How to select Plastic Injection Moulding Machine 8

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3.11.3 Screw rotary speed control

Screw rotary speed is monitored or controlled so as to control the screw surface speed to below a value appropriate for the resin. A speedometer, the kind used in a bicycle, is the usual analog measuring device. A chart converts screw rotary speed to screw surface speed which is a function of screw diameter. See section 2.13.Figure 12. Screw rotary speed to screw surface speed chart

3.11.4 Hydraulic pressure control

Closed loop hydraulic pressure control provides more consistent injection pressure, holding pressure and back pressure from cycle to cycle. Note that hydraulic pressure control is not a good substitute for melt pressure control or cavity pressure control.

The signal from the pressure sensor adjusts the proportional pressure valve to nullify any deviation from the desired value.

3.11.5 Back pressure control

As the screw rotates, it is forced backward by the melt at the tip of the screw. This backward motion forces oil out of the injection cylinders through a flow control valve, which creates a back pressure on the screw.

The back pressure sensor is mounted at the back of the injection cylinder. The same sensor is used for hydraulic pressure control. See Figure 20. Figure 13. Hydraulic/back pressure transducer location

3.11.6 Nozzle pressure/temperature control

Pressure and temperature are the two most important measurable process variables in injection moulding. It could be used to control the injection fill, pack and hold pressures. Figure 14. Nozzle pressure sensor

3.11.7 Cavity pressure control

Located where the action is, cavity pressure control provides the most accurate injection fill, pack and hold pressures. In some cases, a temperature sensor is located within the same housing, providing temperature of the melt in the cavity as well. Figure 15. Cavity pressure sensor location

The cavity pressure curve clearly shows the injection fill, pack, and hold phases. In Figure 23, 1-2-3 is the injection phase, 3-4 is the pack phase and 4-5-6 is the hold phase.

Point 3 is when the mould is completely filled. As the screw advances beyond 3, cavity pressure rises steeply as the melt is being compressed. At 4, injection pressure is reduced to holding pressure which keeps the mould filled as it cools and shrinks. At 5, the melt at the gate is frozen and the hold pressure could be removed. Figure 16. Cavity pressure curve

3.11.8 Tiebar tension measurement

Tiebar tension measurement is used for clamping force control and for avoiding tiebar breakage.

Clamping force control is more appropriate for a toggle clamp than a hydraulic clamp as the toggle amplification of roughly 22 times makes adjustment of hydraulic pressure a poor gauge of clamping force. This is on top of the fact that the amplication is not known. It allows adjustment of the clamping force to a value that is needed (see section 2.2) instead of always at its maximum. The fatigue life of the mould, tiebars and toggles are increased. With the correct clamping force, flashing does not occur.

Clamping force adjustment is done during mould setup. As the mould heats up, it expands, increasing the clamping force. Therefore it may be necessary to readjust the clamping force during moulding.

For clamping force measurement, as few as one tiebar tension sensor is sufficient.

Tiebar tension control avoids tiebar breakage. An alarm is raised when a tiebar is over stressed which is usually caused

by unparallel mould face, mould with an asymmetric cavity or an out-of-synchronization mould height adjustment mechanism.

To avoid tiebar breakage, as few as two sensors on diagonal tiebars could be used. Figure 17. Piezoresistive gauge in tiebar