### Thermoforming vs. Injection Molding and Rotomolding

#### PROCESS

**Thermoforming**
- 3D aluminum form made to mold flat sheets or rolls of thermoplastic
- Heat applied to make rigid thermoplastic into a moldable, pliable material
- Vacuum suction or pressure with suction applied
- Finished form robotically trimmed
- Uncoated, or finished with paints, adhesives, or specialty coatings

**Injection Molding**
- 3D, double-sided molds made from steel, aluminum, or an alloy
- Uses thermoplastic pellets or liquid resins
- Parts heated to a liquid, then injected into the mold
- Finished with paint, adhesives, printed, or specialty coatings

**Rotomolding**
- Uses thermoplastic in creating hollow parts
- Powdered resin is put into a hollow mold
- Mold rotated bi-directionally in an oven
- Melting resin coats the inside of the mold, then cooled and demolded

#### PART AND MOLD COST

<table>
<thead>
<tr>
<th>Process</th>
<th>Cost</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Thermoforming</td>
<td>$$</td>
<td>As part size increases, thermoforming costs are less than injection molding</td>
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<td>Making a thermoforming tool with a single-side is less expensive than a</td>
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<td>double-sided injection mold.</td>
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<tr>
<td>Injection Molding</td>
<td>$$$</td>
<td>Higher upfront cost. Individual parts with injection molding usually cost</td>
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<tr>
<td></td>
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<td>less.</td>
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<tr>
<td>Rotomolding</td>
<td>$$</td>
<td>Upfront cost low compared to other plastic processes.</td>
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<td>Tooling prices depend on size/complexity of design.</td>
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#### LEAD TIME

- **Thermoforming**: 6-8 weeks for production tooling
- **Injection Molding**: 12-16 weeks for production tooling
- **Rotomolding**: 6-8 weeks for production tooling

#### BEST APPLICATION

- **Thermoforming**
  - Run Size: medium - large
  - Best for Run Size: large - extra large parts
  - Suitable for medium to large parts with a high production volume
  - Ideal for parts of up to 36" x 48" x 40" or larger

- **Injection Molding**
  - Run Size: large - extra large
  - Best for Run Size: medium - large parts
  - Suitable for high volume production of parts
  - Ideal for parts of up to 3' x 3' x 3'

- **Rotomolding**
  - Run Size: small - medium
  - Best for Run Size: small - medium parts
  - Suitable for parts of up to 96" x 144" x 40"
  - Ideal for parts with complex geometries

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**Run Size**
- Large parts up to 36" x 48" x 40"
- Can combine various parts into one large part, assembly
- Finished form robotically trimmed
- Uncoated, or finished with paints, adhesives, or specialty coatings

**Injection molding**
- Typical parts up to 3' x 3' x 3'
- Injection molding is the most common modern method of manufacturing plastic parts, ideal for producing high-volume of the same object

**Rotomolding**
- Uses thermoplastic in creating hollow parts
- Powdered resin is put into a hollow mold
- Mold rotated bi-directionally in an oven
- Melted resin coats the inside of the mold, then cooled and demolded

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**LINDAR**
- Forming Manhattan