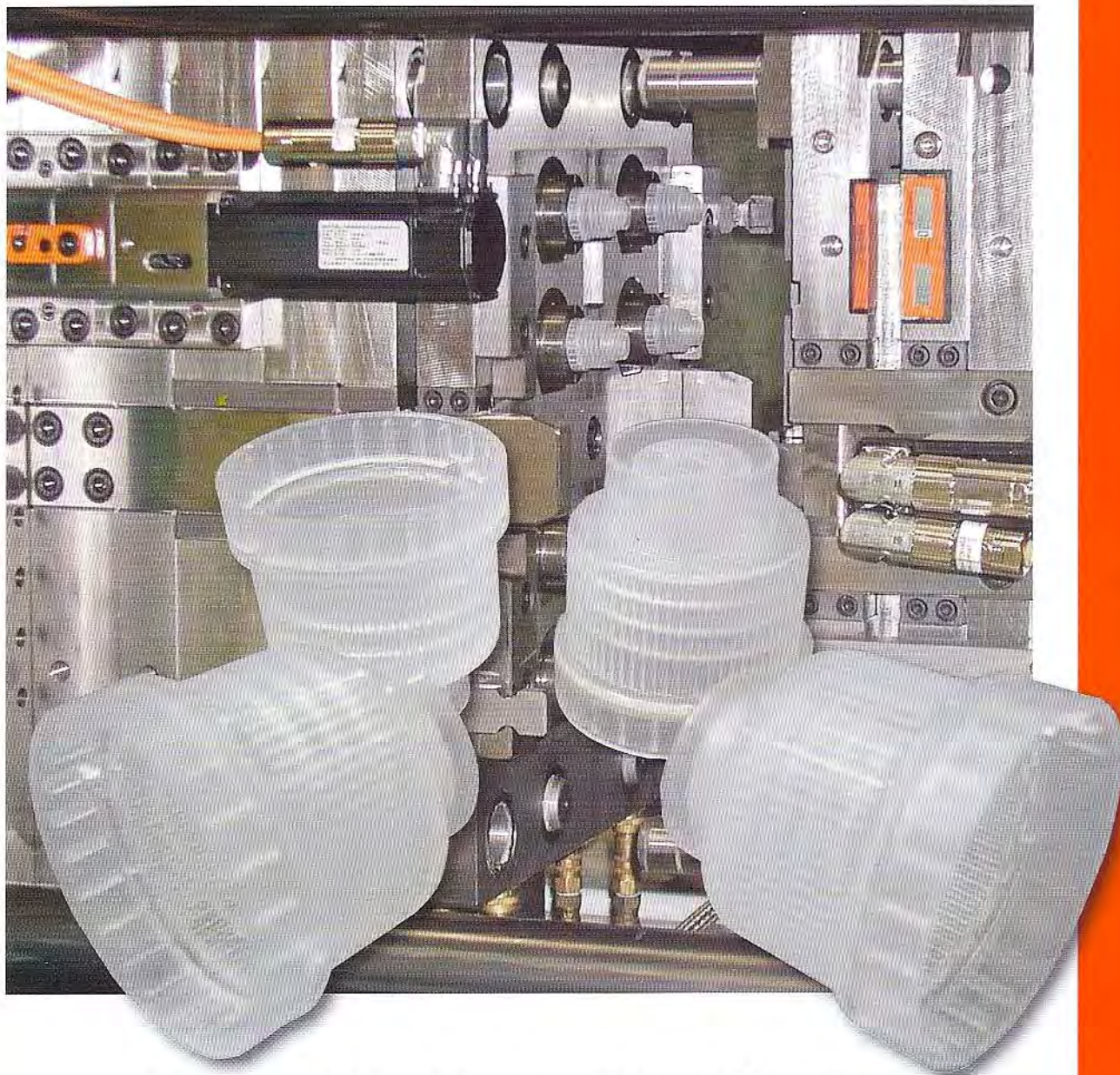


Precision, speed and flexibility



8-cavity electric motor-driven mould for medical technology

Production of a bottle cap with tamper-evident ring

HASCO[®]
Member of the Berndorf Group

The project

MeadWestvaco Galmar GmbH, a major international manufacturer of aerosol sprays, trigger sprayers and dispensers for the cosmetic, pharmaceutical and household chemical industries based in Hemer, Germany, needed an efficient solution for manufacturing a bottle screw cap with a tamper-evident ring for a sprayer.

Until now, the company has been using an hydraulically operated 8-cavity mould.

On the fixed mould side, two block cylinders activated a core puller for demoulding a bead for the protective cap base of the sprayer and also for controlling the slide bars that demoulded the pull-off ring. In the customer's original mould, a self-built 8-point hot runner system with a pneumatically driven needle valve was installed. On the moving mould side, two other hydraulic block cylinders form the core puller for demoulding an internal undercut on the article. A third cylinder operated the gear rack for unscrewing the threads and ejecting the ribs with a stripping motion.

The challenge

Article

Part weight: 3.9 g

Material: PP (HG313 MO Borealis)

Total shot weight: 31.2 g / 8 cavities

Accuracy

To guarantee reliable function, the part must have a dimensional stability of 0.05 mm in the area of the thread, sealing edges and snap-in edges. This necessitates almost complete cooling of the article before demoulding.

Hygiene

Because this article will be used in the pharmaceutical industry, the mould must be designed for clean-room production.

Gating

The part is gated directly via an 8-point hot runner with needle valve. This guarantees the specified quality of the separation point (without stringing etc.) for clean-room and medical technology.

Cycle time

To reduce production costs and thus the cost of the final article, the cycle time for the new system must be less than the 17 seconds required by the present mould.

Demoulding

The outer area of the part has a bead to hold the protective cap, and inside an undercut to accommodate the pump cylinder and a thread for the bottle. The ribs of the tamper-evident ring are all angled at 45°, which means that the use of collapsible cores is not possible.



Bottle cap



Mould structure

The idea

The specifications relating to plastic articles for the medical and food industries call among other things for clean-room production. This contradicts the usual practice of having the various mould movements such as slide units and thread demoulding driven by hydraulic cylinders or pneumatic devices, both of which create risk of contaminating the clean room through leakage. Alternatively, mechanical solutions are possible, but they are unable to comply with the demands for short cycle times.

For this reason, the project idea is based on all the mould movements being activated by electric servo motors. At the same time, they must be able to comply with all the options of a fully electric injection moulding machine.

Servo motors are noted for their high speed in combination with strong power transmission and perfect reproducibility. It was therefore important to find mechanical solutions to convert a rotational motion into a linear motion, whilst being able to cope with very high speed and heavy mass.

All the movements that were previously carried out mechanically or hydraulically have now been successfully switched to servo motors with the aim of creating a clean and efficient drive system.

While adhering consistently to existing standards, the aim was to achieve a significant reduction in cycle time and an improved energy efficiency ratio.

Production procedure

Needle fixing plates advance through two synchronously operating servo motors and precision ball screw drive units

> > gate is closed

With the aid of the latch locking unit, the first parting plane opens, as a result of which the undercut in the fixed mould insert is demoulded.

Simultaneously:

Slide unit opens > separation point is free

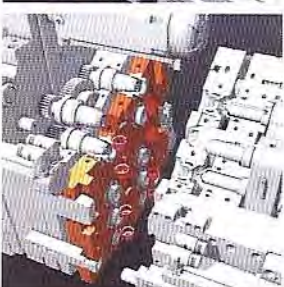
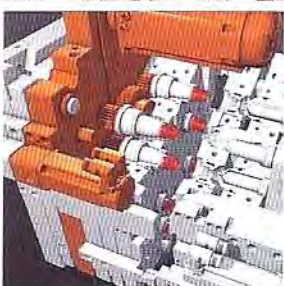
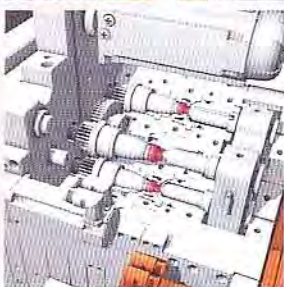
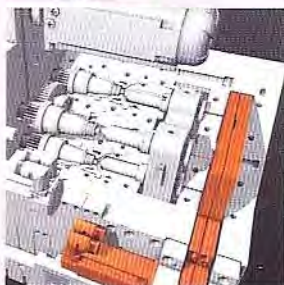
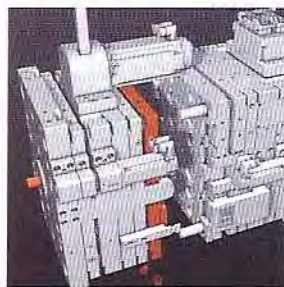
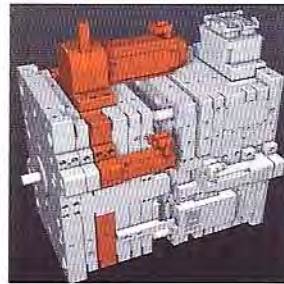
Main parting plane opens

Plates advance through two synchronously operating servo motors and precision ball screw drive units

> undercut of moving mould core is demoulded

A further servo motor takes care of the unscrewing of the cores

Stripping performed by ejector motion



Mould structure

When defining the steel to be used for building the mould, consideration again had to be taken of the specifications laid down by the medical and food industries. Pre-hardened and tempered stainless steel 1.2099 was selected.

This chromium steel essentially corresponds to DIN 1.2085 steel, but has been optimised through specific modification of the metallurgical properties with regard to the machining parameters. Especially with high machining volume – as with this mould – the improved machining parameters such as higher cutting speeds and longer service life of the machining tools can be optimally exploited.

1.2099 steel is also characterised by extremely high dimensional stability and thus guarantees efficient and economical production in mould and tool construction and, through its corrosion resistance, also complies with the stringent specifications of the medical and food industries.

Use of standard mould units

To ensure inexpensive and rapid implementation of the mould project, use was made of HASCO's extensive range of standard mould units.

The complete transmission was calculated and implemented with standardised components from the transmission range. The coordinated and readily available standard range of gear wheels, toothed racks, ball bearings and spherical bushes allow simple calculation and design of the complete transmission unit.

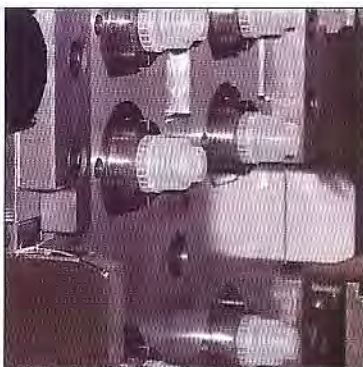
The lateral square guide bars Z07/... and Z17/... as well as guide block Z18/... exceeded the standard dimensions due to the height of the mould system, and were therefore manufactured as special accessories in the customary HASCO quality.

The reliable and positively controlled movement of the sliding plate on the fixed mould half was performed with the help of the Z174/... latch locking unit.

The coating

To reduce cycle time, attention was also paid to the coating of the functional elements. All transmission elements and contour-forming areas were provided with a Diconite DL 5 coating. This coating is biocompatible and approved for use in medical technology.

Diconite DL 5 reduces heating of the component by minimising the coefficient of friction to 0.03μ : Consequently, the amount of wear is reduced while the speed of the mould movements is increased. Another advantage of the coating is the anti-adhesive effect of the plastic in the area of the cavity. The guide rails were coated with Diconite Plus in order to dispense with any lubrication of the guides. Optimum dry running properties with a high level of wear protection were thus achieved.



Mould parting



Thread core in detail



View of fixed mould half

Hot runner and control technology

Nozzles

Use is made of 8 needle valve nozzles Z33406/40x100 from the *Techni Shot* range. The *Techni Shot* nozzles are noted for their versatility.

They are used specifically for challenging projects involving high-performance moulds and/or technical applications.

Especially for high-precision moulds with large production volume requirements, these nozzles guarantee long service life. Because the needle guide is extremely near the gate, the needle remains located during the entire stroke. This means that the usual wear on the needle and in the gate diameter is reduced to a minimum, eliminating short maintenance intervals.

One special characteristic is the homogeneity of the temperature profile over the length of the nozzle, which, in combination with specifically developed tip geometry, enables gentle processing of the plastic melt – something that is also reflected in the quality of the final plastic part.

Hot runner

Designed individually to the particular application, a special naturally balanced 8-point hot runner H4010/... has been incorporated in the heart of the hot half.

The dimensions of the flow channels take account of the three parameters, dwell time, pressure drop, and optimum decompression behaviour.

The surface quality of the flow channels and the use of special diverting elements enable optimum melt exchange and low-shear passage of the melt without any dead spots, basically ensuring that the specifications made on the article are adhered to. Even at maximum injection pressures, the reliable plugging of the smaller diverting elements ensures that the system remains leak-proof.

For optimum heating that is also geared to the hot runner manifold, use is made of moisture-proof, highly temperature-resistant Z11381/... tubular heaters.

Instrumentation and control

The complex hot runner technology is controlled with the aid of the new multi hot runner control unit Z1240/..., which is noted for its fast and accurate controlling and user-friendly programming.

With features such as the ability to see all the control zones at one go, automatic control system recognition and programmable start-up routines, the innovative control unit sets new standards in efficiency, comfort and reliability.

Especially when working with runner technology, it is important to have an intelligent heating system which will protect the heating units. Furthermore, the monitoring unit immediately provides a warning of any problems.



Techni Shot needle valve nozzle Z33.../...



8-point special hot runner H4400/..

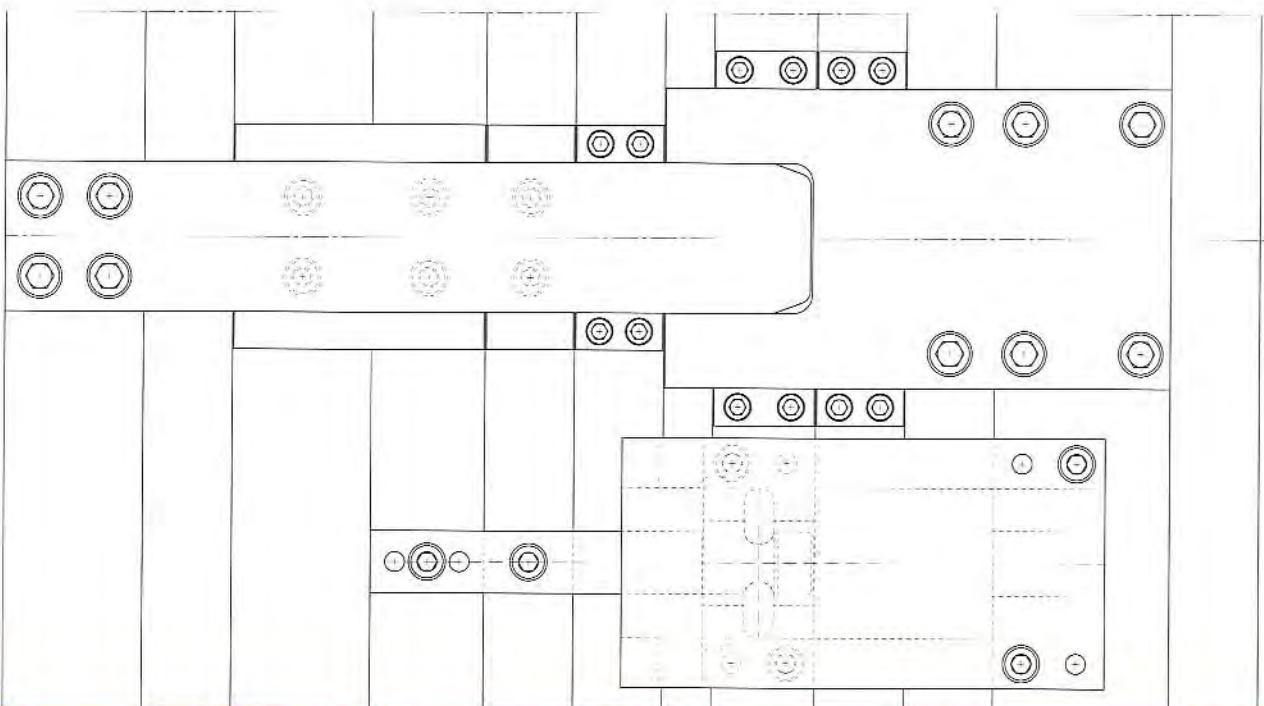
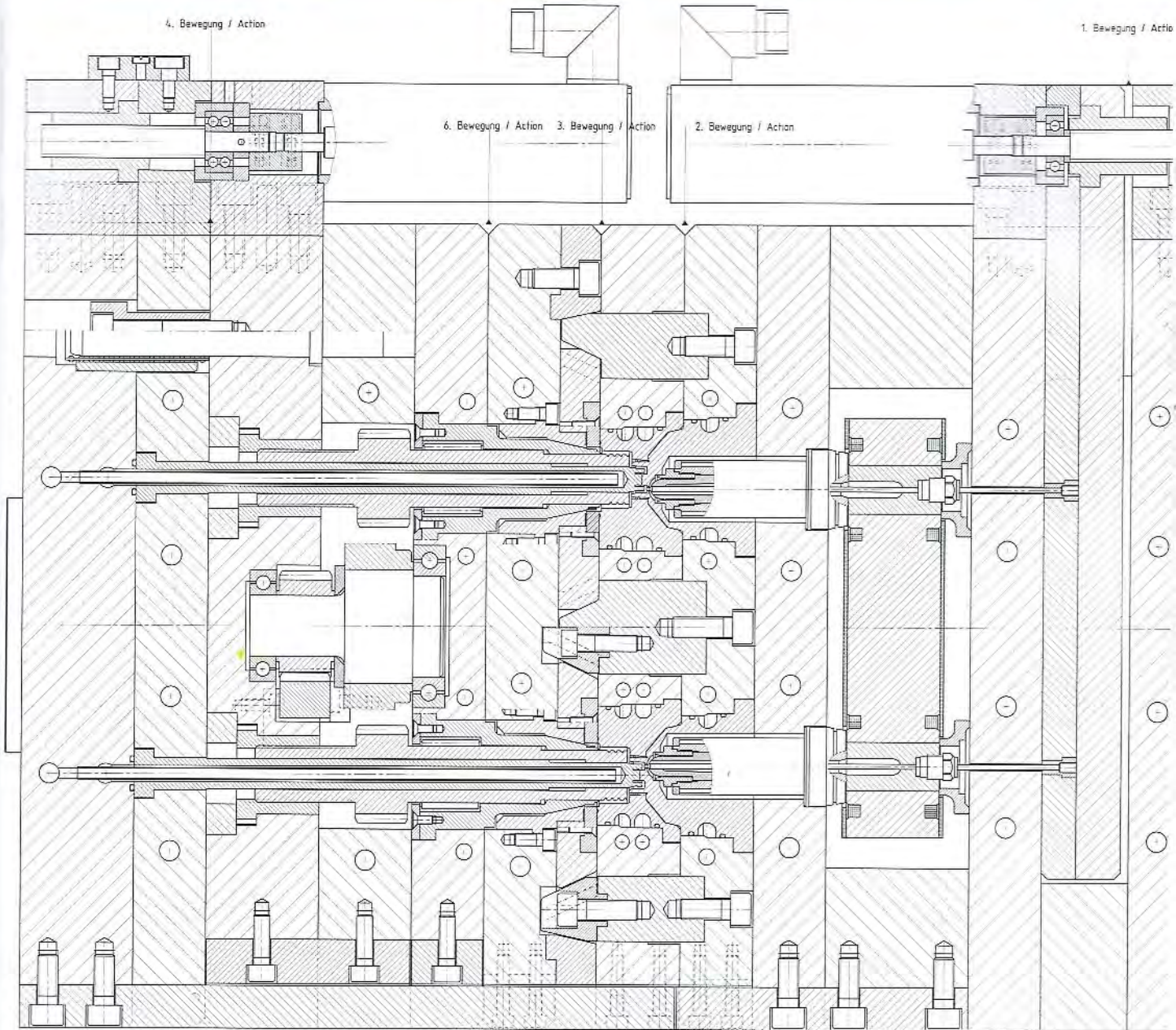


Multi hot runner control unit Z1240/...

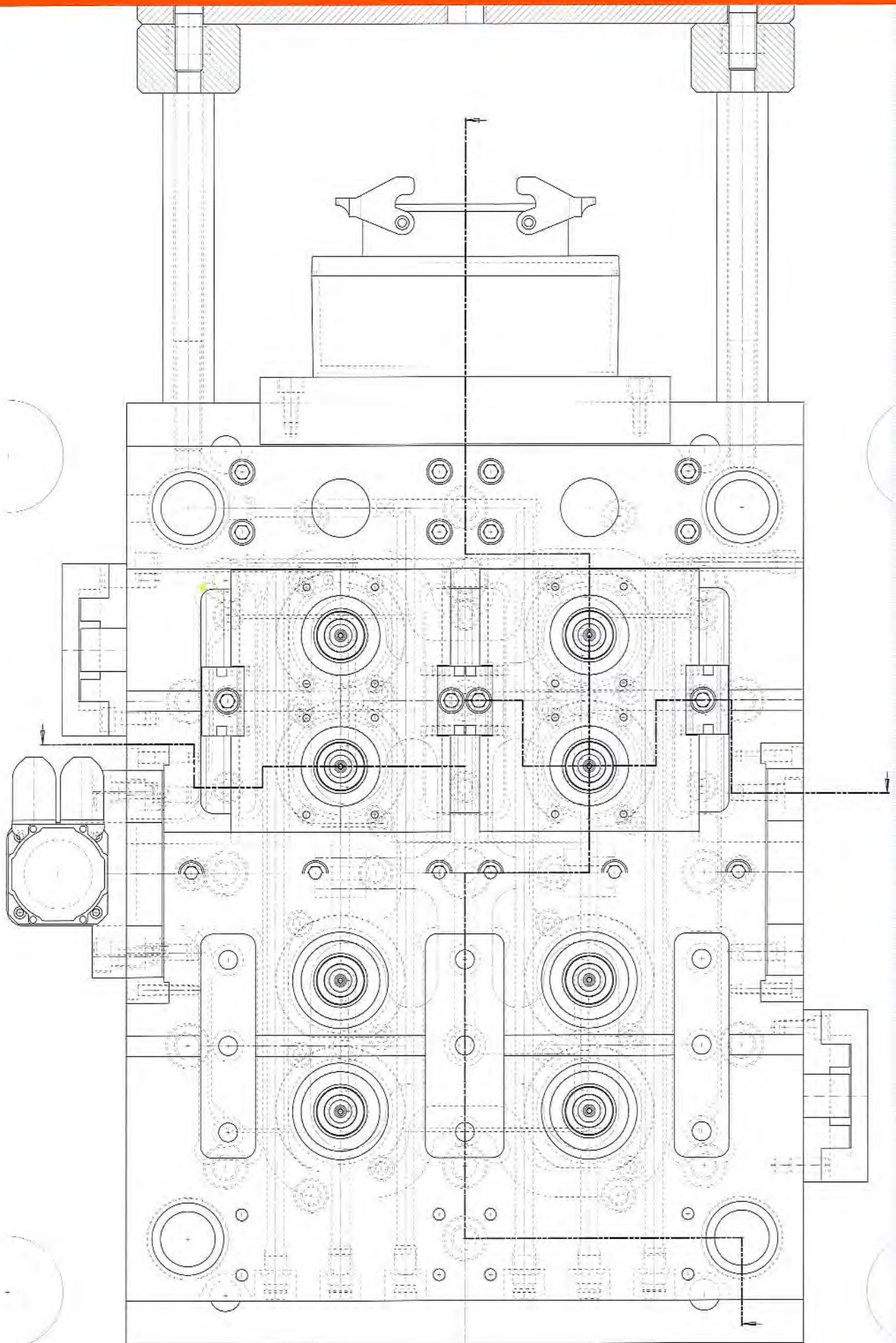


8-cavity mould

BOTTLE CAP WITH TAMPER-EVIDENT RING



8-CAVITY ELECTRIC MOTOR-DRIVE



Injection mould

HASCO®

Member of the Berndorf Group



MWV MEADWESTVACO

KOLLMORGEN®

Because Motion Matters™



DICRONITE®



VREEL 3D ENTERTAINMENT



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