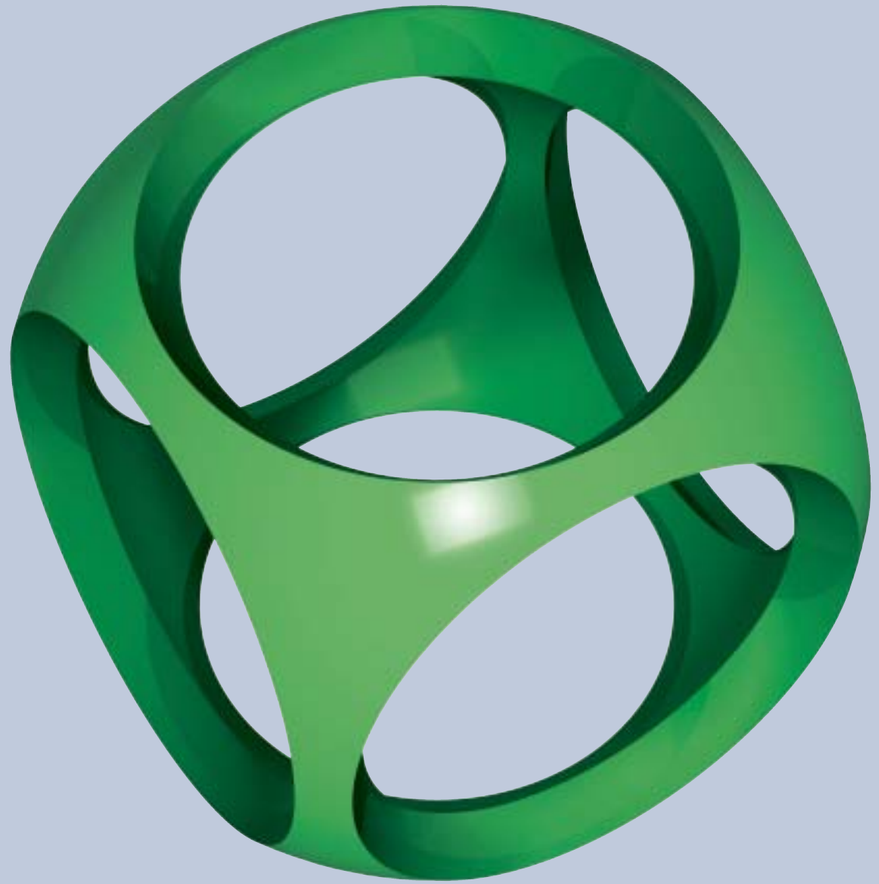
be **the first.**

>> The future belongs to those who prepare
for it today. << Martin Luther King Jun.; (american pastor and civil rights activist)

be **the first.**



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5M/us/03-2003/fr

Innovative injection molding technology

scope of products

ENGEL WORLDWIDE.
Think global. Act local.


01


02


03


04


08


07


06


05

Production

01 ENGEL AUSTRIA GmbH.
Schwertberg, Austria

02 ENGEL AUSTRIA GmbH.
St. Valentin, Austria

03 ENGEL AUSTRIA GmbH.
Steyr-Münichholz, Austria

04 ENGEL AUSTRIA GmbH.
Dietach, Austria

05 Engel Machinery Korea Ltd.
Pyungtaek-City, Korea

06 Engel Machinery Inc.
York, Pennsylvania, USA

07 Engel Canada Inc.
Guelph, Ontario, Canada (Machinery)

08 Engel Canada Inc.
Guelph, Ontario, Canada (Automation Systems)

Over the past half century, Engel has developed into a group consisting of 8 production plants located on 3 continents, with Sales and Service representations in 90 countries.

□ Sales and Service Centres ■ Production Facilities

ENGEL SCOPE OF PRODUCTS.
Injection molding technology from a single source.

Shaping plastics – shaping our world.

Engel is a truly global organization. Wherever injection molding takes place, that´s where we do business. One of the world´s leading injection molding machinery manufacturers, yet still a privately held company embodying the traditional values on which our business was originally built. More than half a century of helping our customers meet every molding challenge has given us consummate expertise – in injection machine technology, in machine control, in automation and in process technology.

But we do not rest on past accomplishments; instead we constantly seek to expand our knowledge. Engel´s annual investment in research and development is one of the largest in the molding industry, allowing us to continue bringing improved molding techniques, processes and equipment to our customers, giving them the competitive edge required in today´s market.

ENGEL CUSTOMER SERVICE DIVISION.
Complete customer satisfaction is the aim.

> COMPETENT
Whether a machine is 2 months or 20 years old, Engel provides information and spare parts upon request. Local service technicians (50 technicians in 37 locations) and Teleservice* allow us to provide fast solutions. Our maintenance* and 24/7* packages provide added assurance of having help whenever you need it.
*available on contract

> WORLDWIDE
Engel service is a decentralized organization affiliated with the worldwide network of subsidiaries and representatives. With technicians worldwide, both reaction time and travel distances are reduced. Six regional service centers, located in Canada, the US and Mexico (which also services Central America and the Caribbean Rim), provide the basis for Engel's North American service network.

> ON HAND
Central storage in our three manufacturing facilities, in connection with an online logistics network including the local parts supplies at the Engel agencies, is the basis for the comprehensive availability of spare parts. Eight regional spare parts centers allow us to provide quick delivery of standard parts.

If upgrading or updating your machine is the option you would like to pursue, Engel offers retrofit / refurbishing services in our manufacturing facilities.

> TRAINING COURSES
Engel provides a step-by-step module-based training concept that offers the right course for every need, with a strong emphasis on practical application. For customer convenience, training courses are held in various locations: Guelph, Ontario; York, PA; Chicago, IL; Santa Ana, CA; Mexico City.

> CUSTOMIZED COURSES
Fully customized training courses are also available. Designed to suit specific requirements, and delivered at the customers' facility, these courses offer additional cost savings for larger groups and machine specific instruction.

> MACHINE / MOLD / MATERIAL TESTING
To enable customers to operate in the most profitable manner possible, we offer a multitude of services for the evaluation of machines, molds and/or materials to optimize the molding process.

> TECHNOLOGY DEMONSTRATIONS
Engel's ongoing strong commitment to technological leadership is supported with our Processing/Training Lab. In this lab a variety of machines and technologies are available for trial, allowing hands-on testing for customer applications.

> PROCESS ENGINEERING SUPPORT
Consultation in the early stages of part design and machine specification may assist in successfully transferring an existing production process/method to a more technically feasible and thus more economic process.

ENGEL TIEBARLESS.
The versatile system for small to medium-sized machines.

Injection units	80 / ...	200 / ...	330 / ...	500 / ...	650 / ...	750 / ...	1050 / ...
Clamp units	Available screw diameter in mm per injection unit						
*TL 28 US [1]	25						
*TL 40 US [1]	25						
*TL 50 US [1]		30					
VC 65 US	18/22/25	25/30/35	30/35/40				
VC 75 US	18/22/25	25/30/35	30/35/40				
VC 85 US	18/22/25	25/30/35	30/35/40				
VC 100 US		25/30/35	30/35/40	35/40/45			
VC 120 US		25/30/35	30/35/40	35/40/45			
VC 130 US		25/30/35	30/35/40	35/40/45			
VC 145 US			30/35/40	35/40/45	40/45/50	45/50/55	50/55/60
VC 165 US			30/35/40	35/40/45	40/45/50	45/50/55	50/55/60

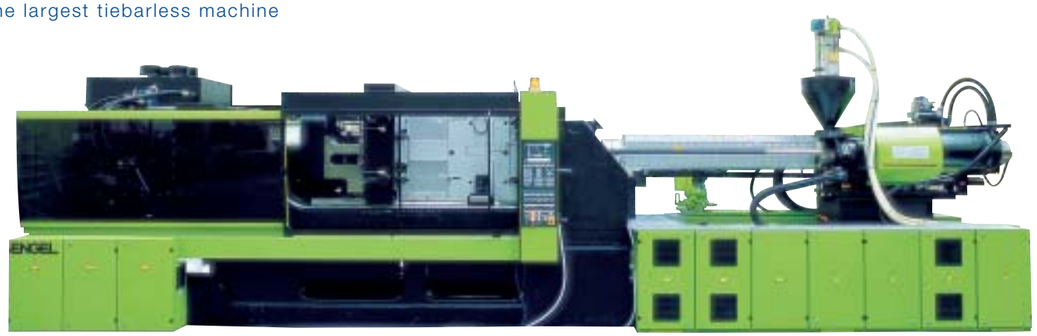
Injection units *	200 / ...	330 / ...	500 / ...	650 / ...	750 / ...	1050 / ...	1350 / ...	1800 / ...	2050 / ...	2550 / ...	3550 / ...	4550 / ...	5550 / ...	7050 / ...
Clamp units	Available screw diameter in mm per injection unit													
*TL 60 US	25/30/35													
*TL 100 US	25/30/35	30/35/40	35/40/45											
*TL 150 US		30/35/40	35/40/45	40/45/50	45/50/55	50/55/60								
*TL 200 US			35/40/45	40/45/50	45/50/55	50/55/60	55/60/70							
*TL 220 US				40/45/50	45/50/55	50/55/60	55/60/70	60/70/80						
*TL 300 US						50/55/60	55/60/70	60/70/80	60/70/80	70/80/85				
*TL 400 US							55/60/70	60/70/80	60/70/80	70/80/85				
*TL 440 US										70/80/85	70/80/90			
*TL 550 US												80/90/105	80/90/105	
*TL 660 US													80/90/105	90/105/120

*Series conversion from the TL system to the ENGEL VICTORY system is taking place continually

[1]Not all options are available on these machine sizes

ENGEL TIEBARLESS 80 / 28 US
The smallest tiebarless machine

ENGEL TIEBARLESS 4550 / 660 US
The largest tiebarless machine



The system
The system is based on the tiebarless injection molding machine concept which was introduced in 1989. The tiebarless clamping system is available in clamping forces ranging from 28 to 660 US tons, thus covering the entire range of applications for small and medium-sized machines.

ENGEL TIEBARLESS ENGEL VICTORY TECH
The economical machine for 80% of all standard applications.

These machine series deliver all the cost and performance advantages of the Engel tiebarless design – larger mold clamping area, simpler and faster mold changes, simplified automation solutions, unsurpassed platen parallelism, reduced platen deflection and shot to shot repeatability.

ENGEL VICTORY POWER
Perfected technology for precision parts when increased performance counts.

Including all the features and benefits of the TECH / TL machines, with an upgraded abrasion resistant barrel for greater processing flexibility, and enhanced hydraulics for improved cycle times.

The platform
The machine system utilizes the tiebarless concept as the basic technology – or platform – for a modular system for the design of complete, application-oriented machines and extension packages.

ENGEL VICTORY SPEED
When fast cycle times take priority.

Additional features of the SPEED machine include electric screw drive – providing parallel screw recovery and energy savings, as well as fully accumulator driven hydraulics and barrier screw design for demanding thin-wall and high speed applications.

Injection units*	80 / ...	200 / ...	310 / ...	440 / ...	740 / ...
Clamp 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
E-MOTION 200 US				35 / 40	45 / 50

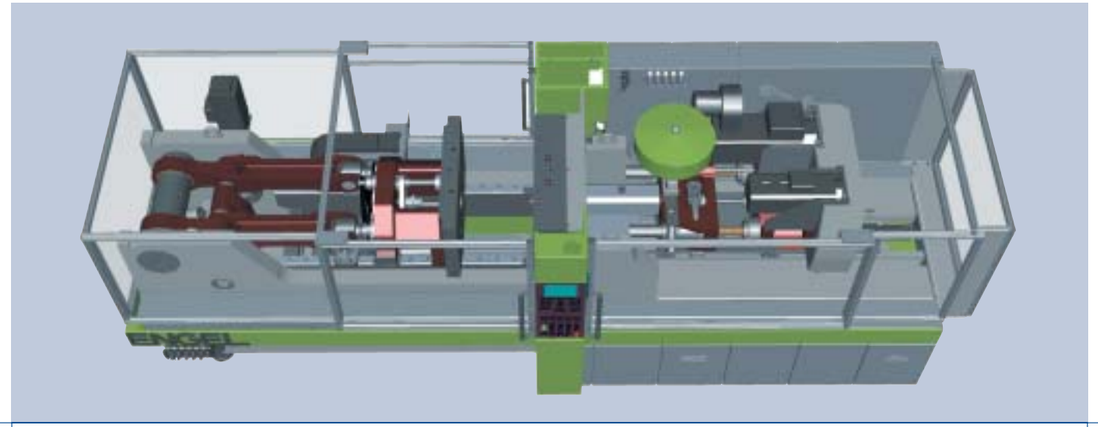
* international type-size designation, calculated from:
max. swept volume [cm³] x max. injection pressure in [bar] / 1000

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. The new range of ENGEL E-MOTION injection molding machines, which feature this technology, enable plastics processors to meet these exacting demands.

The advantages of the ENGEL E-MOTION machine system are increased productivity based on faster cycle times, improved process stability, significantly lower energy consumption, oilfree operation, lower noise emission and minimized maintenance requirements.
In addition, further cost savings will be realized in facility operating costs such as reduced energy supply, cooling water supply and air conditioning requirements.

ENGEL E-MOTION 440 / 165 US



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

> The ENGEL E-MOTION machine system is the all-electric complement to Engel's hydraulic tiebarless injection molding system. A system which has proven itself a good 18,000 times over. It has been developed specially for highly demanding applications such as the production of high-precision and micro-precision parts for medical and other exacting technologies.

> The all-electric drive concept combines high precision and reproducibility (through the use of servo drives) with excellent environmental compatibility (through negligible energy consumption and low emission).

> The ENGEL E-MOTION series of injection molding machines offers, in addition to the advantages of an all-electric machine, the entire spectrum of advantages featured by the traditional Engel tiebarless machines. Complete interchangeability of accessories is another advantageous feature.

> There is no need to re-train the operator, as the control system has remained basically the same, and the machine is operated just like any other Engel machine. The ENGEL E-MOTION can also utilize the wide range of existing application and quality assurance software.

ENGEL CLASSIC.
Classic design for high performance.

Injection units*	1350	1800	2050	2550	3550
Clamp units	**Available screw diameter in mm per injection unit**				
TOGGLE 300 US	55/60	60/70	60/70	70/80/85	
TOGGLE 400 US	55/60	60/70	60/70	70/80/85	
TOGGLE 450 US	55/60	60/70	60/70	70/80/85	
TOGGLE 500 US		60/70	60/70	70/80/85	70/80/90
TOGGLE 500 WP US		60/70	60/70	70/80/85	70/80/90
TOGGLE 550 US		60/70	60/70	70/80/85	70/80/90
TOGGLE 550 WP US		60/70	60/70	70/80/85	70/80/90

Injection units*	2550	3550	4550	5550	7050	11050
Clamp units	**Available screw diameter in mm per injection unit**					
CLASSIC 610 US, 660 US	70/80/85	70/80/90	80/90/105	80/90/105		
CLASSIC 720 US, 830 US		70/80/90	80/90/105	80/90/105	90/105/120	
CLASSIC 880 US, 1000 US			80/90/105	80/90/105	90/105/120	105/120/135

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

Continuity is the key to success

For over 40 years, and despite the many new and alternative systems which have been developed since, Engel has been putting its trust in the advantages of the fully mechanical five-point toggle system. This is not for the sake of tradition, but because of the many benefits these systems offer to processors working in many different branches of the manufacturing industry. This is why we have continued to develop the toggle clamp machine – and will continue to develop it in future, as an proven alternative to the many systems now available on the market.

ENGEL CLASSIC 5550 / 1000 US

Injection unit can be swung out sideways for maintenance work on screw and non-return valve

Sturdy platen support on sliding bearings

Five-point double toggle clamp featuring optimized force distribution

Moving platen of box-type design, with integrated ejector plate

This proven concept has undeniable advantages:

> Optimized force distribution and rigidity of clamping system due to five-point double toggle system and box-type design of moving platen.

> Actual locking force is 10% greater than the rated clamping force thanks to the typical positive locking mechanism of the toggle system, even at high rates of injection.

> Extreme reliability thanks to ruggedly constructed machine components.

> Combination with Engel's compact-design injection units minimizes overall length of machine.

> Easiest conceivable operation thanks to control concept offering full integration potential for machine, robot and peripheral units.

ENGEL DUO.
The large machine program with 2 platen clamp.

Injection units *	2550 / 3550	4550	5550	7050	11050	16050	23050	35050	45050	75050	130000
Clamp units	Available screw diameter in mm per injection unit										
DUO 720 US, 770 US	70/80/90	80/90/105	80/90/105	90/105/120	105/120/135						
DUO 900 US, 1000 US		80/90/105	80/90/105	90/105/120	105/120/135						
DUO 1100 US, 1250 US			80/90/105	90/105/120	105/120/135	120/135/150					
DUO 1400 US, 1650 US				90/105/120	105/120/135	120/135/150	135/150/160				
DUO 1900 US				90/105/120	105/120/135	120/135/150	135/150/160	160/170/180			
DUO 2200 US, 2500 US					105/120/135	120/135/150	135/150/160	160/170/180			
DUO 2800 US, 3000 US						120/135/150	135/150/160	160/170/180	180/190/200	215/230/245	
DUO 3300 US, 3500 US						120/135/150	135/150/160	160/170/180	180/190/200	215/230/245	
DUO 4000 US, 4400 US							135/150/160	160/170/180	180/190/200	215/230/245	
DUO 5500 US, 6000 US							135/150/160	160/170/180	180/190/200	215/230/245	245/260

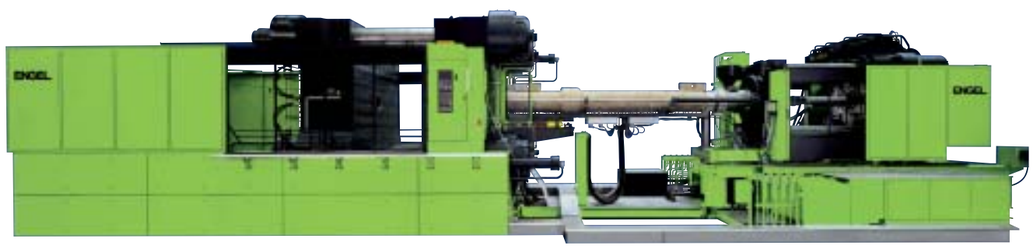
* international type-size designation, calculated from:
max. swept volume [cm³] x max. injection pressure in [bar] / 1000

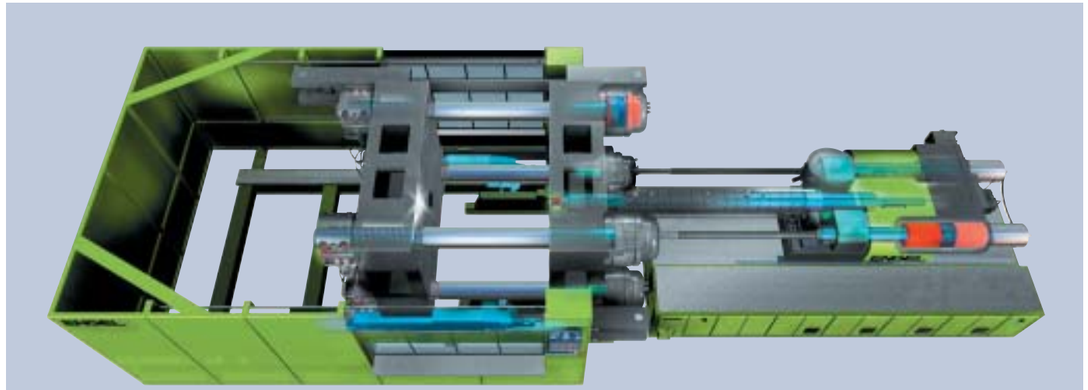
ENGEL DUO –
The universal Large Machine.

Minimum footprint, robust construction, straightforward adaptation of automation and modular upgrading were the design guidelines for the Engel large machine program. Clamp units are offered in 10 different tonnage ranges, from 720 tons to 6000 tons. There are also 11 different injection units designed, offering the most flexible choice when selecting a machine.

The core component of the ENGEL DUO clamp is the moving platen support, which provides extraordinary stability and guidance for large and heavy tools. Two diagonally mounted rapid traverse cylinders precisely control moving platen speed and position, in addition to providing accurate low-pressure mold protection. After mold closing, split nuts lock on the back of the moving platen. Pressure pads mounted on the stationary platen generate clamp force uniformly.

ENGEL DUO 130000 / 6000 US





The advantages lie in the basic concept:

> ”ENGEL DUO Baseframe Technology” – the modular system for your perfectly customized machine.

> Minimum space requirement thanks to a compact two-platen design.

> Cycle time reduction made possible by two diagonally positioned high-speed cylinders, featuring fast locking action and minimized pressure build-up time.

> High reliability in operation and high part quality ensured by sturdy platen guides and parallel travel of the moving platen.

> Easiest conceivable operation thanks to control concept, offering full integration potential for machine, robot and peripheral units.

ENGEL INSERT.
Modularity and flexibility for every application.

Injection units / Horizontal*	200 H / …	330 H / …	500 H / …	600 H / …	700 H / …	1300 H / …	Rotary table
Clamp unit	Available screw diameter in mm per injection unit						Dia. in mm / inch
INSERT … / 55 US	25/30/35	30/35/40					975 / 38.39
INSERT … / 85 US	25/30/35	30/35/40	35/40/45				975 / 38.39
INSERT … / 125 US		30/35/40	35/40/45	40/45/50			1180 / 46.46
INSERT … / 125 WP US		30/35/40	35/40/45	40/45/50			1575 / 62.01
INSERT … / 150 US		30/35/40	35/40/45	40/45/50			1180 / 46.46
INSERT … / 150 WP US		30/35/40	35/40/45	40/45/50			1575 / 62.01
INSERT … / 200 US			35/40/45	40/45/50	45/50/55		1180 / 46.46
INSERT … / 200 WP US			35/40/45	40/45/50	45/50/55		1575 / 62.01
INSERT … / 300 US					45/50/55	55/60/70	1575 / 62.01

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

ENGEL INSERT H
Rotary table machine with horizontal injection unit

ENGEL INSERT 330H / 125 US

Injection units / Vertical*	200 V / …	330 V / …	500 V / …	Rotary table
Clamp unit	Available screw diameter in mm per injection unit			Dia. in mm / inch
INSERT … / 60 US	25/30/35	30/35/40		975 / 38.39
INSERT … / 60 WP US	25/30/35	30/35/40		1180 / 46.46
INSERT … / 90 US	25/30/35	30/35/40	35/40/45	975 / 38.39
INSERT … / 90 WP US	25/30/35	30/35/40	35/40/45	1180 / 46.46
INSERT … / 125 US	25/30/35	30/35/40	35/40/45	1575 / 62.01
INSERT … / 150 US	25/30/35	30/35/40	35/40/45	1575 / 62.01

The basis of success
Through the use of standard structural units for the injection unit and drive, ENGEL INSERT machines offer the same high degree of quality and reliability as the standard range of Engel injection molding machines. These basic types are only the starting point for a wide spectrum of machine variants which can be specifically adapted to every conceivable application.

ENGEL INSERT V
Rotary table machine with vertical injection unit

ENGEL INSERT 330V / 90 US

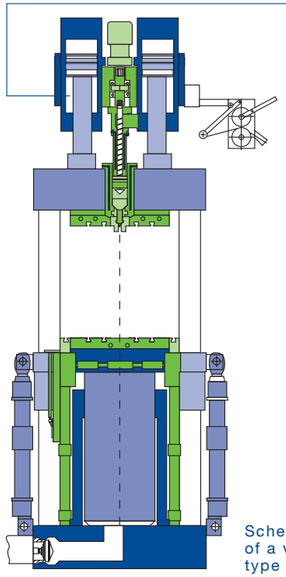
Vertical rubber injection molding machines					
Machine type	Clamp Force	Shot Volume	Heating Platen dimensions		Distance between tiebars
	US tons	in³	standard in	max. in	in
ELAST 110 V	110	17.08 – 61.02	14.17 x 19.69	17.32 x 21.65	17.7 x 10.0
ELAST 175 V	175	26.24 – 122.05	19.69 x 21.65	21.65 x 25.6	23.2 x 11.6
ELAST 275 V	275	45.75 – 219.68	21.65 x 25.6	25.6 x 29.52	26.0 x 12.6
ELAST 440 V	440	91.5 – 366.14	27.95 x 36.22	31.89 x 40.15	32.3 x 19.7
ELAST 660 V	660	164.48 – 640.75	31.5 x 43.3	35.43 x 47.24	37.0 x 23.2
ELAST 880 V	880	164.48 – 1525.6	35.43 x 47.24	39.37 x 51.18	44.5 x 31.5

This is an overview of the most important types of machine and their main specifications.
For more detailed information please request our individual data sheets.

FIFO (First In-First Out) injection unit

The first material in is the first material out. As a result, uniform material temperature and consistency is achieved. This, in addition to the shorter flow path, ensures a higher product quality and faster cycle times.

FIFO: First In / First Out-injection unit



Schematic drawing of a vertical tiebar-type clamp unit

Clamp unit

On all vertical machines 110 tons and above, and on horizontal machines with clamping forces over 300 tons, conventional 4-tiebar clamp units are used.

ENGEL ELAST 275 V

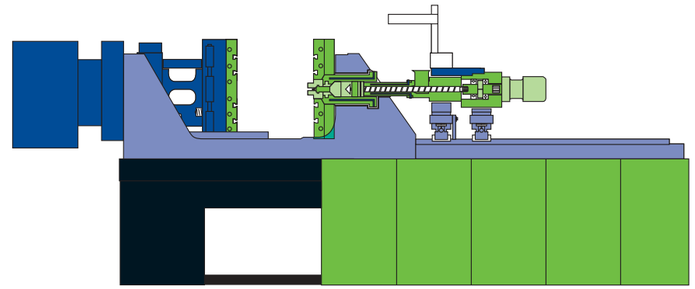
vertical rubber injection molding machine

Horizontal rubber injection molding machines					
Machine type	Clamp Force	Shot Volume	Heating Platen dimensions*		Dry cycle according to
	US tons	in³	standard in	Max. in	EUROMAP 6, in sec.
ELAST 60 HTL	60	17.08 – 21.97	12.59 x 15.75	14.17 x 19.69	3,0
ELAST 100 HTL	100	17.08 – 34.78	14.17 x 19.69	17.32 x 19.69	3,2
ELAST 150 HTL	150	17.08 – 61.02	17.32 x 19.69	19.69 x 21.65	3,5
ELAST 200 HTL	200	26.24 – 122.05	19.69 x 21.65	21.65 x 25.6	4,2
ELAST 300 HTL	300	45.75 – 219.68	21.65 x 25.6	25.6 x 25.6	5,0
ELAST 440 H	440	91.5 – 366.14	27.95 x 36.22	31.89 x 40.15	8,0

* Special applications necessitating larger heating platen dimensions are also possible thanks to tiebarless design.

Tiebarless ENGEL ELAST Clamp unit

The layout of the tiebarless ENGEL ELAST clamp was introduced in 1989, and offers the best conditions for fast mold change cycles and unrestricted automation.



Schematic drawing of a horizontal tiebarless clamp unit

ENGEL ELAST 200 HTL

Horizontal rubber injection molding machine with brushing system

Basic automation: ER-A sprue removal robots.

Sprue removal robots ER-A3/A, ER-A4/A

Sprue removal and separation are an integral part of the automation process. Engel offers sprue removal robots for injection molding machines with clamping forces ranging from 28 to 250 US tons. The control systems for these sprue removal robots are likewise integrated in the machine control systems, thus offering the same advantages as those featured by all other series of Engel robots.

Sprue removal robot ER-A Type 5, 6, 7. Version A or B

Both versions of this sprue removal robot (A + B) are operated via the machine control system. Various sequence programs can be selected from the robot's comprehensive menu software. Both versions are equipped as standard with a back pressure monitoring device in the gripper which enables the robot to recognize the part.

TLi robots: fully benefiting from the tiebarless machine concept.

Integrated handling robots for tiebarless injection molding machines: ER-TLi

For standard "pick and place" applications on Engel tiebarless machines within the 28 to 660 US ton range, the Engel ER-TLi robots represent a low-cost means of automation.

The ER- TLi robot is used in cases where molded parts cannot be gravity-discharged from the mold because they are still hot and easily damaged, or in cases where the parts are to be packed directly at the machine. Normally, the ER- TLi robot is mounted on the stationary platen and the parts are deposited on an integrated conveyor belt located within the safety guard.

Linear robots ENGEL ERC: For comprehensive automation tasks.

ERC			23 - 53 E, EA, EH	63 - 83 E, EH	94 - 144 E
For injection molding machines: (clamp force in US tons)		**US tons**	**40 - 750**	**250 - 2000**	**1500 - 6000**
Demolding stroke	**X**	mm	300 - 700	700 - 1300	1300 - 3000
Vertical axis	**Y**	mm	600 - 1600	1000 - 2200	1800 - 3000
Horizontal axis	**Z**	mm	1400 - 5720	1880 - 8120	2360 - 9920
Max. handling weight (parts + gripper)		ibs	6.6 - 22.0	44.1 - 66.1	66.1 - 176.4
Max. speed (Y-axis) Asynchronous servo drive	**EA**	m/s	2		
Servo drive	**E**	m/s	3	3	2,5 - 3
High-speed drive	**EH**	m/s	5	4	
Repeatability		mm	± 0.05	± 0.05	± 0.1

ENGEL ERC 23 - 53 E (alternative options EA and EH) – Fast and flexible

- Rated for injection molding machines with clamping forces of between 40 – 750 US tons.
- Available with a choice of three different drive variants:
  - > **Asynchronous servo drive (EA)** for long and medium cycle times
  - > **Servo drive (E)** for fast total cycle times (highly dynamic)
  - > **High-speed digital servo drive (EH)** for extremely fast parts removal (demolding times as fast as 0.5 sec where the total cycle time is only 5 sec)

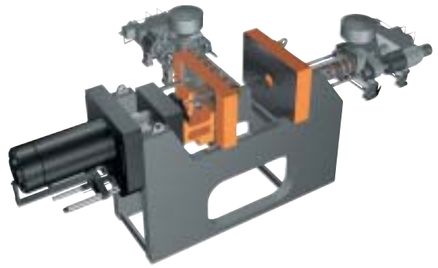
ENGEL ERC 63 - 83 E, EH The Power Class

- Rated for injection molding machines with clamping forces of between 250 and 2000 US tons.
- Particularly sturdy mechanism for the handling of weights up to 30 kg (66 lbs.).
- **Servo drive (version E)** providing linear speeds of up to 3 m/s when handling a working load of 66 lbs.
- **High speed version (EH)** with digital servo drive capable of linear speeds of 4 m/s when handling a working load of 44 lbs.

ENGEL ERC 94 - 144 E The power package for large injection molding machines

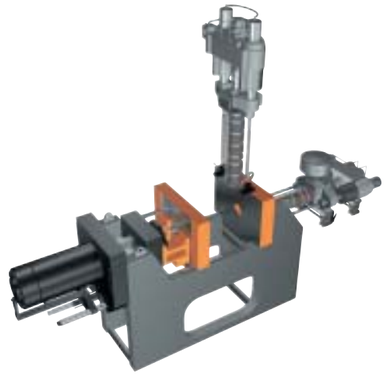
- Rated for use on large-capacity machines with clamping forces upwards of 1500 US tons.
- Axes amply dimensioned for extreme stability.
- Compact construction.
- Servo motor drives only.
- Telescopic vertical axis is standard.
- Helical rack-and-pinion drives, sturdily built and permanently lubricated for low-noise operation.
- Special sequence control software for the synchronized operation of robot and machine
- a valuable cycle time saving feature when demolding "deep-draw" parts.

ENGEL ERC 83 E



Injection units in ”L” arrangement

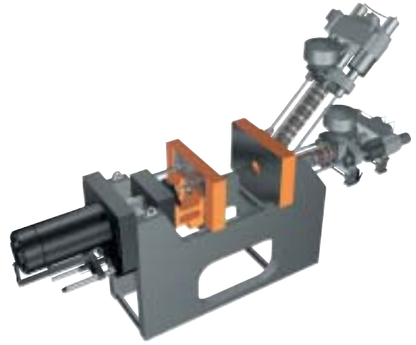
Injection unit combinations in the ”L” arrangement afford free access to the plasticizing unit. The nozzles can be centered by means of a crank mechanism for coupling to the stationary and moving platens. ”L” combinations can be utilized on any desired sizes of injection unit and on all basic machine models.



Vertical injection unit

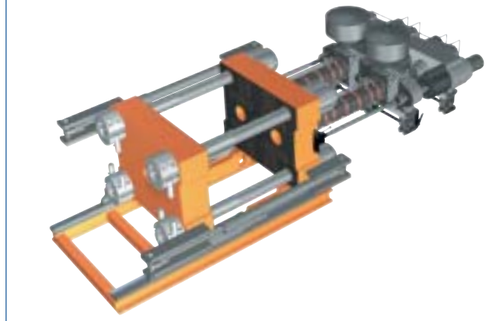
Vertical injection units are mounted above the stationary platen on a moving carriage. When the mold has to be changed, the vertical injection unit can be pushed back in the direction of the horizontal injection unit. This feature also permits easy and accurate centering of the injection nozzle to the sprue bushing.

Machines with vertical second injection unit can easily be set for coinjection molding according to the Engel system.



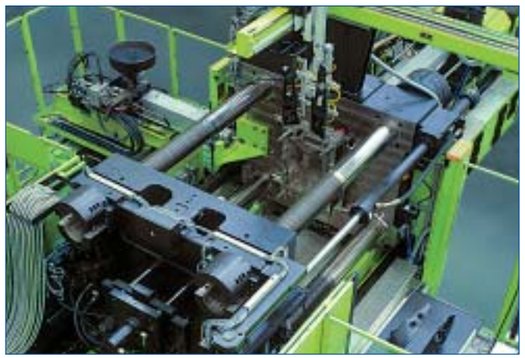
”Piggyback” injection unit

The piggyback injection unit (ie. second injection unit positioned above the main injection unit) constitutes a space-saving solution for an automated Combimelt production cell with a handling robot mounted on the stationary platen. The second unit is positioned at an angle above the main unit. The injection units move in parallel, keeping equal distance between nozzles. While depth of insertion may differ for each nozzle, the length of motion is the same.



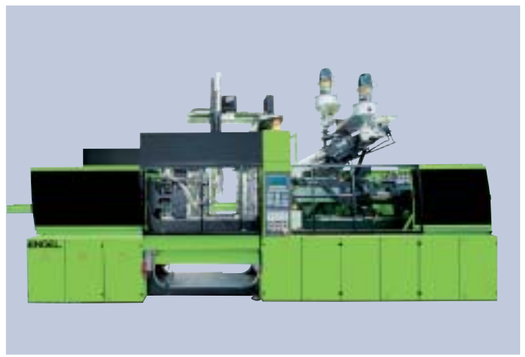
Parallel injection units

Combimelt injection molding machines equipped with several injection units in parallel arrangement can be used for a diversity of applications. One of the principle applications is the production of multi-color rear light covers and other multi-component parts. The machines used are primarily of the large-capacity type, equipped with up to four parallel injection units of varying size.



Combimelt injection modules are available for the entire range of Engel injection molding machines – including large-tonnage ENGEL DUO machines.

Tiebarless injection molding machine with a clamping force of 660 US tons – the largest tiebarless machine which can be equipped with a vertically positioned second injection unit.



Production cell of medium-sized, tiebarless Engel injection molding machine with injection units in piggyback arrangement.

Example of a four-unit machine with three parallel injection units and one additional injection unit in the ”L” arrangement for the production of rear light covers.

ENGEL LIM.
For processing of liquid silicone rubber.

The ENGEL LIM-machine program is matched to the various applications in the processing of liquid silicone rubber. This includes machines for the manufacture of micro products such as micro parts, large-volume products such as insulators and takes into account the large variations of commercially available LSR types including highly reactive and highly filled LSR materials.

Selection criteria for the right combination:

	Screw injection unit	Plunger injection unit	Static mixer	Dynamic mixer
Standard LSR-types				
Highly reactive LSR-types				
Highly filled LSR-types				
High-viscosity LSR-types				
Small injection volumes				
Adding of colour below 1%				
Adding of additives				

ENGEL LIM-screw injection molding machines:

Clamp units	... / 28	... / 35-50	... / 65-85	... / 100-130	... / 145-165	... / 200-240	... / 275-330
Injection unit*	International Size specification: max. shot volume [cm³] x max. injection pressure [bar] /1000						
LIM 80 /... US	18/22	18/22	18/22				
LIM 200 /... US		25/30	25/30				
LIM 330 /... US			30/35	30/35			
LIM 500 /... US				35/40	35/40	35/40	
LIM 750 /... US					45/50	45/50	45/50
LIM 1050 /... US						50/55	50/55

* Available screw diameter in mm per injection unit

ENGEL LIM-plunger injection molding machines:

Clamp units	... / 35-50	... / 65-85	... / 100-130	... / 145-165
Injection unit*				
LIM 100 K /... US	30	30	30	
LIM 200 K /... US		40	40	40
LIM 320 K /... US				45

* Available plunger diameter in mm per injection unit

ENGEL LIM-double plunger injection molding machines:

Clamp units	... /100	... / 135	... / 175	... / 275	... / 440	... / 660
Injection unit*						
LIM 1000 D /... US	2 x 57	2 x 57	2 x 57			
LIM 3000 D /... US		2 x 70	2 x 70	2 x 70	2 x 70	
LIM 6000 D /... US				2 x 100	2 x 100	2 x 100

* Available plunger diameter in mm per injection unit

ENGEL LIM
Plunger injection molding machine,
Type ENGEL VICTORY 100K / 50 US Lim

The ENGEL LIM-Machine range:

> The technology platform for all ENGEL LIM-machines is the proven ENGEL TIEBARLESS-machine lines available from 28 to 660 US tons clamp force

> Suitable injection units available for all applications:
- Screw unit for high viscosity LSR types
- Plunger unit for high reactive, high filled LSR types
- Double plunger unit for large shot volumes

> LSR material feeding and meter mix system

> Support available from Engel application technology center for complete systems including molds

Technology below the surface is the beauty of it.

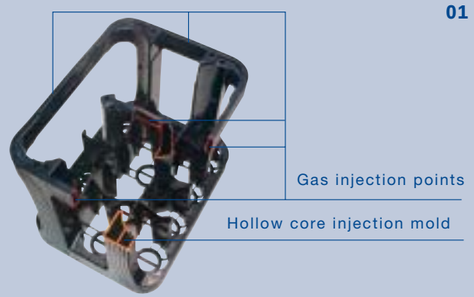
The GASMELT and the WATERMELT processes offered by Engel permit the molding of parts with thicker walls and sections than normally permitted by the material used.
With both processes, a separate pressure medium (nitrogen gas or water) injected during the molding sequence, counter-acts shrinkage caused by the volume change during cooling, by pushing material against the cavity walls. This prevents the occurrence of sink marks and other blemishes.

Close-up of gas pressure control unit

Production unit comprising of Engel injection molding machine with compact WATERMELT Unit. The latter is connected to the machine by the media hoses and interface cable.

Overview of application scope of GASMELT / WATERMELT processes

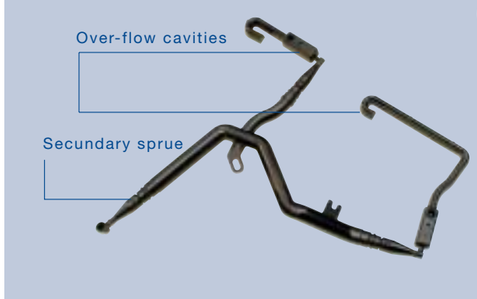
	GASMELT	WATERMELT
Large-area, ribbed parts, e.g. fronts of TV sets		
Engineered parts with large cavities		
Handles with small to medium-sized cavities (up to approx. 1.2 in^3)		
Handles with large cavities		
Structural components with relatively small, partial cavities		
Structural components with large cavities		



01 Example of local gas injection with variable cavity volume. The cavities are located in five separate parts of this ergonomically designed handle in order to ensure optimum smoothness

02 Armrest/handle for car door: example of the GASMELT push-back process. To provide the extremely high quality surface finish required, the entire cavity is filled with material before introducing the gas. In this particular application, the melt is forced back into the barrel

03 Housing for television set with cavities for compensating contraction through shrinkage (surface improvement, avoidance of sink marks) at the points of the housing where fastening elements are incorporated. The cavities are produced using the GASMELT over-flow process



01 Example of car engine water manifold, injection molded by a combination of WATERMELT with the over-flow process (using over-flow cavities) and the flushing process for the most efficient cooling possible. The materiaol (from the over-flow cavities) is reground and fed back into the injection molding process

02 Finished water manifold after sprue and over-flow removal

03 Cross-sectional view of water manifold. The advantage of the WATERMELT process lies in its ability to produce parts of uniform wall thickness over relatively long flow paths

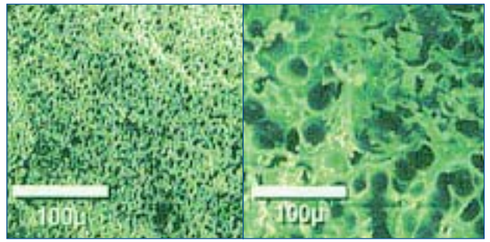
The process technology for ”light“ components

The foam injection technologies.

ENGEL FOAMMELT comprises of the process technologies for thermoplastic foam injection molding for weight reduction of components with thin to medium wall thickness (up to .78 in.) and special requirements for precision.
The main process alternatives are:

a) Physical blowing agents (MuCell® technology, Gas counter pressure process)
b) Chemical blowing agents

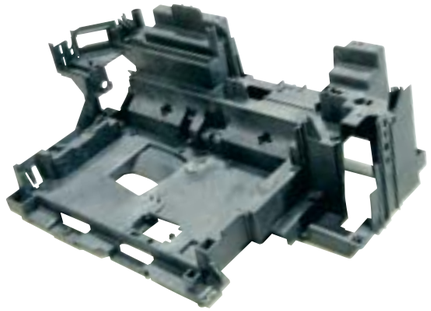
The MuCell® Process – is characterized by a microcellular structure in the molded part resulting from a homogeniously distributed Nitrogen gas held in solution in the plastic melt as a supercritical fluid. The gas is injected directly in the plasticizing cylinder in a specially designed metering zone. During and after injection the gas dissolves from the melt and creates the cell structure in the part.



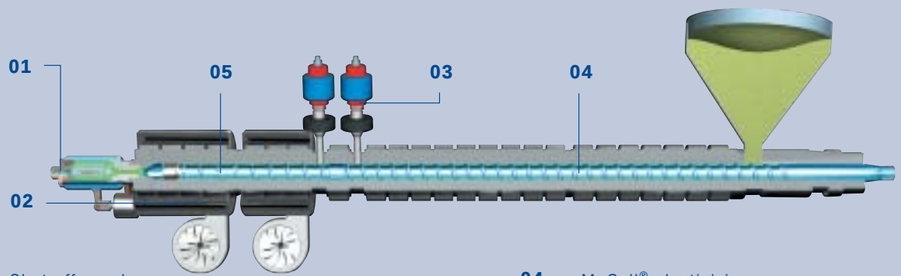
Cross-section MuCell® foam structure

Cross-section conventional chemical foam

Inkjet Printer



Chassis for inkjet printer with special requirements for precision and free of warpage



01 Shut off nozzle
02 Heaterband with additional cooling fan unit for precise temperature control
03 Gas injector
04 MuCell® plasticizing screw (with L/D ratio = 28:1)
05 Mixing zone for homogenizing gas/plastic compound

Production cell consisting of standard injection molding machine integrating the equipment package for MuCell®

The MuCell®-equipment package.

Consists of:
Any standard Engel injection molding machine, plus

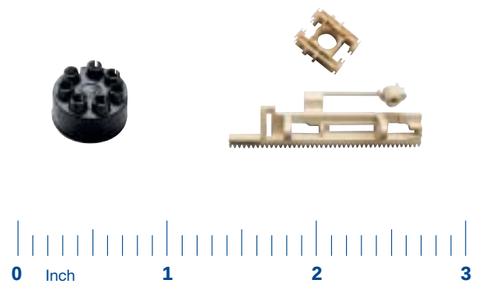
> ENGEL FOAMMELT plasticizing unit including:
- Plasticizing cylinder with extended L/D ratio (28 D), available from 30 to 160 mm screw diameter
- Air cooled heater bands and melt pressure transducer, located in the mixing zone
- Hydraulic shut off nozzle
- 28 D MuCell® screw

> Frame extension for injection unit
> MuCell® process software
> Small accumulator with servo valve for maintaining MPP (Melt Pressurization Pressure)
> Gas supply unit, suitable for mixing Nitrogen or Carbon dioxide gas

Recommended: Accumulator for increased injection speed.

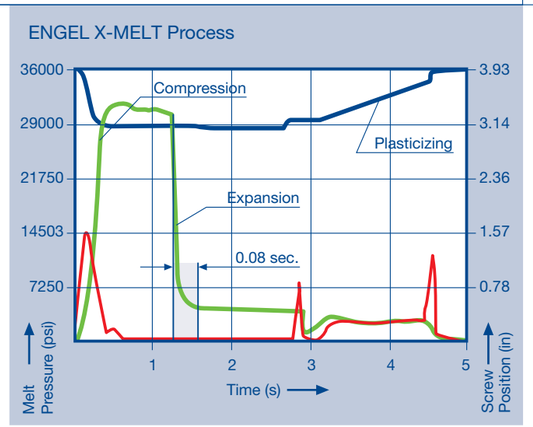
Detail view of MuCell® plasticizing cylinder / mid size with two gas injectors

Injection expansion molding for thinwall and precise components.



The process – the overview.

The real advantage of ENGEL X-MELT technology is the outstanding repeatability of the process cycle. This results from the exact to position, electromechanic screw drive. Variations in the closing behavior of the non-return valve are eliminated by an adaptive software.
The residual melt pressure after expansion acts like the holding pressure used in a conventional injection molding process.

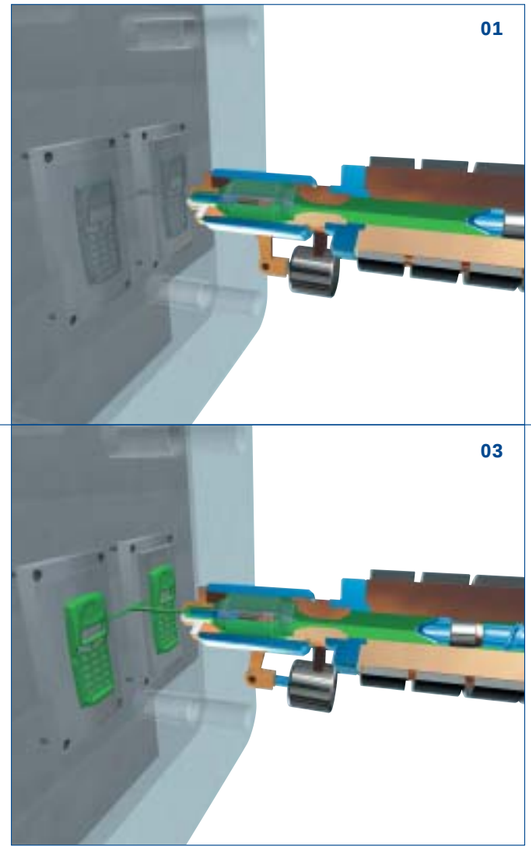


The process concept.

ENGEL X-MELT is a process technology for high speed injection molding using an unconventional method. Conventional high speed injection molding is based on a machine layout with high drive capacity and injection accumulators.
ENGEL X-MELT uses the highly compressed, thus condensed melt as the accumulator itself.
The volumetric filling of the cavity is achieved by the expansion of the melt without the necessity to first accelerate the screw and machine components to high speed and slow them down afterwards. No additional drive power or add-on devices like an accumulator are required.

Where conventional injection molding has reached it´s limit, ENGEL X-MELT commences. Presently components in the shot weight range from 0.0035 to 0.705 oz and with a wallthickness between 0.0039 and 0.039 inch can be molded.
An Essential system requirement is an exactly positionable plasticizing screw. Since this requirement is fully met with the all-electric, tiebarless machine system ENGEL E-MOTION, the ENGEL X-MELT process technology is provided in combination with the ENGEL E-MOTION machines only.

The process cycle.



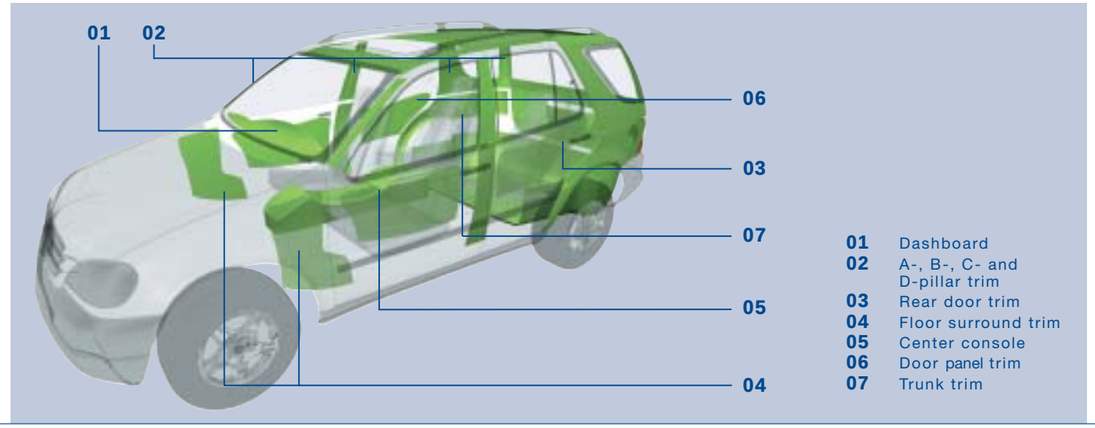
01 Process stage 1: The plasticizing unit of the injection molding machine is equipped with a pneumatic needle shut off nozzle. In the beginning the shut off nozzle is closed. The screw is rotating and plasticizes material like a conventional machine

02 Process stage 2: After finishing recovery, the plastic melt is compressed, with the nozzle held closed by moving the screw forward like a piston. Depending on the application, the compression pressure range varies between 29000 and 36000 psi.
At this pressure the volume of the plasticized melt is reduced by approx. 10%. Subsequently, the melt is kept under pressure in order to maximize temperature and pressure homogenity

03 Process stage 3: With the screw still held in it´s exact position, the shut off nozzle is opened. The sudden release of pressure causes an explosion-like filling of the cavities. The residual pressure acts as holdpressure, compensating for volume contraction due to shrinkage

04 Alternative system configuration:
An alternative to a system with the shut off nozzle as part of the plasticizing cylinder is the possibility of integrating the shut off nozzles as part of a hotrunner system directly into the mold. Using valve gates in the mold eliminates the necessity to consider the runner volume and pressure loss for the process settings. this result in the possibility of even shorter filling times and thinner wall thicknesses with reduced residence time

The Engel process for combining fabrics and plastics.



01 Dashboard
02 A-, B-, C- and D-pillar trim
03 Rear door trim
04 Floor surround trim
05 Center console
06 Door panel trim
07 Trunk trim

The ENGEL TECOMELT molding processes are low-pressure processes. The choice between the two available processes depends on the size of part and/or the mold filling pressure: ENGEL TECOMELT injection molding and ENGEL TECOMELT compression molding.

ENGEL TECOMELT INJECTION MOLDING

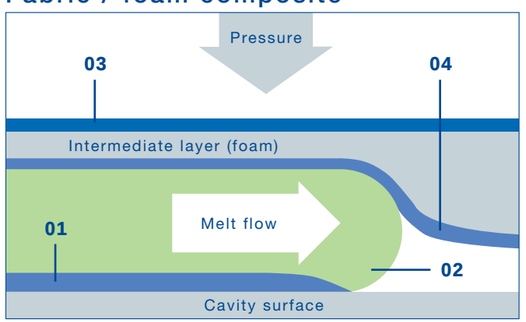
The machines used for the ENGEL TECOMELT injection molding process are conventional, horizontal type machines which feature certain modifications. Low filling pressure provided to fill the cavities sets this process apart from conventional injection molding technology. This can be achieved either through cascade-controlled, multiple pin gating (sequential opening of valve gates) or by combining conventional injection molding with a compression process.

ENGEL TECOMELT injection molding is particularly suitable for long, narrow shaped parts.

ENGEL TECOMELT COMPRESSION MOLDING

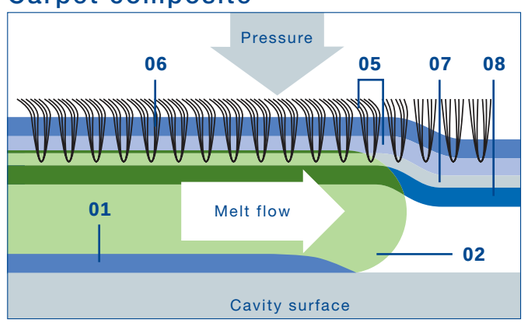
A vertical press is used for the ENGEL TECOMELT compression molding process. The melt is applied to the bottom half of the mold, depositing the extruded plastic while following the contour of the mold cavity. The decorative fabric is then placed on top of the plastic. The clamp closes, compressing the two components together. This melt deposit process offers the advantage of being able to place more melt exactly where more melt is required and, moreover, eliminates the need for costly melt distribution systems (hot runners) in the mold.

Fabric / foam composite



01 Frozen melt layer
02 Plastic melt
03 Top layer (fabric etc.)
04 Bottom layer (interliner)

Carpet composite



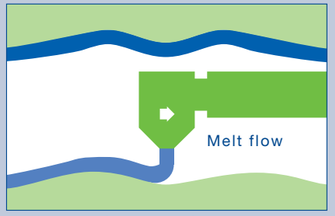
05 Pile with Pile bond
06 Carpet backing
07 Back coating
08 Covering fleece

Horizontal machines for long, narrow parts.

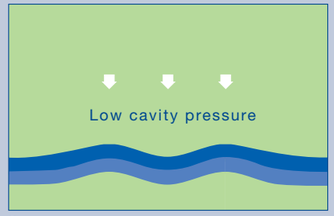
Horizontal injection molding machine model ENGEL VICTORY 1350 / 350 Tecomelt with ENGEL ERC 63/1-C linear robot.

The robot grips the end of the fabric web, pulls the required length of fabric from the reel and cuts it off. The fabric is then inserted into the mold with the aid of a fixing frame and held there by the robot until it is locked in place by the closed mold.

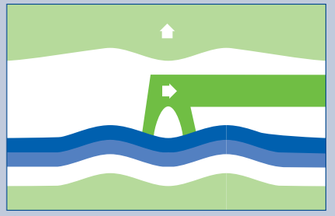
The compression molding process – for large-area parts.



Melt depositing operation



Compression



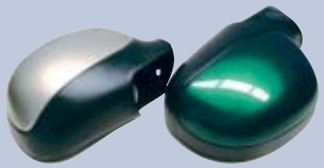
Removal of molded part

Model ENGEL TECOMELT 2500 / 2500 / 800 VR compression molding machine

Detail view of clamping unit with two press molds and view on extrusion dies

High quality surfaces through injection molding with decorative foils.

01



02

03

04

05

06

Individuality is personal life quality.

With today's way of life, surface design has become very important. There is a move to higher quality designs and an individuality of style. The combination of basic materials and decorative foils is created in the injection molding machine.
The surface decoration with foils (resp. multilayer foil compounds) offers new product opportunities such as:

- High quality 3 dimensional surfaces
- Surfaces with special effects (Metallic paint, Alu-design, Chameleon effect, Hologram)
- Design change from piece to piece
- Single step manufacturing concept without post treatment

01 Car body components individually color matched. The alternative to painting

02 Wood- or Aluminium appearance for interior car parts

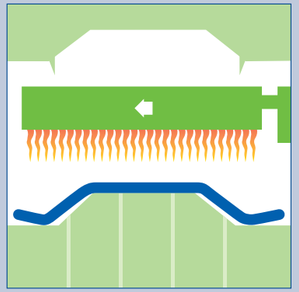
03 Interior Car parts with translucent PC foils in ”day and night design”

04 Cell phone covers in thinwall technology with print-decorated foil

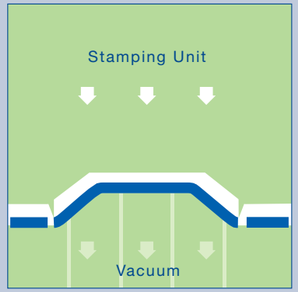
05 Icecream container with decorative foil – representing the cost reduction potential of integrating labeling and molding for fast cycling packing products

06 Surface decoration for garden furniture

The Process.



01 Foil preforming



02 Foil trimming

03 Inserting of foils

04 Injection molding process

01
Process stage 1: 3D – foil shaping in thermoform- or high pressure formpress (necessary only with complex 3D contures – not required for flat parts or for low deep draw ratios. In these cases the foil shaping is done by the injection molding process)

02
Process stage 2: Trimming of the foils by stamping, milling or cutting with high pressure water or laser beam

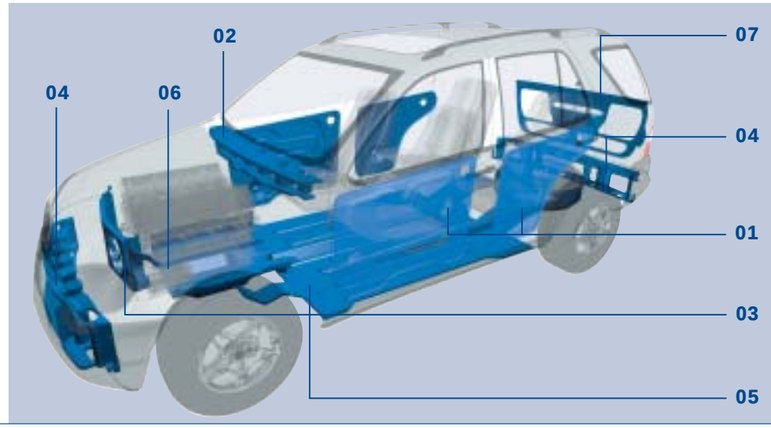
03
Process stage 3: Inserting of foils into injection mold. For exact, repeatable positioning of the foil in the cavity a robot is utilized. In the peripheral handling station, the foils are stored in stacks and, prior to being inserted into the mold, treated with ionized air (dust removal) and deposited into a pre-alignment station.

04
Process stage 4: Injection molding featuring special foil processing know-how.

Production cell for individually decorated thinwall – telephone covers.

Injection molding machine ENGEL VICTORY 200 / 120 Power with High speed linear robot ENGEL ERS and robot periphery consisting of trayserver and additional ENGEL ROBOT ERC 23 / 0-E for foil loading and manipulation.
In order to synchronize the robot periphery with the short cycle time of the injection mold (less than 8 sec.), 2 robots are utilized for foil and finished parts manipulation. The ENGEL ERS robot is engaged exclusively for high speed loading and unloading of the injection mold, and the ENGEL ERC robot for the foil and finished parts manipulation outside the mold.

The technology for ”tough” automotive-parts.



01 Car door module
02 Dashboard support
03 Front end module
04 Bumper support
05 Underbody assembly
06 Sound shield for engine compartment
07 Lift-up tailgate module

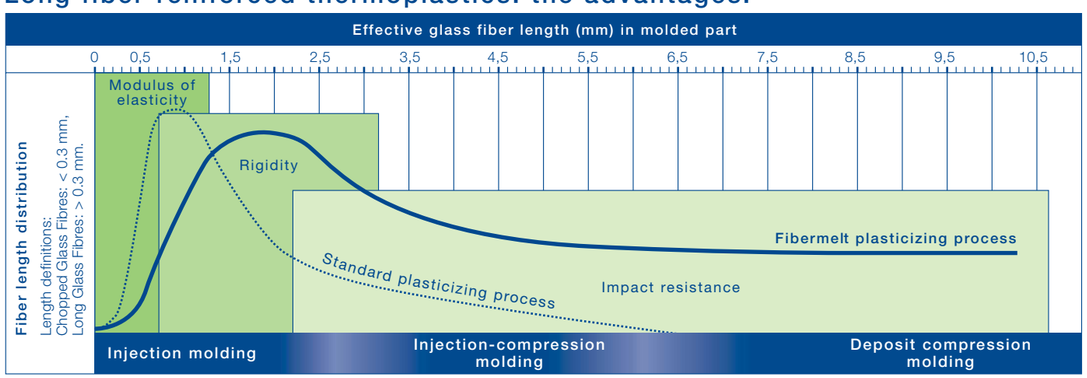
Safety and lightness in the modern car.

Innovative solutions are always needed whenever high strength has to be combined with other properties. In the context of the automotive industry, mass-produced component parts and assemblies must not only feature a whole spectrum of material properties but also meet demanding production requirements. First and foremost, they must be resistant to corrosion, manufacturable by a single-stage process without any need for subsequent finishing, exceptional in strength and light in weight. Parts injection molded from long glass fiber-reinforced thermoplastics have enormous potential for such innovative solutions.

ENGEL FIBERMELT is the technology on which the production of such high-strength parts is based. The main purpose for the ENGEL FIBERMELT technology is to provide a solution for a cost effective automated molding of components with an optimized fiber length distribution.
Basically, there are 3 processes options for the molding of long fiber components:

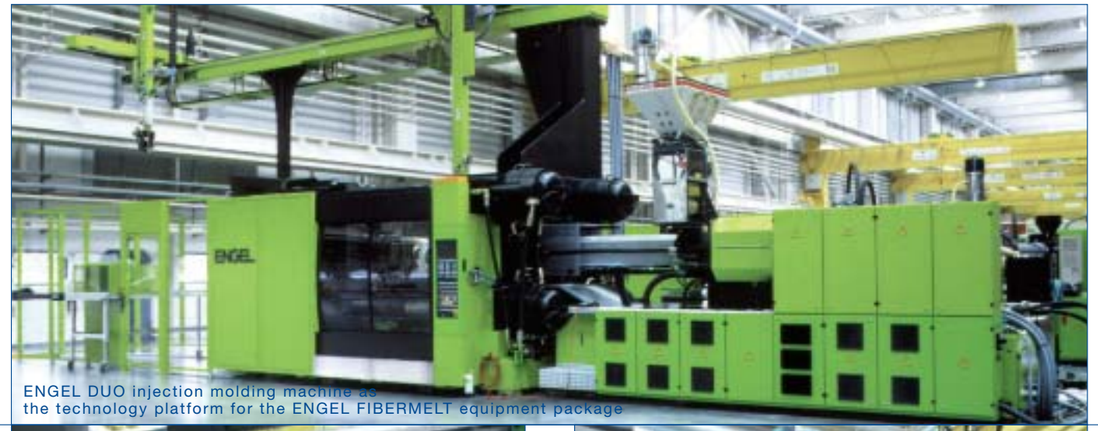
- Injection molding
- Injection compression / coining (special injection molding process)
- Melt displacement process (process in analogy to ENGEL TECOMELT press process)

Long fiber-reinforced thermoplastics: the advantages.

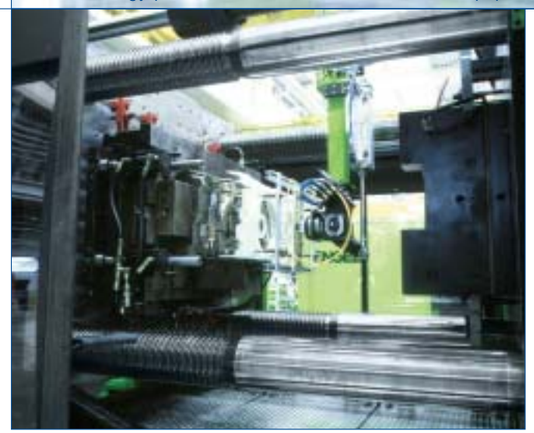


Molded parts reinforced with long glass fibers show a direct relationship between fiber length distribution and the mechanical properties. The chopped (short) fiber content contributes to the rigidity and modulus of elasticity of the molded part, the medium-length fiber content gives the part its strength, and the long fiber content has a decisively positive influence on impact resistance. Due to its gentle processing, the ENGEL FIBERMELT plasticizing system increases the content of long fibers in the molded part.

The production cell for injection-compression molding.



ENGEL DUO injection molding machine as the technology platform for the ENGEL FIBERMELT equipment package



Injection mold for the production of front end modules

Close-up of injection unit with weigh feeding unit

The ENGEL FIBERMELT equipment package

Basis: ENGEL DUO series of injection molding machines with two-platen clamping system.
Technology module: ENGEL FIBERMELT injection unit

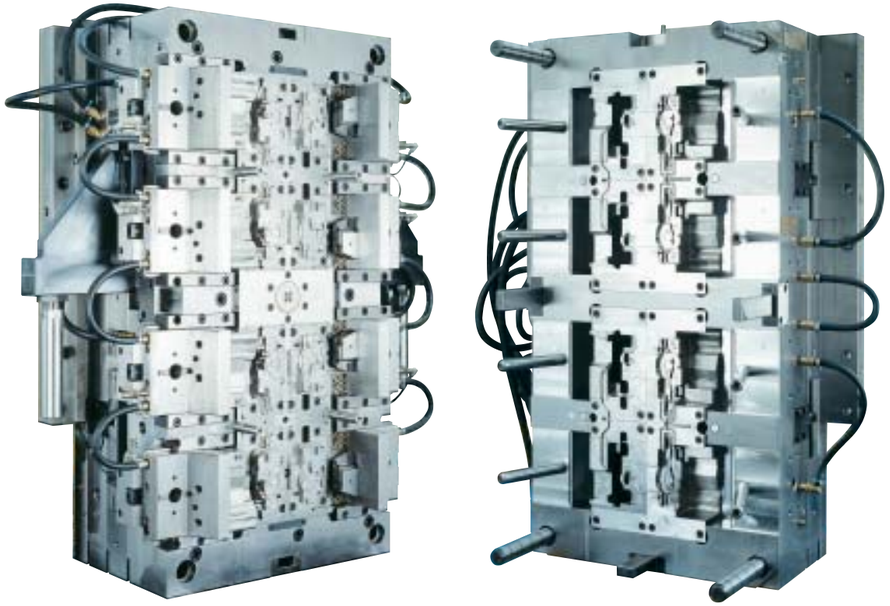
- Fibermelt screw featuring optimized geometry (available in diameters from 90 mm and larger)
- Plasticizing cylinder with L/D ratio of 26:1 for gentle plasticizing
- Electric screw drive for parallel recovery (optional)
- Weigh feeding unit for glass fiber concentrates (optional)
- ENGEL MARATHON screws and non-return valves for exceptional wear resistence (see Marathon leaflets)

Software options

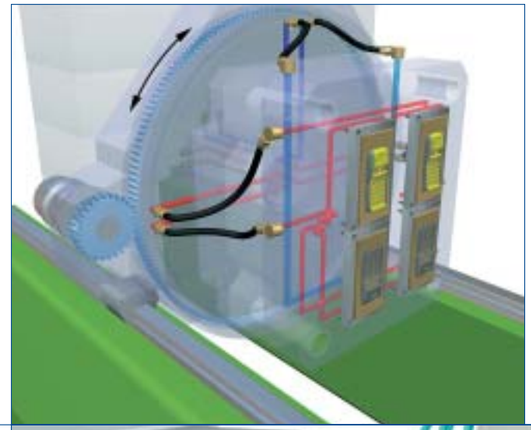
Available for use with Fibermelt is Engel's entire range of application and quality control software (see brochures ”ENGEL DUO” and ”ENGEL CONTROL SYSTEMS”) Of particular advantage when processing continuous fiber-reinforced thermoplastics is the operational software package ”AUTOPROTECT INJECTION MONITORING”. This software monitors the injection and holding pressure profiles of the current process. Real time comparison of reference and actual values detects possible critical deviations at an early stage, thus permitting timely adjustment and, in addition, effectively preventing possible damage to the injection unit and mold.

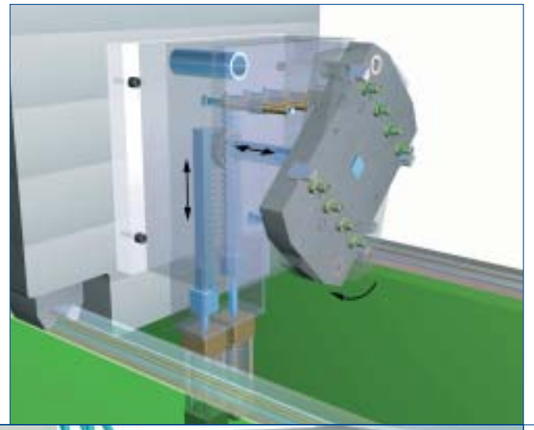
From the initial idea to the finished product.

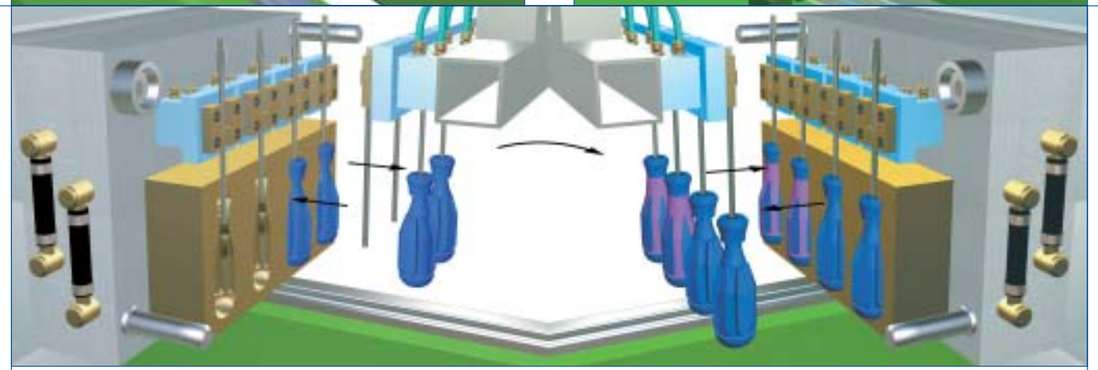
Precision molds are part of the comprehensive injection molding package offered by Engel for the production of innovatively designed parts. They enjoy application wherever unique combinations of functional and material properties are needed for the creation of totally new part designs for completely new functions. Full utilization of the potential of ENGEL COMBIMELT technology is Engel's corporate strategy and corporate objective rolled into one. Engel is specialized in the sequential injection molding of multi-component parts, from automobile components featuring rigid/flexible combinations with integrated seals through to parts combining engineering polymers having different material properties, or combinations of differently colored polymers having the same material properties.



Picture by Schneegans, Emmerich/Germany.







Engel molds – multicomponent molds for a multitude of applications:

> Collaboration between Engel's mold making and application technology departments as well as external mold making partners, is central to the development and manufacture of molds for the production of multicomponent parts for every conceivable application – from automotive engineering through to medical technology.

> Specialization in ENGEL COMBIMELT multicomponent injection molding technology gives Engel the edge on its competitors in terms of know-how and, by the same token, the advantage of increased productivity.

> A fully integrated CAD / CAM production system ensures the highest standard of precision. Moreover, Engel's multicomponent technology is based on the standard range of machines and equipment – an obvious advantage when it comes to meeting customers' requirements quickly and efficiently.