Why is Part Design Important?

Throughout this series of tutorials, we have assiduously[1] avoided the issue of part design. And for good reasons. First and foremost, technologists – of which I am one – are normally not good designers. We tend to get hung up on the nuts-and-bolts of problem solving rather than the esthetics of the thing we're making. And second, there really isn't a good way of categorizing part design, particularly when there are so many applications and variants on the process.

Having cited these caveats, perhaps it is time to review at least some of the generic aspects about thermoformed part design. We try to do this in the next series of lessons. And we begin by considering some of the limitations to the thermoforming process.

Can You Make the Part the Customer Wants at the Price He'll Pay (and Still Make a Profit)?

There are some fundamental reasons for not quoting on a job, even though it appears "doable" and the potential profit is substantial. Some of these are obvious, to wit:

- The parts are too large for the available equipment
- The parts are too small for the available equipment
- Too few parts are needed
- Too many parts are needed

Others depend on the nature of the plastic needed for the job. Consider these limitations:

- The polymer cannot be extruded into sheet
- The polymer cannot be drawn to the requisite depth

- The polymer needs to be drawn to near its extensional limit
- The polymer cannot be reground or reprocessed economically
- The design requires high-performance plastics
- The design requires highly filled or reinforced plastics

Some depend on the match between the part requirements and your forming abilities:

- The design requires complex forming techniques that you don't have
- It is more exotic than your current skills
- The design accuracy is greater than your current abilities
- You cannot trim to the required accuracy
- Your workers do not have the skills to repeatedly form quality parts
- You do not have in-house ability to test product serviceability
- You cannot prototype to determine part acceptability

And still others depend on the characteristics of the design, such as:

- The forces required to achieve the final shape are too high for the available equipment
- The design requires excessive web or trim
- Part tolerances, draft angles are unachievable in thermoforming
- Part design requires uniform wall thickness
- Part design requires stepped wall thicknesses

And finally, the *coup de grace*[2] – Competitive processes are more competitive! This one is probably the most difficult design limitation, simply because companies using competitive processes are now recognizing the capabilities of thermoforming and now are either altering their technologies to compete more effectively or are deciding to enter the thermoforming field.

What Not To Do

In most cases, we know the limitations of our equipment and ourselves. So we quote on parts we know we can mold. In some cases, however, the thrill of "taking a chance" is too much to pass by. That's when the thin-gauge part must be molded diagonally with the mold ends extending beyond the platen. Or when we try to "pressure form" in a press without a proper clamping system, hoping that the press won't open until the part has completely form. Or when the depth of draw of the part is so great that we need to heat the sheet until it sags to the point where it drags across the tooling. Or when … Well, you get the idea.

So, What Lessons Will We Learn?

In this series-within-a-series, we'll take a look at some simple issues such as female or negative molding and male or positive forming. We'll consider design aspects such as corners and chamfers, vent hole locations, and lip and edge formation. And surface texture, draft angles, and more. It should be fun. And maybe we'll all learn something on the way. ■

Keywords: Design, formability, dimensional tolerance, draft angle

[1] Assiduously: Unceasingly; persistently.

[2] Coup de grace: A decisive, finishing stroke.