



e-max



Series

- ENGEL victory
- ENGEL e-motion
- > ENGEL e-max
- ENGEL duo
- ENGEL speed
- ENGEL combimelt
- ENGEL insert
- ENGEL elast / LIM
- ENGEL PETsystems

Integrative technology

- ENGEL robot
- ENGEL control

Services

- ENGEL training
- ENGEL e-factory

Application technology

- ENGEL application technology

Industry sectors

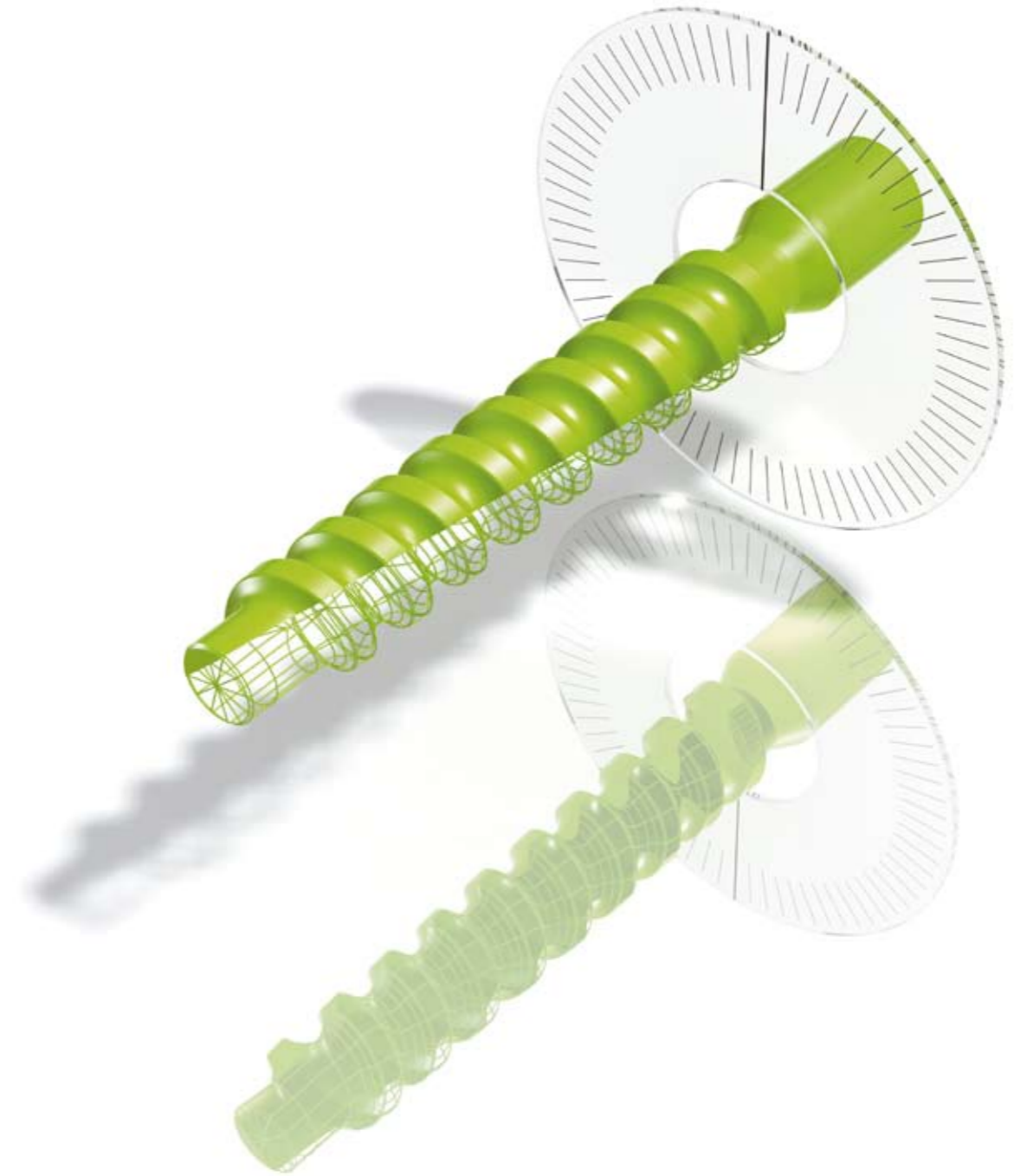
- ENGEL automotive
- ENGEL teletronics
- ENGEL packaging
- ENGEL medical
- ENGEL technical moulding

Summary

- ENGEL portfolio

Language

- german
- > english
- french
- italian
- spanish
- czech
- chinese



ENGEL

be the first.

ENGEL

be the first.

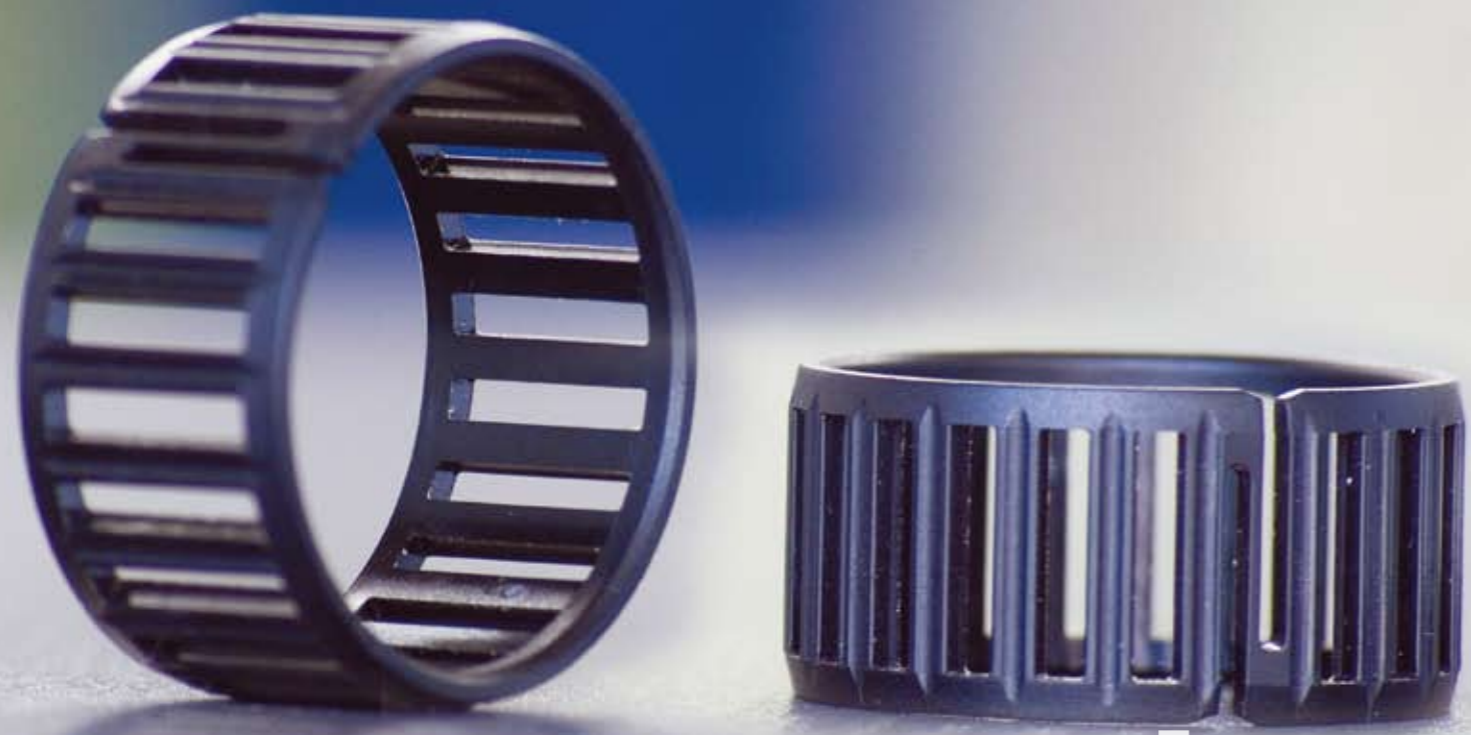


All electric, economical, a machine for the future. ENGEL e-max:

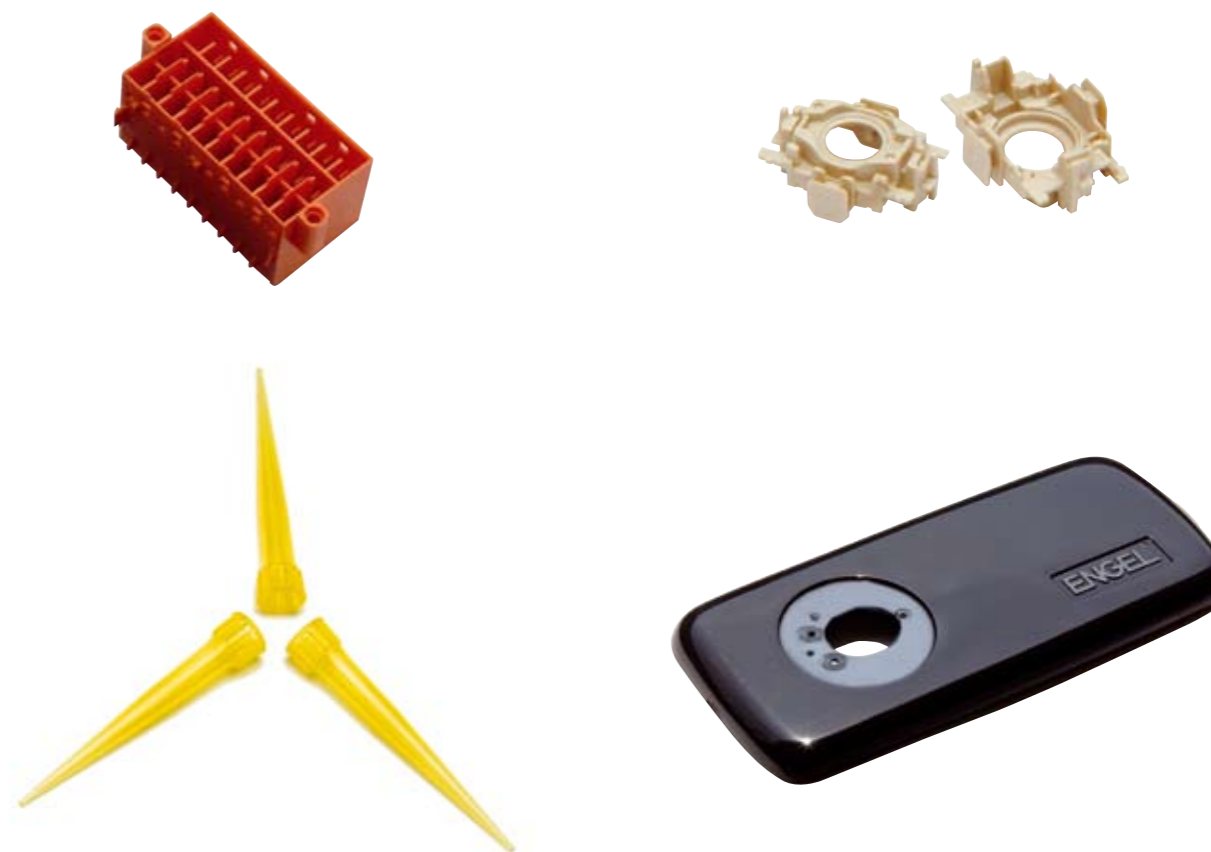
- > Maximum performance and process safety for very high productivity
- > Maximum precision due to all electric drive technology with highly dynamic servomotors
- > Maximum energy efficiency ensures low power consumption
- > Maximum compactness: excellent performance in a small footprint
- > High reliability thanks to highly-integrated control and drive technologies
- > High-performance injection units with peak pressures of up to 2800 bar and up to 450 mm/sec. injection speed
- > Versatile options ensure optimum customisation for any application
- > Electric machines by ENGEL are a more economical option in many applications
- > Electric machines are the next generation technology

Maximum precision and economy.
In a compact package.

The ENGEL e-max is precise. Extremely precise. This is because it is all electric – and a genuine ENGEL. In production, the machine displays maximum cost effectiveness and energy efficiency. Thanks to the compact construction, its high efficiency unfolds in a very small floor space.



precise



Maximum precision means:
the maximum number of good parts

Maximum precision means:
ENGEL e-max.

Maximum precision. Part after part

Maximum precision is required for plugs, contact strips, lenses, medical parts, and other top-quality products. The ENGEL e-max is perfectly geared for this. Thanks to all electric drive technology with highly dynamic servomotors. And also thanks to the high plasticizing precision of the injection unit and the extremely precise closing movements that are a result of the exact linear guidance of the moving platen. The perfect interplay of these features, combined with the sensitive ENGEL autoprotect mould protection, provides for consistently stable processes. Which means: guaranteed consistent quality and the maximum number of good parts.

cost-effective

Focus on cost effectiveness

Today, the ENGEL e-max provides competitive plastics processors with advanced technology for the cost-optimised injection moulding of tomorrow. For example, the machine is extremely cost effective not only in terms of purchase – where it wins people over with its very high-quality and extensive basic equipment – but also during operation.

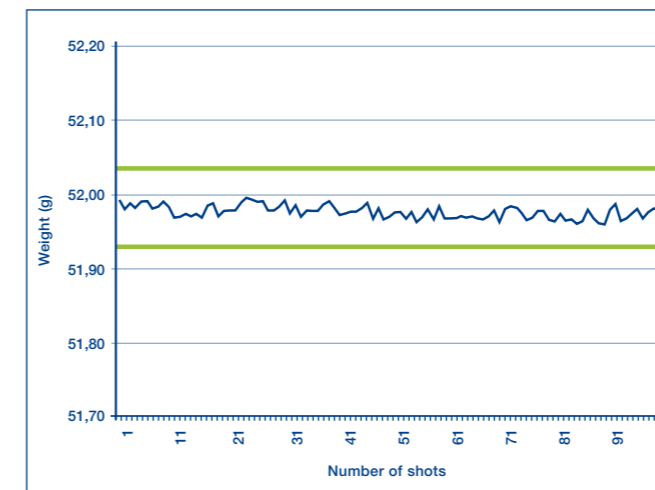
The considerable efficiency and precision of the machine, while simultaneously maintaining extremely high process consistency, ensures maximum productivity – with a very high degree of uptime. What is more, the compact design saves space during production. The highly energy-efficient method of operation ensures low energy consumption. The fact that the ENGEL e-max also works very quietly and has numerous advantages in terms of operating ergonomics provide for a safe, efficient design of the man/machine interface.

All this together makes the ENGEL e-max extremely economical – and a machine for the future.

Very high productivity due to speed and process safety

The ENGEL e-max wins people over with maximum productivity. After all, it is fast and precise with excellent shot-to-shot repeatability – permanently. This results in maximum output at the same high levels of product quality and machine up-times.

Example of the high shot weight reproducibility of the ENGEL e-max



Standard deviation $\delta/\bar{x} < 0.01\%$; Moulded part: 1x holder, PS, parts weight ~ 52g; Machine: ENGEL e-max 440/180, screw diameter 40 mm

Short cycle times

Compared to hydraulic machines, the ENGEL e-max's all electric method of operation is characterized by shorter cycle times – due to the parallel operation of all drives.

The machine is also fast in the area of data communication between the machine control unit and the servomotor drives, due to the high-speed Ethernet network with a data transfer rate of 100 Mbits/sec., and a permanent diagnostic system. This results in the perfect interaction between the control unit and the drive technology. The outcome: nearly overlapping process data curve sets.

High process safety due to precision movements

The electromechanical drive system, consisting of precise linear guide rails and ball bearing screws, in combination with a servomotor with a rotational angle measurement system, provides for precision movements. Due to this high level of precision, the machine is extremely well equipped for technologies such as compression or LIM/LSR processing.

With strong teamwork between machine and robot, the functions of insert and take out work with extreme accuracy due to the precise positioning of the mould. The high plasticizing precision of the injection unit and the exact pressure control are further important characteristics of the ENGEL e-max, providing for the highest degree of process consistency.



Efficient energy use

All electric injection moulding means energy-saving injection moulding. Thanks to the well thought-out energy concept, the ENGEL e-max makes extremely efficient use of power resources, thereby supporting cost-saving production.

The heart of this design is the central power supply for the five servodrives, including recovery of the kinetic braking energy directly back to the main power system. Furthermore, its power factor of > 0.95 ensures that the power supply is not strained by idle power. Even if there are fluctuations in the mains, the ENGEL e-max can be operated safely – as the control unit power is supplied via the central unit of the servo amplifiers.



Maximum energy efficiency due to state-of-the-art technology: the kinetic energy is returned to the main power system when the drives are braked.

Spotlight on: Ergonomics and the environment

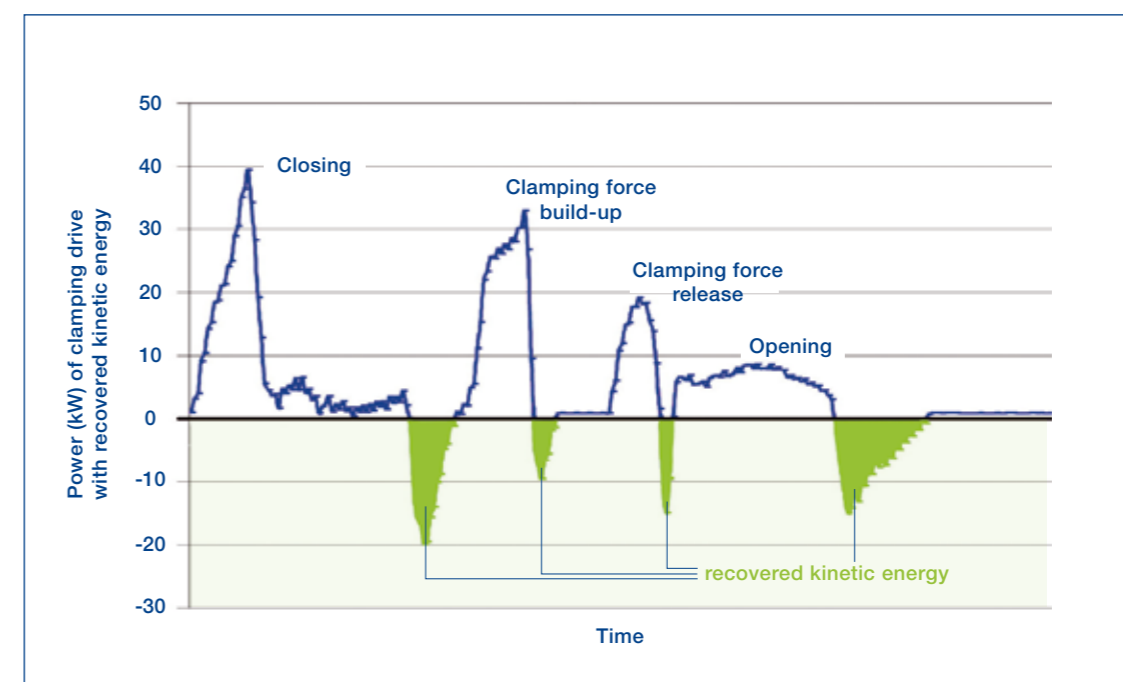
One further advantage of all electric machines compared to hydraulic ones is their lower heat and noise emission levels. The fact that they run quietly significantly reduces the noise exposure for staff.

Just like all ENGEL control units, the ENGEL e-max control unit has an excellent ergonomic design with a touch screen, tilting control panel and a large, bright display. This ensures ergonomically optimised programming and controls – perfectly adapted to the operator's height.

Space-saving production thanks to compact design

Thanks to its compact design the machine requires very little floor space. The length-optimised clamping unit, integration of all electrical equipment in the injection unit frame, and the open injection unit are vital characteristics that help the machine achieve its compact dimensions. The open injection unit also guarantees optimal accessibility.

Recovery of the kinetic braking energy, example: clamping drive



ENGEL e-max 180, closing cycle

The all electric ENGEL e-max from 500 to 1.800 kN

The all electric ENGEL e-max is available in a clamp force range of between 500 and 1.800 kN. The premium quality, comprehensive basic machine is modularly expandable by adding numerous standardised technology options such as injection units with increased injection speed, or mould heating. This allows the machine to respond flexibly to individual injection moulding requirements (see page 19 for more details).

Injection Units	80 / ...	200 / ...	310 / ...	440 / ...	740 / ...*	940 / ...*
Clamping units	Available screw diameters in mm per injection unit					
e-max ... / 50	18 / 22	25 / 30				
e-max ... / 75		25 / 30	30 / 35			
e-max ... / 100		25 / 30	30 / 35	35 / 40		
e-max ... / 180			30 / 35	35 / 40 / 45	45 / 50 / 55*	50 / 55 / 60*

*Coming soon

US tons

Injection Units	80 / ...	200 / ...	310 / ...	440 / ...	740 / ...*	940 / ...*
Clamping units	Available screw diameters in mm per injection unit					
e-max ... / 55 US	18 / 22	25 / 30				
e-max ... / 80 US		25 / 30	30 / 35			
e-max ... / 110 US		25 / 30	30 / 35	35 / 40		
e-max ... / 200 US			30 / 35	35 / 40 / 45	45 / 50 / 55*	50 / 55 / 60*

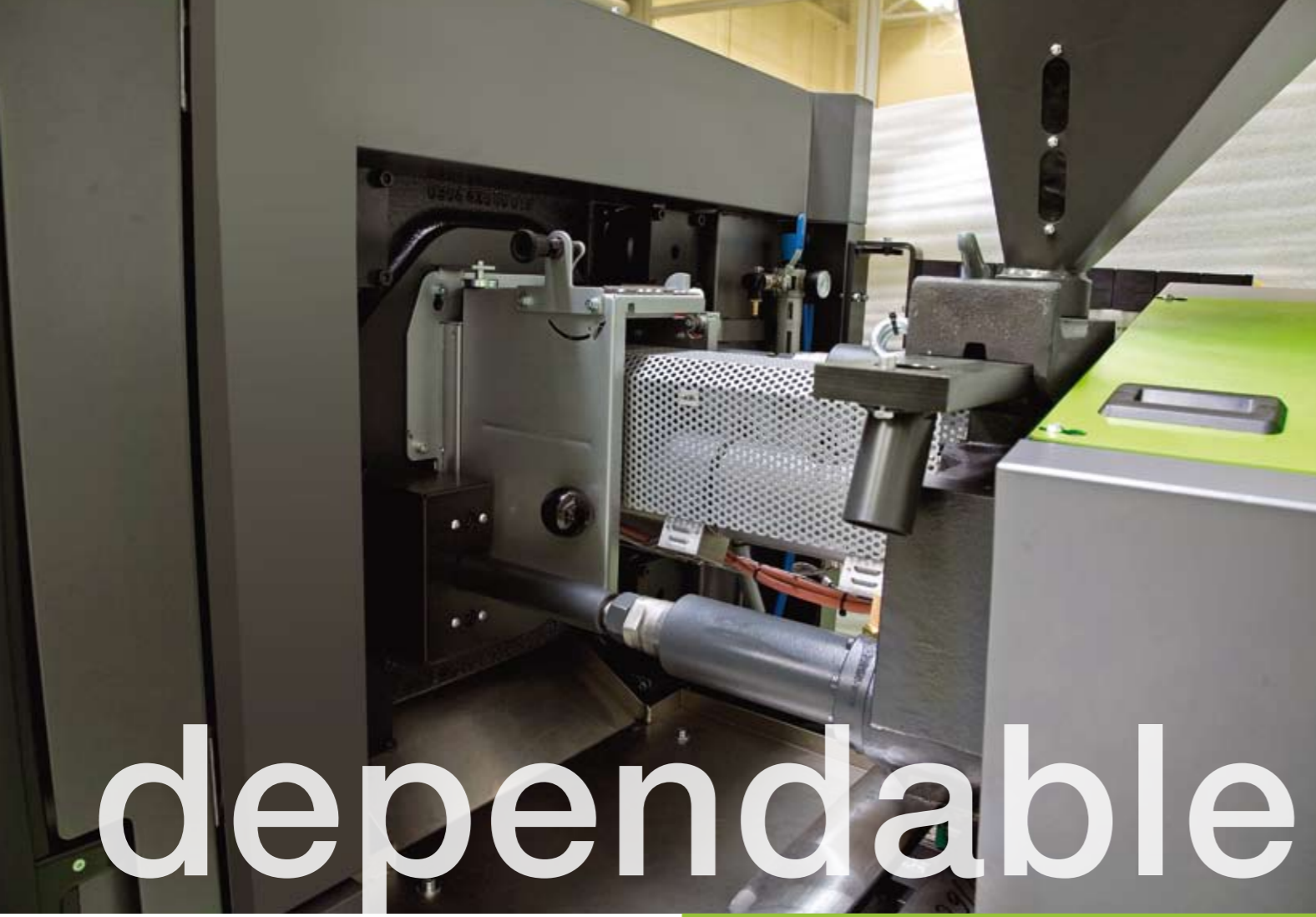
*Coming soon

ENGEL e-max 50 with 500 kN clamping force



ENGEL e-max 180 with 1.800 kN clamping force



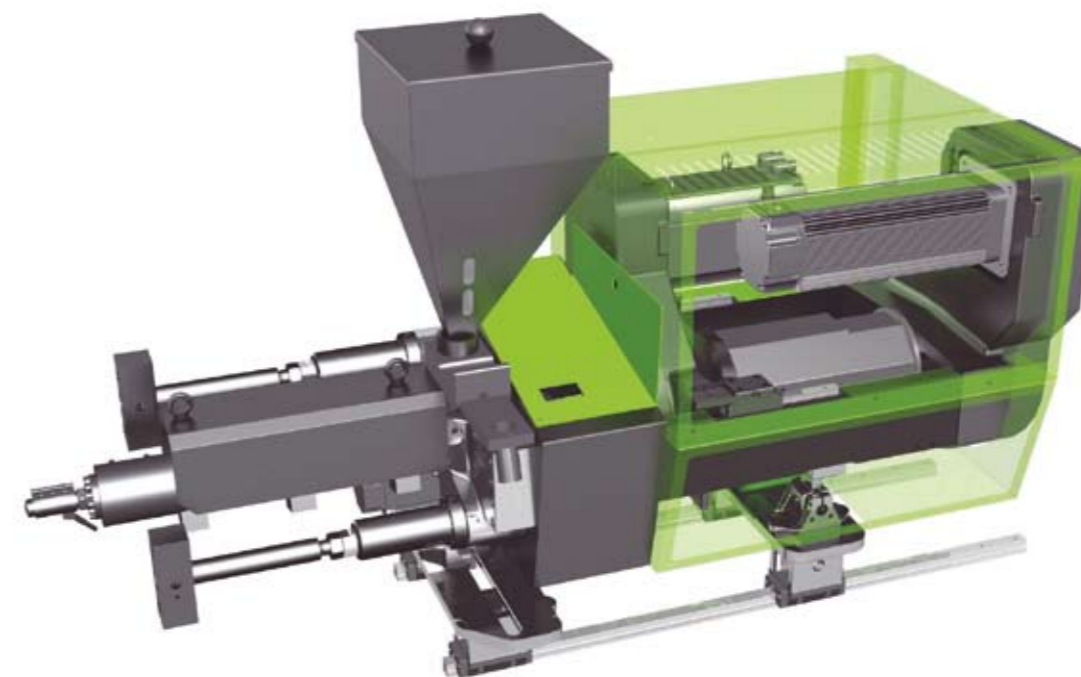


dependable

Tried-and-trusted, precise, dependable: the ENGEL e-max injection unit

Tried-and-trusted technology that you can depend on – the ENGEL e-max has the same high-performance injection units as are used for the popular, all electric ENGEL e-motion machines, which have been in production use successfully for over 10 years, and continue to guarantee optimum precision.

On top of this, the ENGEL e-max offers the familiar standard benefits of other ENGEL injection units. They include, for example, lateral swivelling ability, which substantially facilitates maintenance work on the injection nozzle or screw. Or the quick connect barrel system. This gives you the ability to mount barrels from other ENGEL machines without modifying the ENGEL e-max.



The in-line injection unit on the ENGEL e-max is designed for a perfect combination of high injection speed with high injection pressure. The premium performance class achieves injection speeds of up to 450 mm/sec. and a maximum injection pressure of up to 2800 bar. And: All movements use high-precision linear guides.

Precision injection unit: precision combined with excellent performance

The ENGEL e-max injection unit is geared for top performance and optimal working life. A combination of high injection speed and high injection pressures guarantees maximum injection performance. On top of this, highly dynamic servomotors ensure minimal acceleration and response times.

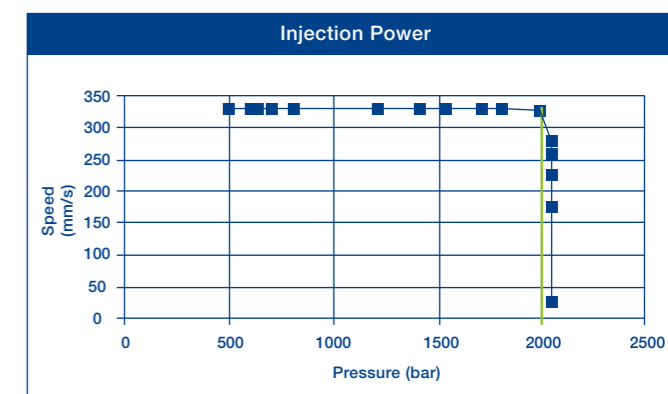
Encapsulated, premium quality belt drives are characterised by quiet running, a long service life and maximum cleanliness. This makes them perfect for cleanroom applications.

Maximum service life and minimal wear and tear are also assured for encapsulated ball-screw spindles with permanent lubrication. One major benefit of the servoelectric drive on the nozzle unit is that you can program the contact force and position the nozzle with the utmost precision.

Well thought-out pressure measurement for long-term precision

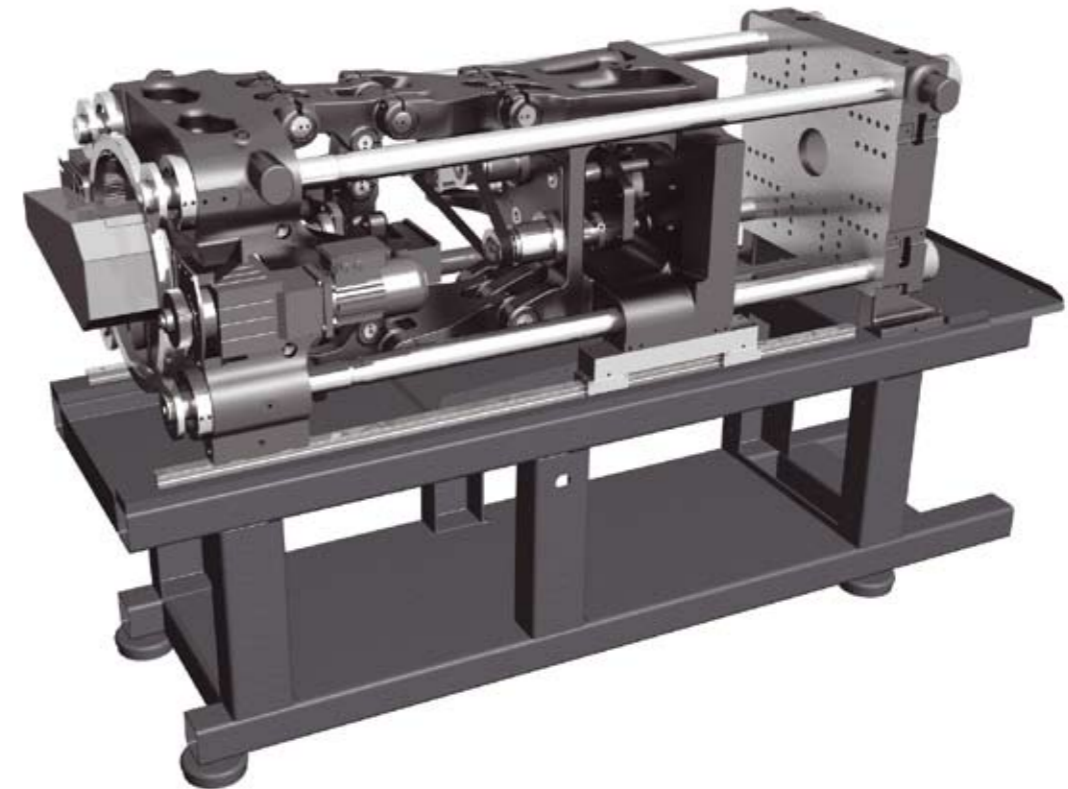
Innovative pressure measurement is crucial for the excellent levels of functional precision the injection unit achieves. Temperature-independent measurements are taken directly at the screw bearing; the system is wear and tear-free, and calibra-

ted for its service life – and it offers an impressive resolution. This ensures maintenance-free, long-term precision. The extremely precise injection, post-injection and build-up pressure measurements are the basis for optimum weight consistency.

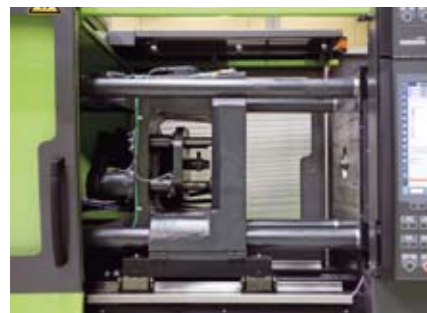


Example of high injection performance (injection unit size 200, screw diameter 30 mm).

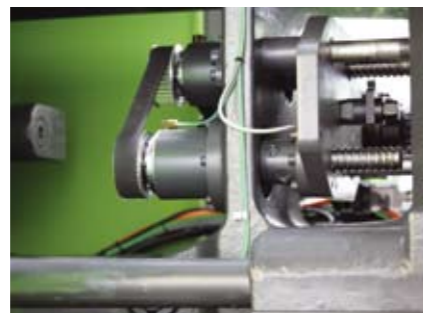
Fast, light and precise movements: the ENGEL e-max clamping unit



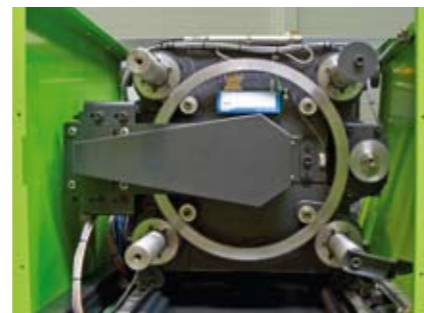
Precise platen and mould movements



Moving platen, modular design with uniform clamp force distribution. Precision linear bearings mean minimal coefficients of friction, and precise platen and mould guidance – even for heavy moulds.



Detailed view of mould height adjustment and clamping drive



Moving platen with servoelectric ejector drive

Performance and precision are our focus

The combination of a 5-point toggle-lever geometry and powerful servomotor drives ensures dynamic movement and shortest possible dry cycles. Just like the injection unit, the clamping unit is also geared for maximum precision. Linear bearings for the moving platen are extremely important to this; they have credibly low coefficients of friction and also guarantee clean tie-bars. This in turn guarantees precise platen and mould movements – even for heavy moulds. The perfect interaction with our sensitive mould protection system, ENGEL autoprotect, provides the lowest possible wear and tear on moulds. The high level of precision in mould positioning also creates ideal conditions for compression and LSR processing.

Fit for large-size moulds

Lower weight and optimum rigidity – platens optimised by finite element methods (FEM) keep accelerated masses down. This offers considerable benefits with respect to the dry cycle time. Thanks to large mould cavity space, which is guaranteed by a generous gap between the tie-bars, you can use both complex moulds and multiple cavity moulds.

Stable processes thanks to clamp force measurement

High-resolution sensors that permanently measure the clamp force ensure that the ENGEL e-max applies the right force cycle to cycle. For example, the clamp force is automatically adjusted if production-related temperature fluctuations occur in the mould. Stable processes with assured premium quality are the result.

ergonomic

Everything under control with the ENGEL LC 200 control unit

A state-of-the-art control unit needs to keep on top of complex processes. At the same time it has to support fast and easy programming. The ENGEL LC 200 is perfectly geared for this task. And its clear-cut, ergonomic controls and logical sequences allow for a more efficient and safer design of the human/machine interface.

- > excellent ergonomic design with a 15" touch-screen, tilting control terminal and a large, bright screen
- > intuitive and easy controls thanks to elements from the PC environment, and the familiar logic and look & feel of the ENGEL CC 200 control unit
- > free pictogram-based programming of the cycle sequence
- > four freely programmable signals included as standard
- > parallel operation of all movements supported
- > the control unit supports maximum precision reproducibility
- > process data logging and quality data documentation gear the ENGEL LC 200 for future challenges.

Optimised user ergonomics



Basic functions

- Power on
- User identification by means of a password
- USB interfaces

Settings: Clear cut control logic

The control logic for the machine supports simple programming of an individual cycle sequence without special programming skills. To support this, the cycle sequence for the injection moulding process is subdivided into separate basic sequences. These basic sequences – mould closing, injection, cooling, and mould opening – along with the additional sub-sequences are mapped to characteristic pictograms.

On top of this, you can select predefined standard sequences (sequential, sequential – sprue ejector, parallel injection and plasticising).

Function library for easier programming

A comprehensive function library provides a range of selectable code blocks. Customers can easily compile sequences by adding or removing blocks. „Drag and Drop“ gives users the ability to select functions from a menu and integrate them with the sequence for serial and parallel execution.

Dialog-based customisation supported

To change a parameter, users simply press the corresponding dialog box on the touch screen and change the setting (e.g. for clamping force, closing or opening speed). A plausibility check occurs after saving the modified data set to prevent major programming errors.

Controls

- Manual controls for machine functions
- Set of fixed keys for standard functions



flexible

Fit for more – modularly expandable thanks to numerous standardised technology options

Geared for individual requirements

In addition to the premium quality and comprehensive set of standard options, the ENGEL e-max can be modified flexibly to match your individual injection moulding requirements thanks to a wide range of standardised technology options. These options include:

- injection units with higher injection speed
- core-pulls
- EUROMAP67
- platen ejector
- mould heating
- mould monitoring
- machine shut-off nozzles
- mould shut-off nozzles
- interfaces for external devices

Thanks to its high level of precision, the ENGEL e-max is also perfectly suited for technologies such as compression and/or LIM/LSR processing (see Fig. page 18).

Geared for Automation

Sprue removal and cutting are basic prerequisites for automated injection moulding. The ENGEL ER-USP (Universal Speed Picker) is a fast, universal device, specially designed for this task and available in two sizes, which match the ENGEL e-max perfectly. The ENGEL ERC series linear robots provide another highly modular system for complex automation of the injection moulding machine using up to six axes.



Fast sprue removal and cutting with the tried-and-trusted ENGEL ER-USP automation solution