical Properties**:

| | |
|---|---|
| Dielectric Constant / Dissipation Factor, IEC 60250: | |
| 0.1 kHz | 2 to 3.3 / <0.02 |
| 1 kHz | 2 to 3.5 / <0.02 |
| 10 kHz | 2 to 3.5 / <0.02 |
| Volume Resistivity, IEC 60093, Ω·cm | $2\times10^{15}$ to $10\times10^{15}$ |
| Surface Resistivity, IEC 60093, Ω | $10\times10^{15}$ to $80\times10^{15}$ |
| Dielectric Breakdown Strength, IEC 60243-1, kV/mm | 25 |

## TYPICAL PERFORMANCE OF CURED MATERIAL

**Adhesive Properties**

After 24 hours @ 22 °C

Lap Shear Strength, ISO 4587:

| | | |
|---|---|---|
| Steel (grit blasted) | N/mm² | 18 to 26 |
| | (psi) | (2,610 to 3,770) |

| | | |
|---|---|---|
| Aluminum (etched) | N/mm² (psi) | 12 to 19 (1,740 to 2,755) |
| Zinc dichromate | N/mm² (psi) | 6 to 13 (870 to 1,885) |
| ABS | N/mm² (psi) | 6 to 20 (870 to 2,900) |
| PVC | N/mm² (psi) | 6 to 20 (870 to 2,900) |
| Polycarbonate | N/mm² (psi) | 5 to 20 (725 to 2,900) |
| Phenolic | N/mm² (psi) | 5 to 15 (725 to 2,175) |
| Neoprene | N/mm² (psi) | 5 to 15 (725 to 2,175) |
| Nitrile | N/mm² (psi) | 5 to 15 (725 to 2,175) |
| Tensile Strength, ISO 6922: | | |
| Steel | N/mm² (psi) | 12 to 25 (1,740 to 3,625) |
| Buna-N | N/mm² (psi) | 5 to 15 (725 to 2,175) |
| "T" Peel Strength, ISO 11339: | | |
| Steel (degreased) | N/mm (lb/in) | <0.5 (<2.8) |
| After 10 seconds @ 22 °C | | |
| Tensile Strength, ISO 6922: | | |
| Buna-N | N/mm² (psi) | ≥6.0[LMS] (≥870) |

## TYPICAL ENVIRONMENTAL RESISTANCE

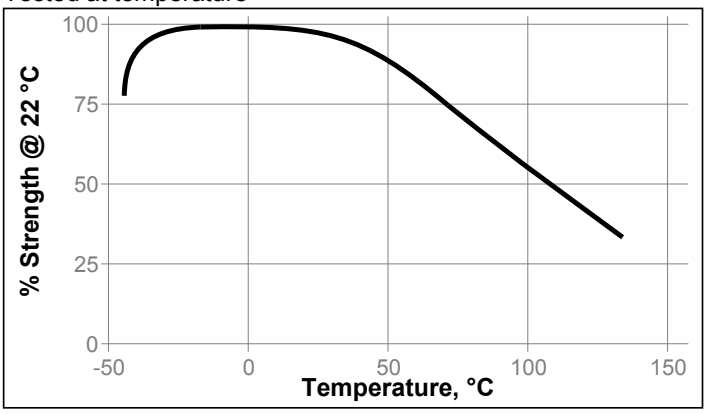
Cured for 1 week @ 22 °C

Lap Shear Strength, ISO 4587:

Mild Steel (grit blasted)

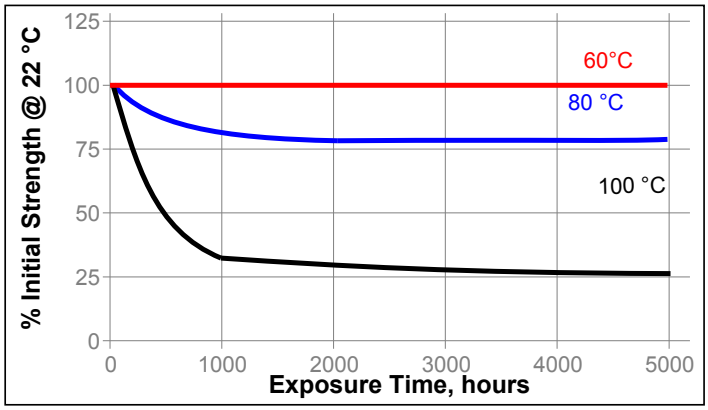
### Hot Strength

Tested at temperature




### Heat Aging

Aged at temperature indicated and tested @ 22 °C




### Chemical/Solvent Resistance

Aged under conditions indicated and tested @ 22 °C.

| | | % of initial strength | | |
|---|---|---|---|---|
| **Environment** | **°C** | **100 h** | **500 h** | **1000 h** |
| Motor oil (MIL-L-46152) | 40 | 100 | 100 | 95 |
| Gasoline | 22 | 100 | 100 | 100 |
| Isopropanol | 22 | 100 | 100 | 100 |
| Ethanol | 22 | 100 | 100 | 100 |
| Freon TA | 22 | 100 | 100 | 100 |
| 1,1,1 Trichloroethane | 22 | 100 | 100 | 100 |
| Heat/humidity 95% RH | 40 | 80 | 75 | 65 |
| Heat/humidity 95% RH on polycarbonate | 40 | 100 | 100 | 100 |

## 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 Material Safety Data Sheet (MSDS).**

**Directions for use:**

1. For best performance bond surfaces should be clean and free from grease.
2. This product performs best in thin bond gaps (0.05 mm).
3. Excess adhesive can be dissolved with Loctite cleanup solvents, nitromethane or acetone.

**Loctite Material Specification[LMS]**

LMS dated October 10, 2005. 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**
(°C x 1.8) + 32 = °F
kV/mm x 25.4 = V/mil
mm / 25.4 = inches
µm / 25.4 = mil
N x 0.225 = lb
N/mm x 5.71 = lb/in
N/mm² x 145 = psi
MPa x 145 = psi
N·m x 8.851 = lb·in
N·m x 0.738 = lb·ft
N·mm x 0.142 = oz·in
mPa·s = cP

**Note**
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 1.2