

PROJECT REPORT

Eching, Germany, May 2011

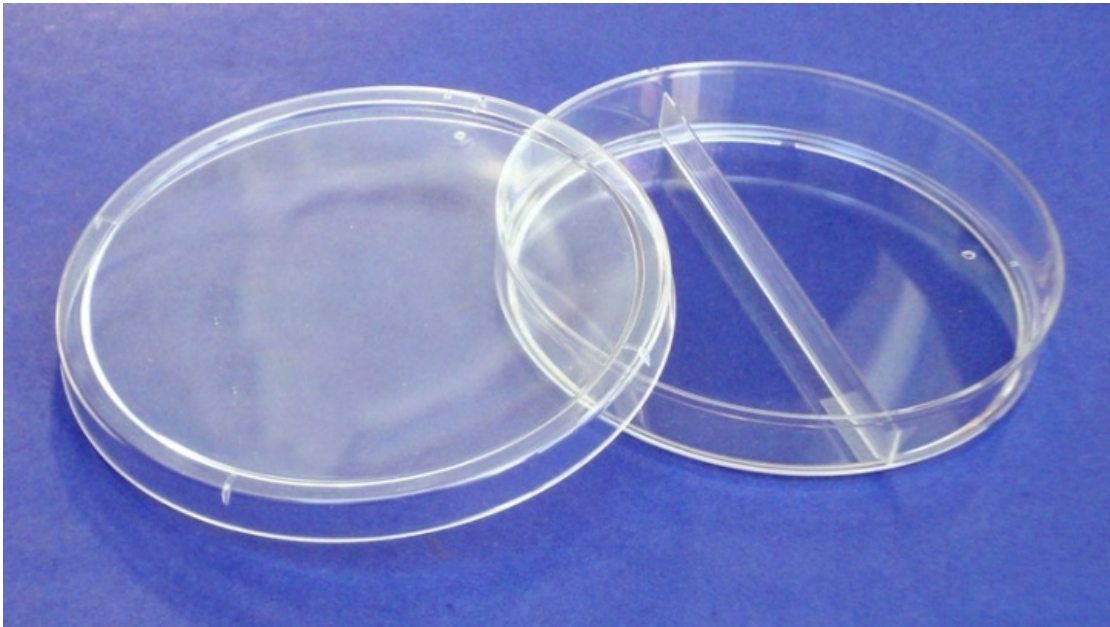


Photo: Author

Figure 1: Petri dishes are articles of daily use in biochemical and medical laboratories. They are used anywhere where germs and bacteria for analysis must be cultured. For about 125 years they have been available on the market made out of glass. Since about 50 years they are available made out of plastic.

HEKUMA holds the “pole position“ in Petri dish production

Petri dishes of glass were invented in 1887 by the German bacteriologist Julius Richard Petri. This makes them a contemporary of the car, which was patented in 1885. Petri dishes are manufactured to this day in many sizes and designs. In addition to the sterilized reusable version made of glass, disposable Petri dishes made of clear polystyrene have been available for approximately 50 years. The latter belong to the category of mass produced injection molded parts that are made in extremely short cycle times on high-performance injection molding machines. Injection molds with two opening planes and 8+8 cavities for the base and lid make up the general standard. The molded parts are extracted, assembled, stacked and hermetically packed fully automatic in order to ensure the hygienic and technical product quality. A leading provider of high performance parts handling systems is HEKUMA, located in Eching near Munich. Their current system technology, presented at the K 2010, assumes the pole position regarding production speed and in product quality. A cycle time of 3.6 to 4.2 seconds for a 90 mm Petri dish from an

8+8-cavity system (depending on the weight of the Petri dish and flatness requirements of the base) equal a significant increase in efficiency of approximately 20 percent compared to the previous version of the system with 4.5 to 5.5 seconds per shot. Now a system taking the next level of performance has "joined the race". With 16 Petri dishes per shot instead of 8, the size of the system has been doubled. Since the cycle time remains almost the same, the performance of a production cell increases by almost 100 percent. Analog to this, the automation system must handle 100 percent more parts per cycle. A project report provides an insight into the details.

HEKUMA has developed and produced high-performance automation systems for high-volume parts handling for more than 35 years. These systems are used preferably where moldings are produced in short cycle times, and where the parts must be removed from the mold and are assembled or packaged in parallel. Typical examples of products in medical technology are micro plates, pipette tips, and in particular Petri dishes. Plastic Petri dishes are, like the glass version, made of two parts: the base and matching lid (Fig. 1). They are disposables which are always required where bacteria, microbes, seedlings, or fungus cultures have to be reproduced on nutrient media for the purpose of analysis, as used in biochemical laboratories, food institutes, or for the purpose of water analysis in hygiene testing laboratories. The growth of cultures and thus the handling of the dishes in laboratories are typically performed fully automatically. Correspondingly demanding are the quality criteria, such as material purity, high transparency, freedom from streaks, or a high flatness of the base. Efficient and short production processes in combination with a minimum use of resources are essential since Petri dishes are a disposable product. Petri dishes made of polystyrene meet these demands. The most common sizes are between 50 and 150 mm in diameter, and have a height of 13 to 15 mm. The base and cover are usually produced simultaneously in a mold with two opening planes (stack mold). Depending on the size and production volume, the mold size is usually between 4+4 cavities and 8+8 cavities.

Pole-position in production performance

At the K-2010, HEKUMA presented the new performance class for the handling of Petri dishes exemplified by an 8+8-cavity system for the production of 90 mm thin-walled Petri dishes. The system design was totally re-engineered and modernized, now providing 20 percent more performance than previous systems. Cycle times in the range of 3.6 to 4.2 seconds (depending on the weight of the Petri dish and the requirements on the flatness of the dish base) are now state of the art. This compares to 4.5 to 5.5 seconds of the previous system generation. Hence the Hekuma systems take the "pole position" when compared to competing systems. Through the modularization of the system concept, the

automation system became more flexible and facilitates the scaling of the number of cavities. In early 2011, the line of the high-performance systems was advanced to the next size, adapted to stack-injection molds with 16 +16 cavities (Fig. 2 and 3). This represents almost a doubling of production. Despite the larger dimensions of all components for parts handling, the dynamic individual performances of the system components are on the level of the smaller systems. The total cycle increases only minimally to 4.8 seconds (mold open time is increased from 0.6 to 0.8 seconds), mainly due to the larger tool sizes and the resulting longer strokes to accommodate the end of arm tooling of the automation and the longer processing time of the injection molding machine.

Handling performance doubled

In order to manipulate and process double the number of molded parts within the same cycle time, the capacity of the automation system was doubled compared to the previous system. The central component is the linear robot type HEKU 3, the currently most powerful version of the HEKUMA-linear axis robots. It provides acceleration rates of up to 8 g (about 80 m / s^2), and speed up to 8 m / s with possible payload capacities of more than 200 kg. The linear axis with reinforced carriage provides sufficient stability for the larger and more extended end of arm tooling. This consists of a sturdy supporting frame, with two base plates for 16 part receptors per mold parting plane. Carbon fiber plates and plastic part receptors reduce the mass to be moved. By precisely controlling the movement of the linear axis, vibration and oscillation are minimized in the stop position. As a result, the molded parts are taken precisely and carefully by the grippers (Fig. 4).

To minimize mold open time, a communication concept between the machine and robot was developed by HEKUMA. It provides, in addition to the usual exchange of data over the Euromap 67 interface (insufficient speed for this application), a communication of the mold position, queried through additional stroke transducers located on the machine clamp unit. Triggered by the sensor, the start signal is given for the entering movement. At this time, the robot gripper is in a waiting position adjacent to the closed mold. The short and resulting safe movement is made possible by the high acceleration performance of the new, more powerful servo drives in the HEKU series.

Fast part manipulation with maximum care

As the Petri dish components are still warm from the manufacturing process, they are not removed using conventional gripping technology, but are form-locked and fixed by vacuum for the greatest possible protection. In the downstream automation, the molded parts are forwarded to two transfer stations, where they are also handled form-locked and thus held

without force (Fig. 5). Subsequently, the transfer station turns the Petri dish bases and lids by 90 degrees in order to correctly orient one to another for assembly. The dishes are placed with the opening upwards as the lids are placed with the opening downwards into the assembly shuttle. Then the lids are placed onto the bases and the assembled Petri dishes are stacked downwards. This prevents the inside of the dish from being contaminated (the lid is larger than the base) or deforming of the product through influences of force. The warmest and most easily deformable Petri dish is always on top of the stack. Thus a total of eight stacks with an adjustable height of up to 33 dishes (max. 500 mm) are formed. The completed stacks are transported via a buffer zone to the automatic packaging station. The packing station is an improved version of the fully automatic packaging system developed by HEKUMA and proven for many years. Here, stacks are individually inserted into a film tube, which is then welded (Fig. 6). The advantage of using the blown tubular instead of a flat film as packaging material is the reduced quantity and length of the welded seams and the associated potential for leaks could be reduced. New is the ability of the system to process thinner films with a minimum wall thickness of 40 microns. Furthermore, the station has been optimized to keep pace with the higher performance requirements. The footprint of the automated system could be significantly reduced through re-engineering. The packaged stacks of Petri dishes are transported by a conveyor to manual packaging stations or to a fully automatic packaging system, where they are placed into bags or cartons.

Flexibility and multipurpose use is part of the concept

Despite the focus on high performance, the automation concept takes into account the consistent, flexible use of all components. With interchangeable inserts, the system can be quickly converted to different Petri dish types and sizes. It is also easily possible to equip the system with additional features like corona treatment.

Summary

With the current degree of evolution of the known high-performance automation systems HEKUMA has succeeded in defending its leading position in handling performance and system efficiency. This is not solely the result of more powerful drives, but above all a continuous fine-tuning of all system modules and interfaces to each other, without compromising long-term quality.



About HEKUMA GmbH

HEKUMA GmbH, is a leading manufacturer of high performance automation systems for injection molding systems, based in Eching near Munich. The company dates back to 1974 when it was formed by the automation pioneer Richard Herbst. Since January 1, 2000, Hekuma is a company of the listed Elexis AG (www.elexis.de).

The capabilities include the development, design, manufacturing, installation and commissioning of complex automation systems with high-performance robots for injection molding machines. More than 5000 systems have been delivered to companies in the medical, automotive, packaging, and consumer products industry. The know-how of HEKUMA lies in precise high-speed parts handling, complex gripper technology, but also in turn-key automation systems with further process steps, such as 100% quality control, labeling, assembly and packaging of the finished product. Another focus is on in-mold-labeling for multi-cavity thermoforming molds (T-IML). HEKUMA currently employs a staff of around 130 employees.

Further Information and press contact

Klaus Wanner / Sales Manager HEKUMA GmbH

Tel.: +49 (0)8165 / 633-300

Fax.: +49 (0)8165 / 633-333

E-Mail: k.wanner@hekuma.com

Editorial Contact:

Dipl.-Ing. Reinhard Bauer – TECHNOKOMM

E-Mail: office@technokomm.at

Figures:



Photo: Hekuma

Fig. 2: The HEKUMA-System – shown here is an example of a 16+16-cavity Petri dish automation – is characterized by its small size and a modular design.

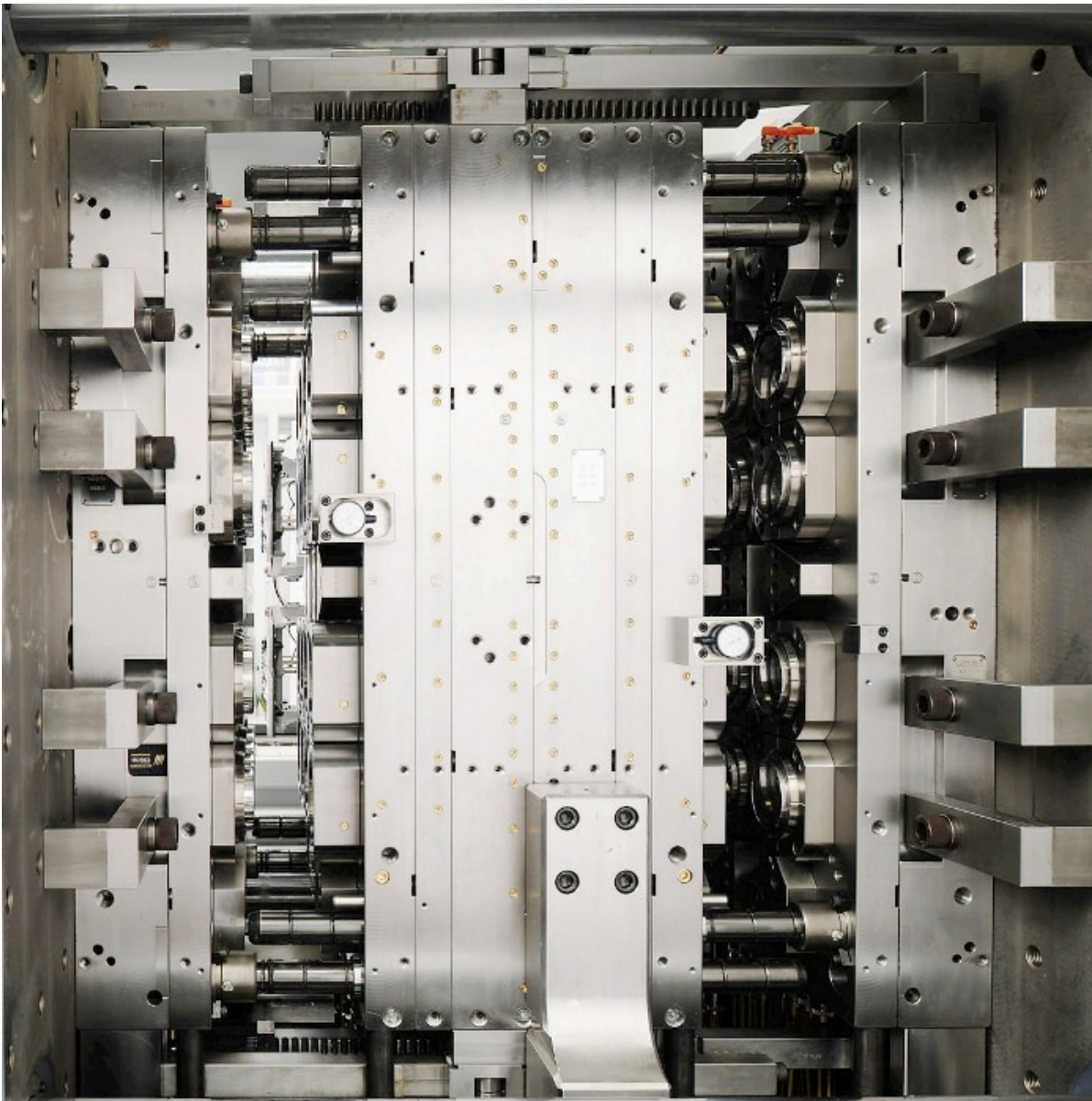


Photo: Hekuma

Fig. 3: For the production of Petri dishes, generally stack molds with two opening planes are used. In one plane the Petri dish base is produced, in the other the lid, shown here for example in a 16+16 cavity injection mold.



Photo: Author

Fig. 4: The double end of arm tooling for removing the 2 x16 parts from both opening planes of the injection mold is manufactured with carbon plates to minimize the moving mass.



Photo: Hekuma

Fig.5: The parts are removed and delivered to the transfer station for a simultaneous in-cycle assembly.



Photo: Author

Fig. 6: The stacked Petri dishes (stack height adjustable) are inserted into a tubular film, which is subsequently welded.



Photo: Author

Fig.7: An example of a finished packed Petri dish stack, which is subsequently packed in larger volumes in transport cartons.