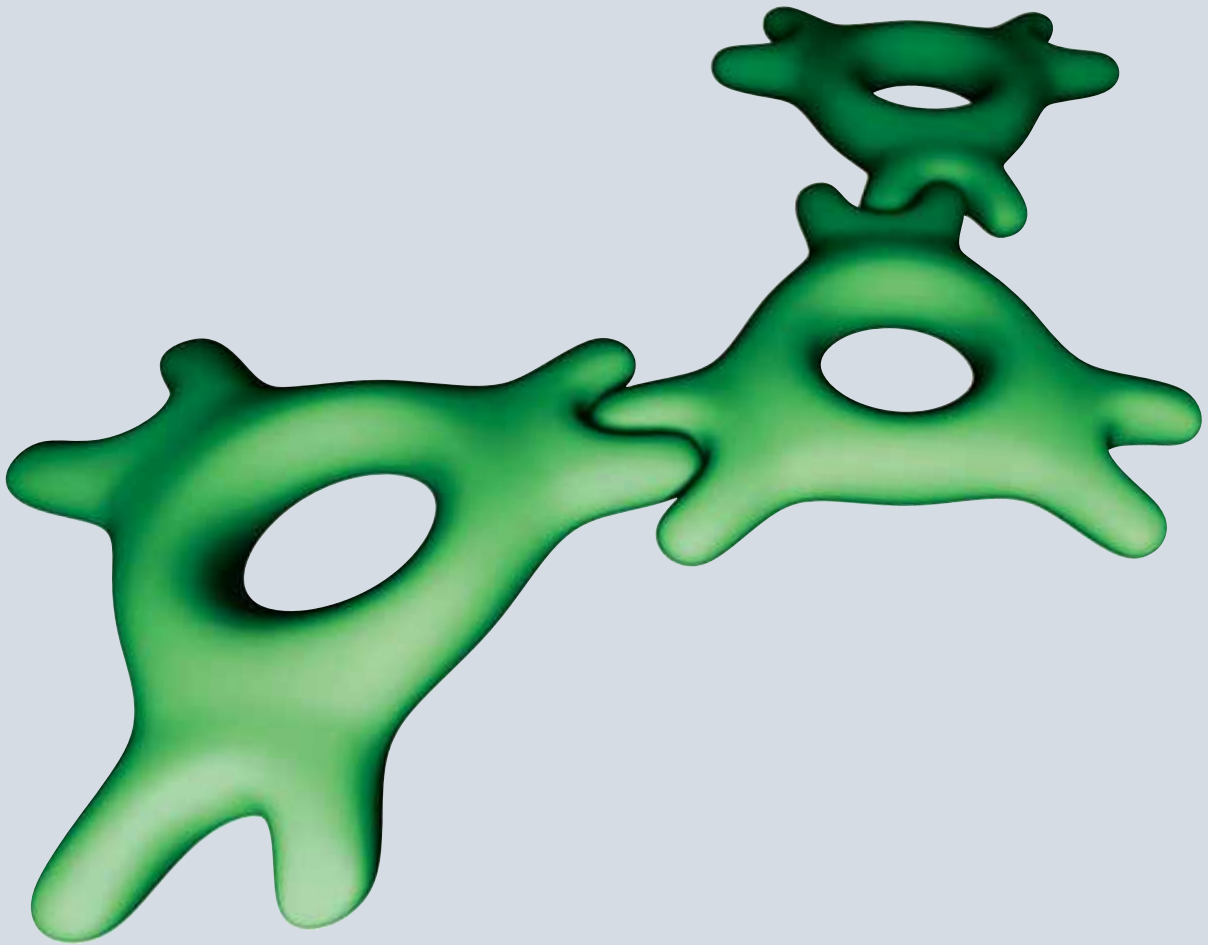


>> Nothing in the world is as strong
as an idea whose time has come. << Victor Hugo (Novelist)
be the first.



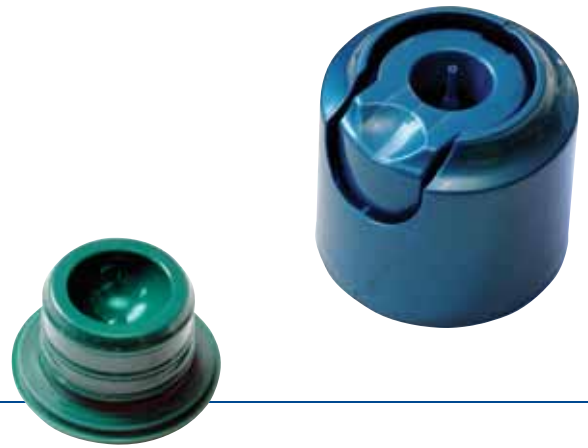
Innovative injection molding technology

ENGEL
e-motion

ENGEL E-MOTION.
Micro parts, precision and speed.

2

Packaging components



Mechanical precision parts



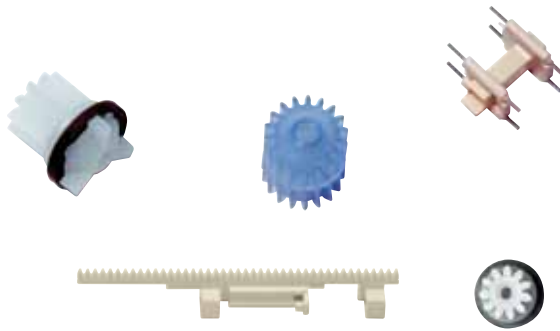


All-electric drive technology opens up new possibilities.

Smaller, lighter, faster, greater precision, improved reproducibility – these are the demands being placed on an ever increasing number of new products and their components. These demands necessitate the use of completely new manufacturing technologies. In the field of injection molding, this means utilizing the potential of all-electric drive technology. Engel's new range of E-Motion injection molding machines, which feature this technology, enable plastics processors to meet these exacting demands.



High-precision micro parts



1 cm



ENGEL E-MOTION.

The machine series for the most exacting requirements.

4

Injection units *	80 / ...	200 / ...	310 / ...	440 / ...	740 / ...	940 / ...	1340 / ...	1640 / ...
Clamping units	Available screw diameter in mm per injection unit							
E-MOTION 60 US	18 / 22	25 / 30	30 / 35					
E-MOTION 110 US		25 / 30	30 / 35	35 / 40				
E-MOTION 165 US				35 / 40	45 / 50 / 55			
E-MOTION 200 US				35 / 40	45 / 50 / 55	50 / 55 / 60		
E-MOTION 200 T US				35 / 40	45 / 50 / 55	50 / 55 / 60		
E-MOTION 250 T US					45 / 50 / 55	50 / 55 / 60		
E-MOTION 310 T US						50 / 55 / 60	55 / 60 / 70	
E-MOTION 385 T US**							55 / 60 / 70	60/70/80

ENGEL E-MOTION 80 / 60 US

* international type-size designation, calculated from:
max. swept volume [cm³] x max. injection pressure in [bar] / 1000

** In development



A whole series for the highest demands.

Engel injection molding machines featuring all-electric drive technology are now available in a range of clamping forces from 60 to 310 US tons (up to 385 US tons in the near future). In the lower clamping force range, up to 200 US tons, four sizes of clamping unit are offered, all of them featuring automation-friendly tiebarless design, while a tiebar clamping unit of new, innovative design is offered in the upper clamping force range.

Common to all machines is the concept of the compact injection unit with short-design double spindle drive.

Options:

All units are also available in a "High Speed" version (higher injection speed). ENGEL X-MELT can be used in conjunction with all injection units up to size 440.

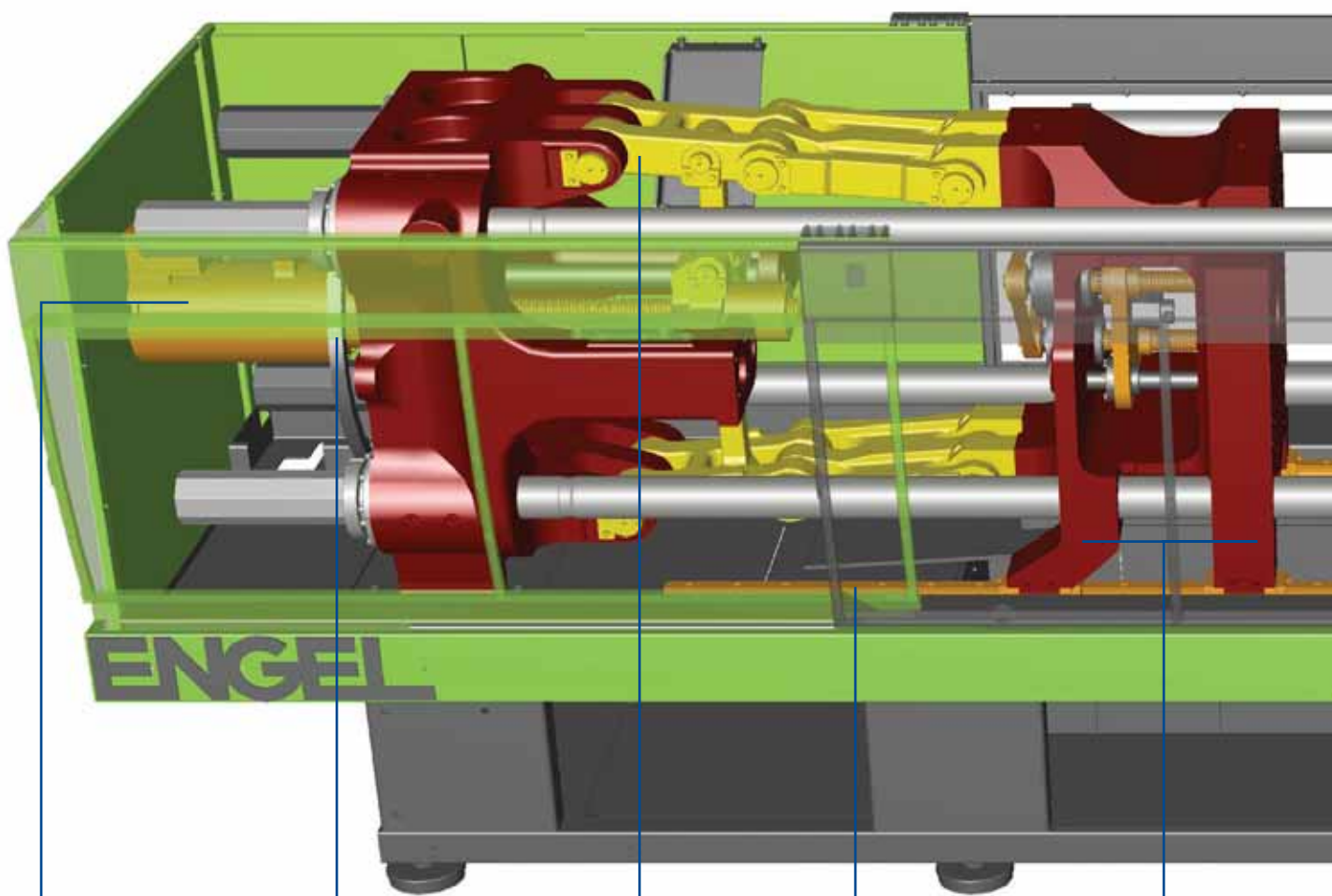
ENGEL E-MOTION 940 / 310 T US



ENGEL E-MOTION.

Toggle clamping unit with tiebars for high clamping force.

6



01

02

03

04

05

See next page for detailed illustrations >>

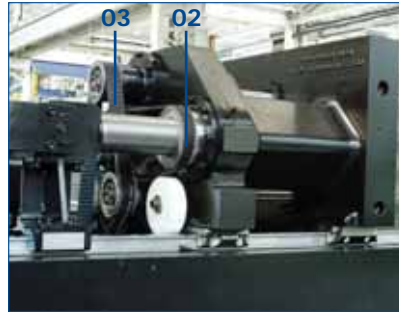
ENGEL E-MOTION – the machine for the most exacting requirements:

- > The ENGEL E-MOTION machine system is the all-electric complement and alternative to the service-proven ENGEL VICTORY series of hydraulic injection molding machines for cases where special demands are made on the product or the production process.
- > The ENGEL E-MOTION series of machines is particularly suitable for applications in which certain requirements – such as universal application for the smallest shot weights, fast-cycling parts or standard parts, extreme reproducibility, low energy consumption and negligible emission – take priority.
- > The ENGEL E-MOTION machine concept combines the advantages of the tiebarless clamping system with those of the traditional yet completely modernized toggle clamping system and is also fully compatible with ancillary equipment, such as plasticizing units and automation peripherals.
- > Shorter cycle times for high productivity due to a decentralized drive concept. Minimized non-productive times through parallel operation of individual electric drives.
- > The ENGEL X-MELT technology module operates only in conjunction with the all-electric ENGEL E-MOTION injection system. X-Melt converts the E-Motion machine into a high-precision expansion injection molding machine for the smallest of shot weights and the thinnest of wall thicknesses.

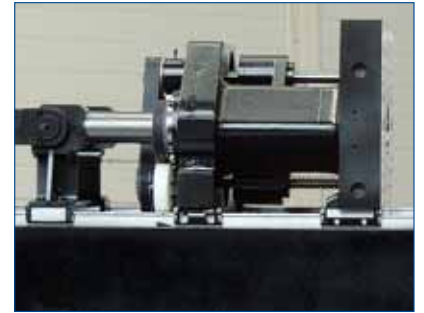
Tiebarless clamping unit.



01
Five-point toggle clamp with maintenance-free, servo-actuated crank drive for fast opening and closing



02 / 03
Detail view of moving platen with mold height adjustment mechanism (02) and ejector drive via servo motor and two recirculating ball screws (03)



04
Detail view of moving platen of box-type design running on double guideway with low-friction precision linear bearings – for absolutely gentle handling of the mold

Tiebar clamping unit.



01 / 02
Detail view of four-tiebar adjusting system with sunwheel and electric motor (02) and central servo drive for toggle mechanism (01)



03
Five-point toggle with direct spindle drive on crosshead for fast opening and closing



04
Detail view of moving platen of box-type design running on double guideway with low-friction precision linear bearings – for absolutely gentle handling of the mold



05
Moving platen of box-type design running on double guideway with precision linear bearings. The tiebars do not perform a guiding function – they serve purely for force transmission

ENGEL E-MOTION.

Tiebarless clamping unit in the lower clamping force range.

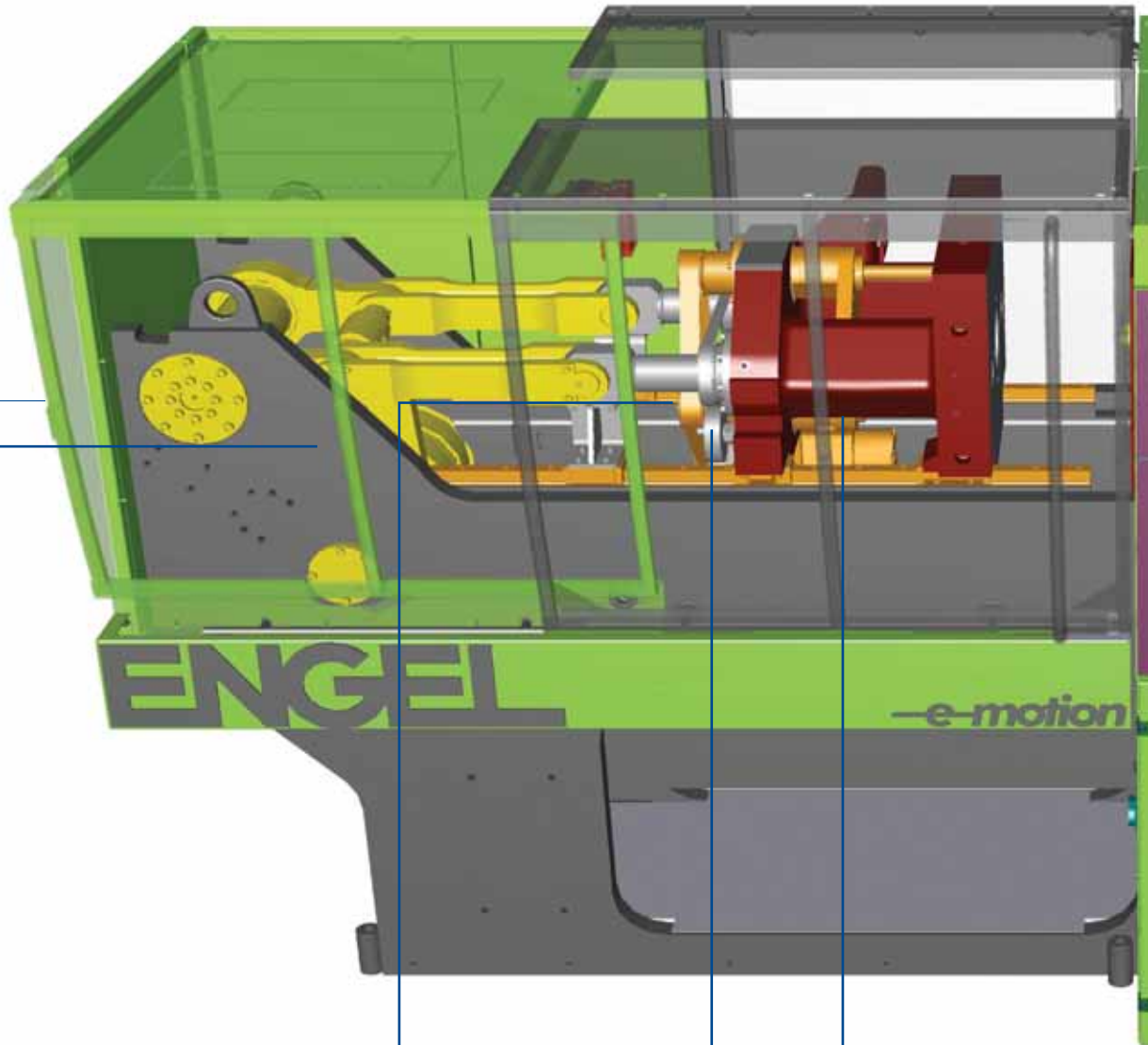
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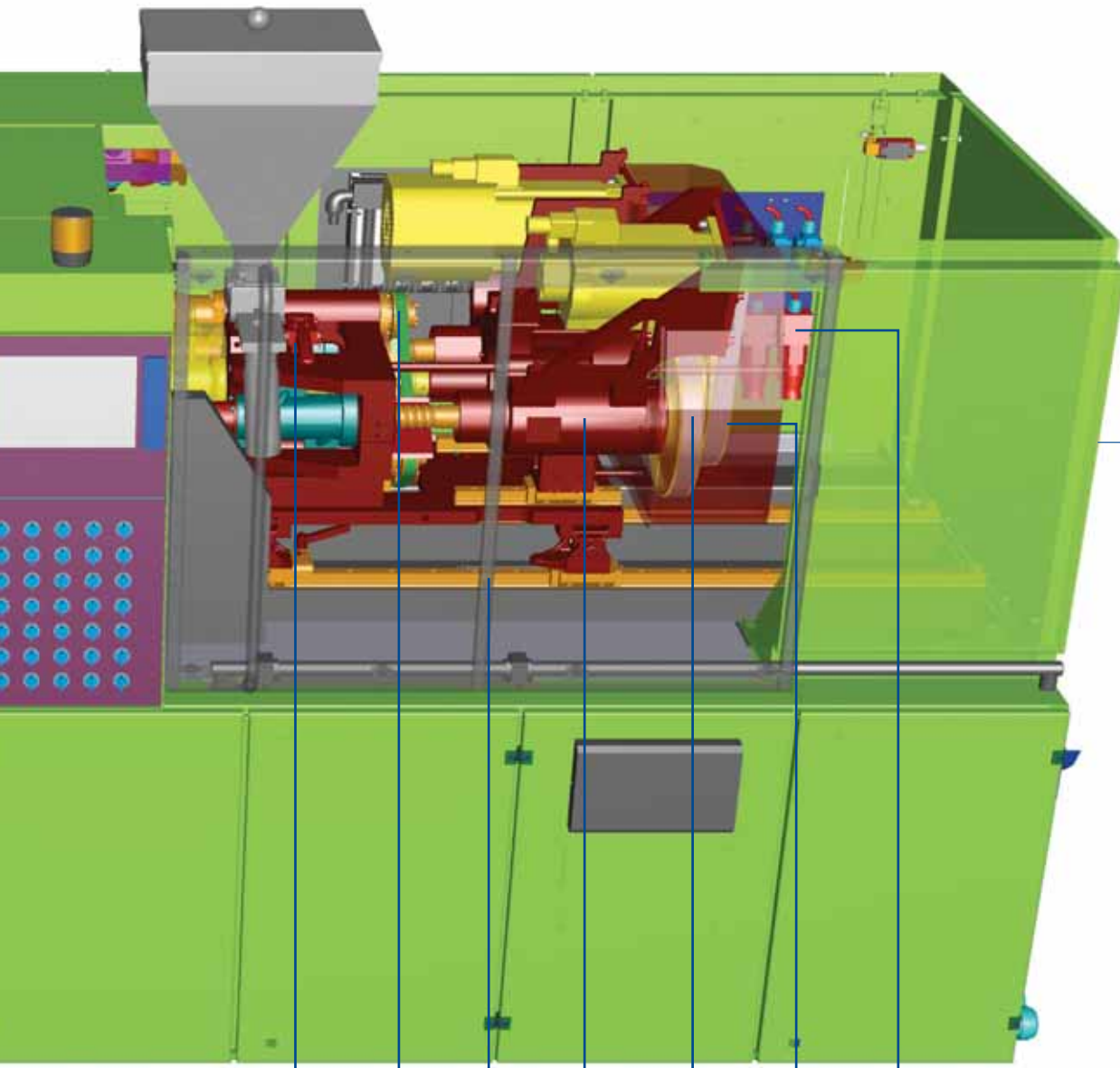
01

02

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The injection unit.



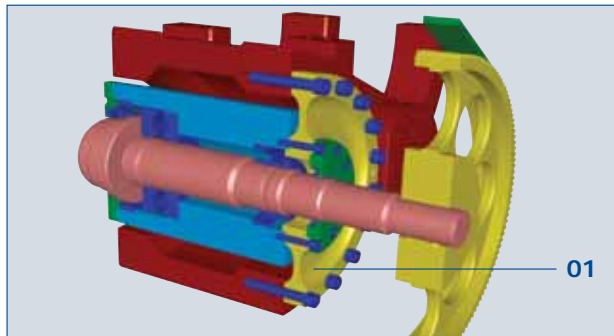
05
The quick barrel change system is standard. Barrels and screws are fully compatible with the ENGEL VICTORY series of injection molding machines



09
Detail view of servo drives for screw rotation and screw advance. Screw advance is performed by a double spindle drive



08
Full view of all-electric, compact-design injection unit



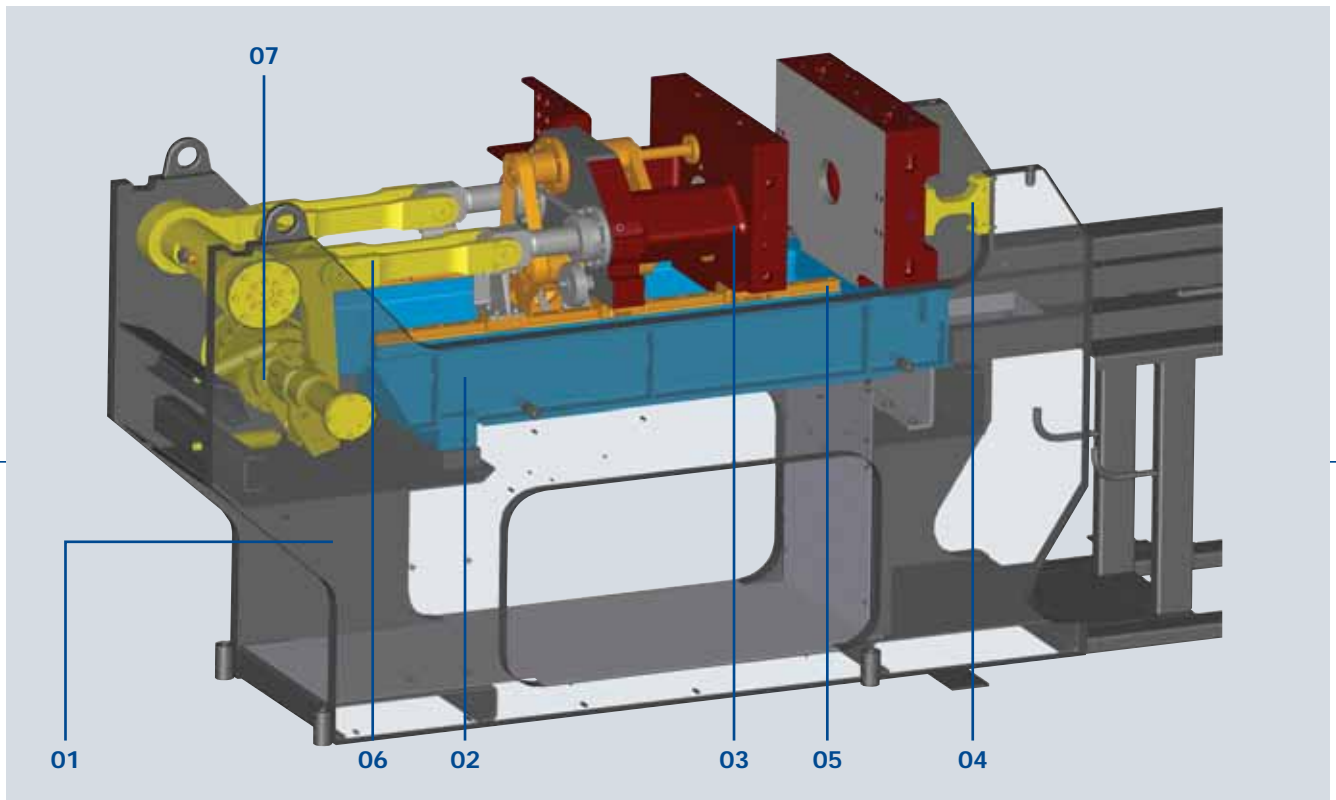
11
Maintenance free, patented "measuring membrane" (01) for indirect melt pressure metering integrated in the screw suspension. The principle: Pressure on the screw expands the membrane. The elastic deformation corresponds with the pressure level

- 06** Drive for contact pressure stroke via two diagonal spindles and electric motor
- 07** All linear movements are performed on linear bearings with machine-tool precision
- 10** Central connecting box for accessory equipment

ENGEL E-MOTION.

The machine system in detail: the clamping unit.

12



The clamping unit.

Within its product range of all-electric injection molding machines, Engel offers two concepts with system-specific advantages: the particularly automation-friendly, tiebarless clamping system for clamping forces up to 200 US tons and the newly designed toggle clamping system for the higher range of clamping forces up to 385 US tons.

The tiebarless clamping unit.

The E-Motion tiebarless clamping system comprises the following main components:

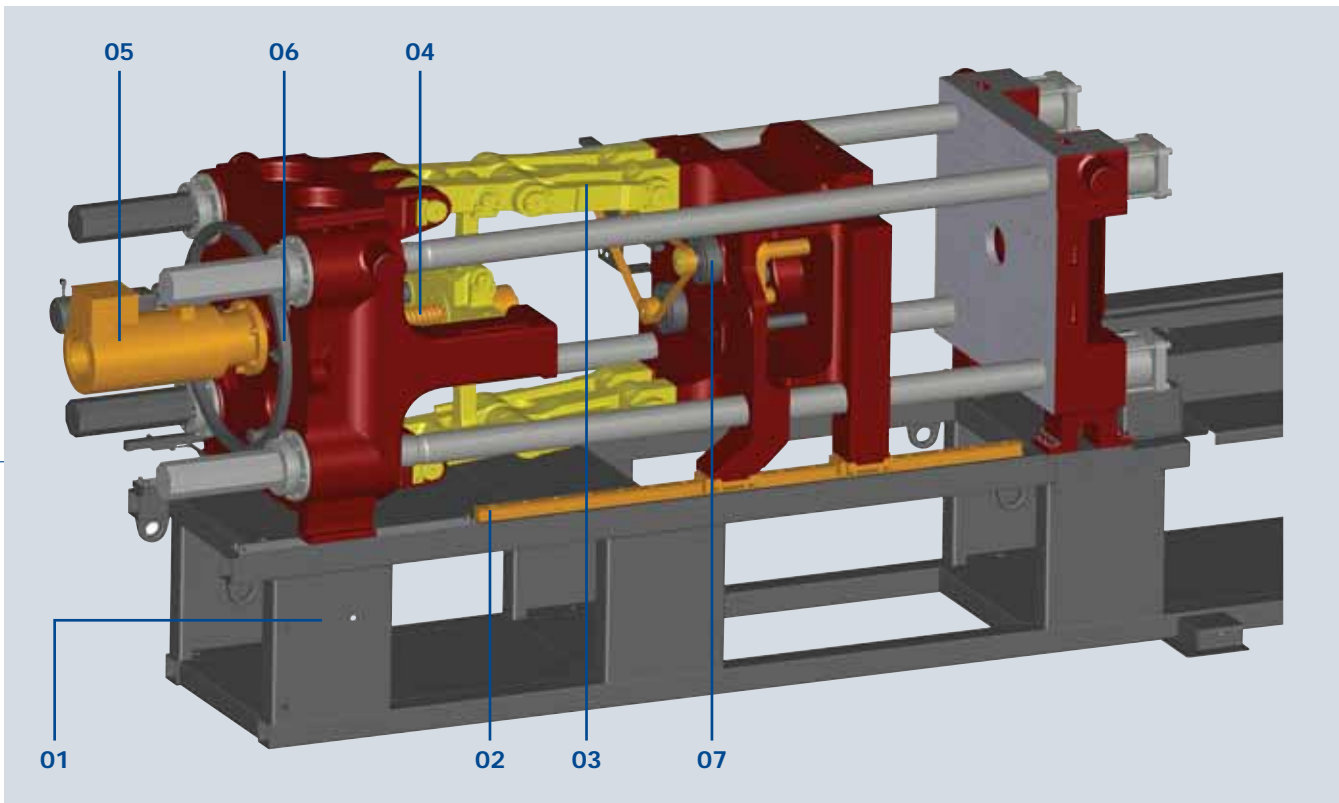
- C-frame unit consisting of power frame (01) and guide frame (02)
- Spacer plates / platens (03)
- Flex-Link (04) between power frame and stationary platen
- Moving platen guide (05)
- Five-point toggle clamp (06)
- Combined crank drive and servo motor (07)

Concept.

The optimum interaction of the power and guide frames ensures perfect force equilibrium and optimum dynamic stability. The combination of toggle clamp and high-performance servo-motor drive makes dry cycle times of approx. 1.3 seconds possible. All system components which perform linear movements run on precision linear bearings on the inner guide frame, thus giving machine-tool precision in continuous operation, irrespective of the load applied by the weight of the mold.

High-resolution measuring and control systems (sine-cosine transmitters in the three-phase servo motors) ensure reproducibility of machine movements within precision tolerances. Clamp force measurement is controlled by means of external pressure transducers.

Enlarged platens (B-platens) are standard and can accommodate large or awkwardly sized molds, thus permitting optimum utilization of machine capacity.



The tiebar clamping unit.

The E-Motion tiebar clamping system comprises the following main components:

- Base frame (01) with precision linear guides (02) for the moving platen
- Three-platen tiebar clamping unit with five-point toggle clamping system (03)
- Toggle drive via ball screw spindle (04) and servo motor (05)
- Four-tiebar adjustment via electric motor for adaptation to mold height (06)
- Ejector unit actuated via servo motor and belt drive running on two ball screw spindles (07)

Concept.

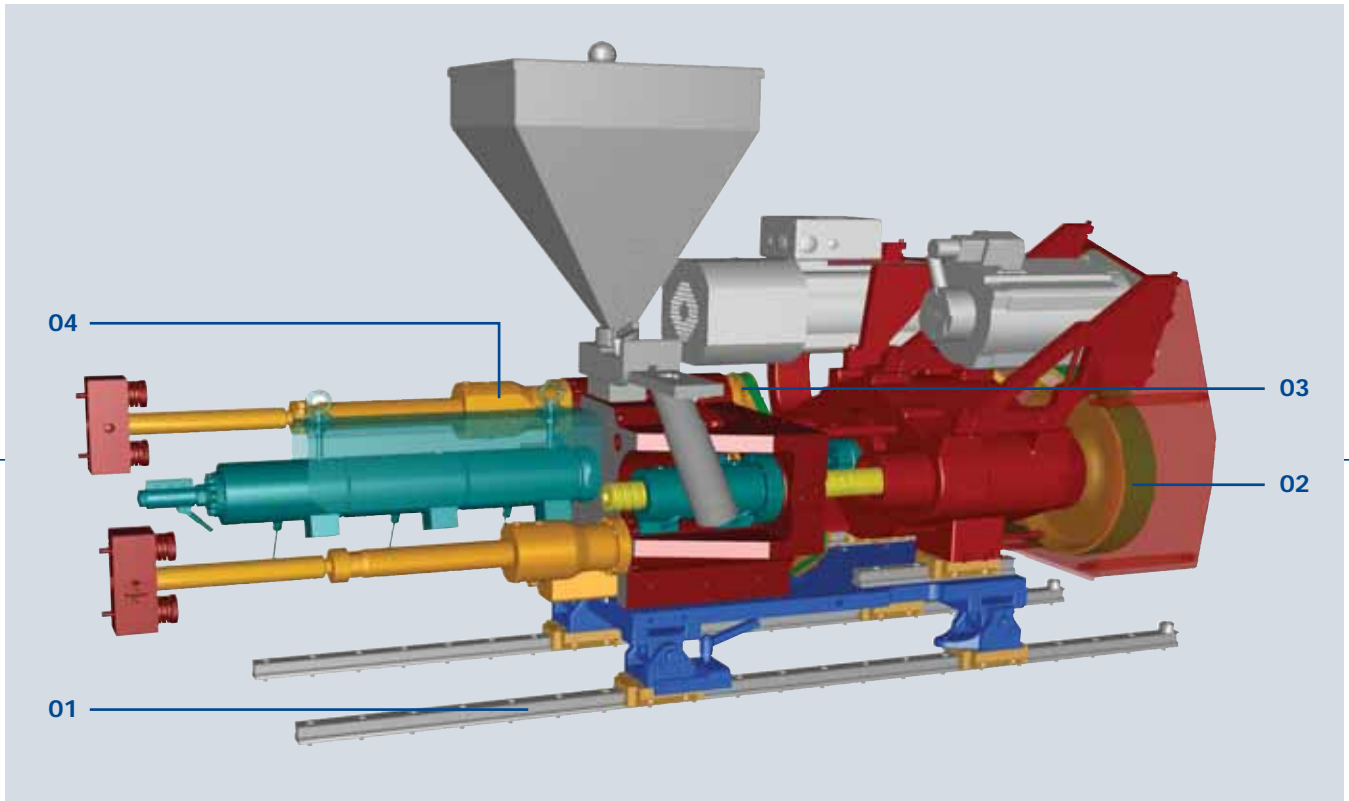
The E-Motion toggle clamping unit unites the advantages of toggle clamping systems with and without tiebars. The four-tiebar system – the tiebars do not perform a guiding function, but serve purely for force transmission – ensures an absolutely balanced flow of forces, while the toggle clamping system performs the required dynamic movements for dry cycle times as short as 1.6 seconds. As in the case of the tiebarless machine, the low-friction platen guides run on precision linear bearings, thus giving machine-tool precision in continuous operation, irrespective of the load applied by the weight of the mold. This low-friction action is an absolute prerequisite for the gentle closing of the moving platen to prevent damage to the mold.

High-resolution measuring and control systems (sine-cosine transmitters in the three-phase servo motors) ensure reproducibility of machine movements within precision tolerances.

ENGEL E-MOTION.

The machine system in detail: the injection unit.

14



The injection unit.

Engel injection units are distinguished by their compact design. This well-proven design concept, which is based on a compact twin-drive system for the injection stroke, is also the basic concept of the electrically driven injection units. The individual structural units are mounted on a carriage with four plates running on precision linear bearings (01).

The injection stroke is performed by a servo motor (02) which drives two recirculating ball screws via zero-backlash toothed belts. This drive concept ensures fast, instantaneous movement. Screw rotation is effected by a second servo motor (03). The outstanding working precision of the injection unit is due not least to the innovative method by which the pressure of the melt is measured. Measurement takes place directly behind the screw by means of a pressure transducer which is integrated in the screw drive and hence unaffected by any disturbing influences.

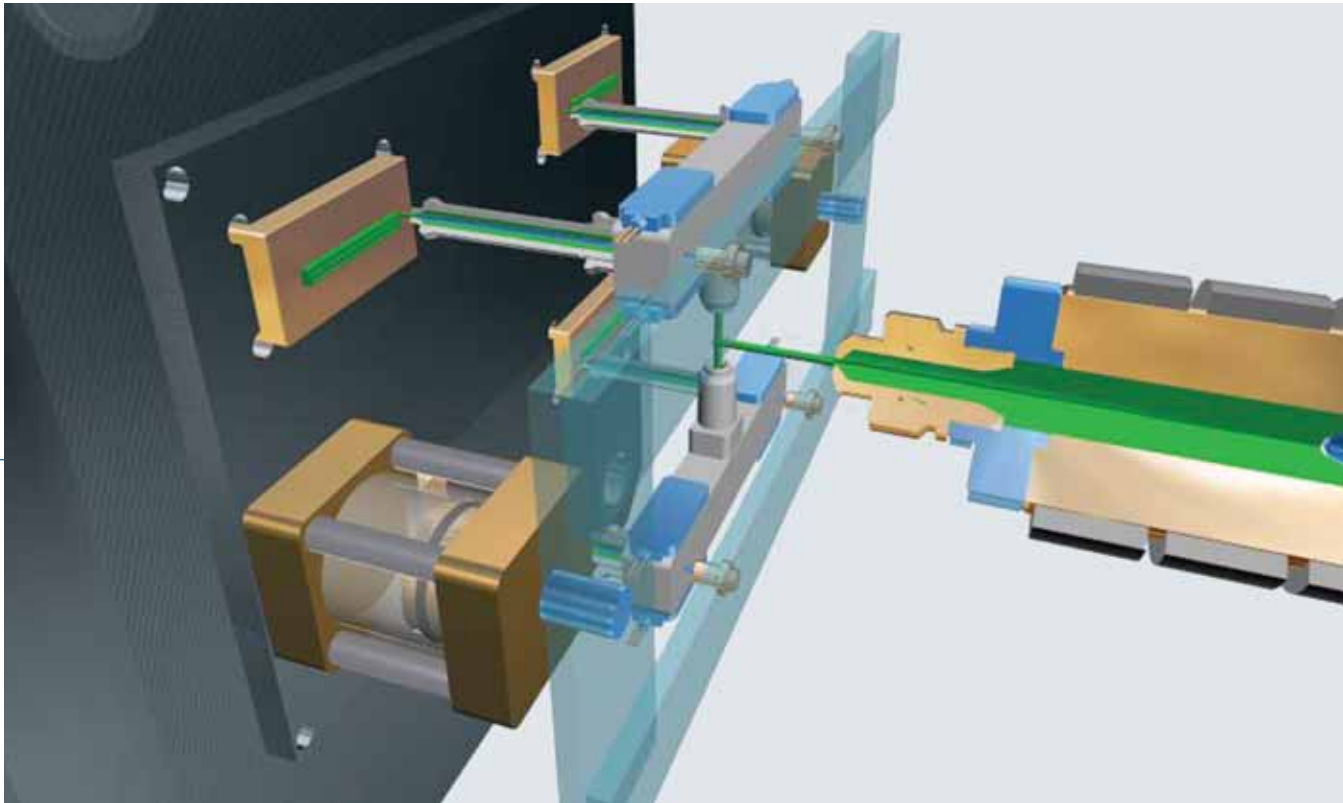
The nozzle contact stroke is performed by two parallel-acting, totally enclosed drive spindles (04) driven by an electric motor. The injection units have been designed for an optimum combination of high injection capacity and high injection pressure (see data sheets). Every injection unit is available in a choice of two performance categories: "Standard" or "High".

Certain tried-and-tested features, such as the cylinder swing-out facility giving easy access for maintenance, or the standard quick-action cylinder mounting system, have been retained. Engel barrels and screws belonging to Engel hydraulic machines can also be used on Engel all-electric machines. No modifications are necessary.

ENGEL E-MOTION injection units make completely new applications possible – especially when used in conjunction with the ENGEL X-MELT technology module for the production of microprecision and thin-section parts.

ENGEL X-MELT.

Application technology for the highest precision.



15

Concept.

Designed for use exclusively in conjunction with ENGEL E-MOTION injection units from size EM 80 / ... to size EM 440 / ..., the ENGEL X-MELT technology module converts the standard machine into a microprecision injection molding machine. The necessary functional precision is largely ensured by the innovative melt pressure measuring system. This comprises a pressure transducer located directly behind the screw – where it is unaffected by disturbing influences – as an integral part of the screw drive.

ENGEL X-MELT begins where conventional injection molding reaches its limits of performance. Shot weights currently range from 20 g down to 0.1 g, with wall thicknesses of between 0.1 mm and 1 mm.

A system prerequisite is an exactly positionable plasticizing screw such as that featured on the ENGEL E-MOTION tiebarless machine system.

Function.

ENGEL X-MELT utilizes the compressibility of the melt as an energy store. The melt is plasticized in the space in front of the screw and then compressed by the piston-like action of the screw. Immediately upon the needle valve nozzle opening, the melt “explodes” into the cavities. X-Melt permits molding of the thinnest of cross-sections and smallest of parts with extremely high precision and reproducibility.

ENGEL CC 200.

The ultimate in machine control and network communication.

16



ENGEL CC 200: The new standard for machine and robot.

Highlights:

- Uniform, intuitive user interface for machine and robot.
- Features traditional Engel operating logic, but adapted for use with Windows software.
- Alphanumeric or graphic data input possible.
- Sequence programming using modular system based on standard sequences.
- Free programming of special sequences.
- Wide range of interface options for commercially available PC hardware.
- Possibility of offline programming on PC considerably reduces set-up times.

- Active and passive communication possible via Internet

Concept.

The CC 200 machine control is a decentralized, high-speed communication system configured with modular hardware units. The nucleus of the system is the PC technology-based high-performance processor with TFT display and touch screen. The CC 200 system unit can be combined with the RC 200 robot control. CC / RC 200 is the central unit for the operation and control of all automation peripherals. Quality assurance and statistical evaluation data are possible as standard.

Hardware.

- 12.1" color TFT with touch screen interface
- Processor: Intel Pentium III / 500
- 32 MB RAM for up to 600 mold parameters
- 1 off Compact flash slot – front side
- 1 off Compact flash slot – rear side
- Chipcard reader – front side*
- 2 off USB ports
- 1 off Ethernet interface – rear side
- 2 off SIM card carriers

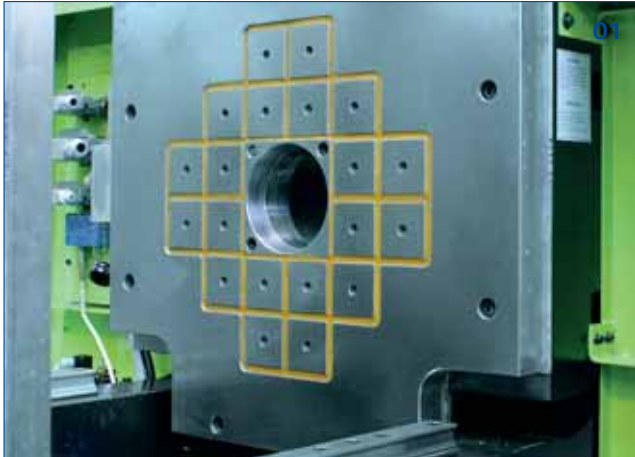
Standard interfaces:

- USB ports for printer, keyboard, CD-ROM, DVD
- Ethernet for central computer and remote maintenance
- CAN bus for sensor / actuator functions



*) The chip card is the "ignition key" for the machine operating system. As many as 15 privileged access levels can be selected for different personnel – from machine operators through to service technicians.

Automation – the complete available range.



17

- 01** **Magnetic platen**
Close-up of optional high-speed mold clamping system using magnetic platens. The magnetic platens are adaptable modules with electrical supply and safety systems which can be integrated into the machine system via interfaces
- 02** **Drive unit for hydraulic core puller**
So as to ensure full compatibility with conventional injection molds, Engel offers a hydraulic drive unit for actuating hydraulic functions. This unit, which can be integrated into the machine system, is available in two basic sizes. It is connected to the machine by means of high-speed couplings. As a further option, one drive unit can be coupled to several machines

- 03** **ENGEL ER-HLI linear robot**
The tiebarless machine concept affords the robot arm unrestricted lateral access to the mold, as there is no upper tiebar to negotiate. This permits a simple design of robot and a saving of space and costs. As the demolding robot and the delivery conveyor can be fully integrated in the machine safety guard, a standard production cell can be supplied complete with robot and conveyor ex works.

Engel Canada Automation Group offers a full range of alternative automation facilities, such as ENGEL ERC robots and Engel sprue pickers.

ENGEL E-MOTION. Special machines for special products.

Production cell with three ENGEL E-MOTION 80 / 60 US machines for the manufacture of microprecision components for the communications industry, e.g. components for DVD readers or loudspeaker components for mobile telephones. Mass production of these parts was possible only through a combination of ENGEL X-MELT technology and the high precision afforded by ENGEL E-MOTION machines.



Photo: HTP High Tech Plastics AG, Neudorf, Austria

18

Lens holder for DVD Player

The molding weighs just 50 Milligrams and consists of LCP with 30% (weight) short glass fibers. A precise serial production can only be achieved with the application technology X-Melt.

Controlled part take out with handling robot



Production Cell based on an ENGEL E-MOTION 80 / 60 US for the large volume production of high precision components made from material TPU. In order to guarantee a controlled part take out, the production cell is equipped with a handling robot and a part conveyor.



Photo: Julius Blum GmbH, Hoeschst, Austria

BLUMOTION-Lamella

is a central element of a shock absorber unit, which is installed in kitchen units to ensure the soft and quiet closing of doors and drawers.

Dimensions in a narrow tolerance range are decisive for the function of the full assembly.

Controlled part take out with handling robot



be the first.



Small and medium-sized machines

ENGEL VICTORY
ENGEL E-MOTION

Large-size machines

ENGEL DUO / CLASSIC

Special applications

ENGEL COMBIMELT
ENGEL INSERT
ENGEL ELAST / LIM
ENGEL macPET

Integrative technology

ENGEL ROBOTS
ENGEL PRECISION MOULDS
ENGEL CC 200

Application technology

ENGEL APPLICATION TECHNOLOGY
Foammelt, Fluidmelt
Tecomelt, Fibermelt

Services

ENGEL TRAINING

Summary

ENGEL SCOPE OF PRODUCTS

Language

german
english
french
italian
spanish

ENGEL NORTH AMERICA: www.engelmachinery.com

ENGEL

Canada: Engel Canada Inc.
Guelph, Ontario, N1K 1C2
tel: 519 836 0220
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e-mail: sales@engel-ec.com

USA: Engel Machinery Inc.
York, PA, 17402
tel: 717 764 6818
fax: 717 764 0314
e-mail: usasales@engel-ec.com

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Mexico City, Mexico 11230
tel: 52 555 399 8999
fax: 52 555 399 2649
e-mail: engelmexico@engel-ec.com