

Vacuum Forming

Volara®, being a web foam, can be vacuum-formed in a linear semi-automatic process. This is an advantage when producing high-volume parts or when combining with other materials.

Vacuum forming consists of heating a plastic to its softening temperature and then forming the hot flexible material to the contours of a mold by air pressure (vacuum). The material is allowed to cool on the mold. This process can be done using a stationary or rotating machine with sheet material, or in line using roll fed material.

Methods of Heating

Infrared heating systems with percentage timers are primarily used. Generally, it is desirable to allow as long a heating time as possible at a low heat setting. A slow soaking heat is most effective because Volara is primarily air, an insulator. Vacuum forming in line involves the use of a long conveyor oven with many banks of heaters. It is recommended that heat be applied to both the top and bottom.

Tooling

Tools can be made from a variety of materials. Wood and epoxy are used for prototype work. Aluminum filled epoxy and water-cooled metal molds are used for extended runs.

All vacuum forming molds require holes, slit channels, or ducts for evacuation of air. These holes or slits are typically 10 - 25 mils to avoid visible marks on the surface of the part. A slight draft angle (2 - 3 degrees for female molds; 5 - 7 degrees for male molds) should be used to facilitate part removal.

Mold proportions are an important factor in thermoforming. The draw ratio (H:D) of a mold determines the overall sheet characteristics required to make good parts.

General Guidelines for Vacuum Forming

- Formability is directly related to the density and the thickness of the sheet. As the density increases formability increases in terms of the ability to produce deeper draws.
- Molds should be designed to allow for 5 - 7% shrinkage. However, the amount of shrinkage can vary and is dependent on the Volara grade, the forming temperature, and the cooling time. To avoid thinning in deep-draw areas it is best to use the male drape forming method in which a "bubble" is first blown then draped over the male mold. A plug assist can also be used.

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Forming Parameters

Vacuum forming temperatures generally range from 230°F to 350° F. A range of 40 - 60% heat has proven effective when vacuum forming Volara. Foam density, thickness, and color determine the final processing conditions.

<u>Grade</u>	<u>Temp°F</u>	<u>Max. Draw Ratio</u>
2A	210 - 320	0.6
4A	220 - 350	0.8
6A	220 - 350	0.8
2E	210 - 320	0.6
4E	220 - 320	0.7
6E	220 - 350	0.8
3M	220 - 380	0.8
4M	220 - 380	0.8
6M	220 - 380	0.8
2AS	220 - 380	0.8
4AS	220 - 380	0.8
6AS	220 - 380	0.8

Caution: Volara will burn if overheated.