

## Plastic Injection Molding with Align Manufacturing

### Step 1: Product Design

- **Begin with a CAD File:** Create a detailed CAD file of your product. Ensure the design meets the specifications for injection molding, including:
  - **Consistent Wall Thickness:** Prevent warping by maintaining uniform wall thickness.
  - **Draft Angles:** Add slight angles to vertical walls for easy ejection from the mold.
  - **Functional Features:** Incorporate practical elements such as:
    - **Bosses** for threaded inserts or fasteners.
    - **Ribbing** for structural reinforcement without increasing material usage.
    - **Living Hinges** for flexibility.
    - **Snap-Fit Joints** for assembly without additional hardware.
  - **Avoid Design Pitfalls:** Steer clear of sharp corners, random holes, undercuts, or sudden shape changes that may cause defects.

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### Step 2: Material Selection

- **Choose the Right Resin:** Select the plastic material that aligns with your product's application. Common considerations include:
  - **Strength:** For durable parts, use materials like ABS or polycarbonate.
  - **Flexibility:** Opt for polypropylene for flexible designs.
  - **Chemical Resistance:** Use polyethylene for exposure to harsh chemicals.
  - **Heat Resistance:** Consider engineering-grade resins for high-temperature applications.

*Align Manufacturing can provide recommendations based on your product's requirements and intended use.*

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### Step 3: Mold Design

- **Plan for Efficiency:** Create a mold design that includes:
  - **Cavities:** Number of cavities to determine production speed.
  - **Sprues, Runners, and Gates:** Channels that direct molten plastic into the mold cavity.
  - **Ejector Systems:** Mechanisms to safely remove the part from the mold.
- **Design for Durability:** Ensure the mold material, typically tool steel, can withstand high production volumes.
- **Incorporate Feedback:** Get detailed blueprints and approvals to ensure the mold meets expectations before production begins.

*Note: Mold design and manufacturing can take up to 20 weeks, so plan accordingly.*

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### Step 4: Prototyping and Testing

- **Create Prototypes:** Before committing to full-scale production, consider prototyping using:
  - **3D Printing:** For rapid, low-cost iterations.
  - **Soft Molds:** For low-volume production and testing.
- **Test for Functionality:** Evaluate prototypes for fit, function, and potential design improvements.
- **Refine as Needed:** Incorporate feedback to optimize your design before creating the final mold.

## Step 5: Tooling Mold Manufacturing

- **Collaborate with Experts:** Allow skilled machinists like Align Manufacturing to create your mold with precision. The mold will include:
  - Cavities for shaping the part.
  - Sprues, runners, and gates for plastic flow.
  - Ejector systems for smooth part removal.
- **Account for Lead Time:** Tooling can take several months. Proper planning ensures production starts on schedule.

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## Step 6: Production Setup

- **Injection Molding Machine Calibration:** Align Manufacturing configures the machine to match your mold's specifications, including:
  - Temperature settings for the material.
  - Injection pressure and speed.
  - Cooling times to maintain part consistency.
- **Material Loading:** Load the selected resin into the machine's hopper.

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## Step 7: Production Run

- **Start the Process:** Begin injection molding with continuous monitoring of the production line.
- **Quality Assurance:** Align Manufacturing inspects parts for defects such as warping, sink marks, or flash. Adjustments are made as needed to maintain consistent quality.
- **High-Volume Production:** Take advantage of multi-cavity molds to produce parts quickly and efficiently.

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## Step 8: Post-Processing

- **Trimming and Deburring:** Remove excess material such as flash from the finished parts.
- **Finishing Options:** Apply finishing techniques such as painting, plating, or texturing to enhance appearance and functionality.
- **Assembly (if required):** Combine parts or add features like inserts.

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## Step 9: Delivery and Support

- **Packaging and Shipment:** Align Manufacturing ensures your finished parts are securely packaged for delivery.
- **Ongoing Support:** Receive continued assistance for future orders, mold maintenance, or design updates.

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