Test series were conducted at the sites of various processors, using their own production molds. The trials confirmed differences in terms of performance between electric machines, too

Precise Machines with Double Benefit

Energy Saving. All-electric injection molding machines are particularly suited for the production of precision components. In terms of hard cash, plastics processors also benefit from their extraordinary low values of specific power consumption. Users must consider certain differences, though.

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Whenever a high level of precision is essential in the production of components, all-electric machines are virtually always the production means of choice. They comply with the close tolerances required in the characteristic values such as melt cushion or cycle time. As a result, for instance, little technical support is required for tools with narrow processing windows. Electric injection molding machines also have the advantage, when, during component production, close tolerances in terms of measurements and weight must be adhered to. Other recommended fields of application are cleanroom production, and processes which require low levels of oil contamination and other particles. To many investors, sound level plays a major part today, because staff are able to concentrate much better in a silent environment – this being another benefit included in electromechanical drives.

Sumitomo (SHI) Demag Plastics Machinery GmbH in Schwaig, Germany, provide support to several customers by conducting tests prior to their purchase. Users could test electric and hydraulic machines with their own production molds, especially with regard to precision and energy saving. Generally speaking, results for the all-electric machines were more convincing than those for the hydraulic machines tested. Some of the tests also showed that the company's IntElect machine's performance is above that of competitors' machines. By giving concrete examples, this article will present details from one of these test series, to make

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clear the benefits and savings potential included in all-electric machines – in particular in the IntElect.

An Energy Saving Bushing

Investigations on various types of injection molding machines were carried out by A. Raymond GmbH & Co. KG in Lörrach, Germany. The company is a specialist in fastening solutions for many branches of industry all over the world. Among other sectors, their customers come from the automotive and construction industry, as well as the solar and consumer goods sectors. To provide for homogeneous quality of the parts, the production process needs to be continuous, reproducible, and adhere to close tolerances. In addition, energy efficiency is increasingly growing in importance. For many years, A. Raymond has actively been involved in making production processes and equipment more ecological.

The supplier chose a bushing from PA66 with a 25 % glass fiber reinforcement, to serve as a reference part in the machine tests. More than 250,000 of these bushings are produced each month for the automotive industry. It weighs just over 1 g and is made in a 32-cavity mold. In the investigations, Sumitomo (SHI) Demag first produced the part on a hydraulic Demag Ergotech 150 (clamping force: 1,500 kN), at 9.9 s cycle time, reproducing production conditions. Then the same test was conducted on an all-electric IntElect 160 (clamping force: 1,600 kN). In a separate investigation, A. Raymond tested an electric 1,600 kN injection molding machine made by another machinery supplier, employing exactly the same mold.

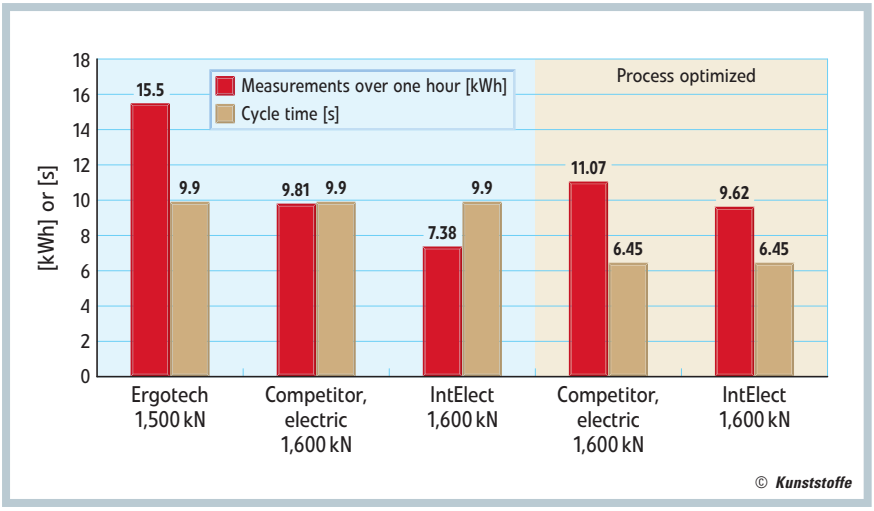

Fig. 1. Comparison of energy consumption between a hydraulic Demag Ergotech 150, an electric IntElect 160, and another electric machine. Process optimization (measured values right and second from right) reduced energy consumption and increased outputs

Half Energy Consumption, Higher Productivity

Conducting the test series, energy consumption of one hour of production was measured by connecting a supply meter to the main feed line of the machine. The hydraulic machine's energy consumption under production conditions was 15.5 kWh. This corresponds to a specific power consumption of 0.84 kWh per kilogram of processed plastic material.

Over the same cycle time, the IntElect unit consumes 7.38 kWh. This means a reduction in energy consumption by more than half **(Fig. 1)**. This machine's specific power consumption thus amounts to 0.40 kWh/kg.

By exploiting the features of all-electric drive technology, it was possible to further optimize the process adjustment and machine motion. Cycle time of the IntElect machine was thus reduced by 35 %, i. e. to 6.45 s. Thanks to the considerable rise in output, increase in productivity is significant. Following the reduction in cycle time, 9.62 kWh, or 0.34 kWh/kg, respectively, of energy consumption was measured on the IntElect equipment.

The actual impact exerted by energy saving and cycle time reduction upon productivity becomes clear in the following example: Consuming 15.5 kWh, which is the amount of energy originally required for production, 2.5 times the original number of parts can be made, if employing the IntElect machine – thanks to the pronounced reduction in cycle times.

The second electric machine tested also showed some benefit against Demag's hydraulic Ergotech 150 with 1,500 kN clamping force. However, the IntElect was superior to this unit too, in regard to energy consumption with the original as →

Fig. 2. Making use of an all-electric injection molding machine gives production benefits due to the high degree of operation precision, in addition to significant energy saving. The photo shows an IntElect 100-340 machine (figs.: Sumitomo (SHI) Demag)

well as optimized cycle times. At 9.9 s cycle time, this machine required approx. 32 % more energy, while, at 6.45 s, consumption was roughly 15 % higher. This is because the IntElect's drive concept is more efficient, due to its direct drive (and consequently no gearbox), which steps up the drive train's efficiency.

Higher Investment that Pays off

Generally, electric machines are more expensive than hydraulic equipment, due to the higher cost of production caused by the drives. A detailed cost-benefit analysis can be made together with Sumitomo (SHI) Demag, to show where in the production of precision components the all-electric IntElect machine is of particular benefit, and the level of cost saving required for the high initial investment to eventually amortize.

The test series showed that one of the crucial features in electric machines is the possible reduction in cycle times, along with the resulting increase in productivity. While usual reject rates amount to approx. 3 %, reduction in this rate is another factor included in the cost-benefit analysis. Other favorable aspects considered in the calculation are better availability, low maintenance and reduced energy consumption. At the same time, the need for cooling is reduced by roughly a third, if compared to hydraulic machines. From experience, users may expect the IntElect to amortize after two or three years, subject to the component and machine clamping force.

Comparative testing, as described above, helps the manufacturers of precision components evaluate the potentials of all-electric machines reliably. Plastics processors thus have at their disposal test data that show the benefits for their respective production in terms of technology and economy, thus facilitating the decision on investment. ■

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