

Variable Frequency Drives – more energy-efficient under certain conditions

The use of variable frequency drives as an effective means to improve energy efficiency in many areas is a widespread recommendation. It should not be forgotten, however, that this is only true under certain conditions.

Energy efficiency through software update

Most high-pressure die casting machines today are powered by hydraulic drive systems. Depending on the size of a machine, it will usually be equipped with one or two AC induction motors with fixed speed, containing either several fixed speed multi-stage pumps or a combination of fixed speed pumps and variable speed pumps. Apart from the number and type of different pumps, careful grading of the different pump stage capacities and their activation during the machine cycle are the predominant factors in terms of energy usage. In some cases significant improvements in energy performance can already be achieved for example by optimising the hydraulic power supply during the machine cycle – which is a simple software update.

Reduction of base load

Apart from the dynamic loads generated during the machine cycle by different motion sequences and loading operations, the hydraulic system is also subject to a permanent base load. Contributors are dynamic pressures, leakages and the efficiency of electric and hydraulic drive components in the low power range. Additionally, a minimum pressure level must be maintained in the system at all times and the drive system capable of delivering it, to ensure the safe and proper functioning of the hydraulic switching and control components in all machine states. Base load is still being consumed even while a die casting machine is standing still, for example during waiting times in the cycle (due to metering, extraction and spraying operations or cooling). If variable speed pumps are used, the volumetric output of the pump systems can be reduced during times while it is not needed to reduce the amount of base load consumed. A relatively simple solution to reduce base load demand as described here is possible through the use of variable frequency drives. Such drive systems can supply a wide range of different power levels seamlessly without requiring profound changes to the machine's hydraulic system. Another advantage is that fixed speed pumps can be used for the low power range of such drives that are more efficient and easier to maintain.

Carefully chosen drive

There are two important basic requirements that must be met for frequency variable drives to improve the energy performance of die casting machines successfully: sufficient know-how regarding how much hydraulic power is needed for different machine states, and there must be sufficiently long time periods during the production cycle during which the speed of the drive can be reduced to such an extent that the resultant base load is lower than that of alternative

drive variants. Especially in the case of hot-chamber die casting machines with fast cycles, or highly optimised cold-chamber die casting cells, the time windows during which the drive power can be reduced in this way are very short. Also the start-up and braking times of the drive system can prove to be problematic. So to avoid a trade-off in the shape of longer cycle time in the case of large machines with relatively inert drive motors, complex and self-learning software technologies will be needed which take the respective start-up and braking times of historical machine cycles into account during the actual production cycle.

With this in mind, we have equipped the appropriately sized machine models of our new cold-chamber series with variable frequency drives to ensure energy-efficient operation of the die casting machine and also greater ease of maintenance.

