

# combimelt

Smart combination of plastics



**ENGEL**  
be the first

## Combine materials for innovative products and economic production



As a manufacturer of high-quality plastic parts, you are constantly facing increasing requirements. Combinations, additions, symbioses and alloys of materials are required for the precise achievement of desired multi-component applications.

Combinations unite individual properties to form a stronger, more advantageous whole. ENGEL combimelt technology follows this principle and includes all known methods for combining plastics in injection moulding. It allows combinations of colours, shapes and functions, or alternative materials.

A wide range of electrical and hydraulic ENGEL injection moulding units, alongside a variety of manufacturing processes, configuration options and automation solutions form the pool from which ENGEL can produce the optimal production cell, tailored to individual requirements.

## combimelt process

### Multi-component injection moulding

In the simplest case – multi-colour injection moulding – the combined plastics differ only in colour, to create a specific design. This method involves the processing of different colours, of the same material, in an individual part. However, it is also often necessary to combine different material qualities in a given part. In these cases, the plastics should possess a common adhesive quality to guarantee that the components of the finished part are securely bonded.

### Further related processes

The processes described above have been enhanced and adapted to fulfil requirements such as optimal process integration and higher part quality. These design and quality requirements are important, for example, in state-of-the-art automotive production or medical technology.

### Assembly moulding

Instead of producing one part using different materials, in this process, individual components are combined to create assemblies or functional units. The different materials used are chosen based on their individual properties. Assemblies with moving individual parts or assemblies with integrated seals can be produced this way.

# Multi-component injection moulding

## Additive processes

**In this process, two or more components are injected next to or on top of each other in successive steps.** Here the individual components form a permanent bond (sequential linking of different components). These combinations of different material and colour ranges open up new potential opportunities in design. Multi-colour combinations are the most common application, e.g. for automotive taillights or touch controls for various devices (pushbuttons with abrasion-resistant symbols). Combinations with translucent coloured plastics (clear, transparent) increase illumination in transmitted light technology (day/night design in automobiles). In multi-component combinations, it is vital to have an optimal addition of the functionality and property of the materials.

## Overmoulding

**Soft, non-slip surfaces on, for example, housing components or instrument handles can be achieved by coating functional thermoplastic parts with elastomer materials (adding consecutive layers).** There are two ways of applying the thermoplastic material. One way is to combine it with rubber: thermoplastic rubber. An exact thermal separation in the mould is essential. After the injection moulding process, the thermoplastic component cools down in the mould; the elastomer component is then injected and subsequently cured. The second option involves combining with liquid silicone rubber: thermoplastic LSR. Here the thermoplastic component also has to cool down in the mould after the injection moulding process. The silicone is then injected and cured (using heat or UV light).

## Coinjection

**This process involves injecting a second component (core) into the first component (skin).** This can be done by injecting two materials into each other sequentially. The result is a multi-layer part (usually three layers). The two outer layers are responsible for a high-quality surface, while reinforcements in the core material improve mechanical properties and heat resistance. Part costs can be lowered by using recycled materials, and foamed core materials can help reduce component weight. Interval injections can be used to achieve a marbling optical effect.

## ENGEL skinmelt

**Two-component injection moulding with a special plasticising process:** Unlike classic coinjection, the skinmelt process involves fusing the two melts prior to injection. The skin material reaches the cavity first. It is pressed against the cavity walls by the injected second material – the core. The result is sandwich parts with premium quality.

### A great opportunity for the plastics industry

ENGEL skinmelt enables the production of parts with a skin made of virgin material and a very high proportion of recycled material in the core: processed plastic waste can be used for the core, which makes an important contribution to a successful Circular Economy. The amount of recycled material which can be used depends on the part geometry and the filling pattern of the cavity. The injection position chosen and the relative viscosity of the skin and core materials are essential. Grade purity of the recycled and virgin material ensures that the sandwich-moulded parts can also be easily recycled at the end of their service life. ENGEL is promoting the increased use of recycled material with this technology.



Multi-colour



Multi-component part



Thermoplastic



Thermoplastic



Coinjection process



Coinjection process



Skinmelt

## Further related processes



ENGEL glazemelt



ENGEL clearmelt



ENGEL varysoft

## ENGEL glazemelt

**Combination injection moulding for large-surface parts:** ENGEL glazemelt enables the injection moulding of flat, crystal-clear plastic parts, offering many benefits. This glazing is lighter, offers total design flexibility and combines perfectly with other materials – including functional integration.

- Large-surface, low-stress multi-component optical parts
- Machine with low clamping force thanks to stack moulds
- A great method for producing large-surface multi-component parts of any kind
- Flexible design and optimal functional integration in the automotive industry

## ENGEL clearmelt

**Scratch-resistant premium surface finishes with visual depth effect:** ENGEL clearmelt enables time-saving and efficient manufacturing of durable scratch-resistant and yet highly-sensitive, self-healing PUR coatings. The impressive 3D effect, integration of decorative components, and pioneering smart switch functions open up a whole new world of injection moulding.

- High levels of scratch-resistance and 3D effect even with low coating thickness
- Advanced and efficient process with multi-component injection moulding technology
- For innovative parts like capacitive foils over-flooded with a clear, protective PUR layer, allowing easy activation of electronic circuits with a simple touch

## ENGEL varysoft

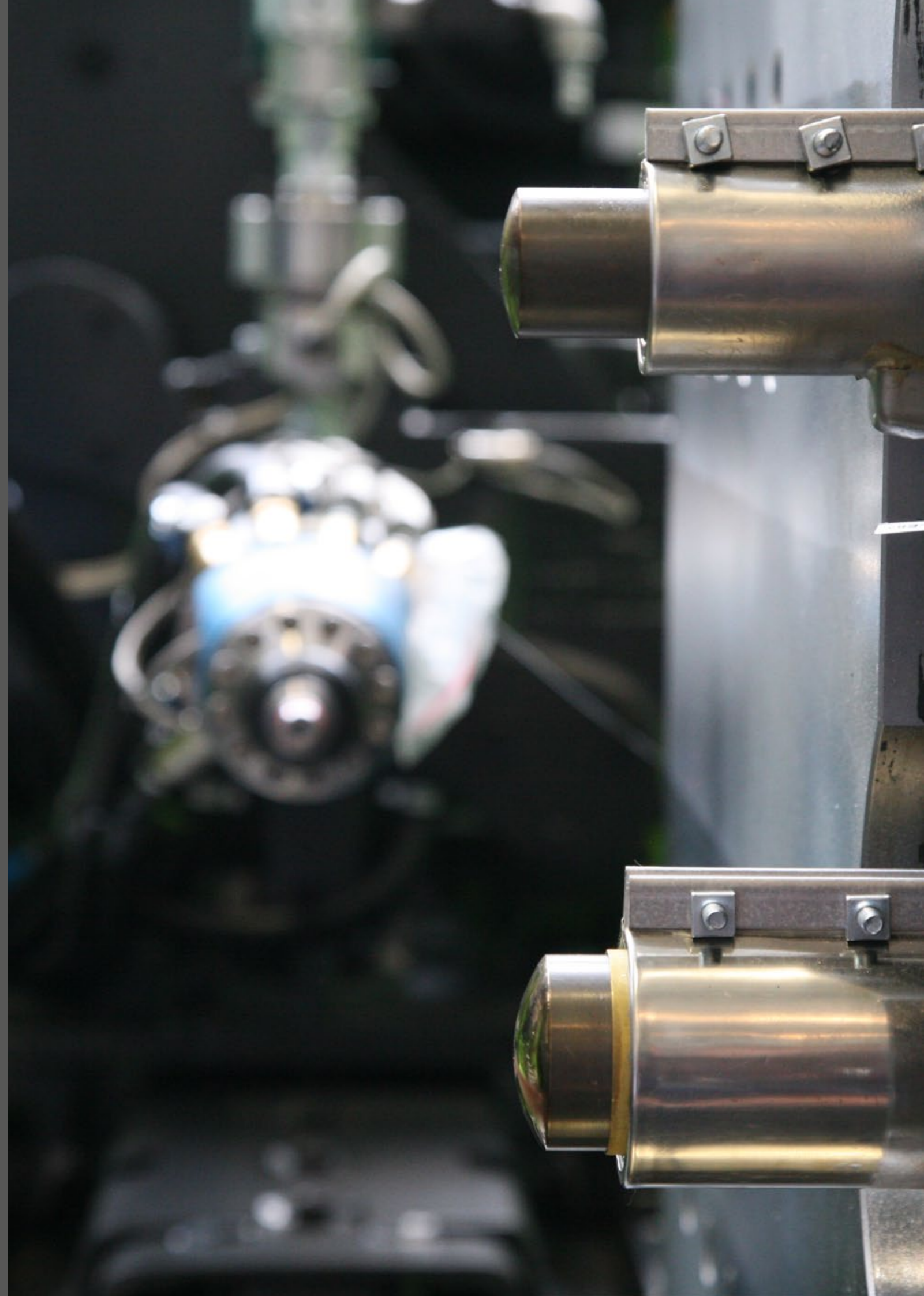
Special interior parts for vehicles: ENGEL varysoft is the perfect choice for the efficient manufacture of **multi-dimensional, soft-touch parts** with a much softer feel. Single-step production of premium lightweight elements used in vehicle interiors by injecting a PUR foam layer between a thermoplastic carrier and a pre-heated decorative film.

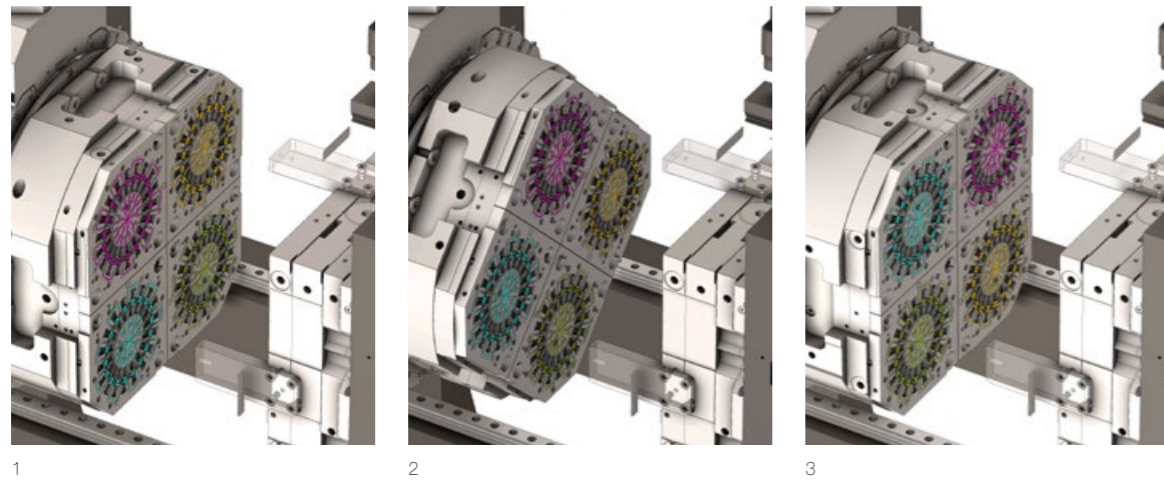
- All three process steps in a one-shot method
- With integrated infrared oven to pre-heat the film
- For lightweight elements with an especially soft core and a premium interior surface, and for undercuts in the part design
- Innovative soft-touch technology for future interior design (our partner: GK tool)



## Combimelt mould designs

**Economic and resource-friendly production:** ENGEL combimelt allows you to produce parts using different components, safely and efficiently, in one single production step. Depending on the product design and type of application, various mould concepts can provide the desired result.





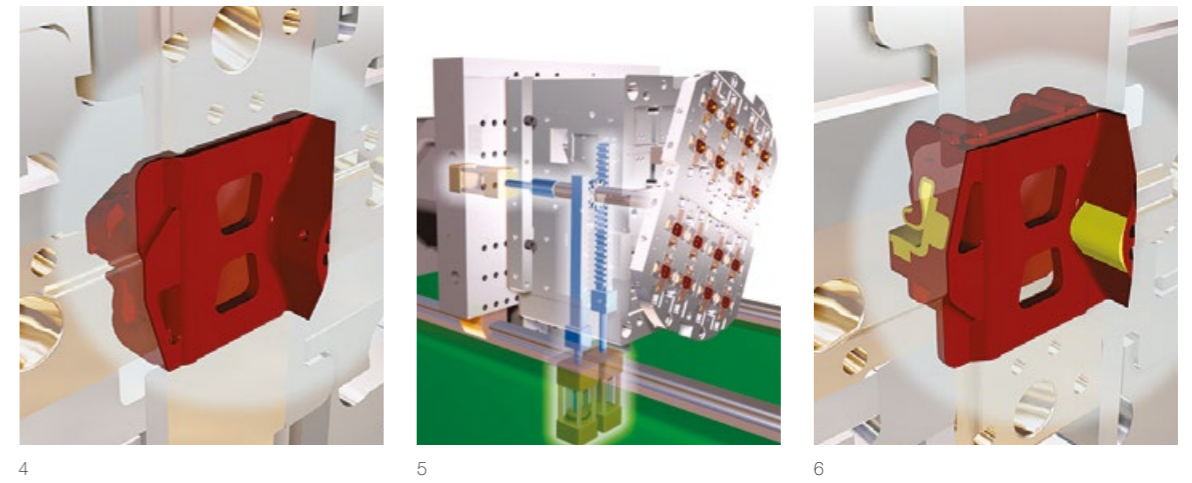
## Rotary table technology

**The universal, efficient solution for all ENGEL combimelt processes:** rotary table technology allows you to meet the most diverse requirements of combination injection moulding with precision and speed. The rotary table is integrated as a fixed module of the moving platen of the ENGEL injection moulding machine. You have the flexibility to use multiple moulds on one production cell.

### The “rotary table” principle

The combimelt process involves rotating the mould half containing the preforms to the second station, where the substrate then is overmoulded with another material during the subsequent injection moulding process. This is repeated at each station (fig 1-3).

- Variable diameter from 600 to 2500 mm
- Suitable for 2/3/4 station operation – reversing mode or rotation
- Alternating rotation  $\pm 180^\circ$
- Exact positioning by electronic rotation angle measurement
- Low height (max. 135 mm)
- Central rotary union for all connections (coolant, oil, electrics)

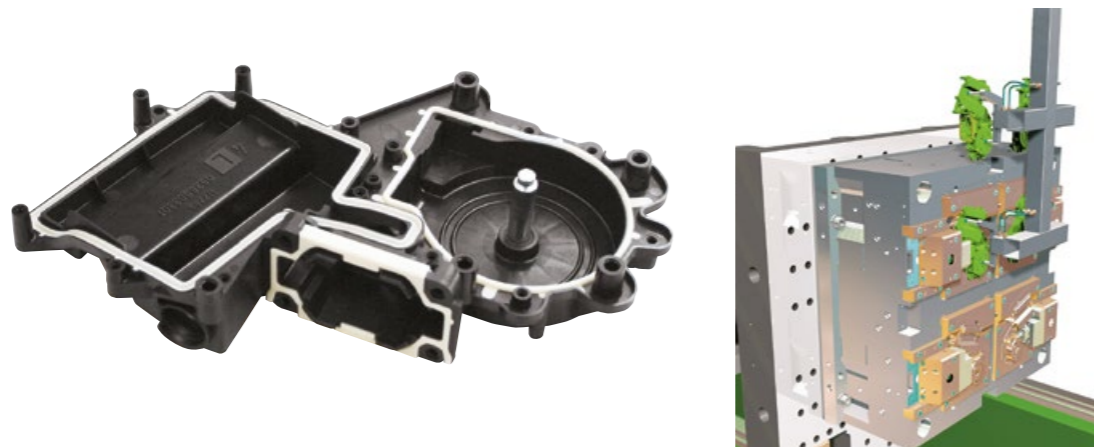


## Index plate technology

Great flexibility in the product design: The index plate technology is the perfect solution if you want to add components to both sides of the moulded part. The index plate is integrated into the mould and responsible for both rotation of the part and transfer into the cavities, different on each side. In this way, sophisticated designs with multiple components can be moulded.

### The “index plate” principle

The drive of the index plate is integrated into the mould half mounted to the moving platen. After the first injection moulding step (fig 4) the partially moulded part is lifted from the cavity, rotated (fig 5) and placed back into the mould for over-moulding in the second station. During the subsequent injection moulding stage, it is possible to over-mould the preform on both the cavity and core side (fig 6).



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## Transfer technology

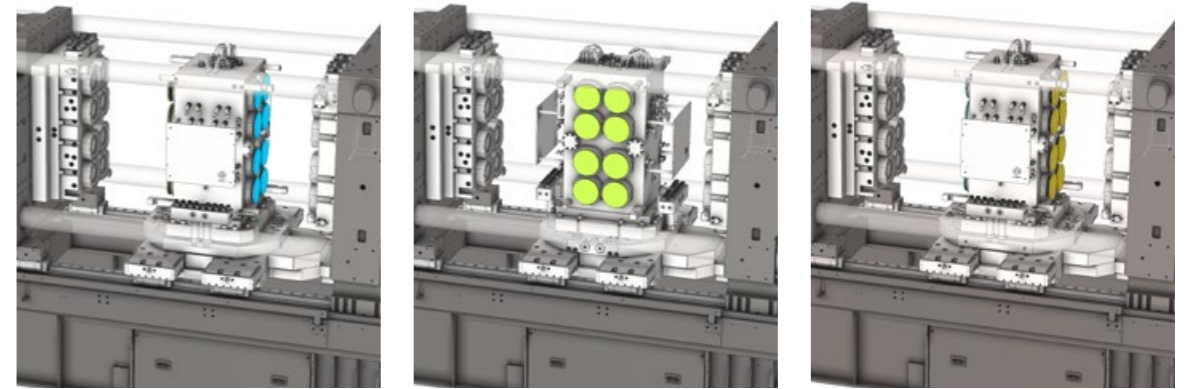
**Whether small batch series, bulky insert parts or special solutions:** you can easily transfer moulded parts during the combimelt process using transfer technology. Automation gives you plenty of options: for example, if you want to insert bulky components or efficiently produce 4-component parts on two injection moulding machines. You might want to consider this technology if a rotary table or index plate solution requires a disproportionately large clamping unit.

### The “transfer” principle

During the combimelt process, a variety of manipulation devices can be used to transfer the preform (fig 7) either between two cavities in the mould itself or between two machines, usually connected by a mounting frame. In addition to robots and grippers, rotary tables are also used, for example, on our vertical rotary transfer machine ENGEL insert.



**Reposition parts easily using customised automation solutions:** e.g. using the dynamic ENGEL viper linear robot, or the multifunctional ENGEL easix, six-axis robot, or various gripper solutions from the ENGEL grip systems portfolio.



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## Horizontal rotary table technology

Manufacture moulded parts efficiently on smaller machines. The ENGEL combi M principle enables you to increase productivity using horizontal rotary table technology. These production cells have opposing injection units mounted on the moving and stationary machine platens and a movable horizontal rotary table or rotary module supported by its own sub-frame. In this way, you can manufacture long moulded parts, between the tie-bars, using a smaller sized machine. In addition, the clamping force requirements can be reduced by using stack-mould technology.

### The “combi M” principle

Combi M machines have a second injection unit integrated into the moving platen. This design does not require a complex melt distribution system in the moving half of the mould. The middle section of a stack mould is mounted on the rotary table, with a horizontal rotation plane. After the first cycle, the preform is rotated into the second cavity and then overmoulded (fig 8-10). As there are two parting lines on combi M machines, the middle rotary table is adjusted flexibly to the opening and closing movement and held in position.

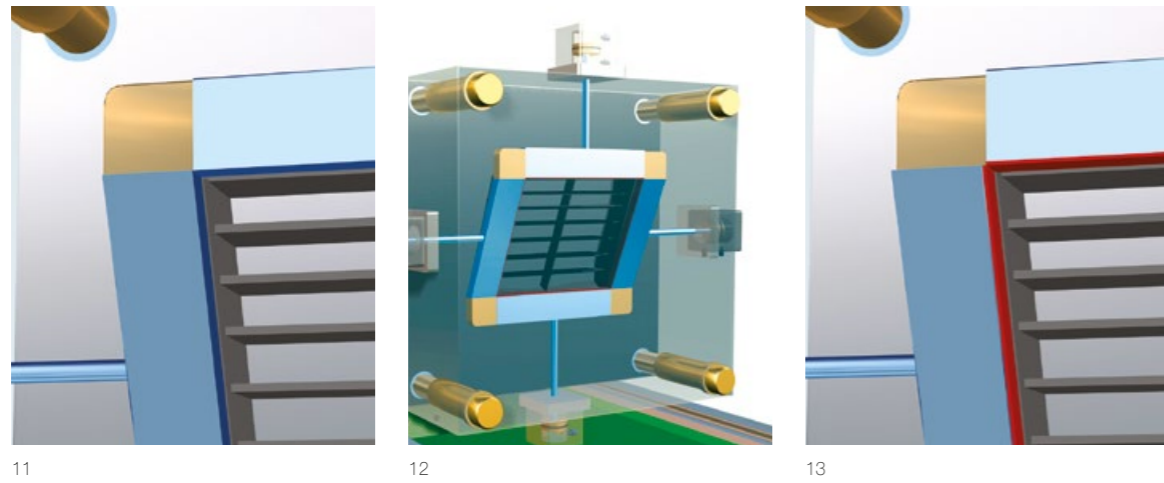
### Cube technology

We use the term cube technology, if not just two, but all four sides of the rotary module are used. This system can be used, for example, to integrate an additional cooling station or to start the next production cycle simultaneously during part removal or insertion.

### Core segment rotation technology

Only individual segments of the rotary module are moved in this concept. The advantage: the mould design is more compact and requires less opening stroke.



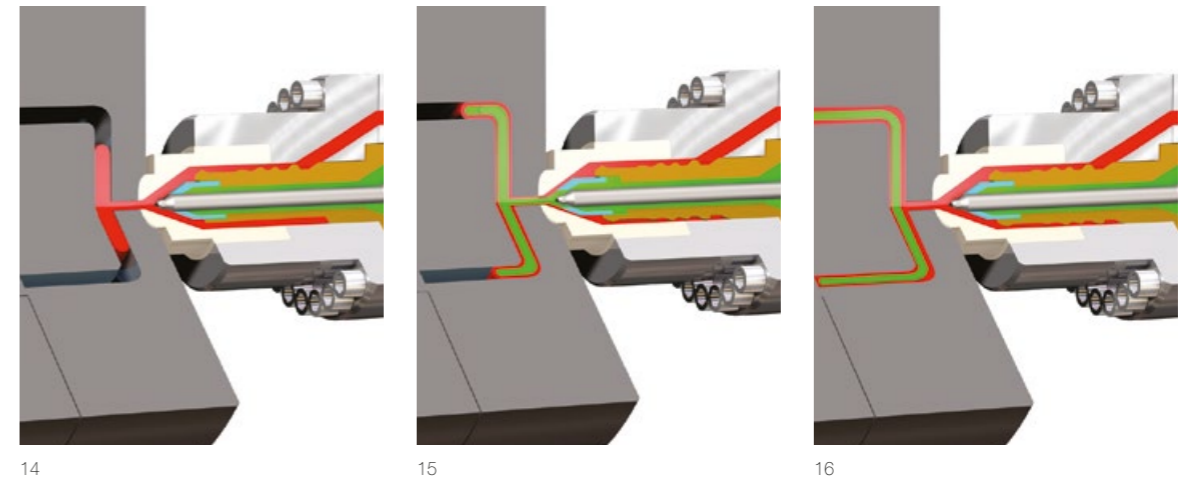


## Core-back technology

**Cost-effective production of small quantities:** core-back technology allows you to produce moulded parts, using several materials, easy and economically. Though the cycle time may increase as a result of the sequential injection moulding process, this technology does not require any manipulation devices during the combimelt process. Furthermore, the relatively compact mould design often makes it possible to use smaller machines.

### The “core-back” principle

While the first component (fig 11, blue) is injected, a hydraulic core blocks the space for the second component in the mould. This space is opened after the cooling time (fig 12) to overmould the preform with the second component (fig 13, red). Unlike other process technologies, the mould is not opened and closed between the shots.



## ENGEL coinjection

**Intelligent optimisation of costs, quality and design:** ENGEL coinjection allows you to not only produce parts at a lower cost, but also to make them more robust and safe for food storage. With this process, multi-layer parts can be produced using a less expensive core material. Or you can use gas-tight core material as barrier layer for optimised packaging. A fibre-reinforced core allows you to overmould an unreinforced skin component. A superb, repeatable marbling effect or tiger stripe pattern can be achieved through interval injection moulding.

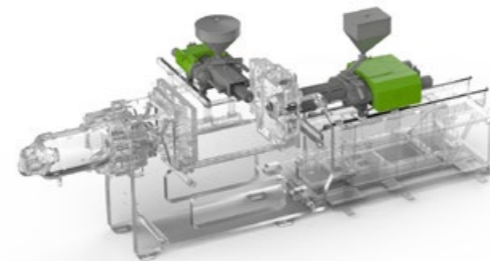
### The “coinjection” principle:

Parts are produced in sandwich, or multi-layer technology on a machine with two injection units with coinjection nozzle. First, the “skin” component is injected and partially filled to a precisely defined level (fig 14). Then, core material is added using the same channel (fig 15). This means that both components are injected into one another. Finally, the finished part is sealed by an additional injection of the first component (fig 16) – so the “skin” envelops the core material completely.

# combimelt unit combinations

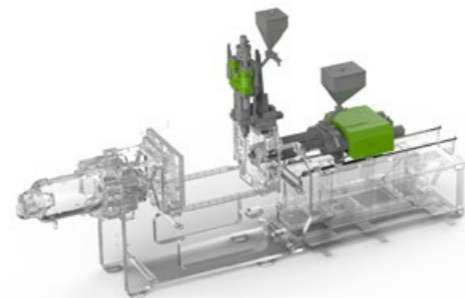
## in H/L position

- Ideal for larger shot weights
- Flexible, horizontal adjustability for mould parting line
- Can be retrofit on ENGEL victory, ENGEL e-victory, ENGEL e-motion, ENGEL duo



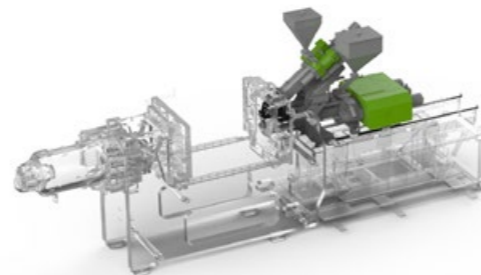
## in H/V position

- Space-saving variant for smaller shot weights
- Available for ENGEL victory, ENGEL e-victory, ENGEL e-motion, ENGEL duo



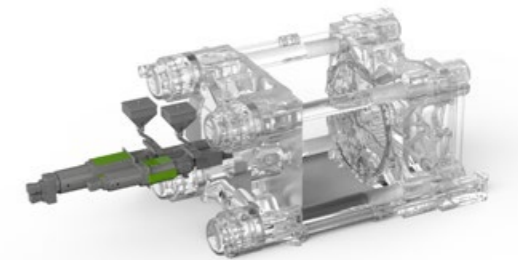
## in H/W position

- Perfect for all automation solutions
- Low height
- Space-saving variant for small and medium shot weights
- Available for ENGEL victory, ENGEL e-victory, ENGEL e-motion, ENGEL duo



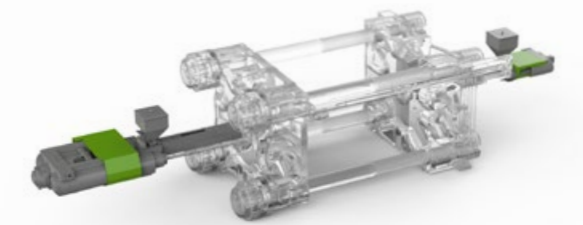
## in H/H position

- Particularly short nozzle distance
- Two units with horizontal adjustability
- For rotary table units up to 2.5 m in diameter
- For ENGEL duo



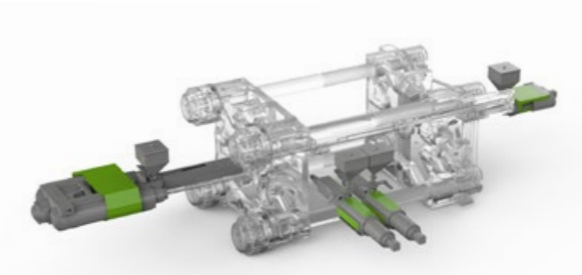
## in H/M position combi M

- Unit on a stationary platen
- "Movable" unit on the moving mould mounting platen
- For rotary table units up to 2 m in diameter
- For ENGEL duo and ENGEL e-motion



## combimelt special variations

- For up to 6 injection units
- For ENGEL victory, ENGEL e-victory, ENGEL e-motion, ENGEL duo





## combimelt basic machines



### ENGEL victory

**The tie-bar-less machine for efficient production of technical parts:** the universal ENGEL victory is your perfect modular system for manufacturing a wide range of technical parts. With its proven tie-bar-less technology, this compact injection moulding machine can even be used for large moulds common to multi-component technology. This means that you only invest in the clamping force you actually require.

- Universal machine for a wide variety of technologies
- Low energy consumption
- More room for automation and mould
- Optimal mould protection
- Clamping force – from 600 kN to 5,000 kN

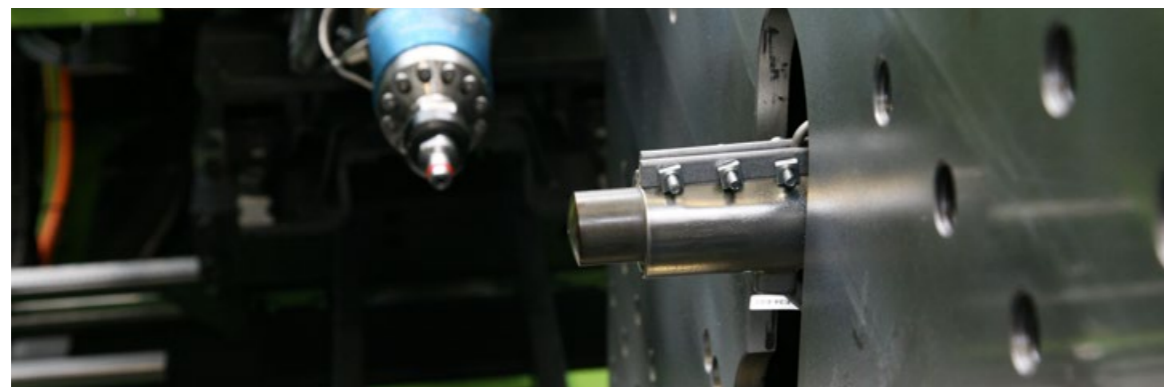




## ENGEL e-victory

**The tie-bar-less machine for high-precision technical parts:** the ENGEL e-victory delivers premium quality to meet the strictest of standards. With its servo-electric injection unit, tie-bar-less mould area and low-emission drive technology, the ENGEL e-victory is the smart, clean choice for the production of precision technical mouldings or small medical parts.

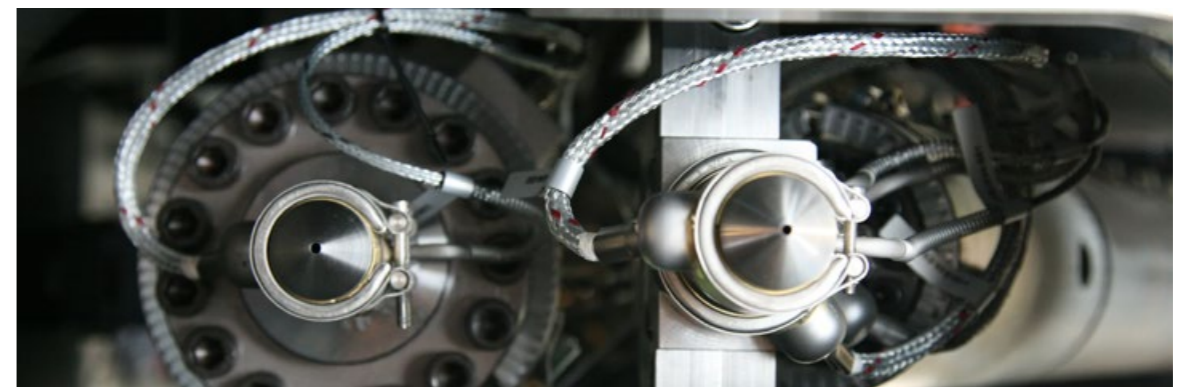
- Precise, servo-electric injection unit
- Suitable for moulds with and without core-pulls
- High energy efficiency
- Excellent mould protection
- More room for automation and mould
- Clamping force – from 800 kN to 2,200 kN



## ENGEL e-motion

**The all-electric machine for high-end applications:** The ENGEL e-motion is the optimal production cell for the ever-growing demands of a dynamic market. Thanks to a sophisticated, flexible, all-electric machine concept that gives you constant, clean quality in a highly efficient way.

- Low maintenance costs thanks to an enclosed lubrication system
- Short injection times due to dynamic servo-motors
- Energy-efficient drive systems
- High performance thanks to fast dry cycle times
- Cleanroom capability with sealed toggle levers
- Clamping force – from 1,100 kN to 3,800 kN





## ENGEL insert

**The machine for perfectly overmoulded insert parts:** with its compact, variable machine concept and vertical clamping unit, the ENGEL insert is the ideal solution. To meet every mould requirement, this series is available with a vertical or a horizontal injection unit. For even higher precision: the ENGEL e-insert, available with a servo-powered, electric injection unit and featuring the innovative hydraulic ENGEL ecodrive as standard.

- Customisable injection moulding machine in the variations of single, rotary & shuttle
- Minimal footprint
- Ergonomically optimised working height without operator platform
- Highly energy-efficient
- Efficient protection of the open work area by means of a light curtain
- Clamping force – from 300 kN to 4,000 kN



## ENGEL duo

**The powerful injection moulding machine for large parts:** with its flexible layout and compact size, the ENGEL duo integrates ideally with your production. Regardless of whether you produce large parts, manufacture highly sophisticated components for the automotive industry or have the need to create the perfect surface for your high-tech products.

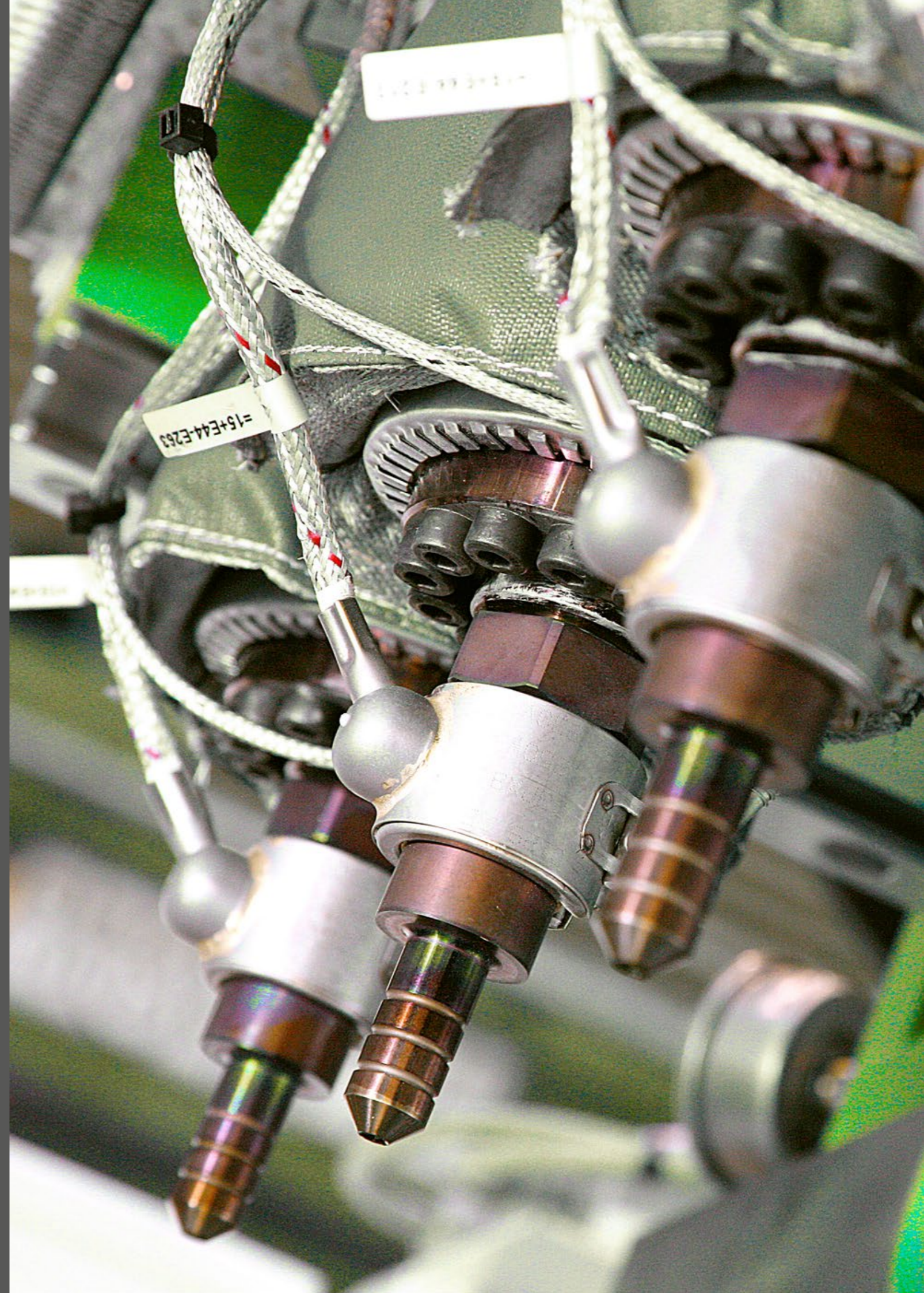
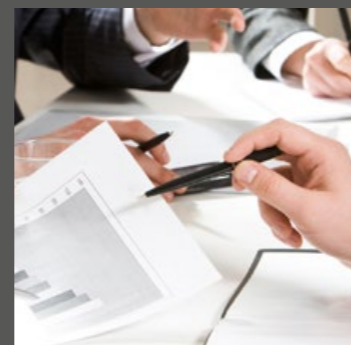
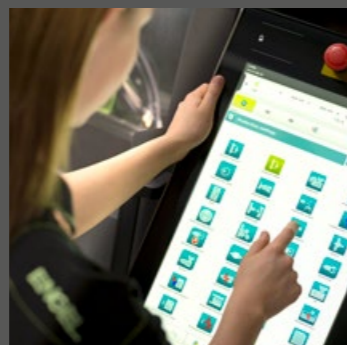
- Very small footprint and low height
- Flexible machine layout with standardised modular principle
- Short cycle times
- Intelligent energy concept
- Maximum cost effectiveness for large-volume and large-surface parts
- Clamping force – from 3,500 kN to 55,000 kN



# ENGEL systems expertise

**The optimal technological solution for your production:** ENGEL designs and brings to life complete turn-key systems, offering premium part quality, stable processes and maximum productivity. Our expertise comes from the experience of decades in injection moulding and numerous projects world-wide. This guarantees that we will create your production cell or line from the best-possible, most effective system components.

- Perfect interaction between machine, technology, peripherals and automation
- Flexible solutions ranging from standard application to special engineering
- Proven modules for efficient, individual turnkey systems
- ENGEL CC300 – smart operation of machine and robot
- Easier to use with added safety for greater efficiency
- Trouble-free and professional service on every continent
- Long-term collaboration with renowned companies
- Professional training and global support





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