How to select Plastic Injection Moulding Machine 9

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3.11.9 Hydraulic oil temperature control

Hydraulic oil must be maintained at between 40 and 50oC. This is done by control of the cooling water flow.

Too high an oil temperature reduces the oil viscosity, and ages the rubber sealing rings faster. For consistent product quality and to improve the PIMM's reliability, it is worth investing in the closed loop temperature control of hydraulic oil, if it is available as an option.

3.11.10 Hydraulic oil level control

In case the hydraulic system leaks, hydraulic oil level in the tank provides an indication. At its simplest, it is a visual level indicator. Alternatively, it could be a float, which activates a switch when the oil level is low. The switch sets off an alarm.

3.11.11 Hydraulic oil contamination control

Contamination and metal filings from cylinder/piston wear degrade the hydraulic oil. Hydraulic oil is filtered at the pump inlet and optionally filtered on return. A differential pressure sensor across the filter raises an alarm when the oil is too contaminated and must be replaced. Alternatively, an optical device immersed in the oil detects how dirty the oil is.

3.12 Energy efficiency

During the design of the machine, what considerations are made to save energy? Some areas include insulation around the band heaters, using proportional valve instead of pressure relief valve, using a variable displacement pump, using a variable speed pump motor.

The simplest drive is made up of a constant speed motor and a constant displacement pump

driving against a constant system pressure (set by the system pressure relief valve). The load to the electric motor is constant throughout the moulding cycle since flow rate and the pressure are constant. In phases of low flow demand, the excess pressurized oil flows back to the tank. When the pressure needed is below the system pressure, excess pressure is dropped at a relief valve or pressure reducing valve. In both cases, energy turns to heating up the oil.

An energy efficient design varies the load to the electric motor as the demand varies in the moulding cycle phases. The proportional valve sets a different system pressure at each phase. However, excessive flow still drains the pressurized oil to the tank. Variable displacement pump and variable speed drive/motor does better by varying the oil flow delivery, further reducing the load to the motor.

By itself, variable displacement pump is less efficient than fixed displacement pump. Similarly, variable speed motor is less efficient than fixed speed motor. However, by generating only the hydraulic oil flow that is needed, overall efficiency is increased.

Piston pump has a higher efficiency than vane pump but demands cleaner hydraulic oil to work well.

In short, an energy efficient design trades higher initial equipment cost for lower operating cost.

3.13 Safety features

The safety gate protects the human operator from mould closing. Once the safety gate is opened, a mechanical stop is lowered and/or electrical and/or hydraulic circuits are broken to prevent the mould from closing. The more methods of interlocking the safer is the machine. Some manufactures only provide mechanical and/or hydraulic locks as options.

Some machines provide the same safety features at the front as well as the back safety gates.

3.14 Metal detector option

When a resin is recycled, it may be contaminated with pieces of metal. A magnetic grating in the hopper prevents ferromagnetic metals from entering the barrel. Even better, a metal detector signals even when non-ferromagnetic metal passes through the hopper. A pump then removes the contaminated pellets.

3.15 Apple to apple comparison

While the discussion so far is centered on technology of the PIMM, it should not be overlooked that price is also an important consideration in machine selection. One must be cautioned of what options are included for that price.

There is almost a standard set of features most machine manufacturers would consider as options. This includes accumulator, core pull, pneumatic ejector, etc. However, there are deviations. Hydraulic safety interlock, cooling water flowmeters, automatic mould height adjustment could be standard in one machine but are options in another.

4. The non-quantifiable attributes

The following attributes of a PIMM is not easy to quantify. However, they should play an important part in the machine selection process.

4.1 Noise and vibration

Heavy masses are accelerated and decelerated during mould opening and closing. If speed control is not done well, they give rise to noise and vibration which affects the life of the machine and also the quality of the parts to be moulded. This is especially so in mould opening when the elastic energy stored in the tiebars, the toggles and the mould are released in a very short period. A good design absorbs the shock.

4.2 Cycle time

Cycle time is the sum of mould closing time, injection time, cooling time and mould opening time. Cooling time is not so much a PIMM attribute as a mould and moulded part attribute. It could be a substantial part of the cycle time. Cycle time is to be as short as possible without affecting the rejection rate of the moulded parts and the long-term reliability of the machine.

4.3 Availability of spare parts

Off-the self electrical relays, timers, temperature controllers that the user could purchase locally helps to reduce the duration and expense of machine down time. PLC controller and computer controller goes against such convenience as they are proprietary, at least the programs in them are.