Multi-component injection moulding

Individual solutions
– greater cost-efficiency
At a glance

Purposeful further development of products: ARBURG supports its customers in the development of modern multi-component solutions with well-founded application expertise.

We have been successfully involved in the production of multi-component moulded parts since as early as 1961. The comprehensive application technology know-how that we have developed since that time benefits you today, both with regard to our machine concepts perfectly adapted to your requirements, as well as to in-depth consulting. Benefit from our extensive experience. Working with ARBURG also means higher process reliability and quality during multi-component injection moulding.

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<th>Special equipment for multi-component injection moulding</th>
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<td>Generously dimensioned clamping units</td>
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<td>Adapted mould installation dimensions</td>
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<td>Core pull connections in close vicinity to the mould</td>
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Standard | Optional
Perfectly harmonised technology
Based on standard solutions for processing several components, machine technology from ARBURG can always be adapted precisely to the relevant injection moulding task:
- The modular product range includes hydraulic as well as electric drive concepts with a wide range of clamping forces and injection units.
- In addition to horizontal ALLROUNDERS, vertical machines can also be used.
- The injection units can be flexibly arranged precisely in line with the mould and process technology requirements.
- Moreover, there are numerous equipment versions available, such as for silicone processing.
- Automation solutions extending through to complete turnkey systems are easily achievable.
This means that no fixed concepts have to be adhered to. In process-engineering terms, everything is possible at ARBURG. The focus is exclusively on the best customer-specific solution.

Reliable process control
Even in the case of technically complex solutions, the ARBURG SELOGICA machine control system ensures a good overview and transparency. This makes complex machine and mould technology simple and easy to handle for the processing of multiple components. Graphic sequence programming makes the co-ordination of several injection units and mould functions simple to understand and clear at all times.
One unique selling proposition of the SELOGICA system with respect to comparable machine control systems is the patented real-time plausibility check that excludes operating errors during sequence programming. Peripherals can be easily and centrally integrated in the control sequence and a wide variety of options for process optimisation, monitoring and documentation ensure that moulded part production always remains at a high quality level.

Utilising unique know-how
When ARBURG co-develops an injection moulding process and advances it further, the search for a cost-effective solution is always a priority. The ARBURG Application Technology department provides all-round competent consulting – across all process versions. The machine specifications are defined in accordance with individual customer requirements. Customers are comprehensively advised on the relevant machine and process technology, and it goes without saying that assistance is provided with the design of moulded parts and moulds. Alternatives are always conceivable thanks to the modularity of the product range and are also explicitly included in the overall evaluation of the best technology concepts.

Future-oriented: With the ALLROUNDER injection moulding technology in combination with the unique SELOGICA machine control system, moulded part manufacturers are perfectly equipped, even for the requirements of tomorrow.
You will be aware that in order to injection mould several components, numerous individual processes are available, which vary in terms of how the components are combined. All these processes have in common that different materials or colours are combined in a single moulded part. This provides you with the option of implementing special design solutions, specific product properties or of integrating functional elements. Production takes place in a fully automated process sequence without additional assembly steps or post-processing. You therefore achieve efficient, cost-effective part production at minimum unit costs. Profitability rises as the number of units produced increases.

### Versatile: process technologies

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#### 1 Interval injection moulding

With interval injection moulding, coloured surface effects can be reproduced through targeted timing control of two injection units. There is no clear colour separation between the components here.

**Important: additional interval unit**

The AUBURG interval unit is a special item of machine equipment used to link a horizontal and a vertical injection unit. It is attached to the fixed mounting platen and can therefore be utilised universally for a number of moulds. To achieve high process reliability, the melt flows are thermally coupled until immediately upstream of the mould gate system.

**Important: independent injection units**

The injection units must work simultaneously and inject in a programmable sequence. For this purpose, AUBURG employs hydraulic accumulator technology or servo-electric drives.

**Advantages**

- Rigid components with smooth or soft outer skin
- Material savings thanks to regranulate core component
- Interesting design effects through transparent skin component
- Simple, cost-effective single-component mould technology

#### 2 Sandwich injection moulding

The sandwich structure with skin and core layers is achieved through the specific timing control of two injection units. The typical three-layer structure is achieved with the aid of an interval unit, as is the case with interval injection moulding.
3 Marbling
During marbling, coloured surface effects are achieved by inhomogeneous mixing of several plastics in one injection unit. Consequently, there is no clear colour separation and the colour effects are not reproducible.

Important: special marbling cylinder
ARBURG supplies a special cylinder module with a piston injection unit for marbling. A mixing section provides a consistent colour mixture.

4 Core-back process
During the core-back process, the cavity is extended by pulling a slide and a second component injected. The sequential cycle is especially suitable for moulded parts with simple geometries.

Important: freely programmable core pulls
The core pulls, which are freely programmable via the SELOGICA control system, ensure a reliable process sequence. Their installation position on the moving mounting platen is user-friendly and ensures short set-up times.

Advantages
- Simple, cost-effective mould technology – no transport of pre-moulded parts, movements integrated in mould
- High number of cavities per mould surface area
**Transfer technology**

With this process, the transfer of pre-moulded parts to the second station via a robotic system takes place directly in the mould, or in a second machine.

**Important: integrated robotic systems**

If, as with ARBURG, the robotic systems are fully integrated in the SELOGICA machine control system, the robotic and mould movements can also be fully synchronised. This results in a high degree of process reliability, flexibility, shorter cycles and therefore enhanced cost-effectiveness.

**Advantages**

- Simple, cost-effective mould technology
- Robotic system can be used for further upstream and downstream production steps
- Thermally separated mould areas can be implemented
- Production steps to the pre-moulded part can be integrated
- Also ideal for bulky inserts

**Important: Separate rotary units**

ARBURG rotary units are attached to the moving mounting platen and can therefore be used for various moulds. They are driven hydraulically or servo-electrically and can be retrofitted. Alternatively, ARBURG servo-electric indexing units are available to rotate the mould platens or inserts. They are integrated in the moving mounting platen and are ideally suited for large opening strokes.

**Advantages**

- Simultaneous sequence resulting in short cycle times
- Four positions/components and more possible

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**Rotation technology**

Here, the pre-moulded parts are transferred to the second station via a horizontal rotary movement. They are not fully demoulded, but remain in the part of the mould that is rotated. Internal or external mould rotary devices are required for this purpose. A distinction is made between rotation of a mould half, a platen or an insert. The last two procedures are also referred to as index rotation.
**Turning stack mould technology**

Stack moulds with a vertical rotary device are used for the central section. The pre-moulded part and finished moulded part are produced simultaneously in parting lines positioned one in front of the another. In addition to two-station moulds, four-station moulds with a cube-shaped central section (rotary movements of 90°) are also used.

**Important: flexible mould opening**

At ARBURG, the sliding unit for the central section of the stack moulds operates in a decoupled manner in the machine base. This allows mould opening to be adjusted flexibly, enhancing process reliability and optimising cycle times through independent machine movements.

**Advantages**

- High number of cavities with small mould surface area
- Comparatively low locking force required
- Loading of inserts during injection moulding process and integration of operations to pre-moulded parts possible

**Assembly injection moulding**

Assembly injection moulding refers to all processes in which assembly steps are integrated directly in the injection moulding process. An assembly step either takes place in the mould following injection, or two incompatible components are combined without a positive material bond using the injection moulding process. During procedures of this kind, transfer processes (transfer technology, rotation technology, turning stack mould technology) are generally used.

**Important: Optimum material combinations**

The requirements relating to the moulded part are crucial during material selection. This should therefore always be performed in collaboration with the material producer. ARBURG can provide assistance with its well-founded expertise and its contacts.

**Advantages**

- Joining techniques or downstream assembly steps can be dispensed with
- Reduced number of parts
- Moveable connections possible
Requirement-oriented: modular machine technology

Opting for multi-component injection moulding technology from ARBURG, allows you to draw on an extensive standard range of technology which leaves nothing to be desired, both in terms of clamping force/injection unit combinations and drive alternatives. As a user, you will find the right machine and equipment for your specific part requirements within this broad range.

Our offerings are completed by practice-oriented accessories such as separate rotary units, integrated robotic systems, as well as comprehensive application technology consulting and project planning. All from a competent source: from ARBURG.

Further information:
- Product information Hydraulic ALLROUNDER
- Product information Electric ALLROUNDER

Fully hydraulic to fully electric

The ARBURG product range, from fully hydraulic to fully electric, benefits from its modular design. Due to the hydraulic accumulator technology of the ALLROUNDER S, or the servo-electric drives of the ALLROUNDER A, the movement axes and also the injection units are completely independent of one another. Reproducible mould filling and particularly high moulded part quality are achieved by means of the
Position regulation of the screws provided as standard. The optional electro-mechanical dosage (AED) on the ALLROUNDER S enables energy-optimised operation.

**Wide variety of combinations**

The individual configuration of the injection units that customers are familiar with as an ARBURG standard is also available for multi-component injection moulding. Thanks to the wide range of injection units, the ALLROUNDERS can be optimally adapted to the required application and energy consumption. Wear-resistant and highly wear-resistant cylinders modules are available, as are cylinder modules for processing thermosets and silicone, plus screws with special geometries. The processing of all possible material combinations is thus fully achievable. On the clamping side, electric ejectors and core pulls are available as well as hydraulic ones.
Requirement-oriented: modular machine technology

The classic: horizontal and vertical
The horizontal-vertical arrangement of the injection units fulfils the majority of requirements with regard to multi-component technology. Thanks to practical equipment details such as manually displaceable vertical injection units, set-up times can be effectively shortened. The large dimensions of the clamping units which provide ample free space are also useful in this regard. For particularly complex moulds, application related adjustments such as extended tie bars are available.

Flexible configuration
In total, five different positions of the injection units with respect to one another are possible. These are freely combinable, as the mould and process technology requires. Solutions with up to six components have already been realised. This means that individual, customised machine technology is available to suit every application.

The alternative: vertical machines
In addition to the horizontal ALLROUNDERs, vertical and rotary table machines are also available for the encapsulation of inserts with several components. Thanks to the detailed range of ARBURG technology, customers are not limited to a specific solution concept. In addition to mould and process technology, aspects such as cost-effectiveness, automation and cycle time should also be taken into account when selecting the ideal machines. The broad modular product range as well as the unique application

<table>
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<tr>
<th>Advantages</th>
<th>Position</th>
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<tr>
<td>Injection in the mould parting line</td>
<td>V</td>
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<tr>
<td>Small footprint</td>
<td>L</td>
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<tr>
<td>Low ceiling height</td>
<td>P</td>
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<tr>
<td>Good accessibility to the mould</td>
<td>M</td>
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<tr>
<td>Good accessibility for robotic system</td>
<td>W</td>
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<tr>
<td>Can be used as a single-component machine</td>
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<td>Suitable for large injection units</td>
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technology know-how from ARBURG help in finding the most appropriate customer-specific solution.

Accessories

Interval units
- Special machine equipment for connecting two independent injection units
- Universal use – installed on fixed mounting platen.
- Easily retrofittable

Rotary units
- Universal use – installed on moving mounting platen
- Easily retrofittable
- Hydraulic version: rotation by 180°, alternatively by 120°
- Electric version: highly precise and fast rotation, freely adjustable
- Programmable via SELOGICA control system

Indexing units
- Alternative to index rotation (rotating mould platen or insert).
- Universal use – integrated in moving mounting platen
- Electric version: very precise and fast rotation, freely adjustable
- Ideal for large opening stroke
- Programmable via SELOGICA control system

Robotic systems
- Complete solution with injection moulding machine and robotic system
- Programmable via SELOGICA control system
Multi-components

Freely programmable: the SELOGICA control system

1 Integrated mould functions
All mould functions and robotic systems are fully integrated in the SELOGICA system and can be programmed in the same way as additional machine axes. For the user, this brings maximum flexibility during set-up. All movement sequences can be perfectly coordinated and comprehensively synchronised. This is achieved through the individual selection of start conditions. In the case of multi-station moulds, for example, start-up and finishing cycles can be programmed both freely and easily. This also applies in conjunction with robotic systems and when not all injection units are in use. Full integration ensures high process reliability. Error messages are shown centrally and in plain text.

User-friendly: Machine, mould and robotic sequence can be viewed centrally.

Maintaining control over sophisticated machine, mould and robotic technology 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 multi-component processing and aimed at making operation quicker, more reliable and more convenient. Here too, ARBURG guarantees you decisive competitive advantages: maximum flexibility with regard to all process versions for high quality and cost-effective parts production.

Further information:
SELOGICA product information
Central user interface
With SELOGICA, users have direct access to all parameters, including those of all the injection units. For example, in the freely configurable process graphics, the injection parameters can also be compared with one another in detail. Complex sequences are made transparent and comprehensive process optimisation and documentation are ensured. For quality assurance purposes, it is important that the parts status is communicated from station to station. This allows reject parts to be reliably detected. An additional benefit is that there is only one data record for the complete production unit, including accessories such as rotary units or robotic systems. Altogether, this ensures a high level of user convenience.

Highlights
• Control centre for the entire injection moulding technology
• Convenient sequence programming with graphic symbols
• Real-time plausibility check
• Free programmability of the production sequences
• Common data record for the entire production unit
• Water-cooled control cabinet for continuous temperature regulation
Application examples

The ongoing technical development of both machines and moulding technology as well as of plastic materials enable a wide range of product-specific solutions to be implemented for your company using multi-component technology. Fully automatic rotary moulds are frequently employed in this context. As an alternative, we are however also developing transfer and insertion techniques to cover further areas of application. Our consulting and technical offerings extend through to the complete design of ready-for-use turnkey solutions in order to provide you with customer-specific solutions, with which your required product properties can be implemented to perfection.

1 Colour-sorted tooth brushes
A five-component ALLROUNDER enables the production of four colour versions of PP and TPE soft-touch tooth brushes in a single production step. In this way, the moulded parts can be pre-sorted according to colour prior to cost-effective downstream packaging. One injection unit works horizontally through the fixed platen and the other four are arranged vertically on a common base plate. A MULTILIFT robotic system ensures fast and reliable parts handling. The three-station, hot runner mould makes removal of the finished parts possible from the closed mould. The pre-moulded parts are transferred via an index platen and an electric rotary unit. All machine, mould and robotic sequences are fully integrated in the SELOGICA control system.

2 Soft-touch keypad
On a customised system for production of a washing machine keypad, thermoplastic and silicone are processed to form a hard-soft combination. Here, various material properties can be brought together in a single production step. A particular challenge is the joint processing of “hot” and “cold” materials in one cycle and one mould: LSR crosslinks at high temperatures, whereas PA requires cooling. The relevant sections in the mould must consequently be separated from one another by means of thermal insulation. This is why transfer technology is particularly suitable here. The moulded parts are transferred in the mould via a MULTILIFT robotic system.

Further information:
Robotic system basic information
3 LED light strip in a single cycle

This customised system is also an excellent example of how several functions can be integrated into one component via multi-component injection moulding. The LED light strip is manufactured on a three-component ALLROUNDER. The lenses are made from a transparent polyamide, the assembly housing is made from ABS and the conductor tracks are made from a conductive PA. LEDs and resistors are supplied as inserts via a six-axis robotic system. The MULTILIFT robotic system performs insertion as well as removal and transport of the finished upper casing. The complete process sequence is managed centrally via the SELOGICA machine control system. In downstream operations, the upper casings are assembled to form the finished LED light strips.

4 In-mould parts assembly

The assembly injection moulding of a universal joint shows how finished components are moulded in a single cycle via multi-component injection moulding. The central cross of the universal joint, made from PBT, connects the functionally integrated, rotating members made from POM. The varying shrinkage rates of the materials is utilised in order to ensure that the various components engage in a wear-free manner. The three-platen mould enables easy separation of finished parts and sprues. The universal joint could not be manufactured in this way using conventional methods.

5 Protective caps turnkey project

As the main contractor, ARBURG performs the development and implementation of customer-specific production cells, including full consulting services. One example is the production of a two-component protective cap for a safety shoe. The production of the caps takes place in pairs, with the set-down of left and right caps in cartons. Two standard ALLROUNDERS are used, each equipped with a MULTILIFT robotic system. The advantage of this solution is that the system works using two separate ALLROUNDERS, which can be operated independently of each other. Part quality is guaranteed thanks to the integration of a cooling section, and cost-effectiveness thanks to the reduction of complex mould technology.
Distances between tie bars of 270 x 270 to 920 x 920 mm | Clamping forces from 400 to 5,000 kN | Injection units from 30 to 4600 (according to EUROMAP)