Processing *Dow Corning*® 3-4207 Dielectric Tough Gel with Liquid Control Corporation:

- **PosiDot® PD20 Meter, Mix, and Dispense Valve and Posimixer® Motionless Mixers**
- **Posiratio® Mini Meter, Mix, and Dispense Machine; Twinmixer® Dispense Valve; and Posimixer Motionless Mixers**

This application bulletin is designed to provide process information for customers who desire to process *Dow Corning*® 3-4207 Dielectric Tough Gel with processing equipment from Liquid Control Corporation. Dow Corning Corporation and Liquid Control Corporation are unrelated companies.

**Dow Corning 3-4207 Dielectric Tough Gel**

**Description**

*Dow Corning*® 3-4207 Dielectric Tough Gel is a fast room temperature curing, primerless silicone material. This two-component, translucent green silicone tough gel has been specially designed to encapsulate, protect, and preserve the electrical characteristics of delicate electronic circuits in severe environments. *Dow Corning*® 3-4207 Dielectric Tough Gel is specially formulated with *Dow Corning*’s new room temperature adhesion technology, which provides excellent adhesion to a wide variety of substrates without heat curing. When the Part A (yellow) and Part B (blue) components are thoroughly mixed in a 1:1 ratio by weight or volume, the product cures in place to form a cushioning, elastomeric, resilient gelled material. The cured “tough gel” retains much of the stress relief of a very soft gel, while developing dimensional stability and non-flow characteristics similar to those of a solid elastomer. These unique properties are maintained at both high and low temperature extremes.

**Uses**

*Dow Corning*® 3-4207 Dielectric Tough Gel is a general purpose encapsulant designed for automated dispensing. This fast curing tough gel can be used in a variety of electronic encapsulating applications, including but not limited to power supplies, connectors, sensors, and a wide array of industrial controls where high or low temperature resistance, dielectric insulation, and protection from dust, moisture, and mechanical shock may be required.

**Features**

*Dow Corning*® 3-4207 Dielectric Tough Gel is ideally suited to protect and preserve the electrical characteristics of many types of macro and microelectronic devices, including hybrid circuits. Other special features of this product include:

- Fast room temperature cure and adhesion; priming not required
- Elastomer-like toughness
- Protection from moisture, dirt, and other atmospheric contaminants
- Protection from mechanical stress and strain caused by thermomechanical shock and vibration
- Easy repairability
- Good dielectric properties, even at high frequencies
- No solvents or cure by-products
- Physical and electrical stability over a wide temperature range from -40°C to 200°C

**HOW TO USE**

**Mixing and Processing**

*Dow Corning*® 3-4207 Dielectric Tough Gel is properly catalyzed by thoroughly mixing Part A (yellow) with Part B (blue) in a 1:1 ratio by either weight or volume. Due to the fast room temperature curing characteristics of this product, automated/airless mixing, metering, and dispensing equipment should be utilized. In applications sensitive to air entrapment, de-airing with a ≥ 28-inch Hg vacuum is required. Amount of vacuum time is dependent on the volume of material.

A somewhat softer gel (lower durometer value) can be obtained by increasing the ratio of Part A to Part B in the initial mix. Likewise, a somewhat firmer gel (higher durometer value) can be obtained by increasing the ratio of Part B to Part A in the initial mix. However, changes in cure rate and adhesion can result when deviations from the 1:1 mix ratio are used.
Pot Life and Cure Rate

After Part A and Part B are thoroughly mixed in a 1:1 ratio, Dow Corning 3-4207 Dielectric Tough Gel will have the following pot life and RT gel times:

- Pot Life: <5 minutes
- RT Gel Time: 7.8 minutes

The introduction of heat will accelerate the cure of the gel. In addition, considerably shorter cure times can result when the part is preheated prior to adding the product or when the product is applied in relatively thin sections.

Adhesion

Dow Corning 3-4207 Dielectric Tough Gel provides excellent adhesion to most electronic components and substrates. However, excellent adhesion cannot be expected on non-reactive metal substrates and non-reactive plastic substrates such as TEFLONM1 coating, polyethylene, or polypropylene.

Prior to production trials, small-scale adhesion evaluation testing should be conducted to ensure suitability to specific applications.

Application Methods2 using Liquid Control Corporation PosiDot® PD20 Valve and Posimixer® Motionless Mixers3

Equipment

The PosiDot meter, mix, and dispense valve is specifically designed to accurately dispense shots from 0.005 to 5 cubic centimeters. This patented dispensing technology features positive displacement metering of the individual “A” and “B” components and can be used with a wide variety of disposable Posimixer® motionless mixers to accommodate specific application requirements.

Application

A PosiDot valve (Model PD20-0.177/0.177) with a 2 inch stroke drive cylinder and 5/16 inch diameter metering rods, pressure fed from two 20 ounce cartridges, was used to develop the following information. The purpose of this test was to establish the equipment necessary to encapsulate an electronic module requiring a 1.500 gram shot of Dow Corning 3-4207 Dielectric Tough Gel.

<table>
<thead>
<tr>
<th>Shot Repeatability:</th>
<th>± 0.001 g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio Repeatability:</td>
<td>± 0.1%</td>
</tr>
<tr>
<td>Mixer:</td>
<td>3/16” x 24 elements</td>
</tr>
<tr>
<td>Flow Rate @ 70 psi:</td>
<td>75.5 g/min</td>
</tr>
<tr>
<td>Mixer Volume:</td>
<td>2.6 cc</td>
</tr>
<tr>
<td>Average Shot Size:</td>
<td>1.508 g</td>
</tr>
<tr>
<td>Standard Deviation:</td>
<td>0.002</td>
</tr>
<tr>
<td>Cycle Rate:</td>
<td>50.1 cycles/min</td>
</tr>
<tr>
<td>Mixer:</td>
<td>3/16” x 32 elements</td>
</tr>
<tr>
<td>Flow Rate @ 70 psi:</td>
<td>73.8 g/min</td>
</tr>
<tr>
<td>Mixer Volume:</td>
<td>3.5 cc</td>
</tr>
<tr>
<td>Average Shot Size:</td>
<td>1.500 g</td>
</tr>
<tr>
<td>Standard Deviation:</td>
<td>0.001</td>
</tr>
<tr>
<td>Cycle Rate:</td>
<td>49.2 cycles/min</td>
</tr>
<tr>
<td>Mixer:</td>
<td>1/4” x 32 elements</td>
</tr>
<tr>
<td>Flow Rate @ 70 psi:</td>
<td>77.4 g/min</td>
</tr>
<tr>
<td>Mixer Volume:</td>
<td>4.5 cc</td>
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<tr>
<td>Average Shot Size:</td>
<td>1.534 g</td>
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<tr>
<td>Standard Deviation:</td>
<td>0.002</td>
</tr>
<tr>
<td>Cycle Rate:</td>
<td>50.5 cycles/min</td>
</tr>
</tbody>
</table>

Notes

- The preceding information is based on lab testing only.
- The PosiDot meter, mix, and dispense valve utilizes disposable Posimixer motionless mixers. Since no reactive components come in contact with each other in the equipment, solvent purging and the associated hazardous waste disposal problems are eliminated.
- When processing Dow Corning 3-4207 Dielectric Tough Gel, it is recommended that a mixer/flow rate combination be established that allows the mixer volume to be cleared at least every two minutes at room temperature.
- If the disposable mixer element becomes plugged due to curing of the silicone gel, simply replace the mixer with a new one and properly dispose of the plugged mixer. Prior to installing the new Posimixer, wipe any excess silicone gel off the PosiDot valve outlet nose using a disposable soft cloth.
- The mixer should be removed from the valve at the start of a prolonged shutdown that exceeds the working time of the material. This prevents migration of the catalyst into the polymer and potential gelling inside the PosiDot valve. For Dow Corning 3-4207 Dielectric Tough Gel, remove the mixer for shutdowns over three minutes.

1TEFLON is a registered trademark of E.I. du Pont de Nemours & Company.
2Information pertaining to application methods supplied by Liquid Control Corporation.
3PosiDot and Posimixer are registered trademarks of Liquid Control Corporation.
Application Methods\(^4\) using Liquid Control Corporation Posiratio\(^5\) Mini Meter, Mix, and Dispense Machine; Twinmixer\(^5\) Dispense Valve; and Posimixer\(^5\) Motionless Mixers\(^5\)

**Equipment**

The Posiratio Mini meter, mix, and dispense machine is available in both fixed and variable ratio designs to accommodate shot sizes from 1 to 25 cubic centimeters. The machine features precision positive displacement metering pumps, allowing cycle rates of up to 30 or more per minute to be obtained (depending on shot size, pump size, and mixer size). A wide variety of disposable Posimixer motionless mixers are available to accommodate specific application requirements.

**Application**

A fixed ratio Posiratio Mini (Model #PRMF-20/25) with 25 mm diameter piston metering pumps, gravity fed from 5 liter stainless steel reservoirs, and a Twinmixer dispense valve with Posimixer disposable motionless mixers were used to develop the following information. The purpose of this test was to establish the maximum flow rates for this equipment at three different pressure settings using Dow Corning 3-4207 Dielectric Tough Gel with a shot volume of 15.6 grams.

<table>
<thead>
<tr>
<th>Mixer: 1/4” x 24 elements</th>
<th>Mixer Volume: 4.5 cc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Rate @ 40 psi:</td>
<td>492.2 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 60 psi:</td>
<td>646.5 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 80 psi:</td>
<td>731.3 g/min</td>
</tr>
<tr>
<td>Shot Repeatability:</td>
<td>± 0.020 g</td>
</tr>
<tr>
<td>Ratio Repeatability:</td>
<td>± 0.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixer: 3/8” x 24 elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixer Volume: 11.6 cc</td>
</tr>
<tr>
<td>Flow Rate @ 40 psi: 615.9 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 60 psi: 759.8 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 80 psi: 801.3 g/min</td>
</tr>
<tr>
<td>Shot Repeatability: ± 0.020 g</td>
</tr>
<tr>
<td>Ratio Repeatability: ± 0.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mixer: 3/8” x 36 elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixer Volume: 16.3 cc</td>
</tr>
<tr>
<td>Flow Rate @ 40 psi: 632.0 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 60 psi: 745.7 g/min</td>
</tr>
<tr>
<td>Flow Rate @ 80 psi: 791.9 g/min</td>
</tr>
<tr>
<td>Shot Repeatability: ± 0.020 g</td>
</tr>
<tr>
<td>Ratio Repeatability: ± 0.2%</td>
</tr>
</tbody>
</table>

**Notes**

- The preceding information is based on lab testing only.
- The Posiratio Mini meter, mix, and dispense machine utilizes disposable Posimixer motionless mixers. Since no reactive components come in contact with each other in the equipment, solvent purging and the associated hazardous waste disposal problems are eliminated.
- When processing Dow Corning 3-4207 Dielectric Tough Gel, it is recommended that a mixer/flow rate combination be established that allows the mixer volume to be cleared at least every two minutes at room temperature.
- If the disposable mixer element becomes plugged due to curing of the silicone gel, simply replace the mixer with a new one and properly dispose of the plugged mixer. Prior to installing the new Posimixer, wipe any excess silicone gel off the Twinmixer valve outlet nose using a disposable soft cloth.
- The mixer should be removed from the valve at the start of a prolonged shutdown that exceeds the working time of the material. This prevents migration of the catalyst into the polymer and potential gelling inside the dispense valve. For Dow Corning 3-4207 Dielectric Tough Gel, remove the mixer for shutdowns over three minutes.

**Patent Position**

A composition prepared by mixing Dow Corning 3-4207 Dielectric Tough Gel Parts A and B is claimed in U.S. Patent No. 5,371,163 and U.S. Patent No. 5,424,384. Dow Corning intends to enforce these patents but will offer licenses thereunder. Dow Corning will ship Dow Corning 3-4207 Dielectric Tough Gel Parts A and B in containers which bear a label license and the invoice will include a statement that the stated process includes a royalty under the above patents. No license, express or implied, is granted under any other patent. If a written license is desired, it can be obtained at a comparable royalty rate upon written request, regardless of the source of the material.

**Limitations**

Our products are neither tested nor represented as suitable for medical or pharmaceutical uses.

**For More Information**

Additional information regarding the use of Dow Corning 3-4207 Dielectric Tough Gel is available from your Dow Corning field sales representative or authorized Engineerered Materials Distributor (EMD). Further information can also be obtained by calling the Dow Corning Select-A-Fax service at (800) 443-2932 and following the voice-prompted instructions, or by contacting Dow Corning Customer Service at (989) 496-6000 or (800) 248-2481.

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\(^4\)Information pertaining to application methods supplied by Liquid Control Corporation.

\(^5\)Posiratio, Twinmixer, and Posimixer are registered trademarks of Liquid Control Corporation.
Safe Handling Information

PRODUCT SAFETY INFORMATION REQUIRED FOR
SAFE USE IS NOT INCLUDED. BEFORE HANDLING,
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For more process information, contact:
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(989) 496-6000

For more information on the Liquid Control Corporation
PosiDot meter, mix, and dispense valve; Posiratio Mini meter,
mix, and dispense machine; Twinmixer dispense valve; and
Posimixer motionless mixers, contact:

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