Thermoset injection moulding

Technology and know-how for integrated solutions
When technology and expertise come from a single source as at ARBURG, you as customer always reap the benefit with problem-free, daily operation - guaranteed. The same applies to thermoset processing. Here we offer you an efficient combination of our proven hydraulic ALLROUNDER machines and a practical thermoset package. This system solution includes all the features required for the immediate production of high-quality moulded parts in large volumes. The addition of the universal high performance of our SELOGICA control system and our extensive experience in application technology enables us to offer you just what you expect from us: the most cost-efficient production solution for your company.

Example: switching elements With the combination of hydraulic ALLROUNDERS and the practical thermoset package, fully functional components can be produced in high volumes.

### Special equipment for thermoset injection moulding

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Thermoset package

Options
Individually adapted technology

Hydraulic ALLROUNDER machines and the thermoset package have been designed as a system solution and include:

- Three-platen technology with four tie-bar guidance and central force application for precise demoulding
- Liquid temperature-controlled cylinder module for precise temperature control suited to a specific material
- Bimetallic cylinder for a long service life
- Special screw geometry for material processing without damage to the fibres

The machine technology can be precisely adapted to the respective injection moulding task thanks to its range of sizes in horizontal and vertical design, its modular adaptability as well as its wide variety of equipment for processing moist polyesters, for example. The ALLROUNDER machines remain universally applicable, regardless of whether they are being used for thermoplastics processing or extended to complete turnkey systems.

Implementing sequences with ease

The freely programmable and high-performance SELOGICA control system enables even complex production sequences to be transparently controlled. This is ensured by the straightforward sequence programming via graphic symbols and the patented real-time plausibility checks. The SELOGICA's equipment is ideally complemented by features such as adaptive mould heating, compression injection moulding or venting. This results in a correspondingly high level of process stability and reproducibility for thermoset processing in particular.

The wide range of options for integrating special peripherals such as brush units demonstrates the universality of the comprehensive central control system for all ARBURG injection moulding technology. No specialist programming knowledge is required for operation. Handling complex tasks with ease – that is the outstanding strength of the SELOGICA.

Exploiting sound practical knowledge

The search for the most cost-effective customer solution is something that also motivates the consultant specialists at ARBURG. In application technology, machine specifications are precisely tailored to customer requirements. This is done on the basis of intensive talks with the customer, in which machine and process technology as well as comprehensive support for designing the injected part and mould are explained in detail. PC-based tools also help when comparing the individual solution concepts and searching for optimal alternatives.

Know-how allround: with many years of application expertise, ARBURG provides comprehensive customer support in all questions related to thermoset processing.
Special: material and cylinder modules

Characteristics such as mechanical strength, dimensional stability, temperature resistance, non-flammability, resistance to abrasion and chemical resistance as well as their attractive price/performance ratio make thermosets very interesting as materials. They are also replacing other materials such as metals.

Special materials of this type require a special machine technology. Optimum thermoset processing calls for precise temperature control in the process, a cylinder module with high resistance to the abrasive contents and specially designed screw geometries. Our technology is tailored towards high-quality production right from the start.

Thermoset: the material for “extreme situations”
The closed-meshed, cross-linked thermoset molecules require a completely different temperature profile to thermoplastics. The compound is injected from a “cold” cylinder module into a “hot” mould. Melting and further heating of the material in the mould causes a decrease in viscosity that is only reversed when cross-linking increases. The finished component is then irreversibly cross-linked, which makes it extremely hard, for example.

Temperature profile of pourable thermosets
Important: adapted plasticising
ARBURG has introduced adapted injection units for granular thermosets and moist polyesters into its modular range of technologies in order to fully meet the requirements for thermoset processing. A high level of production quality is achieved through liquid temperature control with up to four zones and separate temperature control for the feed. Bimetallic cylinders ensure a correspondingly long service life, while special screw geometries ensure gentle processing of the material. Particular attention has been paid to minimising return flows during injection and during the holding pressure phase. The play between the screw and nozzle is adjustable to prevent excess material here. Constant shot weights are achieved via the screw’s mechanical anti-reversing lock.

Pourable thermosets
Pourable thermosets are supplied in the form of granulate, which means they can be fed in the conventional way. The special ARBURG cylinder modules ensure optimum material preparation thanks to the following features:
- Compression-free screws without non-return valves
- Forward-set feeds for L/D ratios of approx. 15:1
- Screw-in nozzles with precise temperature control

Moist polyester (BMC)
The fibrous, non-pourable material is mostly supplied pre-compressed in bales. Of particular interest: there are also moist polyesters that do not shrink during processing, which can be extremely advantageous for various applications. An adapted material feed ideally takes place via special tamping devices such as the INJESTER from ARBURG. The special BMC cylinder modules from ARBURG ensure minimal destruction of fibres through the following factors:
- Compression-free screws with deep screw channel and vaneless non-return valve
- Forward-set feeds for L/D ratios of approx. 12:1
- Optimised feed openings prepared for installing an INJESTER tamping device
- Temperature-controlled cold runner radius nozzles with an entry depth of 100 mm for short sprues
In order to implement your respective application in large volumes with precision and high quality, you need customised injection moulding technology. Only a modular product range such as that from ARBURG enables you as a user to configure not just an acceptable machine, but precisely the right machine for your application.

The reliable hydraulic ALLROUNDER machines form the ideal basis for this: they are perfectly matched to the universal high performance of our SELOGICA control system and the material-oriented thermoset package. The result is a production unit that is always perfectly tailored to your requirements. With this combination, you can do precisely what you want to do on a day-to-day basis: produce moulded parts smoothly and reliably.

Further information:
- Hydraulic ALLROUNDERS brochure
- Vertical ALLROUNDERS brochure

1 **Basis: reliable hydraulics**

The hydraulic ALLROUNDER machines use dual-pump technology that permits simultaneous movements. Precise moulding is ensured by the three-platen technology with four tie-bar guidance of the clamping units, central force application and servo-regulated mould movements. The entire technology effectively counteracts flash and overfeeding.

2 **Horizontal to vertical**

The ALLROUNDER machines can be individually adapted through different hydraulic and electric expansion stages as well as through different arrangements of the injection units. Vertical and rotary table machines are also available for injection moulding inserts. The technology is not, therefore, limited to a specific solution concept.

**INJESTER:**
- Gentle feeding of moist polyester
INJESTER: gentle feeding of moist polyester

INJESTER tamping devices have been developed to cope with the automatic feeding of dry materials with a high filler content. They contribute towards optimum pre-compression, which results in minimal air and gas inclusions. This keeps products free from voids and lends them a glossy surface.

ABURG offers several INJESTER versions with hydraulic piston and servo-electric conveyor screw. What they all share in common is full integration in the SELOGICA control system. The delivery pressure is programmable and the refill container can also be filled without problem during production. In addition, the INJESTER features regulated delivery pressure.
Perfect harmony: the SELOGICA control system

1 Universal compression injection moulding

Compression injection moulding is an important function for improved surface quality, high component strength and reduced distortion. The compression injection moulding sequence is freely-programmable via the SELOGICA, for example through individual selection of the starting conditions. It can also be combined with venting. Compression injection moulding via core pull permits direct sprue separation.

2 Reliable venting

Venting of cavities is crucial with thermoset processing. It provides an effective means of allowing air and cross-linking gases to escape. As a result, the surface is not scorched and complete mould filling for void-free components is guaranteed. Both single and multiple venting operations can be quickly and reliably programmed via the SELOGICA, even during the holding pressure phase.

Maintaining control over sophisticated machine, mould and robotic technologies is the domain of SELOGICA. With this setting and monitoring system, you can quickly set up both simple and complex injection moulding processes, operate them intuitively and perform reliable optimisation. In a word: central management. All technical features of the SELOGICA control system, such as the graphical sequence editor, are also ideally suited for thermoset processing and aimed at making operation quicker, more reliable and more convenient. Here too, ARBURG guarantees you decisive competitive advantages: because we have already integrated all the necessary functions for high-quality and cost-effective part production in the SELOGICA.

Further information:
SELOGICA control system brochure
Adaptive mould heating
The adaptive mould heating automatically adapts the control parameters to the control response of the mould. Several heating zones can also be controlled in parallel via a sensor. This achieves high temperature stability in the mould for excellent reproducibility in production.

Fully integrated peripherals
The SELOGICA central control system integrates robotic systems as well as all necessary peripherals such as brush devices. All processes can be programmed as a function of and synchronous with machine movements. They are therefore part of the overall sequence, appear in the sequence editor with their own symbols and can be centrally monitored.

Highlights
• Control centre for the entire injection moulding technology
• Convenient sequence programming with graphic symbols
• Real-time plausibility checks
• Free programmability of the production sequences
• Common data record for the entire production unit
• Watercooling for continuous temperature control in the control cabinet
Thermosets have a wide range of applications thanks to their special characteristics such as high mechanical strength and rigidity. Thermoset parts are typically used for “extreme situations” in the automotive industry (engine compartment and lighting components) as well as in the electrics and electronics industries (power and miniature circuit breakers, printed circuit boards).

To process thermosets quickly, reliably and economically, you will need special machine technology and special know-how. At ARBURG, you can get everything from a single source.

1. Pistons made from pourable material
The pistons with internal thread are used in the clutches of passenger vehicles. This is a substitution component, which is far less expensive to produce using the injection moulding process. For processing the highly abrasive filled material, an extremely wear-resistant cylinder fitting is used. The 4-cavity mould operates using three-platen technology and separates the sprue directly inside the mould. The heart of the system is a hydraulic ALLROUNDER combined with a MULTILIFT V robotic system. Downstream processing stations such as those for removing burrs and grinding chamfers as well as for visual quality inspection can be centrally programmed and monitored via the SELOGICA control system.

2. Switch casing made from BMC
The switch casings for domestic fuses are injection moulded from a moist polyester (BMC). Feeding of the material is handled by an INJESTER piston feeder device, part removal by a MULTILIFT V. The four casings are picked up, the sprue separated and the articles placed on a conveyor belt. The high-precision 4-cavity mould is electrically heated to an operating temperature of approx. 150 °C. Scorching and porosity are prevented through the use of an optimised mould venting system. A vacuum can also be applied. All of these functions are fully integrated in the SELOGICA control system.

Further information:
Robotic systems brochure
3 Precision encapsulation of inserts

Producing an armature shaft calls for precision across the entire process chain. Moist polyester (BMC) is processed on an ALLROUNDER T rotary table machine with MULTILIFT V robotic system. The inserts are preheated to guarantee a reliable connection between the shaft and the laminations as well as uniform cross-linking of the thermoset. To reliably avoid overfeeding, the mould is designed with extreme precision. The precise positioning of the inserts in the mould via the robotic system is therefore important. Automation of the system, together with the servo-electric rotary table, ensure highly consistent cycles.

4 Insulating rail turnkey project

A good example of the implementation of customer-specific turnkey projects are insulating rails for domestic irons made from moist polyester (BMC). The system includes a hydraulic ALLROUNDER, the INJESTER screw feeder device, a six-axis robotic system as well as a camera system for quality and functional checks. The six-axis robotic system with implemented SELOGICA user interface is ideal for near-contour refinishing of the thermoset parts. This enables the robotic system to be programmed using the same graphics-based system as the machine. No special programming knowledge is required for independent set-up of the robotic sequence.
Distances between tie bars of 270 x 270 to 920 x 920 mm | Clamping forces from 400 to 5,000 kN | Injection units from 70 to 3200 (according to EUROMAP)