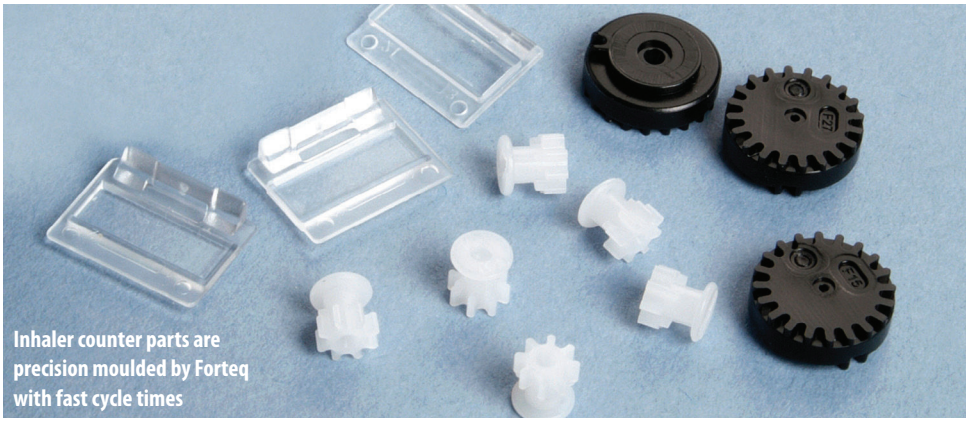
Injection moulder Forteq needs very low variation in the inhaler parts it makes, so has carried out comparative tests on hydraulic, hybrid and all-electric machines. By **David Vink**



Inhaler counter parts are precision moulded by Forteq with fast cycle times

Forteq counts on precision

Swiss company Forteq, with its headquarters in Nidau, designs, moulds and assembles precision plastic gear and transmission and mechatronic devices used in automotive, consumer electronics and healthcare industries.

Its expertise in precision moulding an asthma inhaler counter was explained by Dr Joachim Franke, Forteq Healthcare's managing director, at an open house event held in September at the Wiehe, Germany plant of Sumitomo Demag (SHI Demag).

In 2010, the inhaler accounted for around 80% of the production value in Nidau. The plant has 15 injection moulding machines (mainly SHI Demag machines) with 60-125 tonnes clamping forces, a 1,600m² cleanroom, automatic assembly, printing machines and six Wittmann robotic systems.

Franke spoke in Wiehe about an aerosol asthmatic pressurised Metered Dose Inhaler (pMDI) counter, consisting of 14 parts – 10 of plastic and the rest metal springs. Numerical counter wheels and gears are moulded in POM, the housing in PP and the small viewing window in PMMA. Insys laser equipment writes numbers at 700 characters/min on the wheels, which are made in POM containing laser sensitive colour-change pigments.

Shot weight of the smallest plastic part is 0.73g, part weight 0.023g, requiring mould removal by Wittmann W721 and W723 linear robots with vacuum grippers.

Plastic part dimensions range from 3.5 x 3.55mm up to 22.35 x 16.75mm for the PP housing. Forteq moulds down to precision of 0.005mm, moulding small 0.5mm holes in some parts.

According to Franke, absolute precision calls for absolute process management in, for example, ejection control. Close tolerances ensure sufficiently low friction in the counter drive system, and an absolute fail-pass zero defect policy system is applied to ensure each "firing" is counted.

Forteq uses 32-cavity moulds with hot runners to ensure fastest possible cycle times for large production volumes of "millions per month", while keeping the number of moulding machines to a minimum. The machines are required to have fast parallel movements. There should also be "minimal use of expensive medical approval plastics and regranulate is not allowed", Franke observed.

As the machines are used in an ISO 7 (Class 10,000) cleanroom environment, they have to have low particle emissions and ease of maintenance, along with fast and easy changeover of tools and the 14mm screws.

Forteq carried out batch-to-batch variation studies using hydraulic, hybrid and all-electric drive machines from different companies. The machines used identical moulding parameters and the same 4-cavity hot runner trial mould.

> 'Maintenance of tightest possible tolerances is essential'

Forteq has installed Demag IntElect electric machines and Wittmann robots in a cleanroom where it produces inhaler counter parts

When moulding a POM numerical wheel, hydraulic machines produced wheel thickness varying from 2.80mm to almost 2.90mm, while hybrid machines achieved 2.84mm to 2.87mm.

Repeatability tests on a production tool looked at drum wheel and ratchet pawl parts on hybrid and all-electric machines, using the same process settings and cavity. Results showed drum wheel diameter of 7.875-7.900mm using the hybrid drive and 7.91-7.92mm using the electric drive. Cycle time fell from 11.5s for the hybrid drive to 9.5s for the all-electric drive.

Tests were also done on a 22.35mm nominal diameter cap, which again showed less deviation with the electric drive, and with cycle time reduced from 11s to 10.2s.

The ratchet pawl inner diameter deviated from around 1.465mm to almost 1.51mm on hybrid machinery, compared with 1.485mm to just under 1.51mm with the electric drive, and cycle time fell from 7.6s to 6s. Process optimisation cut cycle time further to 4.2s, along with even closer dimensional tolerance (around 1.49 to 1.492mm).

Franke said: "Testing all part combinations is not economically justifiable, yet patient safety has to be ensured. Therefore, maintenance of tightest possible tolerances is absolutely essential."

He gave statistical Cpk values (process capability index) of well above 2 for all cavities. ■