SILICONE INJECTION MOULDING

Highly flexible with LSR and HTV
HIGHLY ELASTIC

The basis for processing silicone: system solutions from ARBURG.
The application range of silicone is just as flexible as the material itself. Individually adapted solutions from specialists are required here. And these are precisely what we provide. Competent and reliable for all industries, also in combination with other materials. More than 35 years of experience with several thousand silicone applications realised speak for themselves. As does our ALLROUNDER injection moulding technology, which can be flexibly adapted to your part requirements. Always 100 %!

WIR SIND DA.
We were there from the outset when silicone injection moulding was developed. Our in-depth expertise and our modular technology enable us to set the benchmark in the industry. This means we can always offer you the best possible system solution - whether for LSR liquid silicone (Liquid Silicone Rubber) or HTV solid silicone (High Temperature Vulcanisation). Dosing and temperature control adapted to the material, precise moulding and reliable removal are all a matter of course. This applies throughout the entire high-volume production run.

AT A GLANCE

Perfect combination: ALLROUNDERs individually adapted to the task at hand.

Highlights

- All machine types can be used for silicone processing
- Fully integrated peripheral equipment and mould technology
- Automated turnkey systems
- LSR micro injection module
- Versatile team of silicone specialists
Full utilisation of options
Based on ARBURG’s comprehensive offerings for processing liquid silicone (LSR) and solid silicone (HTV), the machine technology can always be adapted precisely to the injection moulding task at hand:
- wide selection of machine series, sizes and injection units
- Numerous equipment and configuration options, as with multi-component technology, for example

Keeping processes under control
Our machine control system easily integrates process-specific peripherals equipment. Thanks to process programming with real-time plausibility check, even complex processes can be set up with ease. Numerous functions for process optimisation, monitoring and documentation ensure top quality moulded part production. These include, for example, adaptive mould heating circuits or the evacuation of cavities.

Reliance on expertise
Benefit from our many years of experience: from individual machine specifications and detailed process technology consulting through to assistance with moulded part design and mould configuration. Alternative concepts are also no problem for us. Comprehensive testing facilities at our worldwide Technology Centers round off the offerings. Significantly greater cost-effectiveness for you – that is our primary objective.

### SILICONE PACKAGE

<table>
<thead>
<tr>
<th>Standard</th>
<th>Option</th>
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<tbody>
<tr>
<td>Liquid temperature controlled cylinder modules for LSR or HTV with special screws</td>
<td>Control functions such as temperature-dependent post cooling</td>
</tr>
<tr>
<td>Customised nozzle technology</td>
<td>Adaptive mould heating circuits</td>
</tr>
<tr>
<td>Interfaces for air blow units, dosing systems and flow monitoring</td>
<td>Special peripherals such as dosing systems, brushing and demoulding devices</td>
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<tr>
<td>Vacuum and air blow units as well as water flow monitors</td>
<td>INJESTER tamping device for HTV</td>
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Liquid silicones (LSR) and solid silicones (HTV) are high-quality materials which only develop their unique properties following a special process. Precise temperature control is decisive. While high temperatures are required for vulcanisation, the cylinder module must be kept cool. Otherwise, the reactive material mixture would undergo premature cross-linking. Consequently, thermal separation of the different areas must be ensured – for example by retracting the cool nozzle from the hot mould.

PROCESSING: SOPHISTICATED

Mixing / dosing
Injection / vulcanisation

160 - 220 °C
20 - 50 °C

Mixing/dosing

Injection/ vulcanisation
Integrated functionality through hard/soft combination: jet discs with silicone nubs, for example, are easy to clean.

Unique properties

The material properties of high-temperature vulcanised silicone rubbers only arise through cross-linking at high temperatures. Their use is always advantageous where thermoplastics (TPE) and conventional elastomers reach their limits. The outstanding features of moulded parts from LSR or HTV include:

- High resilience
- Odourless and tasteless
- Chemical, UV, ageing and temperature resistant (up to 180 °C)
- Flexible when cold (to -50 °C)
- Pleasant tactile qualities
- Electrical properties
- Sterilisability
**LSR: “liquid” becomes highly elastic**

Liquid silicones are addition cross-linking silicone rubbers made from two components (catalyst and cross-linking agent). For better delivery capability and storage characteristics, they are supplied in separate containers. A special LSR dosage system homogeneously mixes the two “liquid” components as well as the added dyes and additives. The now reactive material mixture vulcanises very rapidly at high temperatures – completely without decomposition products.

**HTV: “solid” becomes highly elastic**

Solid silicones are self-cross-linking silicone rubbers made from a single component supplied in the form of bales, blocks or strips. For the processing of the “solid” feedstock, a special INJESTER tamping device is required in order to ensure a continuous, bubble-free material feed. Solid silicones also vulcanise rapidly at high temperatures.

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**REQUIREMENTS**

<table>
<thead>
<tr>
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<th>LSR</th>
<th>HTV</th>
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<tbody>
<tr>
<td>Complex, delicate part geometry</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Small components</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Simple automation</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Short vulcanisation and cycle times</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>High number of cavities</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Low number of cavities</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Material configurable</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Material costs</td>
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Many conditions need to be taken into account to achieve a stable, reproducible process. This applies in particular to liquid silicone (LSR), where two components have to be mixed homogeneously and injected “cold” into a “hot” mould. We save you work with our comprehensive process expertise and our ALLROUNDER injection moulding technology, which is precisely tailored to the process. After all, the quality of your production can only be as good as the components you use.

Precise: disk-type non-return valve, which closes automatically via spring force.

Matched to the mould: large selection of different nozzles.

Process-reliable: cylinder module with liquid temperature control helps prevent premature cross-linking.
Adapted plasticising

Owing to the low viscosity of LSR, the cylinder module is of particular importance. The cylinder module and nozzle feature liquid temperature control in multiple zones to ensure constant thermal conditions. The zero-compression screw with reduced channel depth and L/D-ratio reduces the material volume and additionally mixes all the components. The special disk-type non-return valve ensures precise dosage during the injection and holding phases.

Effective use of materials

The necessary cleanliness during LSR processing is ensured through additional sealing of the cylinder modules. In addition to an open nozzle, a number of needle-type shut-off nozzles featuring a standardised hydraulic drive are available. A single cold runner nozzle also allows for direct injection and consequently sprueless part production.

<table>
<thead>
<tr>
<th>EUROMAP size</th>
<th>Screw [mm]</th>
<th>Injection volume [cm³]</th>
<th>Injection pressure [bar]</th>
</tr>
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<tbody>
<tr>
<td>5</td>
<td>8</td>
<td>2.5</td>
<td>2000</td>
</tr>
<tr>
<td>30</td>
<td>12</td>
<td>6.8</td>
<td>2200</td>
</tr>
<tr>
<td>70</td>
<td>18</td>
<td>23</td>
<td>2500</td>
</tr>
<tr>
<td>100</td>
<td>15</td>
<td>18.6</td>
<td>2500</td>
</tr>
<tr>
<td>170</td>
<td>25</td>
<td>59</td>
<td>2500</td>
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<td>290</td>
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<tr>
<td>800</td>
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<td>318</td>
<td>2470</td>
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<td></td>
<td>55</td>
<td>474</td>
<td>1650</td>
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</table>
Trouble-free processing of solid silicones (HTV)? No problem for our INJESTER tamping device! This is easy and quick to clean, which is particularly advantageous for HTV, as this material is frequently fabricated on a product-specific basis. This also results in frequent material changes. For you, a high degree of process reliability in conjunction with short set-up and standstill times means: greater cost-efficiency throughout.
Special material feed

The INJESTERS have been designed for the automatic feed of paste-like materials and are fully integrated into the machine control system. All standard containers, as well as bales, blocks and strips, can be processed reliably. Optimum pre-compression is assured, resulting in minimal air and gas inclusions. No voids are formed in the components and the surfaces remain flawless.

Perfect processing

During HTV processing as well, precise temperature control prevents premature cross-linking. For this reason, the nozzle and cylinder module feature liquid temperature control. The adapted feed opening of the cylinder module is prepared for mounting an INJESTER. The zero-compression screw with a special non-return valve is adapted for the processing of HTV.
MACHINE TECHNOLOGY: UPON REQUEST

Everything from a single source! You can rely on our injection moulding technology when processing silicones: the ALLROUNDER precisely adapted to your LSR or HTV application, including dosing, vacuum and demoulding technology if you so wish, as well as the complete automation solution. This means that you do not have just any production solution at your disposal, but the very best one.
Individual selection

With the relevant equipment packages and options, silicone processing is possible on all ALLROUNDERS. This applies to hydraulic, electric and vertical models, whether with large or small clamping forces and injection units, whether for multi-component processing or the encapsulation of inserts. Our product range leaves nothing to be desired – customised, down to the last detail.

Precise basis

Protective mould use and high-precision moulding without flash formation or overfeeding. With our ALLROUNDERS, we achieve this, for example, through proven three-platen technology with four tie-bar guidance for even force application. Furthermore, our machines offer comprehensive freedom for attachments. This renders the feed of a variety of materials completely trouble-free.
System solutions for LSR and HTV

Individually tailored and always efficient concepts can be realised with us. In some cases, an ALLROUNDER with process-specific equipment may be sufficient, in others, a complex turnkey system with quality assurance or packaging stations may be the perfect solution. We are your technology and systems partner – to ensure the best injection moulding technology for your company.

Further information:
products and services brochure
Custom adapted: mould venting with modular vacuum technology.

Centralised: interfaces for process-specific accessories.

Further information: robotic systems brochure
Dosing units

Pneumatic, hydraulic or perhaps rather servo-electric dosing units? The choice is yours. For complete solutions with ALLROUNDERs, we work closely with leading industry manufacturers. Interfaces for centralised actuation and monitoring are standard in our silicone package.

Vacuum and air blow units

We offer you a wide range of equipment both for evacuation and air blow of the moulds: from interfaces and electrical connections through vacuum valves and air blow units with pressure reducers through to vacuum pumps. All of the solutions can be programmed via our machine control system. We can also optionally implement connections on the fixed or moving clamping platen.

Robotic systems

Complete solution with an ALLROUNDER: our versatile robotic technology can be precisely adapted to your particular handling task. Ideal conditions, also for silicone injection moulding, for example in combination with multi-component applications for hard/soft combinations.

Brushing and demoulding units

Demoulding the elastic silicone parts in a process-reliable yet gentle manner is a complex requirement. In addition to automated removal, special brushing and demoulding devices are also often required – particularly in the case of small parts and multi-cavity moulds. The relevant interfaces for centralised actuation and monitoring are available to you for this purpose.
CONTROL SYSTEM: SMART

Maintaining control over the machine, mould, robotic technology and peripheral technology requires a suitably powerful central control system. This calls for smart technology that offers extensive data integration options, monitors and adaptively controls your process, and supports you in every operating situation. All the features of our SELOGICA and GESTICA control systems are designed for a fast, secure and convenient set-up and operating process. This allows you to get the best out of all your applications.

Highlights

- SELOGICA and GESTICA – fully compatible
- Graphic sequence programming
- Real-time plausibility check
- Assistance packages and connectivity modules – ready for digitalisation
- Central control system for complete production cells

Further information:
SELOGICA and GESTICA brochure
Reliable evacuation
Complete mould filling without air inclusions or surface burn marks: evacuation of the mould prior to injection is important for smooth silicone processing. Evacuation can be implemented very flexibly via dedicated symbols. You can use the signals from the vacuum units for process and quality control purposes. This ultimately results in the transparent control and documentation of the entire evacuation process.

Integrated peripherals
Mould, robot or peripheral equipment functions: all processes can be adjusted and centrally monitored, depending on or in synchrony with machine movements.

Adaptive heating circuits
A high degree of temperature stability in the mould is essential for reproducible part production. Our adaptive mould heating circuits automatically adapt the control parameters accordingly. Several heating zones can be controlled simultaneously via a sensor.
APPLICATIONS: IN PRACTICE

Owing to its numerous positive properties such as temperature and chemical resistance, the use of silicones regularly results in new solutions and product ideas. As a technology and system partner, we offer you the best basis for the processing of silicone as well as for combination with other processes – with well-founded expertise and customised, cost-effective technology.

Clean breathing masks: high-end technology for burr-free and rework-free high-volume parts.

Rapid demoulding of 128 seals: servo-electric demoulding device reduces cycle times.

Caps weighing 0.009 g: special LSR micro injection module with 8 mm injection screw.

Further information:
Application expertise brochure
Turnkey projects brochure
Combined: button from two silicone materials with different Shore hardnecesses.

High-precision Fresnel lens: reliable moulding of structures with point radii of 7.2 µm.

Reliable hard/soft combination: robotic system rotates button housing in the mould.

Medical drug implant: turnkey project produces fully automatically in clean room.