WHITE PAPER

Choosing a Plastic Manufacturing Process

A decision guide for packaging engineers picking between thermoforming, corrugated plastic, injection molding, and the alternatives

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Executive Summary

Process selection drives every other decision in a plastic part program. It sets tooling cost, tooling lead time, per-part cost, design freedom, material options, and quality risk. Picking the wrong process is the single most expensive mistake a packaging engineer can make. Most of the time it happens because someone defaulted to the process they already knew instead of the one that fit the part.

This paper walks through the six processes a packaging engineer should know, the five variables that drive the selection, and a decision tree that gets to a working answer in five questions or fewer. It is not exhaustive. It is built to be useful in the first ninety minutes of scoping a new part.

The short version. For hollow vessels, blow molding (small to medium) or rotational molding (large). For sheet-built totes and dividers, corrugated plastic fabrication. For thin-wall packaging at high volume, light gauge thermoforming. For rigid housings and guards under ten thousand units a year, heavy gauge thermoforming. For complex, two-sided parts above twenty-five thousand units a year, injection molding. For fiber-reinforced or thermoset parts, compression molding. Each has a place. Most teams pick wrong because they treat one process as the default.

1. The Six Processes Worth Knowing

There are dozens of ways to make a plastic part. The six below cover roughly 95 percent of packaging and industrial part programs. The rest are specialty processes (dip molding, extrusion blow molding, vacuum casting, additive manufacturing) that deserve their own conversation when the geometry calls for them.

Thermoforming

Heats a plastic sheet until it sags, then forms it over or into a one-sided aluminum tool using vacuum or air pressure. The sheet cools, trims, and ejects. Detail lives on the side that contacts the tool. The back face is whatever the back of the sheet looks like after stretching.

Two flavors. Light gauge (0.015 to 0.080 inch) runs on inline machines at high speed for clamshells, trays, and packaging. Heavy gauge (0.080 to 0.300 inch and above) runs on sheet-fed machines for housings, guards, large dunnage, and equipment skins. Same physics, different machines.

Corrugated Plastic Fabrication

Cuts, folds, welds, and rivets twin-wall polypropylene sheet (also called coroplast or fluted plastic) into reusable totes, dividers, dunnage, and shippers. Tooling is a steel rule die, a CNC routing table, or nothing at all. Parts are flat panels that get folded or welded into the final shape.

This is the lowest-tooling, fastest-turn process in the family. New parts can go from CAD to a fifty-piece short run in days. Production tooling for a die-cut blank runs a few hundred to a few thousand dollars.

Injection Molding

Clamps a two-sided steel mold shut, injects molten resin under high pressure, cools, and ejects. Both faces of the part are designed. Walls are uniform. Detail is fine. Undercuts, ribs, bosses, and threads are designed in with slides, lifters, and collapsible cores.

The price of all that design freedom is steel tooling. Molds run $30,000 to $300,000 and take three to six months to print. Below roughly 25,000 parts a year, the tooling will not amortize against any other process.

Blow Molding

Forms hollow parts by inflating a heated parison of resin against the inside of a mold. Three variants: extrusion blow (bottles, fuel tanks), injection blow (small precision bottles), and stretch blow (PET bottles for beverage and packaging).

Use it when the part is hollow and the inside surface does not need fine detail. Common for fluid containers, fuel tanks, ducts, and large bottles. Tooling is cheaper than injection molding but the geometry is limited to closed hollow shapes with a parting line.

Rotational Molding

Loads powdered resin into a hollow mold, then heats and rotates the mold so the resin coats the inside surface uniformly. Cools, opens, ejects. Long cycle times (15 to 60 minutes per part) but very low tooling cost and the ability to make large hollow parts (kayaks, water tanks, playground equipment, industrial bins).

Sweet spot is large hollow parts in low to medium volume. Wall thickness can be tuned by adjusting resin charge. Not a fit for parts that need fine detail or tight tolerance.

Compression Molding

Places a pre-measured charge of resin (often a thermoset like BMC or SMC, or a fiber-reinforced composite) into a heated steel mold, then compresses it shut to form and cure the part. The dominant process for fiber-reinforced parts, electrical components, and high-temperature applications.

Use it when the material has to be a thermoset (won't reflow) or a fiber composite. Tooling cost is comparable to injection molding.

2. The Five Variables That Drive Selection

Process selection comes down to five questions. Answer them in this order and the right process usually picks itself.

Volume

Volume is the single biggest driver. Below 100 parts per year, almost anything except injection molding makes sense. Between 100 and 10,000, thermoforming and corrugated plastic dominate. Between 10,000 and 50,000, the decision gets interesting. Above 50,000, injection or blow molding usually wins.

Geometry

Is the part flat-panel and assembled? Corrugated plastic. Is it hollow? Blow or rotational molding. Is it a tray, clamshell, or housing with one-sided detail? Thermoforming. Is it a complex two-sided shape with internal features? Injection molding. The geometry tells you what process is even possible before cost enters the conversation.

Material Requirements

Some materials only run on some processes. Thermosets and fiber-reinforced composites require compression molding. Most engineering thermoplastics (PETG, ABS, polycarbonate, HDPE, polypropylene) run on multiple processes. ESD, FDA, UL94, and cleanroom grades exist for all the major processes but the available resin selection narrows.

Lead Time

First-article date matters. Steel injection tooling will not print in six weeks. Aluminum thermoforming tooling will. Corrugated plastic can ship a short run in a week. If the program needs first-article in two months, the process menu is short.

Design Stability

If the part is still revving, do not buy steel tooling. Thermoforming and corrugated plastic let the design move through three or four iterations before tooling write-off becomes painful. Injection mold tooling locks the design. A revision costs weeks and thousands of dollars.

3. The Decision Tree

Run through these in order. Stop at the first match. Then go deeper on the process-specific decisions inside that family.

Question	Likely answer
Is the part a hollow vessel (bottle, tank, fuel cell)?	Blow molding for small to medium. Rotational molding for large (over ~5 gallons).
Is the part assembled from flat panels (totes, dunnage, dividers)?	Corrugated plastic fabrication.
Is the part a tray, clamshell, or thin-wall packaging at high volume?	Light gauge thermoforming.
Is the part a large rigid housing, guard, or panel under ~10,000/yr?	Heavy gauge thermoforming.
Is the part complex, two-sided, fine-featured, and above ~25,000/yr?	Injection molding.
Is the part a thermoset or fiber-reinforced composite (BMC, SMC)?	Compression molding.
Is the part still in development with frequent revs?	Thermoforming or corrugated plastic. Both have low tooling and fast turns.

> *Most parts have a clear answer from these five questions. The tough cases sit right at a threshold (around 25,000 parts a year, or right at the edge of what thermoforming can hold). Those are the cases worth talking through with a fabricator who runs more than one process.*

4. Cost and Lead Time Side-by-Side

Tooling cost and lead time are where process selection actually shows up in the program budget. The table below is rough. Real numbers depend on part size, complexity, material, and tolerance.

Process	Tooling cost	Tooling lead time	Volume sweet spot	Per-part cost
Thermoforming (light gauge)	$3k to $25k	2 to 6 wk	5,000 to 500,000/yr	Low to medium
Thermoforming (heavy gauge)	$5k to $30k	3 to 8 wk	100 to 10,000/yr	Medium
Corrugated plastic fabrication	$0 to $3k	Days to 2 wk	10 to 5,000+ /yr	Low (assembly-heavy)
Injection molding	$30k to $300k+	12 to 24 wk	10,000 to millions/yr	Lowest at scale
Blow molding	$15k to $100k	8 to 16 wk	1,000 to millions/yr	Low at scale
Rotational molding	$10k to $100k	6 to 14 wk	100 to 5,000/yr	Medium (slow

Process	Tooling cost	Tooling lead time	Volume sweet spot	Per-part cost
				cycles)
Compression molding	$20k to $200k	10 to 20 wk	500 to 100,000/yr	Medium to high

Two things to read out of this table. First, the tooling cost spread between corrugated plastic and injection molding is a factor of one hundred or more. A program that runs 500 units a year cannot afford to be wrong about which side of that spread it belongs on. Second, the lead time spread is roughly the same factor. A program that needs parts in eight weeks does not have an injection-molding option.

5. Where Kiva Fits and Where We Send You Elsewhere

Kiva runs two of the six processes covered in this paper, in-house and at production scale: thermoforming (heavy and light gauge) and corrugated plastic fabrication. That covers most reusable packaging, dunnage, totes, dividers, equipment housings, and industrial trays.

For the other four processes, the honest answer is: we are not your shop. If the part wants to be injection molded, we will tell you and point you to a molder. If it wants to be blow molded or rotomolded, same. We would rather lose the quote than build a program on the wrong process and watch it fail in service.

TWO FOLLOW-UP PAPERS IN THIS SERIES

- "When to Thermoform, and How to Design for It" covers heavy and light gauge thermoforming, design rules, materials, and the RFQ checklist.
- "Designing Reusable Packaging That Earns Its Keep" covers corrugated plastic fabrication for returnable totes, dunnage, dividers, and trays.

Together, the three papers cover the majority of the decisions a packaging engineer makes scoping a custom plastic part program.

About Kiva Container Corporation

Kiva Container Corporation is a custom thermoforming and corrugated plastic shop in Anaheim, California. Founded in 1986. AS9100D and ISO 9001:2015 certified. Women-owned. All design, tooling, and production in-house at a single facility.

CAPABILITIES

- 2 inline thermoformers, max sheet 23.5 by 18.5 inch (light gauge)
- 4 sheet-fed thermoformers, max sheet 46 by 54 inch (heavy gauge)
- Pioneer flatbed die-cutter, max 78 by 150 inch (corrugated plastic)

- Gerber M3000 turbo router and cutting table, max 75 by 120 inch
- Gauge range 0.015 to 0.300 inch on thermoforming, 2mm to 10mm on corrugated
- Materials: PVC, RPET, PET, PETG, ABS, styrene, polycarbonate, acrylic, HDPE, PE, HMWPE, Kydex, ESD, conductive
- Sonic welding, proprietary flat welding, wire bending
- In-house aluminum CNC tooling, steel rule dies, 3D printing, screen and digital printing
- Full design through production cycle, no outsourcing

Most customers are packaging engineers and buyers in aerospace, medical, and material handling. Order profile runs from short prototype runs to repeat production. Custom engineering is the default, not the exception.

> *Not sure which process fits your part? Send what you have. We will tell you which way we would build it before we quote, and if it is not one of ours we will tell you that too.*

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