

# LIQUID SILICONE RUBBER THAT SELF-ADHERES TO POLYCARBONATE



Fully automated, two-part injection molding processes can be used for making ventilation masks from ELASTOSIL® LR 3078.

Creating a secure bond between a silicone and polycarbonate usually requires considerable effort. WACKER's new ELASTOSIL® LR 3078 silicone rubber compounds offer excellent adhesion to this thermoplastic and can be processed efficiently via two-part injection molding.

Plastic parts combining a hard and a soft component are common. In most cases, a rigid thermoplastic provides the strength for these hard/soft compounds, while the job of the soft component is to act as a sealant, to dampen vibrations or to absorb sound. The latter can also improve the tactile properties of the molded part.

Product designers frequently turn to polycarbonate for the hard component, as it is transparent, impact resistant, thermostable and can be used for medical devices. More and more often, the choice of soft component falls to silicone elastomers, which are chemically and biologically inert, remain flexible at low temperatures and resist heat and aging. Good adhesion is a must for creating hard/soft compounds that work reliably – and can be manufactured cost-effectively on a large scale. Up to now, however,

pairing polycarbonate with silicone has presented a challenge: achieving reliable adhesion with traditional silicones has necessarily meant either coating the surface of the polycarbonate with a primer or activating it with a plasma treatment – an additional, costly step.

### Innovative Formulation

The new grades in the ELASTOSIL® LR 3078 series of silicone rubber products provide strong adhesion to polycarbonate with no need for treating the thermoplastic substrate ahead of time. These self-adhesive silicones are compatible with fully automated, two-part injection-molding processes.

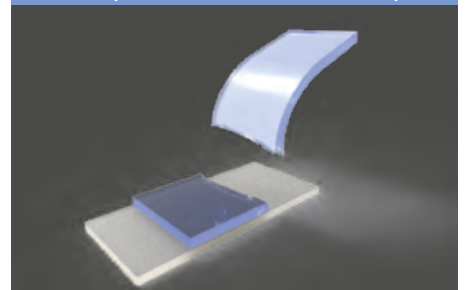
### Advantages of ELASTOSIL® LR 3078

- Excellent adhesion to polycarbonate (Apec® 1745, Makrolon® 2405, etc.)
- Freedom of design
- Does not stick to the metal mold
- Very reliable solution available for sealing
- Guarantees correct seal positioning in two-part injection molding
- Contains no bisphenol A (BPA) adhesion promoters
- USP Class VI and ISO 10993 certification available



90° Peel Test according to ISO 813

### Torn Sample from a Peel Test: 3D Graphics



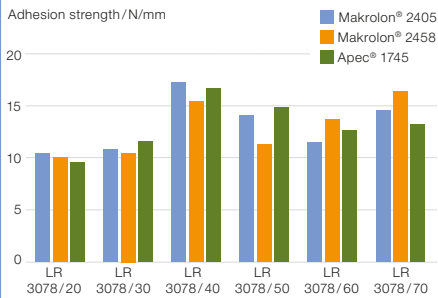
Peel testing stressed samples of compound materials to their breaking point. The soft silicone component consistently tore, while the bond between the hard and soft components remained intact.

### A Firm Bond

Adhesion builds up quickly with the new self-adhesion technology, reaching very high adhesion values even before the product leaves the injection mold. Because the silicones do not stick to the metal mold, hard/soft molded parts can be easily demolded with no need for secondary finishing.

The bond strength of ELASTOSIL® LR 3078 was studied in 90° peel tests based on the ISO 813 standard, in which the force needed to peel off the silicone layer at an angle of 90° to the polycarbonate substrate was determined for test strips of the sample material. The peel forces established in these tests were at least 10 newtons per millimeter. In addition, the soft components tore during peel testing, whereas the bond between the hard and soft components remained intact. Along with the high peel-force values, this result – designated a cohesive failure – serves as proof of excellent adhesion.

**ELASTOSIL® LR 3078 - Adhesion after Injection Molding on Selective Polycarbonate Grades**



Adhesion of ELASTOSIL® LR 3078 on three commercially available grades of polycarbonate.

**Short Cycle Times, No Mold Deposits**

Liquid silicone rubber products from the ELASTOSIL® LR 3078 series cure quickly, yielding short cycle times and very good productivity, even at relatively low temperatures.

ELASTOSIL® LR 3078 grades have a very low tendency to form possible deposits in the mold. Because this greatly reduces

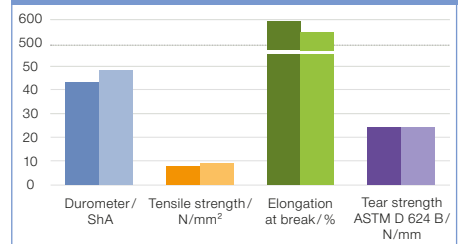
the need to interrupt production in order to dismantle and clean molds, these products open the door to fully automated processes. They also allow manufacturers to produce highly accurate, complex structures. Additionally this series is an answer to the component miniaturization trend.

Given the limited thermostability of the polycarbonate, these thermoplastic-silicone compound materials are not post-cured at high temperatures before use – the polycarbonate would not withstand the thermal stress. The mechanical properties of the new silicones are very good even without postcuring, however, delivering low compression set values. This means that sealing elements made from the new silicones remain highly elastic and function well for long periods of time.

Cured rubber made from ELASTOSIL® LR 3078 is biocompatible, as demonstrat-

ed by selected tests meeting ISO 10993 and United States Pharmacopeia (USP) chapter <88> Class VI standards. What is more, polycarbonate-silicone compound materials made with ELASTOSIL® LR 3078 can be steam-sterilized, as their mechanical properties remain virtually unchanged even after one hundred sterilization cycles with steam heated to 134 °C. The adhesion force values deteriorate only slightly after repeated sterilization.

**ELASTOSIL® LR 3078/40 - Effect of Steam Sterilization**



Mechanical properties of the cured, self-adhesive liquid silicone rubber before and after 100 steam-sterilization cycles (ISO 17665 – aging test according to EN 868-8; 134 °C, 5 min).

**Product Table ELASTOSIL® LR 3078**

ELASTOSIL®	LR 3078/20	LR 3078/30	LR 3078/40	LR 3078/50	LR 3078/60	LR 3078/70
<b>Product Data</b>						
Appearance	translucent	translucent	translucent	translucent	translucent	translucent
Viscosity (D = 1 s <sup>-1</sup> ) / mPa·s	200.000	600.000	1.200.000	1.500.000	1.900.000	1.800.000
Viscosity (D = 10 s <sup>-1</sup> ) / mPa·s	90.000	250.000	350.000	450.000	500.000	550.000
Cure conditions: 5 min / 165 °C in press						
Density / g/cm <sup>3</sup>	1,09	1,09	1,13	1,12	1,14	1,15
Durometer / ShA	20	30	40	50	60	70
Tensile Strength / N/mm <sup>2</sup>	5,3	4,9	8,5	8,7	8,2	7,7
Elongation at break / %	680	620	590	490	430	350
Tear strength ASTM D 624 B / N/mm	12	15	24	23	30	25
Compression set (22 h at 125 °C) / %	17	13	11	9	12	10

These figures are only intended as a guide and should not be used in preparing specifications.

**New Product Design Freedom**

The chemical bond formed with ELASTOSIL® LR 3078 prevents gaps from arising between the hard and soft components, where dirt can collect, or bacteria and mildew can form colonies. Because it is a biocompatible and steam-sterilizable material, ELASTOSIL® LR 3078 is perfect for medical applications. Other industries can utilize injection-molded compound materials made of polycarbonate and silicone as well, such as the automotive industry, which can incorporate them into the transparent components found in ambient interior lighting.

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