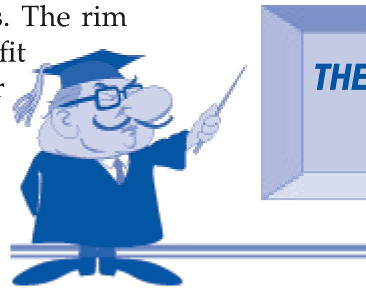
The Rim

THERMOFORMING 101



So, we know about draft angles and corners and wall thickness variation and on and on. But what about the rim? You know, the region of the formed part that forms the periphery of the part. This lesson focuses on some of the important issues dealing with the rim. In the next lesson, we'll look at the characteristics of the trimmed edge itself.

Does the Rim Have a Function in the Part?

Other than just being the edge of the part, let's say. In thin-gauge forming of axisymmetric parts such as cups, the trimmed-out rim is usually manipulated in a post-molding operation known are rim-rolling. Here, the cup is rotated along its axis as the rim is heated and softened. The rotating action forces the soften rim against a shaping ring that effectively rolls the rim into an annulus. The rolled rim provides great stiffness to an otherwise flimsy thin-walled container.

Staying with thin-gauge products for a moment, the rim design for lidded containers often requires interlocks and detents that must be quite precise. In certain instances, the container rim may include denesting features that allow stacked containers to be readily separated by the customer.

What about the rim on a heavy-gauge part? Often the rim is the finished edge of the part. The rim may be very simple, such as the trimmed end of a flat surface. Or it may be very complex, with radii, chamfers, and ridges. The rim may be designed to fit into or over another part, Or it may be trimmed to accept secondary assembly features. The part design may require the trim line to be "hidden," so that the rim is U-shaped with appropriate radii or chamfers.

Can We Get the Formed Part Off the Mold?

Before we contemplate this question in detail, remember that thermoformed parts shrink as they cool. So they shrink away from the sides of a female or negative mold cavity and onto the sides of a male or positive mold cavity. If we build a simple cup mold, for example, and design the rim so that the plastic is formed over a ring at the mold top, we need to provide adequate draft to get the thing off the mold. In other words, the rim will not have right-angled sides. Does this affect the design? By the way, this design is often called a "dam" design. This design minimizes excess plastic from being drawn over the edge of the mold and into the mold cavity. Frequently a trim line concentric to the dam will also be molded in. This is often called a "moat."

We discussed the hidden trim line a minute ago. How are we going to get the part off the mold? Flip-up sections? Removable sections? It is very difficult to get moving mold sections to seat without a gap between mating parts. As a result, we may wind up with a "witness line" right at the most cosmetic portion of the part. And keep in mind that, without plug assist, parts really thin rapidly when vacuum- or pressure-drawn into parallel-walled mold sections.

What About Texture?

Whenever you draw textured sheet, the texture flattens. In grained sheet, the effect is called "grain wash." The typical rule of thumb is that texture flattening is acceptable if the local draw ratio is less than about two or the local thickness is more than half the original sheet thickness. The real problem occurs in the rim area where the sheet is often drawn into sharp corner radii. One design method is to chamfer the rim. A second is to facet the surface design. A third is to use a series of steps. In each of these cases, the objective is to trick the eye into seeing local architecture rather than texture.

The alternative to drawing textured sheet is to texture the mold. However, as any mold maker will tell you, it is very difficult to build uniform texture into very sharply radiused corners.

You should never fall into the habit of leaving rim design to the end of product design. ■

Keywords: rolled rim, moat, dam, hidden trim line, textured sheet

This is the last TF 101 column written by Throne. The new TFQ editorial staff will determine whether the column will continue.