



## **Cycletime Tips - Automotive**

### **Volume 23: Living Hinges in Polypropylene Parts**

The use of polypropylene (PP) in living or integral hinges is something that is not a new design feature to our industry. But in many parts this detail often tends to be ignored. Living hinges, if designed, processed, and used as intended, can survive hundreds of cycles. Unfortunately, if we neglect any one of the following attributes it could lead to disappointing performance.

#### **Thickness**

It is not uncommon to see hinge thicknesses of .008". Given that fact, the pressure loss as we fill the part will be substantial. Placing ribs and bosses "post-hinge" (as the material flows into the cavity) is a bad idea if one wishes for sink free parts, since the hinge freezes off before the gate. One mistake that is often made regarding filling through such a thin wall section, is the use of slow fill speeds. This causes a hesitation as the material enters the hinge area and often results in several weld lines on the hinge that wouldn't be there normally. That being said, venting is critical to promote fast filling.

#### **Gate Location**

Gate location is a feature that is non-negotiable. Promoting a symmetrical flow-front formation through the hinge is of utmost importance. The gate should encourage flow perpendicular to the hinge to minimize the potential for weldlines. Mold filling simulation is the best means to determine your ability to fill and where weldlines might be located. Element size and configuration in the mesh construction is very important to refine in the hinge area to capture true pressure loss.

#### **Cooling**

The key for prolonged hinge life is correct mold cooling in the hinge area. Typically, this area needs to have a parallel water circuit running as close as possible to the hinge. This portion of the mold is also controlled at a low temperature (<80°F). This is done in an attempt to minimize crystalline development and promote fatigue life. It is not uncommon to flex the hinge several times upon ejection, in an attempt to elongate the web.

#### **Material Selection**

As for material selection, homopolymer PP is the best choice with random copolymer PP being a close second. The higher starting tensile strength and improved fatigue resistance of the homopolymer allows for longer life. This material will also tend not to blush (stress whiten) as the hinge is flexed. The presence of ethylene in the copolymer not only inhibits the performance in this area; it will also have a white appearance in the hinge area as it is flexed. The application, however, might require some added toughness and copolymer brings that versus homopolymer. As we melt these materials for processing, melt uniformity is also a feature that must be optimized.

Jim Cardinal and I have assisted with many hinge applications. Please let us know if we can help you.

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