

Making a Better Firearm with Polymers

*Using Plastic Injection Molding to Improve
Form, Function, and Fit*

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Improving Form

Challenge: The polymer grip area under the barrel was ill-fitting, causing a visible gap at the end of the pistol. This easy-to-spot flaw also diminished performance, causing the slide to bind and, in effect, making it a single shot pistol instead of semi-automatic.

Solution: Tool troubleshooting and fully automated molding achieves consistent output that fixes the gap.



Whether it's for sports, home protection, or law enforcement, gun owners are passionate, educated and willing to pay for the best quality, aesthetics and performance. But as the demand for firearms grows, many firearms manufacturers are finding that their current supplier is no longer able to meet requirements for volume and quality. Sub-par parts and timeline delays can mean lines down, a scenario that is costly yet avoidable.

This paper identifies common challenges and opportunities to improve Form, Function, and Fit of firearms. The use of polymers in both optical and non-optical components, as well as improved automation and assembly, can help ensure better finished quality.

Form: Improving Aesthetics with Proven Processes

Looks and texture matter in firearms. Grip texture impacts comfort and traction, while parting lines and color matching can add or detract from the perceived quality and value of your product.

The right injection molding techniques can help avoid many common issues in firearms manufacturing like visible seams and stress, uneven or unattractive texture, or uneven color.

- Material selection: your supply partner can suggest materials that meet appearance, strength and cost targets
- Precise color matching: consistent custom blends can deliver seamless quality
- Gating: mold flow analysis will determine the proper gate location and size for minimum material stress and fewer visible seams



Scientific molding, as used by Empire Precision Plastics, is a recognized method for improving the quality of injected molded parts and assemblies. This approach identifies and controls key processing factors such as temperature and cavity pressure to ensure consistently high quality from operator to operator, shift to shift and part to part.

Improving Function

Challenge: A pistol grip made by one U.S. firearms manufacturer's existing supplier was unable to pass heat tests. To meet law enforcement's high-use needs, 600-800 rounds must be able to be fired as quickly as a magazine could be reloaded.

Solution: A custom-blended resin is able to withstand the extended heat. Altering the molding design to eliminate a post-mold cooling fixture further reduces stress by cooling in a reverse configuration.



The Result

- Reduced scrap
- Lower rejection rates
- Fewer part problems such as cracking, overstressing and visual defects
- Reduced cost and faster delivery

Function: Improving Performance with the Right Materials

Performance under stress is key for both polymers and your end product. Firearms are subjected to high heat and repeated handling. The right molding materials and processes make for a more robust product.

The best-fit materials for firearms are ones that are resistant to heat, scratch, and impact. A supply partner that provides strong engineering support can advise you on the materials that make the most sense for your product.

Nylon Type 6 and Type 6/6 are chosen for their strength and chemical resistance, among other favorable properties. Many automotive applications utilize these materials for their engine intake manifolds, for example.

	Engineered Thermoplastics	Thermoplastic Elastomers	Colorants	Additives
Firearms				
Stocks Frames Receiver	<ul style="list-style-type: none"> Structurally reinforced polymers Nylon Polypropylene Polybutylene terephthalate 		<ul style="list-style-type: none"> Wood grain Camouflage Custom colors IR masking Pre-colored formulations 	<ul style="list-style-type: none"> Warp reduction Weight reduction Process optimization
Handguards Forearms Picatinny Rails Magazines	<ul style="list-style-type: none"> Structurally reinforced polymers Lubricated polymers Nylon Polypropylene Polybutylene terephthalate 	<ul style="list-style-type: none"> Vibration damping TPEs Soft touch TPEs 	<ul style="list-style-type: none"> Wood grain Camouflage Custom colors IR masking Pre-colored formulations 	<ul style="list-style-type: none"> Warp reduction Weight reduction Process optimization
Recoil pads		<ul style="list-style-type: none"> Vibration damping TPEs 	<ul style="list-style-type: none"> Camouflage Custom colors IR masking Pre-colored formulations 	<ul style="list-style-type: none"> Process optimization
Grips	<ul style="list-style-type: none"> Structurally Reinforced Polymers 	<ul style="list-style-type: none"> Vibration damping TPEs Soft touch TPEs 	<ul style="list-style-type: none"> Camouflage Custom colors IR masking Pre-colored formulations 	<ul style="list-style-type: none"> Process optimization
Projectiles				
Bullets	<ul style="list-style-type: none"> Lead replacement Engineered resins Nylon 	<ul style="list-style-type: none"> Thermoplastic urethanes 	<ul style="list-style-type: none"> Ballistic tip fluorescent colors/phosphorescent 	
Shotgun Shells Wads Buffer	<ul style="list-style-type: none"> Polyethylene 		<ul style="list-style-type: none"> Biodegradable custom colors 	<ul style="list-style-type: none"> Performance improving additives

Source: PolyOne

Fit: Improving Productivity with Better Assemblies

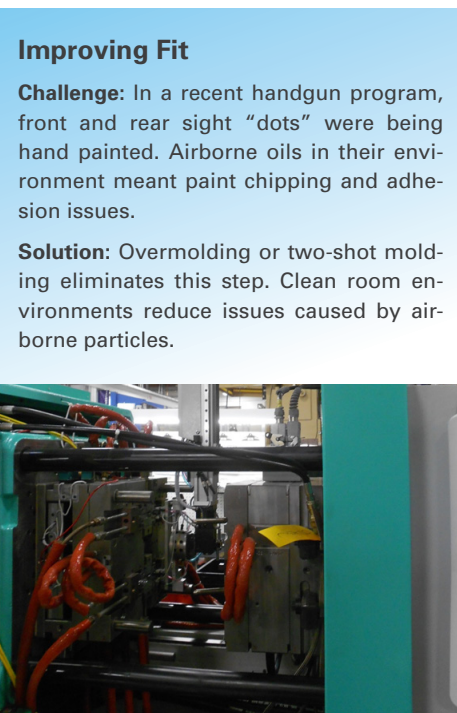
Seamless alignment is key to high performance firearms and to your productivity and profits. Working with an injection molding partner that can provide both prototype and volume production, and also manufacture the optics involved in scopes, results in more complete sub-assemblies.

Single source molding for both opaque and optical parts can improve fit of finished assemblies.

Advanced Automation

The use of robotics helps ensure more cost-effective and precise plastic production. Appropriate implementation of automation can:

- Eliminate human error
- Cut down production time
- Reduce injection molded assembly costs
- Improve process repeatability



Summary: The Benefits of Polymer

Polymer has quickly become the standard material from which firearms and their accessories are made. It is lightweight, impervious to corrosion, durable, can take almost any shape, and is less expensive to make.

1. **Lighter weight** — Polymer frames make handguns much lighter and more desirable for concealed carry.
2. **Reduced recoil** — Polymer materials are less rigid than steel and are capable of compression. When a round is fired and the slide impacts the frame, a polymer frame will compress and absorb felt recoil.
3. **Resistance to moisture** — If a steel gun is left in an area with substantial moisture, rust will quickly set in and compromise the frame. Polymer materials will never rust.
4. **Lower cost** — In most cases, polymer frame handguns are cheaper than steel frame handguns. An exception would be HK pistols, which are quite expensive.
5. **Serviceability** — In some polymer frame handguns made today, the rails can be replaced after thousands and thousands of rounds of use.

ABOUT EMPIRE PRECISION PLASTICS

Empire Precision (<http://www.empireprecision.com>) has a 20-year legacy of partnership with its customers in solving their most challenging injection molding problems. Empire provides firearms manufacturers with plastic molded parts and assemblies, from prototype to high volume manufacturing and assembly. Their comprehensive in-house capabilities allow for faster time-to-market and better finished quality, improving profit margins for their customers.

Empire molds precision firearm components such as:

- Grip / frame
- Upper & lower receiver
- Trigger
- Safety
- Trigger guard
- Back strap
- Slide cover
- Magazine floor plate
- Follower
- Magazine assembly

[Learn More](#)

Empire Precision Plastics is certified to ISO 9001:2008 quality management standards, ITAR registered, and Federal Firearms Licensed, # 6-16-055-07-6F-03014.

To learn more about how Empire's advanced technology and disciplined approach can benefit your firearms program, **contact us at info@empireprecision.com**.

If you're frustrated with the quality of your molded parts, **request a no-cost evaluation**.

[Request Troubleshooting](#)

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