

High Performance, Not Only for Precision Mini Components

Small Machines. The smaller the parts, the higher are the demands for quality and precision. In order to meet these demands also under utmost cost pressure, a new injection molding machine combines Engel's tiebarless technology with all-electric drives. Because it frequently is mold dimensions and not the necessary clamping force that determine machine size for the production of very small components, the compact 30-ton machine offers dual savings – for investment costs and floor space.

**GERHARD DIMMLER
FRIEDRICH MAIRHOFER
WERNER KAPPELMÜLLER**

Whether high-precision plastic optics or miniature connectors for mobile equipment such as smartphones or tablets – the rapid development in this market segment during recent years was driven mainly by Japanese injection molder manufacturers, who consistently adapted their products to the continually increasing demands for higher precision. Now, Engel Austria GmbH in Schwertberg, Austria has introduced a new machine concept aimed at the global electronics industry. Introduced at the K 2013, Engel's e-motion 30 TL (Fig. 1) is the first injection molder developed in Europe that is able to produce e.g. optical lenses for mobile equipment, with maximum form deviations in a range of a few μm . Also beyond this area, the new high-performance machine will meet the demands of the consumer electronics industry, because it can also help to significantly cut reject rates.

In this field, the concept of a tiebarless clamping unit is a unique selling proposition. Since the market introduction of the first tiebarless injection molders 25 years ago, Engel has been continuously



Fig. 1. The Engel e-motion 30 TL is the shortest all-electric 30-ton machine on the market

increasing its know-how in tiebarless technology and regularly applies for new patents, thereby ensuring a competitive advantage. So far, well over 60,000 tiebarless injection molders with clamping forces between 280 and 5,000 kN have been sold worldwide.

One-Piece Frame Reduces Weight, Overall Length, and Costs

In 2001, Engel introduced the first all-electric injection molders without tiebars. The Engel e-motion was offered in versions for 550, 1,000, and 1,800 kN with a

barrier-free clamping unit. However, as opposed to tiebarless hydraulic machines, the all-electric counterparts have a dual machine frame. Originally, the dual frame was necessary to ensure platen parallelism during clamping, and to prevent the mounting plate from tipping. However, the disadvantage of the dual-frame machine concept is that the machines are longer, heavier, and more expensive.

For the new smallest version of this model range, a one-part frame concept was developed, which makes the machine lighter, more cost effective, and significantly shorter (Fig. 2). Development of the frame components that handle the

Translated from *Kunststoffe* 2/2014, pp. 48–50

Article as PDF-File at www.kunststoffe-international.com; Document Number: PE111607

Fig. 2. A one-part frame concept was developed for the small tiebarless machine



clamping forces was based on the many years of experience with Engel's tiebarless hydraulic machines of the "victory" series, whose design principle was developed further consistently. Hereby, the design engineers used tests to verify endurance and deformation behavior, because design and the resulting deformation behavior have a decisive influence on precision on the clamp side.

With the new solution, a deformation compensator consisting of compression and bending elements, distributes the clamping force evenly over the entire mounting plate, and in addition permits very simple fine adjustment of platen parallelism. With the dual-frame concept, this was considerably more difficult. Thanks to the new design, platen parallelisms with tolerances of less than 0.02 mm are obtainable, whereas tolerances of 0.1 mm are normally specified for this clamping force segment – also for machines with tiebars. With 0.2 mm, the Euromap specifications are clearly higher. As a result, Engel's e-motion 30 TL achieves extremely high precision also on the clamp side. Patents are pending for the new design features.

In order to reliably manufacture components with low wall thicknesses as well, the machine is equipped with the proven inline injection unit 50, which permits injection speeds of 800 mm/s – with an acceleration of 30 m/s² and injection pressures up to 2,400 bar. Consequently, compared with competitors, Engel's e-motion 30 TL operates with the fastest injection axis (manufacturer's claim, *editor's note*).

Due to the obsolete second frame, the machine is lighter by some 15 %, which saves costs during production as well as during transport and installation. With an overall length of just 3 m, the Engel

e-motion 30 TL is the shortest 30-ton machine on the market with all-electric drive technology (manufacturer's claim, *editor's note*). Moreover, the barrier-free mold space accepts comparatively large molds. Because there are no obstructing tiebars, the mold platens can be fully utilized up to their edges. As a result, the machine offers a platen area of 440 × 420 mm – a size that is usually only found on tiebar machines with clamping forces of 800 kN and more. Also this aspect reduces the

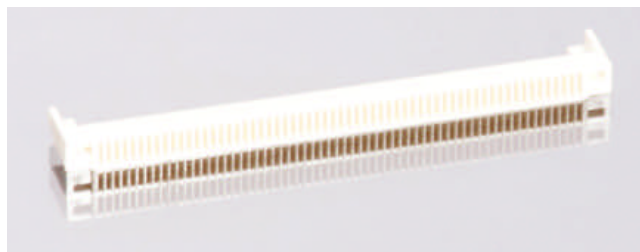


Fig. 3. During the K2013, an Engel e-motion 30 TL injection molder produced 60-pin board-to-board connectors (figures: Engel)

machine's space requirements. Particularly in cleanrooms, the injection molder's footprint is an important efficiency factor. Nowadays, optical lenses are produced in cleanrooms.

High-Performance Machine with Low Energy Consumption

For cleanroom operation, the joints of the three-point toggle are sealed. This measure prevents lubricant entering the workspace, so that lubricant consumption is reduced by up to 90 %. In addition, the constant friction ratios lead to a further reduction in the energy demand of the drives. In total, the all-electric machine achieves a previously unmatched energy efficiency in this market segment (efficiency class 8+ acc. to Euromap 60.1).

Amongst other things, the toggle's maintenance-free crank drive and servo-

motor contribute to the remarkably short dry cycle times of 0.9 s with an opening stroke of 200 mm. Ejectors and mold height adjustment have been integrated in the movable mounting plate. All main movements are actuated servo-electrically, which permits the synchronization of parallel movements.

During the K exhibition in October 2013, Engel demonstrated the impressive abilities of the new high-performance machine with the production of 60-pin board-to-board connectors made of LCP (**Fig. 3**) in a 16-cavity mold. In spite of the very close pin spacing of 0.5 mm, Engel's e-motion 30 TL worked with a cycle time of only 6.3 seconds. What's more, the 16-cavity mold boosted productivity. In general, 4 to 8-cavity molds are used for producing FFC/FPC connectors.

Outlook

The consumer electronics industry is characterized by particularly short times to market. To keep up with these developments, Engel can benefit from its wide range of in-house competence, which also includes drive and measurement technology as well as FEM simulation. Presently, Engel is extending the new ma-

chine concept with higher clamping forces up to 800 kN.

The new machine's success in the highly competitive market for small machines below 1,000 kN have pushed these developments even further. In a well-known electronics company, Engel's e-motion 30 TL has already asserted itself against Asian competitors. ■

THE AUTHORS

DIPL.-ING. DR. GERHARD DIMMLER, born in 1973, is Vice President of Product Research & Development at Engel Austria GmbH, Schwertberg, Austria; gerhard.dimmler@engel.at

FRIEDRICH MAIRHOFER, born in 1979, is Product Manager for all-electric injection molders at Engel; friedrich.mairhofer@engel.at

ING. WERNER KAPPELMÜLLER, born in 1956, is Head of Mechanical Development for small and medium machines at Engel; werner.kappelmuller@engel.at