EASTMAN

Tips for thermoforming

Eastar™ 6763 copolyester and Eastman Tritan™ MP100 copolyester—Extruded sheet

Sheet extruded from Eastar™ 6763 copolyester and Eastman Tritan™ MP100 copolyester is easy to thermoform. This brochure lists some helpful tips in processing Eastar and Tritan.

Mold design

Eastar 6763 and Tritan MP100 can be used successfully with male molds, but female molds are recommended. Thermoformed parts made with female molds will have more consistent flange thicknesses, easier part removal, and reduced bridging (i.e., webbing) issues.

- Generous draft angles (minimum radius of 5/64 in. [1.98 mm]) throughout the mold design will reduce tray fracture issues.
- To achieve acceptable finished part detail, vacuum channels should lead directly from the vacuum mold inlet to the vacuum holes on the corners of the mold. Vacuum channels should always be kept clean. Minimize the use of right angles in the vacuum system and piping to maximize vacuum speed. This will enable good contact between the plastic and the mold.
- To prevent excess bridging and flange thinning, use proper cavity spacing, especially on male molds. For every inch (25 mm) of depth into the mold cavity, there should be an inch of space between cavities.

Note: Mold shrinkage will vary depending on the thermoforming process equipment but is typically 0.40% to 0.45% for Eastar™ copolyester and 0.65% to 0.75% for Eastman Tritan™ copolyester.

Thermoforming process

- Eastman recommends starting with quality Eastar 6763 and Tritan MP100 sheet. Quality sheet is characterized as having consistent gauge, low contamination, low cosmetic defects, and good inherent viscosity (i.e., molecular weight).
- Coatings or internal additives are often used to separate packages within a stack (i.e., denesting).
  - Silicone-coated sheet is often used to optimize denesting of packages. Eastman suggests using Dow Corning® 365 silicone emulsion.
  - When silicone coating is not permitted, an internal antiblock or denest concentrate can be added to Eastar or Tritan resin during extrusion. These are typically blended with Eastar or Tritan resin at a ratio of 50:1 to 100:1. Eastar additives cannot be used in products made of Tritan, and Tritan additives cannot be used in products made of Eastar.
  - With Tritan, the antiblock and denest concentrates must be specifically formulated for Tritan. These are typically blended with Tritan at a ratio of 20:1 to 10:1.
  - Contact your Eastman representative for more details.
- The mold surface should maintain a consistent temperature of 100°F (40°C) to 140°F (60°C) to prevent chill line formation or sticking.
- Heat settings on thermoforming equipment should be adjusted to produce the highest possible sheet temperature without sticking or bridging. For Eastar 6763, the optimum sheet temperature range for thermoforming, as measured by temperature-sensitive tapes, infrared thermometer, or

Eastman recommends following these tips to fully experience the benefits of easy thermoforming with Eastar™ 6763 copolyester and Eastman Tritan™ MP100 copolyester on a consistent basis.

handheld pyrometer, is 280°F (138°C) to 300°F (149°C). For Tritan MP100, the optimum sheet temperature range for thermoforming is 300°F (149°C) to 350°F (177°C). Higher sheet temperatures during thermoforming promote lower internal stress in the final packages. However, overheating film and sheet can cause the sheet to sag, resulting in bridging (webbing) in the final thermoformed package.

- As sheet temperatures increase, the plastic starts to sag, which will eventually cause bridging. Sag is the result of temperature and time in the oven. Higher sheet temperatures without additional sag can be obtained by
  - Decreasing cycle time and increasing oven temperature
  - Heating the sheet without using the full oven length and increasing temperature on the area closest to the mold. Note: Chain rails must be parallel for this setup.
- Two-sided heating may be required.
- For blank-fed male mold thermoforming machines, forming can be improved and bridging can be eliminated by using wire-helper grids.
- Internal stresses should be monitored using a polarized light table.

Cutting sheet

Sharp, properly guarded, and well-maintained steel cutters are required for proper trimming of formed packages. A typical trimming press uses steel rule or matched metal dies.

Steel rule die design

- Double-bevel measuring 3-point, 0.042 in. (1.07 mm) with a Rockwell C hardness of 45 to 55 is suggested.
- Blisters of Eastar 6763 and Tritan MP100 should be cut through completely when using steel rule cutting. The cutting stroke on the trim press should stop (i.e., fixed stroke) just after cutting through the blister. This is known as a "kiss" cut.
- Stainless steel striker plates 0.125 in. (3.2 mm) thick with an equivalent or slightly softer hardness than the die material is recommended.
- Heated steel rule knives can often improve the quality of the cut.
- Dies should have steel backup plates with a thickness of 0.030 in. (0.76 mm).
- Backup plates should be made of metal with a Rockwell C hardness of 30 to 35.

Match metal punches and dies should be properly maintained and have as close to zero tolerance as possible.

EASTMAN
The results of **insight**™

Eastman Corporate Headquarters
P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations