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Introduction to Thermoforming and Vacuum Forming

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Table of Contents

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Introduction

We are providing you with this white paper because we have learned that many people, including engineers, often do not really understand plastic forming processes. Thermoforming is the forming of heated plastic on a mold to create a desired shape. Thermoforming, vacuum forming and pressure forming are considered thermoforming processes.

Often confused with injection molding and rotational-molding, thermoforming processes are unique and have distinct differences for a variety of applications. We hope the following guide clearly explains each of these processes, how they differ, and when they would be utilized.

Thermoforming processes are used in a wide variety of applications like medical devices, fitness equipment, and electronic equipment. Thermoformed parts are used in automobiles and airplanes. Both modes of transportation use thermoformed parts for enhancing their interiors.

Thermoforming produces custom plastic enclosures that are durable, cost-effective, high quality and aesthetically appealing while offering close tolerances, tight specifications and sharp detail. It offers flexibility in tooling and engineering, and fast set-up, in the production of custom plastic parts.

Thermoforming is usually the process of choice when producing large parts in quantities from dozens to thousands. And, thermoforming is especially helpful when producing prototypes. In this white paper report we will illustrate how each process works and the advantages of each.

If you have other questions, please contact Mayfield Plastics at **508.865.8150**. or **800.339.3476**.

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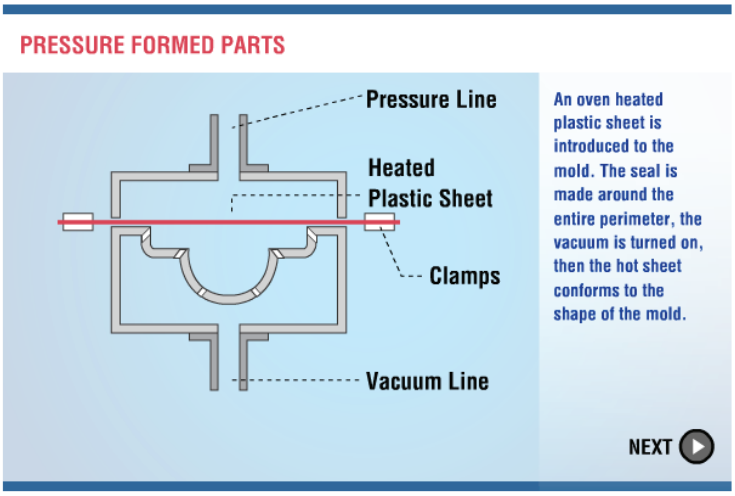
Pressure Forming

Pressure forming can achieve the high quality and detailed look of injection molding, without the expensive tooling costs. By using air pressure on the back side of the sheet during the forming process, textures, undercuts and injection molding details can be achieved. This is not usually possible with the vacuum forming process.

Mold makers start by creating a pattern based upon drawings and specifications of the custom part. From the pattern, these craftsmen produce either a hardwood or aluminum mold. A wooden mold is used mainly for a customer who requires a prototype or a very low volume production run. An aluminum temperature controlled mold is used for a full production run and when the pressure forming process is required, temperature control of the mold is used to ensure repeatability.

The pressure forming technique used by Mayfield Plastics provides for forming heavier sheet from 0.063” thick up to 0.375” thick. The technique is accomplished by forcing a hot sheet against a female mold by introducing compressed air into the back side of the heated sheet while applying vacuum to the tool side. This method will provide as much as 75 psi working on the sheet surface, as compared to the 14 psi in vacuum forming.

Pressure Forming



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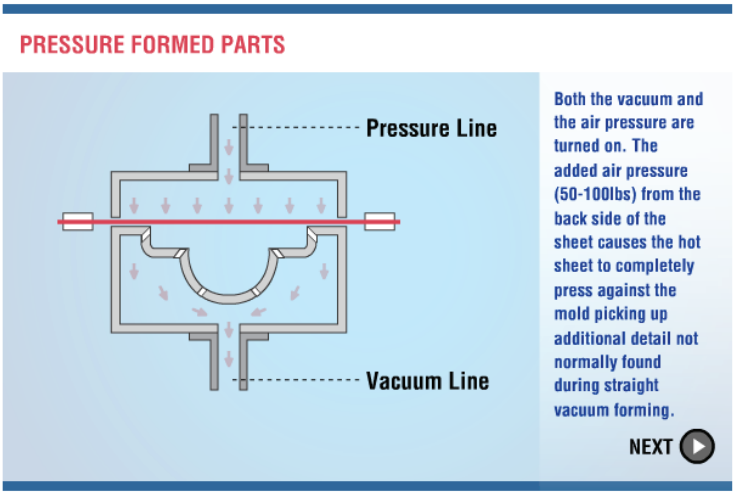

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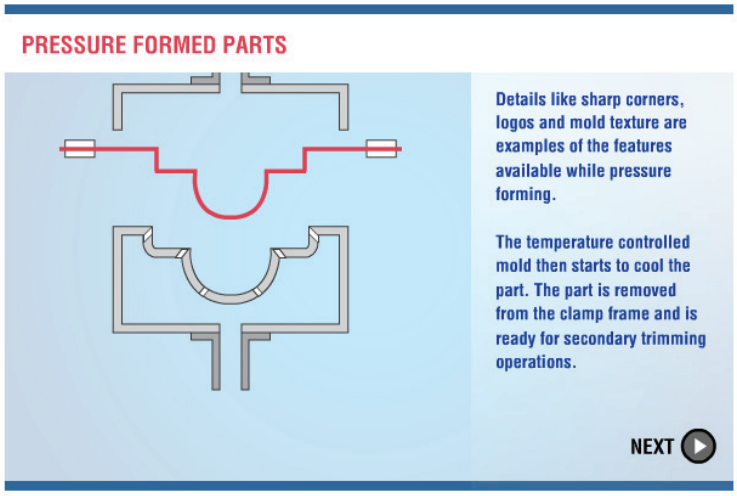

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Vacuum Forming

Vacuum forming is an economical process for producing large sized, low volume parts at a reasonable price. Vacuum forming involves the controlled heating of a thermoplastic material to a temperature where its shape may be heated to conform to the shape of the mold. The physical change to the pre-heated thermoplastic is accomplished by the use of vacuum pressure.

The advantages of vacuum forming are the capability to form large parts without expensive equipment and tooling. Vacuum forming allows for large production runs, and inexpensive mold and design modifications.

Thermoplastics most commonly specified are ACRYLIC, ABS, HDPE, LPPE, PP, PVC, PETG and polycarbonates. Precolored sheets of some of these materials are also commonly used in the thermoforming of plastic parts.

Secondary operations routinely used to produce finished parts include painting, pad printing, hot stamping and silk screening.

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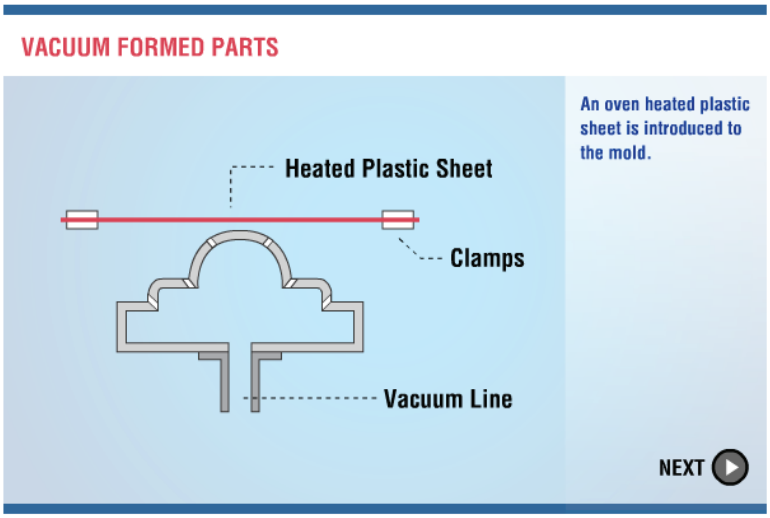
Vacuum Forming



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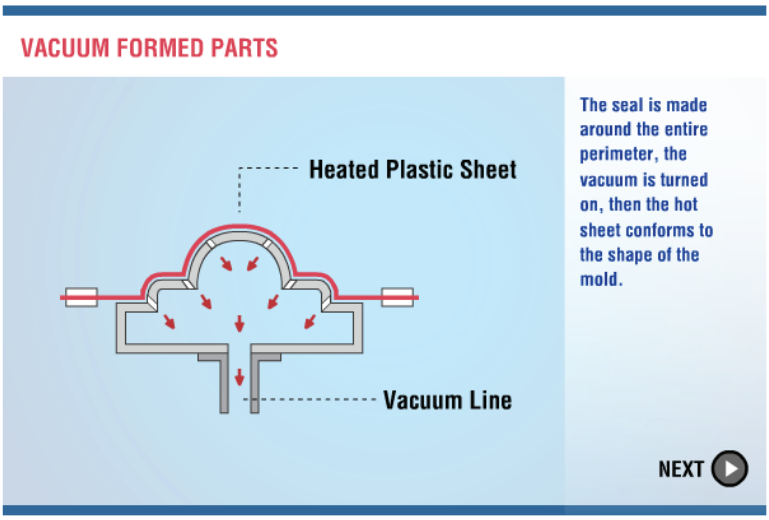

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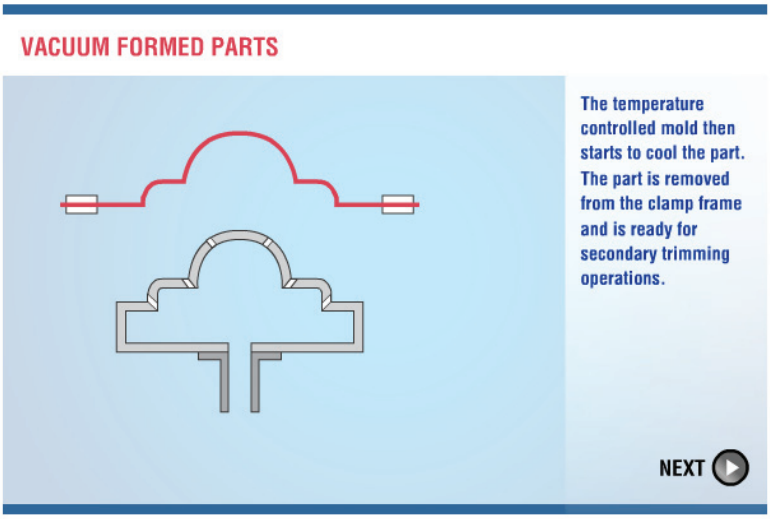

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Thermoforming Mold Making

The quality of thermoformed plastics parts depends on the expertise used to produce the molds that produce exceptional plastic parts.

Mayfield Plastics is one of the few thermoforming companies that controls all facets of mold making in-house. Talented designers and machinists hand make the majority of our molds in-house. This provides the ultimate control over quality, delivery, and part repeatability.

Thermoforming molds can be produced from a wide variety of materials, depending on the size of the part, quantity, detail and accuracy. In some cases, molds may be made from wood or a combination of wood and other materials in a "fabricated" assembly. As previously mentioned, these molds are crafted completely in our facility by experienced mold makers, most of whom have been on the job for over 30 years. They possess the prime characteristics of fine craftsmen: talent and experience coupled with immense pride in their work.

Plastic Thermoforming or Injection Molding?

In deciding between plastic thermoforming and injection molding for your next project, there are several important factors to keep in mind:

Tooling costs for thermoforming are significantly lower than tooling costs for injection molding. Thermoforming, particularly pressure forming, is more cost effective for very large parts where the tooling costs would be prohibitive with injection molding. Despite pressure forming's lower costs, nothing is sacrificed in terms of quality. Plastic thermoforming can achieve highly cosmetic finishes that have an elegant look and that provide the look and feel that meet the end user's expectations.

Thermoforming applications often also use painting and secondary assembly in the production of value-added parts. In the end, the best way to decide how to proceed is with the assistance of a trusted, knowledgeable plastics processor.

Mayfield Plastics' engineering support staff can walk you through the design and manufacturing of your part to ensure the best geometries and most efficient processes to meet your bottom line requirements.

Mayfield Plastics has injection molding partners. We can recommend fine injection molding companies to work with customers whose plastic forming needs are not suited to the thermoforming, pressure forming, and vacuum forming processes that define our success.

Put our plastic expertise to work for you—call Mayfield Plastics at **800.339.3476** to begin the process.

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Thermoforming or Rotational Molding?

Rotational molding and thermoforming both offer advantages, depending on the type of project at hand.

The key advantages of thermoforming include:

- Sharp detail
- Tight tolerances
- Flexible tooling and engineering
- Efficient set-up

Rotational molding offers:

- The ability to mold multi-piece parts as one unit
- Consistent wall thickness
- Strong outside corners

A well-trained, experienced plastics engineer can help you determine whether thermoforming or rotational molding is right for your project.

Mayfield's engineering support staff has the knowledge and expertise to help with these and other considerations, including:

- Material selection
- Improving geometries
- Concept development
- Final design

If rotational molding is the best fit, we can help you find the right rotational molder to meet your project requirements.

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Plastic Enclosures, Radomes & Other Thermoforming Applications

Thermoforming can be used to manufacture an endless array of plastic enclosures, trays and other components for a wide variety of markets. Scroll through the list below to get an idea of Mayfield's own specialties in this area and then call us to see how we can make the difference in your next project.

Medical

- Equipment covers
- Sidewalls, user interface panels
- Bezels and enclosures
- Internal components
- Work-in-progress trays
- Hospital room panels

Mayfield has extensive knowledge in manufacturing high quality heavy gauge plastic enclosures, thermoforming products and packaging for the medical industry.

Telecom

Radomes for:

- RVs
- Yachts
- Military aircraft
- Commercial aircraft
- Ground-based operations

We have significant thermoforming experience in the production of all radome shapes and sizes.

Industrial

- User interfaces
- Bezels
- Enclosures
- Plastic housings
- Panels

Diversified

- Bins, totes and bases
- Office furniture and interior panels
- Plastic enclosures for fitness equipment
- Underground pipe supports and housings
- Domes and panels for a variety of industries
- Marine vehicle parts
- Transportation components, plastic covers and enclosures

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Plastic Enclosures, Radomes & Other Thermoforming Applications

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Plastic Fabrication in Thermoforming

Heavy-gauge thermoforming provides the capabilities to create a wide array of parts, including:

Heavy-gauge

- Plastic enclosures
- Structural bezels
- Radomes
- Covers
- Equipment panels

Thin-gauge

- Packaging
- Medical applications
- Work-in-progress trays
- Food containers
- Seedling trays

Plastic fabrication in combination with heavy-gauge thermoforming provides additional value by creating much larger parts while keeping tooling costs down. CNC, heating and bending, and other plastic fabrication processes can be combined to create a variety of diversified and complex plastic parts.

Mayfield Plastics' plastic fabrication expertise allows us to create the end product that you need for your next project. We also have the capabilities to thermoform materials from the thinnest plastic film to sheets as thick as a half-inch.

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Vacuum Forming FAQs

Vacuum forming, a low-cost thermoforming process, offers an economical method of creating large-size, low-volume plastic parts. Mayfield Plastics has a half-century of thermoforming wisdom and expertise that you can rely on to answer your thermoforming questions. Read through the most frequently asked questions below, or call us at **800.339.3476** for more detailed answers.

What size of parts can be vacuum formed?
Mayfield has the capabilities to vacuum form parts as small as an ice cube to dimensions as large as 8 feet by 5 feet. Any thermoplastics with the appropriate melt strength can be vacuum formed, and Mayfield Plastics' dedicated staff has the expertise and technical know-how to help you select the best material for your part.

Is design and engineering assistance available for my vacuum-forming project?
Yes. In fact, the high level of design and engineering assistance available from Mayfield sets us apart from other thermoforming companies. From concept to final design, we can improve the geometries of our customers' products, ensuring a better part and better control over costs.

What tolerances are required for radii and draft angles?
The project's specifics and geometries determine these dimensions. Mayfield's experienced engineering support staff is available to help each customer work through the design process to make sure the final vacuum-formed part is the right part for your project.

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Vacuum Forming FAQs

Does Mayfield manufacture thermoformed tooling?
Mayfield has the capability to make, maintain and store all tooling in-house. The ability to control all facets of tool making is a huge differentiator for Mayfield Plastics and allows us to manufacture "Custom Made Parts with an Elegant Look."

Does Mayfield provide post-operation assembly?
Yes, we provide a wide array of assembly procedures, allowing for the production of large, complex final plastic parts.

What file formats are accepted?
Mayfield largely works with SolidWorks, Cimatron and Mastercam, although we have the ability to import just about any type of file, including IGS.

Can I arrange a tour of Mayfield's manufacturing facility?
Mayfield Plastics is pleased to welcome all customers, both new and existing, to tour our new 60,000-square-foot facility.

Summary

We hope you found this guide informative and helpful in choosing the right process for your plastic enclosure needs. Please call or email us using the conact information below for additional information or to discuss your particular design or production challenges.

Mayfield Plastics' engineering support staff can walk you through the design and manufacturing of your part to ensure the best geometries and most efficient processes to meet your bottom line requirements. If your project requires injection molding, we can identify a Mayfield business partner to meet your needs.

Put our plastic expertise to work for you—call us at **800.339.3476** to begin the process.

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