THERMOFORMING INNOVATION DRIVES SCALABILITY FOR OEM PARTS

PROFILE PLASTICS, INC.

Illinois has a unique history of invention and innovation—including the cell phone, dishwasher, the Ferris Wheel, and even Twinkies among others. Beyond these well-known contributions, the plastics industry has played a significant role in this legacy. Illinois has ranked among the top states for plastic parts production for many years.

Thermoforming is a key driver of this sector's growth, advancing from manual processes to automated production methods over the last 40 years. This transformation has enabled manufacturers to achieve greater quality, consistency, flexibility, and capacity, ultimately benefiting OEMs seeking high-performance plastic components.

What is Thermoforming?

Thermoforming is a manufacturing process that starts with a thermoplastic sheet. Heating the sheet in an oven makes it pliable, allowing it to be formed into complex shapes using a mold, or tool, combined with vacuum and/or low air pressures.

Thin-gauge thermoforming is commonly used for consumer packaging and small disposable items, while heavy-gauge thermoforming produces large, durable parts perfect for OEM applications. These parts can match or exceed the strength of metal or fiberglass while being significantly lighter.

The three primary thermoforming processes include vacuum forming, pressure forming, and twin sheet forming:

- **Vacuum forming** uses a vacuum to remove air and pull the hot sheet tight to the tool, so it takes on the tool's geometry, a technique widely used for over 70 years
- **Pressure forming** adds low-pressure airflow behind the sheet to create more complex shapes and refined surface details
- **Twin sheet forming** adds a second sheet and forces air between them, molding them against two opposite tools to create lightweight hollow parts that are mechanically bonded by heat and pressure

Why Thermoform?

While injection molding remains a common and cost-effective method for producing high-volume plastic parts, thermoforming often offers distinct advantages at lower volumes and for larger parts while delivering the same high cosmetic finish and geometric detail often associated with injection molded parts. Typical thermoforming applications can include external skins like panels and enclosures and internal components such as drip trays or guards, across a wide range of industries.

Due to fundamental differences in the processes, per piece cost will likely be higher than injection molding; however, the overall total cost is often less with thermoforming due to significantly lower cost tooling— tens of thousands of dollars versus hundreds of thousands. In addition, the typical time to market is reduced due to easier-to-produce aluminum tooling sourced locally.

Advancements in Automation

Originally, trimming thermoformed parts required manual processes such as sawing, drilling, and/or cutting. This leads to variations in dimensions and potentially unsafe work practices. The introduction of CNC machines revolutionized this process, significantly improving precision and efficiency, as well as operator safety.

Early Illinois adopters of 5-axis CNC trimming helped pave the way for automation in thermoforming. These developments reduced labor requirements, material waste, and finished part variation. As a result, thermoforming has become a viable process solution for precision applications.

Innovations such as molds with pneumatic articulation combined with advanced thermoforming machine process controls enabled the creation of complex undercuts and other advanced part design features. These enhancements further expand the capabilities of thermoforming, making it a compelling alternative to traditional manufacturing methods.

Enhancing Product Efficiency

Modern facilities leverage advanced tooling and automation to accommodate a wide range of production volumes. From small-batch runs of a few hundred parts to large-scale production in the tens of thousands, thermoforming provides an adaptable manufacturing solution.

Continued improvements in heating and machine technology have also optimized cycle times and trimming accuracy, expanding the potential applications for thermoformed components.

For example, pressure forming was developed in the late 1980s, in large part by Illinois thermoformers. This forming method has evolved into a highly refined process capable of producing parts with detailed features such as embossed logos and intricate textures.

Scalability and Innovation

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Thermoforming in Illinois Manufacturing

Illinois remains a hub for thermoforming innovation, with manufacturers continuously refining their techniques to improve quality and reduce costs. The state's expertise in heavy-gauge thermoforming supports industries such as:

- Medical equipment
- Food & beverage
- Transportation
- Material handling
- Recreational equipment
- Industrial and specialty products

With a strong foundation in engineering and automation, plus support from local partners, Illinois-based thermoformers contribute to the region's reputation for plastic production excellence. They originate new processes and sustainable practices, including the recycling of plastic waste.

Thermoforming continues to drive efficiency and advances in modern manufacturing. As this technology evolves, it remains a crucial solution for OEMs seeking high-quality, cost-effective plastic components. This industry will continue to shape the future of manufacturing both in Illinois and beyond.◆

About the Author: Mark Murrill is President of Profile Plastics, Inc. in Lake Bluff. He can be reached at mark.murrill@thermoform.com or 847.604.5100.