LOCTITE®

# 5404™

March 2008

## PRODUCT DESCRIPTION

5404™ provides the following product characteristics:

| | |
|---|---|
| **Technology** | Silicone |
| Chemical Type | Silicone |
| Appearance (uncured) | White to gray paste[LMS] |
| Components | One component - requires no mixing |
| **Cure** | Heat cure |
| **Application** | Bonding |
| Specific Benefit | Combines good electrical isolation and high thermal conductivity |
| Flexibility | Enhances load bearing & shock absorbing characteristics of the bond area. |

5404™ is designed to bond metallic heat sinks, ceramic chips and circuit board substrates. 5404™ applications include the bonding of various heat generating devices (power devices) to their respective heat sinks. The adhesive is designed to provide a strong bond between the device and its heat sink as well as low resistance to the flow of heat from the electronic device to the heat sink. A typical application would be the bonding of any power semiconductor, module, graphics processor or other heat generating device to a heat sink or metal enclosure in an electronics circuit.

## TYPICAL PROPERTIES OF UNCURED MATERIAL

| | |
|---|---|
| Specific Gravity @ 25 °C | 2.3 to 2.45[LMS] |
| VOC, ASTM D 3960, g/l | 32.1 |
| Flash Point - See MSDS | |
| Extrusion Rate, g/min: | |
| Pressure 0.35 MPa, temperature 25 °C: | |
| Semco Cartridge | 180 to 400[LMS] |

## TYPICAL CURING PERFORMANCE

We recommend minimizing the time during which the fixtured parts are exposed to a temperature above 30°C. This will help maintain a consistent dispersion of the conductive filler within the adhesive matrix.

Suggested minimum heat cure conditions for either IR or convection oven: 10 minutes at 150°C or 15 minutes at 130°C. All times given above are exclusive of heat up rate. It is essential that the bond lines attain these temperatures for the stated times. Cure rate is very dependent on the oven type used, the size and geometry of the parts being bonded as well as their composition.

## TYPICAL PROPERTIES OF CURED MATERIAL

Cured for 1 hour @ 150 °C

**Physical Properties**:

| | | |
|---|---|---|
| Coefficient of Thermal Conductivity, ISO 8302, W/(m·K) | | ≥0.95[LMS] |
| Shore Hardness, ISO 868, Durometer A | | 53 to 63[LMS] |
| Elongation, ISO 37, % | | ≥65[LMS] |
| Tensile Strength, ISO 37 | N/mm² | ≥1.3[LMS] |
| | (psi) | (≥188) |

Cured for 1 hour @ 130 °C

**Physical Properties**:

| | | |
|---|---|---|
| Coefficient of Thermal Expansion, ISO 11359-2, $K^{-1}$ | | $1.04\times10^{-4}$ |
| Glass Transition Temperature, °C | | -40 |
| Young's Modulus | N/mm² | 4 |
| | (psi) | (580) |

**Electrical Properties**:

| | |
|---|---|
| Dielectric Constant / Dissipation Factor, IEC 60250: | |
| 100 kHz | 6.3 / 0.1292 |
| 1 kHz | 5.8 / 0.0364 |
| 1 MHz | 5.4 / 0.0148 |
| Volume Resistivity, IEC 60093, Ω·cm | $2.9\times10^{14}$ |
| Surface Resistivity, IEC 60093, Ω | $4.3\times10^{14}$ |
| Dielectric Breakdown Strength, IEC 60243-1, kV/mm | 19.2 |

After 1 week @ 85 °C / 85% RH

**Electrical Properties**:

| | |
|---|---|
| Dielectric Constant / Dissipation Factor, IEC 60250: | |
| 100 kHz | 5.75 / 0.0591 |
| 1 kHz | 5.6 / 0.0193 |
| 1 MHz | 5.4 / 0.0139 |
| Volume Resistivity, IEC 60093, Ω·cm | $3.2\times10^{14}$ |
| Surface Resistivity, IEC 60093, Ω | $6.2\times10^{13}$ |
| Dielectric Strength | 17.1 |

Cured @ 50 °C

**Electrical Properties**:

| | |
|---|---|
| Volume Resistivity, IEC 60093, Ω·cm | $6.4\times10^{11}$ |
| Dielectric Breakdown Strength, IEC 60243-1, kV/mm | 19.2 |

Cured @ 100 °C

**Electrical Properties**:

| | |
|---|---|
| Volume Resistivity, IEC 60093, Ω·cm | $1.10\times10^{11}$ |
| Dielectric Breakdown Strength, IEC 60243-1, kV/mm | 20 |

## TYPICAL PERFORMANCE OF CURED MATERIAL

**Adhesive Properties**

Cured for 30 minutes @ 130 °C

Lap Shear Strength, ISO 4587:

| | | |
|---|---|---|
| Aluminum to Aluminum | N/mm² | 1.2 |
| | (psi) | (175) |
| Steel to Steel | N/mm² | 1.6 |
| | (psi) | (232) |
| Aluminum to Epoxy glass | N/mm² | 1.1 |
| | (psi) | (160) |

Cured for 1 hour @ 130 °C

Lap Shear Strength, ISO 4587:

| | | |
|---|---|---|
| Aluminum to Aluminum | N/mm² | ≥2.1[LMS] |
| | (psi) | (≥305) |
| Steel to Steel | N/mm² | 2.2 |
| | (psi) | (320) |
| Aluminum to Epoxy glass | N/mm² | 1 |
| | (psi) | (145) |

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## GENERAL INFORMATION

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

### Directions for use

**Application**

This composition contains .13 mm diameter glass spheres to produce an adhesive bond line of about .13 to .15 mm. The amount of adhesive applied to the part or heat sink should be limited to the amount necessary to fill the bond. The dispensing or application of the adhesive should be done in such a manner as to eliminate air entrapment within the bond line.

**Heat Curing**

Our laboratory test experience indicates that a period of time is required for the bond line temperature to approach the set temperature of the curing oven. The factors which affect this time-lag and hence, the bond line temperature include, but are not limited to: the type of oven (infrared, convection, conveyorized, type of conveyer belt, batch, type of oven racks), the size, shape and color of the bonded components (thermal mass and heat absorption or reflection), and the surrounding or other-side components on the board. Therefore, it is important to note that the cure profiles should be used as a guide and that the potential thermal effects of the board, components, and oven be accounted for when setting your curing conditions.

**Loctite Material Specification**[LMS]

LMS dated July 13, 2001. 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.

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Reference 1.3