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Technical Article

Ribs add strength and stability in thermoformed parts

Ribs are value-added design features for thermoformed parts. They provide strength and rigidity without increasing wall thickness. Discover the guidelines and important considerations you need for best designing ribs on highly cosmetic, close-tolerance parts.

What are Ribs?

As design features, ribs improve the structural performance of a part without adding wall thickness or cost. They increase rigidity and mitigate the risk of cosmetic defects. Otherwise, large flat panels could take on warping and oil canning, the appearance of waves or ripples.

The alternative to using ribs in the design is to increase the gauge of the plastic material; however, that also increases project costs. Thicker plastic also increases part weight and processing time.

Applications for ribs include panels for machinery and enclosures for medical devices. These highly visible, structural parts can have supporting ribs on the inside and a smooth, cosmetic surface on the outside.

Design Guidelines for Ribs

Key factors when ribs include draft, spacing, base radii and height.

- Draft is an angle or taper that designers apply to vertical walls to facilitate removing the part from the mold after thermoforming. With ribs, apply a draft angle of at least 3°.
- Spacing refers to the distance between ribs. To ensure uniform material distribution, don't put ribs too closely together.
- Base radii are applied to the bottoms of ribs. Use at least 25% of the material's thickness. For example, if the gauge is .250", apply a minimum base radius of .0625".
- Height is important because it can cause webs or cooling issues because of uneven material distribution. For best results, review rib height with an experienced thermoformer.

Additional Considerations for Ribs

Making sure that ribs are designed properly allows for more even stretching of the plastic material during thermoforming. It's best to design ribs shorter than the height of the outside walls of the part. And too many ribs can cause unacceptable wall thinning.

Tool design is another important consideration. Depending on the depth of the ribs, you may need a plug assist to ensure a more uniform wall thickness. With a negative or concave tool, a plug assist uses a plug that's shaped to the part's contour to pre-stretch and distribute the softened plastic sheet before pressure or vacuum is applied. This helps to control material flow, improve part strength, and avoid defects. Alternatively, you could apply a larger draft angle or base radii.

65 Waukegan Road • Lake Bluff, IL 60044 • P: 847.604.5100 • www.Thermoform.com

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If your application allows or requires hollow or double wall parts, consider Twin-sheet forming. This thermoforming technique uses two heated sheets and two molds, fusing them together during production. It results in smooth outside surfaces with supporting ribs on the back.

Conclusion

With thermoplastics, most product designers don't know the starting thickness they need. Their focus is on the final thickness they want. Ideally, it's best to partner with a thermoformer experienced in Design-For-Manufacturing (DFM) so your concept can be optimized. You'll gain the expertise you need to overcome challenges and turn your ideas into reality.

Download the Thermoforming Design Guide for additional information about ribs, as well as other critical design features.

Get the most out of thermoforming for OEM parts. Contact Profile to get started with your project.

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