combimelt
Clever combination of plastics

ENDE
be the first
Innovative products and economic production through the combination of materials

As a manufacturer of premium plastic materials, the requirements that you have to fulfill are constantly increasing. Combinations, additions, symbioses and alloys of materials are required for the precise achievement of desired multicomponent 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. Combinations of colours, shapes, functions, or alternative materials therefore become a reality.

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**

**Composite and combination 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 component. In these cases, the plastics should possess a common adhesive quality to guarantee that the components of the finished part are securely bonded.

**Enhanced process**

Enhanced processes are often necessary to fulfill requirements such as optimal process integration and high product quality. These design and quality requirements are important, for example, in modern vehicle manufacturing and medical technology.

**Assembly moulding**

Here the aim is to assemble individual components for assemblies or functional units, and not to produce individual multi-component parts. In this instance, the different materials are chosen based on their specific properties. Assemblies with moving individual parts or assemblies with integrated seals become possible.
Composite and combination injection mouldings

Addition process

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 control elements 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 here. 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 must cool down in the mould; the elastomer component is then injected and subsequently cured. The second option involves combining with liquid silicone: 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 process

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. As a result, multi-layer components (usually three layers) can be produced. The two outer layers are responsible for the high-quality surface, while reinforcements in the relevant core materials improve mechanical properties and heat resistance. Component costs can be lowered by using recycled materials, and foamed core materials can help reduce component weight. One can use interval injections to achieve the desired optical effect through “marbling”.

Multi-colour part
Multi-component part
Thermoplastic rubber
Thermoplastic LSR
Coinjection process
Coinjection process
**Enhanced process**

**ENGEL dolphin**

**Stylish look and pleasant feel for multi-component parts:** ENGEL dolphin is the perfect injection moulding process, for example, for the production of sophisticated interior components in modern vehicle manufacturing. This innovative, two-component injection moulding process makes applying a premium soft-touch surface to components such as instrument panels or door trims effective and economical.

- Two-component injection for increased structural strength and premium feel in one production step
- Compact production units, reduced logistical effort and optimised manufacturing costs
- Support structure flooded with microcellular, foamed polyester
- Foam injection moulding with "negative" compression technology (precision opening)

**ENGEL glazemelt**

**Combination injection moulding for large-surface parts:** ENGEL glazemelt enables the injection moulding of flat, crystal-clear components from plastics, allowing you to enjoy the 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
- Total design flexibility 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 thin coating thickness
- Advanced and efficient process with multiple 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 components for vehicles:** ENGEL varysoft is the perfect choice for the efficient manufacture of multi-dimensional, soft-touch components 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 component design
- Innovative soft-touch technology for future interior design (our partner: GK tool)
Assembly moulding

Seal assembly

Components including a sealing element are produced in a single injection moulding process. A hard-soft composite is created. One application area is the integrated assembly of sealing elements by sequential composite injection moulding. ENGEL combimelt can be used to produce sealing elements both from cured and thermoplastic elastomers. Optimal product properties can be achieved by combining up to 6 components with different properties.

Assembly production

By carefully selecting materials that do not adhere to one another, moveable joints can be created. Assembly of the parts can be combined with the actual injection moulding process.

Suitability & bond strength

The table provides an overview of the bond strength that can be achieved for a host of material combinations. This depends on the material combination, the process and process control, and on the geometry of the moulded part. If optimal material bond strength cannot be achieved, adhesion modifications by way of mechanical anchoring elements may help.
Budget and resource-friendly production: ENGEL combimelt allows you to produce parts from 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.
Index plate technology

Great flexibility in the product design: Look no further than index plate technology if you want to add components to both sides of the moulded part. The index plate is integrated into the mould and assumes both rotary and transfer functions of the component into the cavities, which differ on both sides. In this way, sophisticated designs with multiple components can become a reality.

The “index plate” principle

The drive of the index platen is integrated into the mould half mounted to the moving platen and adapted to the actual moulding requirements. After the first injection moulding stage (image: 4) the partially moulded part is lifted from the cavity, rotated (image: 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 substrate on both the cavity and core side (image: 6).

Rotary table technology

The universal, efficient solution for all ENGEL combimelt processes: rotary table technology allows you to meet the most diverse requirements in combination injection moulding with precision and speed. The rotary table is integrated into the desired ENGEL injection moulding machine as a fixed module of the moving platen. In this way, you have the flexibility to use the complete production unit for several injection moulds.

The “rotary table” principle

The Combimelt process involves rotating the mould half containing the substrate 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 (image 1-3).

- Variable diameter from 600 to 2500 mm
- Suitable for 2/3/4 station operation – reversing mode or rotation
- Alternating rotation ± 180°
- Exact positioning by electronic rotation angle measurement
- Low height (max. 135 mm)
- Central rotary union for all connections (coolant, oil, electrics)
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. The relevant robot technology gives you plenty of options: for example, if you want to integrate bulky insert parts or ensure the efficient production of 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 (image: 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.

Transfer parts easily using individually designed automation solutions: e.g. with the dynamic ENGEL viper linear robot, with the multifunctional ENGEL easix, six-axis robot, and with various gripper solutions from the ENGEL grip systems portfolio.

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 stationery 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, within the tie-bars, utilizing machinery of a much smaller scale. In addition, the clamping force is reduced by 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 rotary table, with a horizontal rotation plane, carries the middle section of a stack injection mould. After the first cycle, the preform is applied to the second cavity by the rotation and then overmoulded (image: 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.

Turning stack mould technology
We use the term turning stack mould technology if not just two, but all four sides of the rotary module are used. You can use this system, for example, to integrate an additional cooling station or start the next production cycle simultaneously during removal or insertion work.

Core segment rotation technology
Only individual segments of the rotary module are moved here. The advantage: mould design is more compact and required opening stroke of machine is much smaller.
Core retraction technology

Economic production of small quantities: core retraction or slider technology allows you to produce moulded parts, from several components, simply 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 retraction” principle

While the first component (image: 11, blue) is injected, the space for the second component is locked by a hydraulic valve gate in the mould. This is opened after the cooling time (image: 12) to supplement the preform with the second component (image: 13, red). Unlike other process technologies, this injection process takes place without opening and closing the mould.

ENGELE coinjection

Intelligent optimisation of costs, quality and design: ENGELE 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, you can inject a less expensive core material into the first component for multi-layer injection moulding components, and can perfect packaging by using a gas-tight core material as a barrier layer. A fibre-reinforced core allows you to supplement an unreinforced skin component and a superb, reproducible marbling effect or tiger stripe pattern can be achieved through interval injection moulding.

The “coinjection” principle:

Moulded parts are produced in sandwich, or multi-layer bonding, in a machine with two injection units and a coinjection nozzle connecting them. First, the “skin” component is injected and partially filled to a precisely defined level (image: 14). Then, core material is added using the same sprue system (image: 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 (image: 16) – so the “skin” envelopes 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
ENGEL victory

The tie-bar-less machine for efficient production of technical mouldings: the universal ENGEL victory is your perfect modular system for manufacturing a wide range of technical mouldings. With its proven tie-bar-less technology, this relatively small 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 all-rounder for a wide variety of technologies
- Low energy consumption
- Generous freedom 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
- Generous freedom 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 unit 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 short dry cycle
- Clean room capability with sealed toggle levers
- Clamping force – from 1,100 kN to 3,800 kN
**ENGELE** 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 model range is available with either vertical or horizontal injection unit. Plus, as the ENGEL e-insert, available with a servo-powered, electric injection unit and featuring the innovative hydraulic ENGEL ecodrive as standard, it can achieve even higher precision.

- Insert 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

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**ENGELE** 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
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. We have developed this know-how over the decades through the implementation of numerous projects worldwide. This guarantees that we will create your production cell or line from the best-possible, most effective system components.

- **Perfect interaction between** machine, technology, auxiliaries and automation
- **Flexible solutions** ranging from standard application to special engineering
- **Proven modules** for efficient, individual turnkey systems
- **ENGEL CC300** - smart operation of machine & 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