

Royalite® Laminates Thermoforming Guide

Royalite laminates can be processed on most standard vacuum forming machines that are capable of heating the sheet from both sides. Compared to the processing of straight ABS sheet, the laminate construction poses some restrictions in mold and part design. Also, more precise heat control is required to differentiate between dissimilar materials.

PART DESIGN CONSIDERATIONS

De-lamination or thinning out of the foam can occur with Royalite laminates in deep draw, concave areas and sharp corners. Therefore, draw ratios should never exceed 2.5 to 1; with a relatively safe ratio being 2.25 to 1. Also, a 0.25" minimum radius must be maintained in inside corners. Sharper radii are achievable if the depth of draw is one inch or less.

VACUUM FORMING

Standard vacuum forming machines may be used. However, because of the thermal conductivity of the foam in some laminates, the heaters on the flexible, "soft feel" layer side must be set differently than on the rigid ABS or ABS/PVC side. Typically the flexible side heaters run at about one half of the output of the rigid side heaters, depending on the thickness of the rigid substrate. The greater the rigid thickness, the greater the output differentials. It is normally best to run the rigid ABS or ABS/PVC substrate toward the top heaters and heat the rigid side at about standard heat settings.

The sheet should be heated with a soaking type heat. The object of the heating cycle is to get the flexible side surface to its proper temperature while simultaneously reaching 330 °F to 380 °F on the surface of the rigid substrate. The flexible side should not be overheated nor heated too quickly as this will cause the skin to blister and the foam under the skin to rupture and break down the cell structure.

The thermoforming temperature ranges for Royalite laminates are as follows:

Flexible "soft feel" side

- R104 and R105 laminates: 280 °F - 320 °F*
- Rigid ABS or ABS/PVC side: 330 °F - 380 °F*

*measured with infra-red sensor

Radiant type heat is preferred; therefore ceramic heaters are the elements of choice. The rigid substrate material can be heated quickly while still using a soaking type heat for uniform forming. Nichrome wire and kelrod heaters also work, but it may be necessary to screen out some of the infrared heat to better allow the heat to penetrate the foam layer. It is also good processing technique to deliver the heated sheet to the forming station as soon as possible to prevent the flexible surface from chilling too much. This will have a secondary effect of giving you better detail on the part.

TOOLING

Most types of molds from temperature controlled aluminum to wood molds will work. However, different types of mold materials will result in vastly different cooling cycles, so temperature controlled molds are the most efficient.

Typical forming methods employed are:

1. Standard Drape
2. Inverted Drape
3. Snap Back

As a rule, plug assist are not used except in trimmed out areas.

TRIMMING

It is best to use spiral down-fluted routers coming in from the foam side. This will not eliminate, but will minimize fraying. Dies with beveled edges produce excellent results, especially when cutting through the foam side first. This tends to produce a smoother edge finish. Standard plastics drilling techniques can be used, but when sawing this material, sawing from the flexible side is recommended to minimize fraying.