Scope of products
The portfolio
When things get a bit tougher in the business world, it's good to have a partner you can rely on. To our customers and partners, working with ENGEL means TRUSTING in a company that has been led reliably and kept on course by one family for decades. Our aim has always been to use our EXPERIENCE and COMPETENCE in every area of PLASTICS PROCESSING to live up to our reputation as a WORLD LEADER. We set new standards in a dynamic and diverse industry through INNOVATION and SYSTEM COMPETENCE. We offer the right machine for every application – and in addition to premium QUALITY, we focus on MODULARITY and INDIVIDUALITY. We believe in the importance of not only listening to the immediate concerns of our customers, but also anticipating their future requirements. We support our partners with SERVICE and EXPERTISE. This is also why we have created a GLOBAL network of subsidiaries that enable us to be READY whenever and wherever you need us.
Contents

1 Machine series
victory ........................................ 8
e-victory ....................................... 10
e-motion ......................................... 12
e-mac ............................................. 14
duo .................................................. 16
e-duo .............................................. 18
v-duo ............................................. 20
e-speed .......................................... 22
insert ............................................. 24
elast ............................................... 26
e-cap .............................................. 28
flexseal .......................................... 30

2 Automation .................................. 32

3 Plasticising technology .................. 36

4 Technologies
combi mel t ....................................... 42
coinject/skinmelt ............................ 43
LIM/LSR ......................................... 44
glazemelt ....................................... 45
coinmelt ......................................... 46
variomelt ....................................... 47
foammelt ....................................... 48
foilmelt ......................................... 49
tecnomelt ...................................... 50
gasmelt/watermelt ......................... 51
clearmelt ....................................... 52
optimelt ........................................ 53
organomelt .................................... 54
Fibre reinforced plastics .................. 55

5 Services
Overview ...................................... 56
ENGELE leads the global market for injection moulding machines. And not without a reason: from 280 kN to 55,000 kN clamping force, from hydraulic to all-electric, and from horizontal to vertical. You will find the right machine for your application with us.
Manufacture precise parts **efficiently.**

The universal, tie-bar-less ENGE victory machine series is a modular design matrix for cost-effective injection moulding production. Its flexibility and reliability make it the ideal solution for manufacturing all sorts of parts with strict requirements, from toothbrushes and pipe fittings to complex vehicle components.

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**The ENGE victory bonus**

**Tie-bar-less technology: large moulds on a small machine**  You only invest in the clamping force you actually need.

**Low energy consumption levels** as standard thanks to little friction, clamp pressure lock-in and electro-hydraulic variable capacity pumps.

**Mould protection, great platen parallelism and even clamping force distribution** in the mould thanks to

- the patented ENGE force divider

**No restrictions** in the mould area enable

- complex and innovative mould designs
- fast mould set-up
- free space for robot movements

**Universal injection moulding machine**

- basic machine for lots of different applications and a wide range of technologies, (e.g. multi-component technology).

**More energy efficiency** thanks to

- the optional servo-hydraulic ENGE ecodrive system with different drive variations (consecutive or parallel movement sequences)
The tie-bar-less machine for high-precision parts.

Due to its highly accurate servo-electric injection unit, the ENGEL e-victory is perfect for manufacturing technical parts that have to meet high quality requirements (e.g. delicate, complex, optical or micro parts).

It already has the hydraulics “on board” for complex moulds with hydraulic components such as core pulls, and this machine’s tie-bar-less mould area and low-emission drive technology makes it very suitable for clean room use.

The ENGEL e-victory bonus

By teaming a servo-electric injection unit with the innovative servo-hydraulic ENGEL ecodrive system, the ENGEL e-victory combines the best of two worlds.

Higher energy efficiency and precision levels due to
- the servo-hydraulic ENGEL ecodrive system
- a servo-electric injection unit

Mould protection, great platen parallelism and even clamping force distribution in the mould due to
- the patented ENGEL force divider

No restrictions in the mould area enable
- complex and innovative mould designs
- fast mould set-up
- free space for robot movements
The ENGEL e-motion bonus

Highly accurate and extremely fast: Both the precision and the speed of this machine make it worth the investment.

Excellent cleanliness and durability due to
- an encapsulated toggle lever
- linear guidance of the moving platen

Low maintenance costs due to
- an enclosed lubrication system and
- oil bath lubrication for the ball screw spindle

Energy efficient production
- the high-performance injection units are able to achieve injection speeds that were only attainable with hydraulic accumulators before

Short injection times due to
- dynamic servomotors with rapid acceleration

Always faster, always more precise, always cleaner. The ENGEL e-motion is the ideal production unit for the continuously growing demands of a dynamic market. Thanks to a flexible, all-electric, highly efficient machine design that delivers constant and clean quality – best for medical, fast-running packaging applications and electric multi-component solutions.
The compact all-electric machine for standard applications.

The all-electric ENGEL e-mac offers a great benefit due to very strong performance data while taking up very little room in a production floor. It is fast and extremely cost-efficient in production, due to its low energy consumption. Above all, the investment comes at an incredibly reasonable price.

For a successful introduction into all-electric injection moulding. Offering high output at low investment costs, the ENGEL e-mac is ideal for cost-effective standard applications.

The ENGEL e-mac bonus

All-electric and compact: The all-electric ENGEL e-mac achieves high output at a low investment cost.

Increase the productivity level: more machines in the production floor due to the small footprint. The machine design is applicable for a large variety of applications.

Wide range of applications due to
- more options for standard applications

Long life for the clamping unit due to
- linear guidance of the moving platen (the tie-bars act as tie-rods only)
- ENGEL IQ clamp control (software for process control and monitoring the injection procedure)

Even more process consistency and shot weight stability thanks to these optional systems
- ENGEL IQ weight control (software for process control and monitoring the injection procedure)
- ENGEL smartshut (self-locking non-return valve)

Low energy consumption due to
- an all-electric drive concept with an innovative kinetic energy recovery system
ENGEL
duo

Powerful machine for large parts.

ENGEL is the pioneer of the two-platen technology. The ENGEL duo machines are true powerhouses and cover a wide range of clamping forces up to 55,000 kN. They are able to handle the largest shot weights easily, and are therefore perfect for the production of large containers or sophisticated vehicle parts.

The ENGEL duo bonus

Space-efficient production
The machine has a very small footprint thanks to its compact proven dual-platen design.

Excellent operating safety and part quality due to
- solid platen support and guide
- precise platen parallelism
- sensitive mould protection

Short cycle times due to
- optimised process dynamics
- synchronised locking device

More productivity and less energy consumption due to
- iQ-weight control (optional)
- iQ-clamp control (optional)

Clean mould area due to
- low-friction platen guiding on carriages (no tie-bar guiding)

More energy efficiency due to
- the servo-hydraulic ENGEL ecodrive system with optimum working point (standard up to duo 23060, optional from duo 35050)
- electrical screw drive (optional for all sizes)
The ENGEL e-duo bonus

The first electric two-platen machine with performance data compatible to those of the proven ENGEL duo series.

Low friction thanks to innovative linear bearing with highly precise servomotor that ensures the most accurate control.

Less space required due to
- the compact design and smaller footprint

Additional energy savings due to
- a high injection capacity without hydraulic accumulators

High precision moulding using
- electric drive technology – maximum repeatability guaranteed

ENGEL e-duo

Electric powerhouse for large high-precision parts.

The ENGEL e-duo is the first machine to bring the benefits of electric drive technology to the large-scale machine segment. The machine offers a high injection rate without requiring hydraulic accumulators – a significant contribution to reducing energy consumption. This series is perfect for producing parts that require large flow lengths as well as high precision and energy efficiency.
Space-saving vertical machine for large lightweight parts.

The ENGEL v-duo demonstrates the benefits offered by vertical injection moulding machines to large-scale machines. Therefore, the ENGEL v-duo is ideal for the production of high-precision parts which are both large and lightweight.

The ENGEL v-duo bonus
An extremely small footprint thanks to a compact design, with low height and weight. Outstanding energy efficiency in standard configuration.

Customisation with
- sliding table
- equipment for reactive technologies
- automation

Enhanced ergonomics
- easy access
- safety for the operator
The high-speed machine
for maximum output.

All system components of the ENGEL e-speed series are designed for maximum speed, dynamics and consistently working at maximum performance. Therefore, the ENGEL e-speed is perfectly adapted for the requirements of the packaging industry.

The ENGEL e-speed combines the proven high-performance all-electric machine series ENGEL e-motion and the properties of the ENGEL speed series: a combination of highest injection rates and maximum energy efficiency.

The ENGEL e-speed bonus

ENGEL’s fastest machines. The series is created for maximum output continuously produced at a high performance level.

Short cycle times thanks to
- extremely fast dry cycle times
- high injection speeds (of up to 1000 mm/s)
- parallel movements

Servo-electric screw drive for
- increased efficiency with high shot volumes

Excellent cleanliness and durability due to
- an encapsulated toggle lever
- linear guidance of the moving platen
ENGEL insert

Inserted parts **perfectly overmoulded.**

With its vertical clamping unit, the ENGEL insert series is the ideal solution when it comes to overmoulding inserted parts. Depending on your mould requirements, the ENGEL insert series can be delivered with either a vertical or a horizontal injection unit.

For the production of parts that have to meet particularly high precision standards, the ENGEL e-insert is the best choice. The standard version of this machine is equipped with a servo-electric injection unit and the innovative hydraulic ENGEL ecodrive.

**The ENGEL insert bonus**

**Very small footprint**
- no operator platform necessary, because the working height has been ergonomically optimised
- very compact design due to the vertical injection unit

ENGEL e-insert, the machine for **maximum precision**

**Horizontal parting line guarantees**
- easy and precise insertion and positioning of inserts in the cavities

**Easy access due to**
- a safety light guarding

**Available in three versions**
- rotary (rotary table)
- single (stationary lower mould mounting platen)
- shuttle (sliding table)
The elastomer machine that adapts to your needs.

Elastomers are perfect for all sorts of special functions. They act as a seal, absorb noise and vibrations, protect joints, and are highly resistant to heat and low temperatures.

The ENGEL elast series consists of machines and automation solutions which have been developed specifically to process elastomers. As a result, any elastomer can be processed efficiently and reliably.

**Homogeneous plasticising** due to
- FIFO or screw units for rubber strips or solid silicone.

**Very fast cycle times** due to
- specially designed machine movements

**High platen rigidity**
- for high quality requirements in the elastomer production

The ENGEL elast bonus

This is a flexible power package for elastomer applications of any kind. It can be used on both vertical and horizontal machines.
Based on 10 years of e-cap experience and a consistent focus on the production of beverage caps and closures, we have developed a new generation of the e-cap series. The all-electric machine concept offers a combination of performance, energy efficiency, cleanliness and stability that is unique to the market. In short, the e-cap is the most effective solution for beverage caps and closures production.

The ENGEL e-cap bonus
All-electric benefits with maximum performance and stability.

Maximum performance
- robust machine design for cycle times under 2 sec.
- optimized for the production of beverage caps and closures

Maximum cleanliness
- sealed toggle lever and encapsulated spindle lubrication
- substantially reduced risk of part contamination by lubricants

High energy efficiency
- all-electric drive system with energy recovery
- kinetic energy accumulator to reduce power peaks
- reduction of energy required for machine cooling
With the flexseal you can produce all types of flat seals and O-rings very efficiently on the smallest footprint. This hydraulic machine is suitable for all common rubber compounds and guarantees reliable and efficient processing.

The ENGEL **flexseal** bonus

The flexseal is equipped with the energy efficient hydraulic ENGEL ecodrive as standard. This is particularly beneficial due to the longer heating stages in the manufacture of O-rings and flat seals.

Open design
- excellent accessibility to the strip feeder and injection unit

High precision
- outstanding results with all common elastomers (rubber, solid silicone, LSR & TPE)

Energy efficient hydraulic drive
- ENGEL ecodrive
- particularly beneficial due to longer heating stages in the manufacture of O-rings and flat seals

The compact hydraulic machine
for O-rings and flat seals.

With the flexseal you can produce all types of flat seals and O-rings very efficiently on the smallest footprint. This hydraulic machine is suitable for all common rubber compounds and guarantees reliable and efficient processing.
2 Automation

ENGEL leads the global market for injection moulding machines. And: Number 1 with over 25,000 automation solutions installed worldwide. In addition to our subsidiaries and world-wide service network, more than 450 specialists at ENGEL automation are dedicated to automation. Our competence centres provide you with experts in technologies, CE certification and efficient overall project engineering.
ENGEL automation

Perfectly matched components and system solutions.

The dynamics of the market pose more and more complex challenges to your production. ENGEL offers you solutions that precisely match your desired level of automation: from modular to tailor-made system solutions. Automation expertise at all levels: We design and supply complete production systems in which all processes, from the injection moulding machine to the robot to the automation peripherals, are perfectly matched. So that you can rely on the highest part quality, stable processes and maximum productivity – and that your entire production is running smoothly.

The ENGEL automation bonus

- comprehensive product portfolio
- global automation expertise
- optimally matched products
- more than 40 years' experience in automation
- complete control integration of ENGEL components

More than the sum of all its components.
ENGEL products can be totally integrated into the machine control unit. Mechanical and control integration of the individual components results in the most compact solutions, whose functions are always optimised with regard to performance and user-friendliness.
3 Plasticising technology

It all depends on the plasticising unit. It defines both the quality and the performance of modern injection moulding machines. The plasticising unit defines the feasible melt quality, the repeatability of the injection moulding process, and above all the life expectancy and cost effectiveness of the machine.
Focus on the **plasticising unit.**

Improved performance, service life and efficiency for injection moulding machines.

Perfectly matched

The individual components such as the plasticising screw, non-return valve, and barrel match perfectly on an ENGEL machine. And they cover – in various packages – the wide-ranging market requirements. These requirements range from the production of thin-walled parts made of standard plastics produced at extremely short cycle times all the way to highly corrosive or abrasive plastics.

Plasticising engineering solutions: Material classes

- **basic:** for additive-free thermoplastics with low corrosive potential
- **advanced:** for thermoplastics with additive content of up to 30%, corrosion resistant material execution
- **high-performance:** In combination with 3 zone screws for thermoplastics with additive content above 30%, corrosion-resilient material execution

Geometry is the key

Where process engineering requirements are tougher, standard geometries are often not sufficient. ENGEL offers a wide selection of custom geometries for such cases. They ensure maximum plasticising capacity, superb colorant blending, and excellent plasticising consistency.

Technology packages

Moreover, ENGEL offers additional technology packages in the various material classes designed to meet the requirements of special process technologies. They include processing of plastics that are highly sensitive to shearing or high performance screws for high feed volumes with improved melt quality.

- PVC package
- high-performance package for caps and closures production
- self-cleaning package for fast material/color changes
- packages for optical and glazing applications

ENGEL solution expertise

The requirements on the plasticising unit are continually becoming tougher. Plastics with special properties require the use of additives to fulfill requirements. In view of increasing productivity, these new plastics need to be processed faster and with premium quality on state-of-the-art injection moulding machines. All these factors lead to increased stress on all plasticising unit components – resulting in a shorter service life as well as in process variations.

Success through ongoing development

To be able to fulfill increasing demands in the future, plasticising systems require continuous development – both in terms of geometry and material execution. With our extensive experience, competency and state-of-the-art facilities, such as our own materials laboratory, or screw testing center, ENGEL remains on the leading edge in plasticising engineering.
When you need moulded parts with special properties. ENGEL injection moulding machines support all options for standard injection moulding at the highest level. But ENGEL also offers the right solutions for special products that cannot be manufactured using standard technology.
When individual characteristics and function join to form a more powerful whole, the result is superior in performance compared to a stand-alone solution. The ENGEL combimelt technology follows this principle. Instead of assembling individual parts, a combination of materials is achieved by injection moulding. This approach creates innovative moulded parts with different colours, properties and functions.

Decades of experience
ENGEL offers the appropriate application and machine technology to produce the parts you designed: whether by sequentially adding materials or simultaneous injection of two components, whether you need two, three or up to six different components in a cycle, whether you are producing microparts or heavyweights.

ENGEL combimelt
Combination expertise.

ENGEL coinjection
Reduce costs and improve quality.

ENGEL coinjection is a sequential form of multi-component technology. It involves a second component (core) being injected into the first component (skin). A special coinjection nozzle controls the ratio between the first and second components using a different pressure.

This method can save costs, as it allows a cheaper core material, for instance recycled material. It is also possible to enhance the quality of a part by giving it a fibre-reinforced core and an unreinforced skin. Sink marks can be prevented by using expanding agents in the core, which can also lead to a reduction in the clamping force required – an additional positive side effect.

In the packaging industry, coinjection is applied in barrier injection moulding. When polyolefins are processed, a gas-tight material like EVOH is used as a barrier layer in the core.

Another special application of coinjection is interval injection moulding, used to produce parts with a marbled appearance. Because of repeated switching between the two components during the injection process, a repeatable marbling effect is created when moulding parts with complex profiles, and a tiger stripe pattern in the case of simple profiles.

ENGEL skinmelt
Complex component geometries – high proportion of recycled material.

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 displaced by the flow of core material and pressed against the cavity walls, while the core is filled with the second material. The result is sandwich parts with premium quality.

A great opportunity for the plastics industry
ENGEL skinmelt enables products with a skin made of virgin material and a very high proportion of recycled material: 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 play an important role here. Grade purity of the recycled and virgin material ensures that the sandwich-moulded products can also be easily recycled at the end of their service life. ENGEL is promoting increased use of recycled material with this technology.
The ENGEL LIM machine range has been designed to handle the many different applications that involve processing liquid silicone rubber.

The ENGEL LIM portfolio includes flexible systems for production of diverse products – from micro parts to multi-component applications (thermoplastic/LSR composites) to high volume parts (e.g. high voltage insulators). All systems offer a wide range of combinations and configurations.

**LIM injection unit**
- available with screw conveyor or injection plunger

**Perfeks metering**
- system compatible with all popular brands of metering pumps and systems

**Integrated control**
- metering pumps
- automation components, interface of de-moulding devices

Crystal clear large surface area parts offer decisive benefits compared to silica glass. They are lighter, offer more freedom in design, and can be perfectly combined with other materials – including functional integration. Thanks to ENGEL’s intelligent glazemelt technology, these large surface area, multi-component parts can be produced with excellent optical quality, low stress and extreme efficiency.

Arranging the moulded parts in layers saves clamping force and at the same time supports the production of the largest possible parts in relation to the clamping force. This process is not entirely restricted to crystal clear moulded parts, but suitable for any kind of multi-component part with a large surface area.

Especially developed for this process, ENGEL offers a plasticising unit (screw, non-return valve, cylinder head, cylinder) with optimised geometry.
The successful injection-compression moulding process extends the injection moulding process by adding a compression movement of the clamping unit. This offers versatile capabilities depending on your application. Where melt distribution with substantially reduced clamping force is the major focus for moulded parts with a large surface area, the process demonstrates its capability in the evenly distributed cavity pressure for thick-walled moulded parts. This opens up a large range of applications from automobile glazing, through optical lenses, to moulding of finest micro structures for innovative analysis applications in medical technology (lab-on-a-chip).

ENGEL coinmelt
Decisive benefits.

Maximum repeatability and optimised dynamics open up new potential for speed and force-controlled injection compression moulding with the all-electric ENGEL e-motion series.

Active parallelism control for the clamping unit on the ENGEL duo dual platen machine for large-scale moulded parts guarantees optimised moulding despite a decentralised sprue position.

Equipment packages that match your expectations form the basis for cost-effective production.

ENGEL offers the machines to match, perfectly equipped for your application:

- Maximum repeatability and optimised dynamics open up new potential for speed and force-controlled injection compression moulding with the all-electric ENGEL e-motion series.
- Active parallelism control for the clamping unit on the ENGEL duo dual platen machine for large-scale moulded parts guarantees optimised moulding despite a decentralised sprue position.
- Equipment packages that match your expectations form the basis for cost-effective production.

The combination of the injection moulding process with a variotherm mould temperature control enables the manufacture of moulded parts with special surface qualities. Variotherm describes the function, namely that the injection moulded part is not cooled with a constant temperature of the temperature control medium but rather with a cyclically variable temperature. Variothermal process control means a combination of cyclic heating and cooling.

The goal of this strategy is to use the glass transition or crystalline melting temperature to temporarily control the mould wall temperature while the mould is filling to prevent the outside skin from cooling off too fast. This permits the “self-healing” of surface flaws, such as flow marks or weld lines, as well as enabling the casting of fine surface structures, such as nanostructures on optical lenses. Although the principle of cyclical heating and cooling is identical for all applications, the methods, particularly for cyclical heating, are very versatile.
Lightweight technical moulded parts with excellent precision, low distortion levels and therefore maximum dimensional and shape stability are what ENGEL foammelt is all about. They are produced by proportioning inert gas (nitrogen or carbon dioxide) directly into the plasticising unit on the injection moulding machine, where it is completely dissolved in the molten plastics and held in a one-phase polymer-gas mix with the aid of constant pressure control of the screw.

The foaming process is only initiated once the material has been injected into the mould and there is a significant drop in pressure in the cavity. The foaming pressure, which replaces the post-injection pressure of the conventional injection moulding process, has a uniform effect along the entire length of the part and therefore reduces any inconsistent shrinkage (distortion). Parts made with this method have a compact outer layer and a microcellular foam structure inside. The material density is reduced, which in turn reduces the weight of the moulded part.

In an additional step, once the injection process has been completed, the mould cavity can be monitored and opened when a predefined final wall thickness has been reached. The negative compression process allows the foam structure, and therefore the part properties, to be set specifically, a higher degree of foaming to be produced and even more homogeneous cell distribution to be achieved.

ENGEL foammelt is a low pressure injection moulding method. Therefore, machines with a lower clamping force can be used compared to standard injection moulding methods.

ENGEL foilmelt
Individual surfaces and smart, value-added functions thanks to foils.

Added value thanks to design
No matter if your design needs are simply technological, playfully romantic, or elegantly stylish: The design options that decorative foils offer are numerous. Decorative foils set design highlights in many fields of daily life. Surfaces in wood, aluminium or carbon look support customisation of automotive interiors. Foils with imaginative designs upgrade the look of sports equipment, mobile phone covers, furniture components, office accessories, trendy lifestyle products and packaging.

Added value thanks to functional integration
Besides surface decoration, foils are also perfect for the specific integration of additional functions in the part: Passive transponders integrated in labels can be inserted in the mould and back injected to allow automatic, contactless identification of moulded parts. Typical applications for the RFID (Radio Frequency Identification) technology can be found in pallets, transport boxes or implants. Newly developed, pressure sensitive foils based on capacitive technology can be used for measuring weights, identifying objects or positioning, or as electric switches (“smart plastics”).

ENGEL foilmelt
Individual surfaces and smart, value-added functions thanks to foils.
The demand for decorative parts in vehicles is growing. They reduce both the tendency to splinter and reduce the level of ambient noise. Whether column trims or door panels, back shelves, boot linings, the intelligent ENGEL tecomelt technology offers an extremely efficient and cost-optimised approach to producing textile-plastic composite parts. Moulding of the part and assembly details occurs in a single step with textile decoration.

Due to the specific structural properties of fabrics and foils, which would not be capable of withstanding "normal" process conditions in standard injection moulding, ENGEL tecomelt relies on the consistent implementation of strategies for low pressure cavity filling. This can be achieved by a multiple point sprue system with cascade control, or by combining conventional injection moulding with a compression moulding process.

Material savings and cycle time reduction are critical economy factors. For moulded parts with greater wall thicknesses, or considerable wall thickness differences; these product properties are not always achievable using conventional techniques as a high level of shrinkage causes undesirable surface defects.

The ENGEL gasmelt and ENGEL watermelt gas and water injection processes provide a cost-effective solution.

Precise hollow structures and less material
Depending on the requirements, the pressurised media (gas or water) create specific hollowed channels. This saves material, reduces the thickness of walls that require cooling and at the same time improves the surface finish precision.

The potential applications with gas as a pressure medium are versatile. From creating small gas bubbles in localized melt concentrations to complex hollow structures (pipes in freely definable, three-dimensional shapes that other processes could not achieve).

Due to its viscosity, using water as a pressure medium achieves lower wall thicknesses and more constant wall thicknesses over the centrifugal stroke, especially with thick-walled parts.
Scratch-proof, high quality surfaces combined with 3D effects that visibly impress. Thanks to ENGEL’s innovative clearmelt process, decorative parts with these characteristics can now be produced in a time-saving, cost-effective and highly productive manner. A thermoplastic carrier is flow-coated with transparent or coloured polyurethane – using familiar techniques from multi-component injection moulding such as sliding tables, horizontal rotary tables etc.

**ENGEL clearmelt. A flood of benefits.**

Compared to standard thermoplastic methods, the required level of scratch resilience and 3D effect is achieved with thin coatings using the ENGEL clearmelt approach. Conventional coating systems can only achieve similar quality in time-consuming and expensive multiple coating processes. These are, due to the multiple stage process, also prone to higher reject levels.

In contrast to this, ENGEL clearmelt achieves visually impressive effects on decorative parts using back-injected foils as a carrier. This makes panels in vehicle interiors eye-catching. And: This technology might shed new light on the world of switches in the future. The reason for this is that ENGEL clearmelt also supports overlaid carriers with integrated circuits which are comprehensively protected by a layer of PUR sufficiently thin to support easy handling.

More and more frequently, high-quality optical components are being made of plastics. The polymer materials are lighter than glass and offer product designers more freedom. Optical moulded parts are characterised by stringent requirements with respect to contour precision, internal stress, transparency and cost effectiveness. These requirements can be fulfilled thanks to gentle plasticising, optimised shut-off behaviour of the non-return valve and precise process guidance.

Excellent moulded part quality and cost effectiveness aren’t necessarily a contradiction. The multi-layer optimelt technology with external cooling developed and patented by ENGEL is the best proof of this, and achieves precisely this balancing act.

A pre-moulded part is produced first, and then coated with further layers of the same material in subsequent steps. Overmoulding compensates for sink marks on the surface of the previously formed layer, achieving a premium visual quality. Photometric investigations have shown that the interfaces between the layers do not influence the performance and function of lenses in luminaires.

Since the cooling time in injection moulding increases proportionally with the square of the wall thickness, multi-layer technology significantly increases efficiency, especially in the production of thick-walled parts. Multiple thin layers cool down more quickly than one thick layer. If the lens body is also removed from the mould for cooling, the cycle time is further reduced. Cooling in air takes longer than in the mould, but is no longer part of the cycle time.

* Focus on precision.
  **ENGEL optimelt**

- The injection-compression process supports the manufacturing of moulded parts with a low level of internal stress.
- In multiple layer injection moulding, the moulded part is built up by adding layer after layer of the same material – excellent contour trueness and shorter cycle times are therefore reconcilable.
- Variothermal mould temperature control is used whenever it is necessary to mould fine structures with utmost precision.
The sustainable revolution in lightweight engineering. ENGEL’s organomelt technology replaces metal insert components with particularly lightweight yet strong organic sheets and, through functional integration, opens up completely new possibilities in component development.

ENGEL organomelt involves the thermoforming of thermoplastic fibre preforms being merged with injection moulding in a processing cell.

Parts manufactured in this manner impress through their stability and mechanical qualities. Another plus of the ENGEL organomelt technology is its cost-effectiveness. The highly integrated and automated processes allow fit-for-use parts to be produced at a very low cost and with very small amounts of resources.

All of these are preconditions for series production deployment in the automotive industry. Of course, innovative lightweight engineering concepts are also interesting for other areas of application, such as housings for portable electronic devices with minimal wall thicknesses. The solutions available are as diverse and as plentiful as your ideas.

To benefit from the full potential of fibre composite technologies, it is not just necessary to select the best composite material for each application, but also to choose the most efficient combination of processes and systems.

With the specially founded Center for Lightweight Composite Technologies, ENGEL will – in co-operation with partner companies and institutes – help you plan and implement tailored system solutions.

ENGEL offers specially developed horizontal and vertical infrared furnaces, fully integrated into the CC300 control unit, for highly homogeneous heating behaviour.

Additionally, ENGEL has extended the use of its organomelt technology with the use of UD tapes. The ENGEL tape laying cell is based on a pick & place principle and guarantees precise placement of the individual tapes thanks to its high-resolution camera system. The layup is then consolidated in the ENGEL consolidation unit in a manner that is gentle on the material and has minimal residual porosity.

ENGEL strives to create new approaches and constant further development, especially in the area of lightweight composites. As an innovative partner, ENGEL provides the following technologies in this area: organomelt (see page 54), HP-RTM, in situ.

To meet the specific demands of lightweight construction and its processes, ENGEL designed the v-duo specifically for the processing of fibre-reinforced plastics. To achieve an optimal process chain, all peripherals for the technologies have been integrated into the CC300 control unit. As a result, ENGEL has long been a pioneer for fibre-composite technologies and offers single-source turnkey solutions.
5 ENGEL services

Plastics processing represents a constantly shifting challenge for you and your machines. We support you with our extensive know-how and our service range. This includes **global support on-site, high quality retrofitting,** and **optimization tools** (available at all times) as well as a comprehensive, professional training portfolio.
A broad machine portfolio – a comprehensive service portfolio

At ENGEL, we not only offer the latest technologies and state-of-the-art production systems, but also a broad range of services to ensure your long-term success. A versatile team of experts provides service and on-site support, quickly available, high-quality retrofitting and optimisation tools, as well as professional consulting and training. With our support you get the best out of your production cells.

ENGEL services
Superb individual support

- **OEM parts**
  A perfect fit, reliable, durable
- **ENGEL formula 24**
  Our formula for success and enhanced safety
- **Plasticising units**
  For improved cost effectiveness, performance and service life of injection moulding machines
- **Retrofit**
  Continuous high quality output and availability
- **ENGEL care**
  Our maintenance packages for continuous high results and optimal quality output
- **ENGEL Protect**
  Intelligent system protection by ENGEL
- **Oil maintenance unit**
  Reduced maintenance costs and less unplanned machine downtime
- **Hose service**
  Improved safety by regular replacement of hoses
- **ENGEL everQ**
  Verified process reliability of production-relevant sensor data with test certificate
- **ENGEL relocation service**
  The optimal solution for machine relocations – whether within the company, within a country or across borders
- **ENGEL training**
  Be ready for your production requirements
- **Consulting & Coaching**
  Find and leverage hidden potentials
- **e-connect**
  Your complimentary portal for ENGEL services
- **e-connect.monitor**
  Monitoring of process-critical components during operations for predictive maintenance
- **e-connect.24**
  The 24/7 remote maintenance package

Support – we assist you on-site!

- save on downtime costs
- immediate worldwide 24/7 support
- expert support from the ENGEL service team
- for any ENGEL injection moulding machines no matter the generation
- for all ENGEL technologies and any control unit version

Upgrade – install reliable added value!

- for all ENGEL injection moulding machines
- individual upgrading of your machine in OEM quality
- to add and optimise functionality
- equip machines for use with new applications and technologies
- utilise machines with even greater cost effectiveness

Know-how – Boost your expertise!

- comprehensive training with a focus on knowledge transfer
- make the most of your machine’s potential
- individual seminars and training programs for you and your employees
- informative events on industry-specific topics
- take advantage of efficient, targeted and practical information, instruction and training
- either at your own facility or at one of the worldwide ENGEL training centres