LORD® 304 Epoxy Adhesive

Description
LORD® 304 adhesive is a general purpose, high viscosity, two-component epoxy adhesive system used for applications that require gap filling or non-sag characteristics on a vertical surface. This adhesive system provides excellent adhesion to prepared metals, fiberglass reinforced plastics (FRP), phenolic, wood, prepared rubber and other materials. LORD 304 adhesive can be either room temperature cured or heat cured for faster processing.

Features and Benefits

**Durable** – provides load bearing properties equal to or greater than the materials being bonded.

**Environmentally Recommended** – contains no solvent, nonflammable and virtually odorless.

**Environmentally Resistant** – resists moisture, sunlight and weathering.

**Temperature Resistant** – performs at temperatures from -30°F to +250°F (-34°C to +121°C).

**Chemically Resistant** – resists dilute acids, alkalis, solvents, greases and oils.

**Excellent Engineering Properties** – provides low shrinkage, good creep properties and low water absorption.

**Non-Sag** – remains in position when applied on vertical or overhead surfaces, allowing for greater process flexibility.

Application

**Surface Preparation** – Remove soil, grease, oil, fingerprints, dust, mold release agents, rust and other contaminants from the surfaces to be bonded by solvent degreasing or alkaline cleaning.

On metal surfaces which are free of oxidation, use an isopropyl alcohol wipe. If necessary, use an abrasive material to remove tarnish. Always follow abrasion by a second cleaning to ensure removal of loose particles.

When bonding cured rubber, allow LORD 7701 adhesion enhancer/surface modifier to flash off before applying LORD 304 adhesive. Prime glass and ceramic surfaces with LORD AP-134 adhesion enhancer/surface modifier to promote adhesion.

Handle prepared surfaces carefully to avoid contamination. Assemble as soon as possible.

**Typical Properties***

<table>
<thead>
<tr>
<th>Property</th>
<th>304-1 Resin</th>
<th>304-2 Hardener</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Grey Paste</td>
<td>Off-white Paste</td>
</tr>
<tr>
<td>Viscosity, P @ 77°F (25°C)</td>
<td>40,000 - 400,000</td>
<td>20,000 - 100,000</td>
</tr>
<tr>
<td>Brookfield HBF T-Bar Spindle E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Helipath, 1 rpm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Density</td>
<td>11.5 - 12.3</td>
<td>8.4 - 9.0</td>
</tr>
<tr>
<td>lb/gal</td>
<td>(1378 - 1474)</td>
<td>(1007 - 1078)</td>
</tr>
<tr>
<td>(kg/m³)</td>
<td>185 (85)</td>
<td>&gt;200 (&gt;93)</td>
</tr>
<tr>
<td>Flash Point (Closed Cup), °F (°C)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Data is typical and not to be used for specification purposes.*
Mixing – Thoroughly mix the proper amount of resin and hardener until uniform in color and consistency. Be careful not to whip excessive air into the adhesive system. Heat buildup due to an exothermic reaction between the two components will shorten the working time of the adhesive. Mixing smaller quantities will minimize heat buildup. Do not use any adhesive that has begun to cure.

Applying – Apply the mixed adhesive to bond surfaces using automatic meter/mix/dispense equipment or any convenient tool such as a stiff brush, spatula or trowel. If using automatic meter/mix/dispense equipment, gear pumps are not recommended due to the high viscosity of this product.

For general use, a film thickness of approximately 0.02 inch (0.51 mm) is recommended. To control bondline thickness, a small amount of solid glass beads can be added into the mixed adhesive.

Join the parts in such a way as to avoid entrapped air. Apply only enough pressure to ensure good wetting of the adhesive on both surfaces. Squeezing a little adhesive out at the edges is usually a sign of proper assembly. It is not necessary to clamp the assembly unless movement during adhesive cure is likely. Maximum adhesion will occur only with parts which mate well without the need for excessive clamping pressure during cure. Excessive clamping may squeeze too much adhesive from the bond area which can result in a poor bond.

Curing – LORD 304 adhesive will cure to full strength in 24-48 hours, provided that the adhesive, substrates and ambient temperature are 65°F (18°C) or higher. Higher temperatures will provide faster cure times; however, the bondline temperature should not exceed 325°F (162°C). Elevated temperature cure produces the highest bond strengths and impact resistance. Firm recommendations of cure times and temperatures depend on material composition and heating methods.

Once the adhesive has cured, it can be filed, sanded, machined or otherwise handled in the same way as a light metal. Paint, lacquers, enamels and other coatings can be applied to cured adhesive.

### Typical Properties* of Resin Mixed with Hardener

<table>
<thead>
<tr>
<th>Mix Ratio, Resin to Hardener</th>
<th>Mixed Stress Joint Design</th>
<th>High Temperature, 50-250°F (10-121°C)</th>
<th>Low Temperature, -40 to 100°F (-40 to 38°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Purpose, -30 to 250°F (-34 to 121°C)</td>
<td>by Volume 1:1.3</td>
<td>by Weight 1:1</td>
<td>by Volume 1:2.6</td>
</tr>
<tr>
<td>Mixed Stress Joint Design</td>
<td>by Volume 1:1.3</td>
<td>by Weight 1:1</td>
<td>by Volume 1:2.6</td>
</tr>
<tr>
<td>High Temperature, 50-250°F (10-121°C)</td>
<td>by Volume 1.5:1</td>
<td>by Weight 2:1</td>
<td></td>
</tr>
<tr>
<td>Shear Stress Joint Design</td>
<td>by Volume 1.5:1</td>
<td>by Weight 2:1</td>
<td></td>
</tr>
<tr>
<td>Low Temperature, -40 to 100°F (-40 to 38°C)</td>
<td>by Volume 1:2.6</td>
<td>by Weight 1:2</td>
<td></td>
</tr>
<tr>
<td>Peel Stress Joint Design</td>
<td>by Volume 1:2.6</td>
<td>by Weight 1:2</td>
<td></td>
</tr>
<tr>
<td>Solids Content, % 100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working Time, hr @ 75°F (24°C) 1-2</td>
<td>54 g mass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Handling Strength, hr 8-16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed Appearance Grey Paste</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cured Appearance Grey</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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## Typical Cured Properties*

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength at Break, psi (MPa)</td>
<td>4360 (30.1)</td>
</tr>
<tr>
<td>ASTM D882-83A, modified</td>
<td></td>
</tr>
<tr>
<td>Elongation, %</td>
<td>10</td>
</tr>
<tr>
<td>ASTM D882-83A, modified</td>
<td></td>
</tr>
<tr>
<td>Young's Modulus, psi (MPa)</td>
<td>146,000 (1007)</td>
</tr>
<tr>
<td>ASTM D882-83A, modified</td>
<td></td>
</tr>
<tr>
<td>Glass Transition Temperature, °F (°C)</td>
<td>133 (56)</td>
</tr>
<tr>
<td>ASTM E1640-99, by DMA</td>
<td></td>
</tr>
</tbody>
</table>

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## Bond Performance

<table>
<thead>
<tr>
<th>Substrates</th>
<th>Cold Rolled Steel to Cold Rolled Steel</th>
<th>Aluminum to Aluminum</th>
<th>SMC to SMC</th>
<th>Natural Rubber to Cold Rolled Steel</th>
<th>SBR to SBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Rolled Steel and Aluminum</td>
<td>2790 (19.2)</td>
<td>2190 (15.1)</td>
<td>590 (4.1)</td>
<td>50 (8.8)</td>
<td>113 (19.8)</td>
</tr>
<tr>
<td>Test @ Room Temperature</td>
<td>A</td>
<td>A</td>
<td>FT</td>
<td>65R/8C/A</td>
<td>34R/SB</td>
</tr>
<tr>
<td>Failure Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test @ Hot Strength, 180°F (82°C)</td>
<td>350 (2.5)</td>
<td>295 (2.0)</td>
<td>230 (1.6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure Mode</td>
<td>A</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test after 7 days in H₂O @ 130°F (54°C)</td>
<td>3000 (20.7)</td>
<td>2900 (20.0)</td>
<td>770 (5.3)</td>
<td>295 (3.6)</td>
<td>113 (19.8)</td>
</tr>
<tr>
<td>Test after 24 hours</td>
<td>A</td>
<td>A</td>
<td>FT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test after 14 days Salt Sprayed Exposure</td>
<td>2620 (18.1)</td>
<td>1950 (13.4)</td>
<td>885 (6.1)</td>
<td>18 (3.1)</td>
<td>113 (19.8)</td>
</tr>
<tr>
<td>Test Immediately</td>
<td>A</td>
<td>A</td>
<td>FT</td>
<td>A</td>
<td>R</td>
</tr>
<tr>
<td>Failure Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test after 14 days @ 100°F (38°C), 100% RH</td>
<td>2070 (14.3)</td>
<td>1620 (11.2)</td>
<td>610 (4.2)</td>
<td>30 (5.3)</td>
<td>63 (11.0)</td>
</tr>
<tr>
<td>Test Immediately</td>
<td>A</td>
<td>A</td>
<td>FT</td>
<td>17R/A</td>
<td>30R/SB/A</td>
</tr>
<tr>
<td>Failure Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test @ -30°F (-34°C)</td>
<td>1550 (10.7)</td>
<td>920 (6.3)</td>
<td>580 (4.0)</td>
<td>69 (12.1)</td>
<td>107 (18.7)</td>
</tr>
<tr>
<td>Failure Mode</td>
<td>A</td>
<td>A</td>
<td>FT</td>
<td>70R/10C/A</td>
<td>50R/C</td>
</tr>
</tbody>
</table>

### Substrate
- Cold Rolled Steel and Aluminum
- Sheet Molded Compound (SMC)
- Styrene Butadiene Rubber (SBR)
- Natural Rubber

### Bonded Parameters
- Metal Lap Shears: 1.0"x0.5"
- SMC Lap Shears: 1.0"x1.0"
- T-Peels: 1.0"x3.0"
- 45° Peels: 1.0"x1.0"

### Failure Mode Definition
- Adhesive Failure: A
- Cohesive Failure: C
- Fiber Tear: FT
- Rubber Failure: R
- Stock Break: SB

### Surface Treatment
- MEK Wipe, Grit Blast, MEK Wipe
- 30-grit Sandpaper, Dry Rag Wipe
- Primed with LORD 7701 Surface Treatment
- Primed with LORD 7701 Surface Treatment

### Bond Area
- 0.010" Film Thickness: 72 hr @ RT
- 1.1 by Weight

### Cure
- 1.1 by Weight
- 1.1 by Weight
- 1.1 by Weight

### Mix Ratio
- 1.1 by Weight
- 1.1 by Weight
- 1.1 by Weight
**Cleanup** – Clean excess adhesive on the bonded assembly, as well as the equipment, prior to the adhesive cure with hot water and detergent or an organic solvent such as ketones. Once adhesive has cured, heat the adhesive to 400°F (204°C) or above to soften the cured adhesive. This allows the parts to be separated and the adhesive to be more easily removed. Some success may be achieved with commercial epoxy strippers.

**Shelf Life/Storage**

Shelf life is two years from date of manufacture when stored at 60-80°F (16-27°C) in original, unopened container.

LORD 304-1 resin will crystallize if exposed to temperatures below 60°F (16°C), resulting in a lumpy or grainy appearance. If resin exhibits any indication of crystallization, heat material to 80°F (27°C) for 6 hours, mixing occasionally by hand. Be sure to scrape down sides and bottom of container. Continue to heat and mix until material is smooth and homogenous. Allow material to reach room temperature before application.

Values stated in this technical data sheet represent typical values as not all tests are run on each lot of material produced. For formalized product specifications for specific product end uses, contact the Customer Support Center.

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