

Customer Success Story:  
MET Advanced Technology Systems

# Vickers® by Danfoss Proportional valves dramatically improve production efficiency

Start-up innovation company MET Advanced Technology Systems (MET) provides state-of-the-art industrial automation solutions and wanted to develop a high-pressure polyurethane injection system to improve efficiency in commercial and domestic refrigerator manufacturing. The system needed easily controlled flexibility to accommodate different refrigerator sizes and rapid, accurate positioning capability to compensate for quality issues arising from the low-volume, manual sheet metal production phase. MET turned to a solution comprising proportional valves, linear scales, and expertise from Danfoss that allowed them to design a system that met their targets for speed, flexibility, power, and economy.

*“Danfoss’ advice and support as well as its products have contributed significantly to the project’s success”*

*Murat Merdin, R&D Manager at MET Advanced System*

#### Location

Urla-Izmir, Turkey

#### Challenge

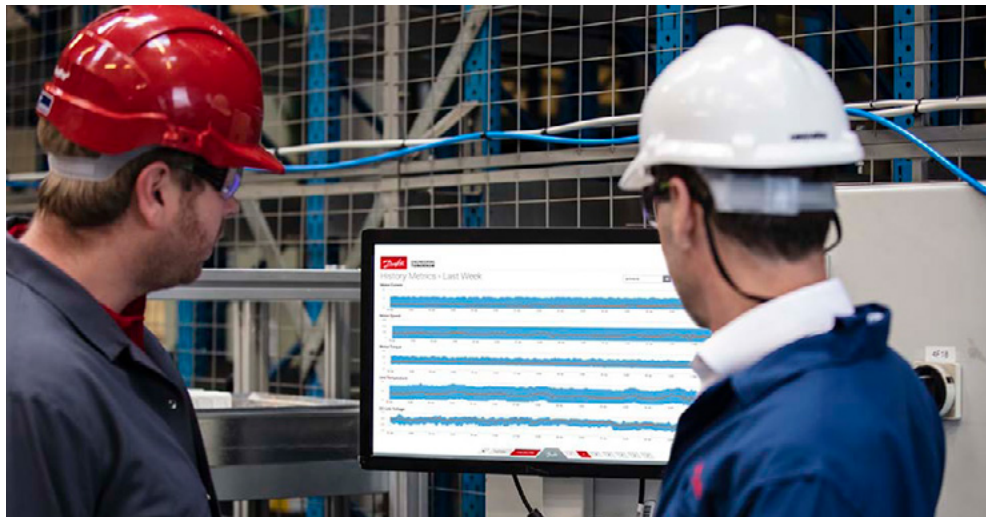
The challenge was to develop a system with numerically controlled walls that could be moved in seconds to accommodate different product sizes, while withstanding forces generated by the injection pressure.

#### Solution

The solution developed by MET comprises a hydraulically activated press table to maintain the necessary force in the limited space required.

#### Results

Operators can adjust the length, width and depth of the system in seconds, allowing product change to a different model within a couple of minutes. Production efficiency and throughput are significantly improved.



#### Background

MET Advanced Technology Systems ([www.metltd.net](http://www.metltd.net)), founded in Izmir Techno Park, Turkey, is dedicated to developing unique products for the industrial automation sector. One project involved developing a polyurethane system for the home appliance industry; and when challenged to achieve the process flexibility its customer required, MET found an ideal solution in Danfoss’ products and technical support.

Polyurethane systems are used for manufacturing many products in the home appliance industry, particularly domestic and commercial refrigerators. During manufacture there is a polyurethane injection process where mixed chemicals are injected into a cavity for insulation and reinforcement purposes. After injection, the polyurethane expands within the cavity generating a pressure as it does so. Accordingly, the products must be molded using fixtures to avoid structural and/or visual problems. Traditionally, most systems have been designed to handle just a single product, and a new version is needed for every product change.

## Challenge

Traditional systems create huge investment costs, as the low production volumes make each system prohibitively expensive. Additionally, they create problems due to inefficiency as well as inflexibility. They have hinged walls and hydraulic upper tables which are moved by positioning valves with no position feedback. Hydraulic cylinders are driven from bottom stroke to top end, with no ability to be stopped at an intermediate position or otherwise positioned numerically.

The inefficiency in this design impacts productivity because in serial production, small adjustments are needed to compensate for deformation of molds, fixture guides, product carriage, and other parts. Most operators use tapes and bands to cover the difference between fixture and product. However, this process is labor-intensive, time-consuming, and expensive.

MET's idea was to develop a universal system suitable for different-sized products. It would bring double benefits, because the flexibility designed for adapting to different product sizes could also be used to compensate for deformations and wide manufacturing tolerances. The challenge was to develop a system with numerically controlled walls that could be moved in seconds to accommodate different product sizes, while withstanding forces generated by the injection pressure.

## Solution

The solution developed by MET comprises a hydraulically activated press table to maintain the necessary force in the limited space required. This has four independent servo hydraulic axes positioned around the side and front walls which allows the upper table to be positioned parallel to the product table. Control is achieved using closed loop feedback obtained from linear scales, with all four axes synchronized to a virtual axis. This motion control system allows speeds of one meter per second with 0.05 mm positioning accuracy anywhere within the stroke. The table achieves this performance while working up to 30 tons pressure and handling a mass inertia of up to three tons.

Key to this hydraulic system is Vickers by Danfoss K(B)FD/TG4V proportional valves, which provide a controlled hydraulic fluid flow in direct proportion to a command signal. The valves feature integral control electronics, with factory-set adjustments of gain, spool deadband compensation and offset to ensure consistent valve-to-valve repeatability.

The valves operate from a standard 24 V power supply with a wide tolerance band, and command signals of either  $\pm 10$  V or 4-20 mA. With a single 7-pin connector, installation wiring is simplified and replacement is a simple plug-and-play operation. Offering excellent durability, the valves have been shock and vibration tested, and have IP65 or IP67 ingress protection.

## Results

MET's universal solution dramatically improves production efficiency and throughput. Operators can adjust the length, width, and depth of the system in seconds, allowing production change to a different model within a couple of minutes. This flexible system can also compensate for machining errors in producing the system or mold. Refrigerator bodies are manufactured from sheet steel using a combined blanking, punching, and bending process. This manual, low volume activity will inevitably generate quality issues with slight variation in refrigerator body tolerances, so that in some cases they are slightly deeper than the fixture by 0.2 mm for example. However, the MET system's speed and precision of adjustment allows users to easily overcome problems such as these — in this case, by positioning the upper table 0.5 mm higher.

MET expects that its customers will enjoy a return on investment (ROI) break-even point within one to two years if they have low production volumes and a large variety of products. As product variety decreases, ROI could extend to three or four years.

## Conclusion

*"Danfoss' advice and support as well as its products have contributed significantly to the project's success. We originally selected Danfoss because its price/performance ratio was satisfactory, while allowing us to achieve the positioning accuracy and maximum travel speed we were looking for,"* says Murat Merdin, R&D Manager at MET.

*"They provided us with a complete solution rather than just a kit of parts. As we worked together, we found Danfoss' local support to be invaluable. This was enhanced by effort from its local distributor Entek."*

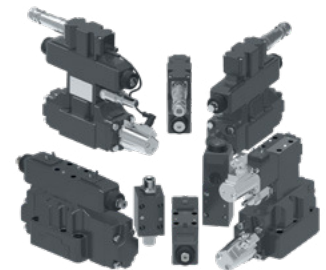
*"The organization's knowledge and experience of the products and how to apply them is of great help to partners like ourselves. Although the application was innovative, we were able to use proportional valves and linear scales straight from Danfoss' standard product range. We achieved very good results — well above our design requirements — without having to use special products."*



*The press table has four independent servo hydraulic axes positioned around the side and front walls which allows the upper table to be positioned parallel to the product table*



*MET developed a universal system suitable for different-sized products*



*Key to the hydraulic system is Vickers by Danfoss proportional valves*



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