Distinctive Plastics, Inc.

Technical Injection Molding Services ISO 9001:2000 - UL

1385 Decision St.
Vista, CA 92081
Tel.: 760.599.9100
Fax: 760.599.1919

What is Gate Freeze and why is it important?

The molten plastic enters the cavity through the gate. Mold filling is a dynamic phase where the melt temperature, pressure, flow velocity are all changing with time. Time here is from the start of injection, which is the start of the forward movement of the screw. As the cavity begins to fill and is nearly full, the holding pressure phase starts. The melt flow velocity is reduced and the melt temperature simultaneously drops. Both these cause an increase in viscosity of the melt. (Refer to the viscosity article for effect of injection speed on viscosity.)

The gate has a fixed cross sectional area. When the viscosity of the plastic in this area and surrounding it drops to a value where the plastic cannot flow any more, the gate is now considered frozen. The plastic cannot flow into the cavity anymore. The time it takes to reach this stage is called the gate freeze time.

In the molding process, the holding pressure must be applied until a point that the gate is frozen. If the pressure is not applied for sufficient time, there are two phenomena that could happen. The first one is the underpacking of the part where the cavity is not sufficiently packed with the required amount of material. This is usually manifested in the part as voids or sinks. The second one is when the plastic pressure inside the cavity is high enough to flow back out of the cavity. The result is also underpacking. The second one usually takes place when the holding time value is just a little lower than the gate freeze time when the cavity is full of pressurized plastic.

Gate freeze time is a function of the type of plastic, gate size and design and the processing parameters of the machine. For every mold a gate freeze study must be done. A gate freeze study is a graph of part weight versus holding time. A constant part weight is an indication of the gate freeze. See the attached picture.