FIRSTMOLD
FIRST YOUR NEED • MOLD YOUR PART

FAQ

INJECTION MOLDING

TOP 20 QUESTIONS FOR BUYERS & ENGINEERS

Contents

1. Is injection molding suitable for low-volume production?

Yes. Injection molding is not limited to high-volume production. With an appropriate tooling strategy, it can also be economically viable for pilot runs and low-volume production. Three factors make this possible:

- **Rapid tooling:** Rapid tooling uses a simplified mold structure and manufacturing process to reduce tooling cost and lead time.
- **Tool material selection:** Aluminum can be machined quickly, while pre-hardened P20 steel provides greater wear resistance and a longer service life.
- **Standardized master mold base:** A standardized mold base can be reused across multiple projects. Only the product-specific core and cavity inserts need to be manufactured, reducing material use and machining time.

Before investing in production tooling, prototype and market validation are recommended to confirm the design, functionality, and demand. Once both have been completed, the tooling solution can be selected based on the planned production volume and required mold life.

Typical Manufacturing Routes by Project Stage and Production Volume

Project Stage	Recommended Route	Typical Quantity Range
Appearance validation	3D Printing	1–50
Functional validation	CNC Machining	1–100
Pre-production testing	Vacuum Casting	10–100
Low-volume production	Rapid Tooling	100–10,000
Mass production	Steel Production Tooling	5,000+

► **RELATED VIDEO**: Low-Volume Injection Molding Explained

2. Should the mold maker and injection molding supplier be the same company?

Not strictly required, but generally recommended. An integrated mold-making and injection molding supplier is often a lower-risk option for complex, tight-tolerance, or time-sensitive projects. Tooling and molding teams can jointly resolve part defects, while single-point responsibility reduces supplier disputes, mold transfers, repeated process setup, and cross-supplier maintenance.

If tooling and molding are handled separately, align in advance on molding-machine compatibility, mold-trial and sample-acceptance criteria, technical documentation, and post-transfer warranty and repair responsibilities.

How First Mold Helps:
First Mold is an integrated mold-making and injection molding supplier, covering DFM, tooling, mold trials, production, and quality inspection within one workflow.

3. How Can a Supplier's Capacity, Certifications, and Factory Management Be Verified Remotely?

Remote evaluation should not rely solely on certificate copies or promotional videos. Verify the supplier through three types of evidence:

Verify certifications independently : Check the issuing certification body or IAF CertSearch. Confirm the legal entity, factory address, applicable standard, certification scope, and validity.

Assess actual production capacity : Review machine models, clamping-force range, shot capacity, available shifts, machine utilization, current production load, and maintenance records.

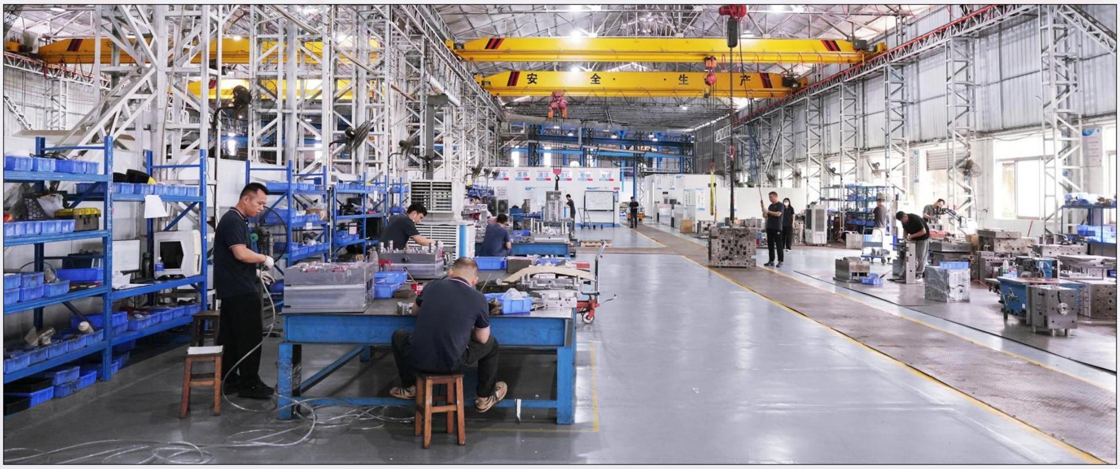
Inspect factory operations remotely : Use a live video walkthrough rather than edited footage. Review machine nameplates, production areas, material and mold storage, 5S practices, machine guarding, fire exits, PPE use, and forklift–pedestrian separation.

Verification Example: First Mold

Certification	Certificate Number
ISO 9001:2015	135335
ISO 13485:2016	134573
ISO 14001:2015	133691
ISO 45001:2018	133692

Verify applicable certificates: IAF CertSearch
View production equipment: First Mold Equipment List

Certificate status, validity, and scope can be verified through the relevant certification body or accreditation database.



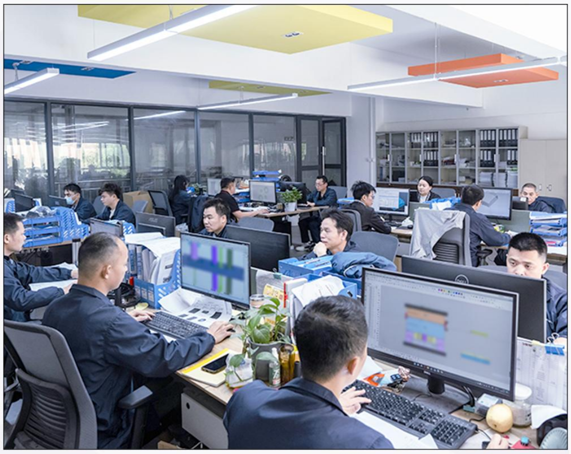
4. What Information Is Needed to Request an Initial Mold and Production Quote?

An initial quotation normally requires three types of information:

- **Part design:**
A 3D CAD model is preferred. If no 3D model is available, First Mold can create one from a physical sample through 3D scanning or reverse engineering.

- **Material:**
Provide the intended resin type or grade.

- **Quantity:**
State the initial order quantity.



Any known cost-sensitive requirements, including tight tolerances, cosmetic textures, inserts, or secondary operations, should also be stated during the initial inquiry.

If neither a 3D model nor a physical sample is available, the product design must be completed before the tooling price can be finalized. DFM review is performed after a product design or 3D model is available.

5. What Determines Mold Cost and Part Price?

Mold cost is generally an upfront, one-time investment determined mainly by mold size, cavity count, tool steel, expected mold life, runner system, tolerances, surface requirements, and manufacturing complexity.

Part price is a recurring per-unit charge influenced by resin type and part weight, molding-machine size, cycle time, cavity output, order quantity, scrap rate, labor, inspection, packaging, and secondary operations. Depending on the quotation structure, the part price may also include an amortized portion of the mold cost.

When comparing quotations, confirm whether the mold cost is listed separately or amortized into the part price to avoid double counting.

6. When Does a Multi-Cavity Mold Reduce the Effective Unit Cost?

A multi-cavity mold reduces the effective unit cost only when the projected lifecycle volume exceeds the break-even volume and the cumulative savings from the lower part price offset the additional upfront tooling investment.

Multi-cavity tooling is generally more suitable under the following conditions:

High and stable demand :
The estimated annual usage (EAU) and total lifecycle volume are sufficient to amortize the higher tooling investment.

Substantially frozen product design :
The risk of subsequent design changes is low, as modifications must generally be repeated across multiple cavities, increasing both cost and workload.

Suitable part geometry :
The part size and geometry allow a balanced cavity layout, runner system, and cooling design.

Machine capacity is sufficient :
Shot capacity, clamping force, tie-bar spacing, and platen size meet the mold requirements without offsetting the cost savings.

Calculation formula:

Effective unit cost = Tooling cost / Expected lifecycle volume + Part price excluding tooling amortization

Break-even volume = (Multi-cavity tooling cost - Lower-cavity tooling cost) / (Lower-cavity part price - Multi-cavity part price)

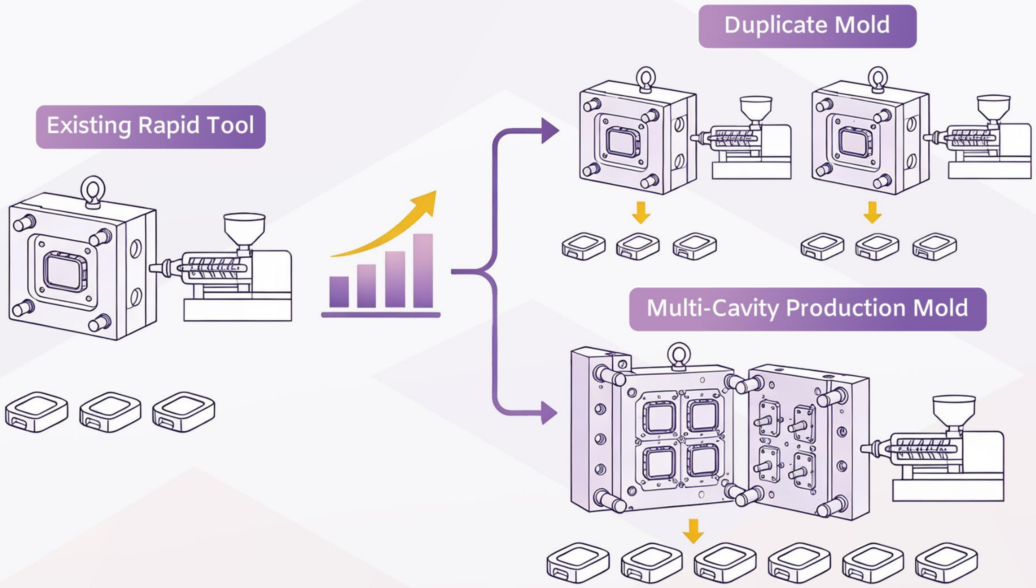
7. Can the initial mold support future production growth?

Not necessarily. Molds have inherent physical limitations. Aluminum rapid tooling generally cannot be directly “upgraded” into high-life steel production tooling. Repairs, surface treatments, and replacement of wear components may temporarily extend tool life, but they cannot overcome these fundamental limitations. Converting a single-cavity mold into a multi-cavity mold is also difficult because the mold base, runner, cooling, and ejection systems typically require redesign.

If demand increases unexpectedly, a new mold should be built while the existing mold remains in production, with sufficient time allowed for mold trials, sample approval, and process validation. There are two common options for long-term capacity expansion:

Duplicate the existing mold :
Add capacity quickly using the validated design.

Build a multi-cavity production mold :
Increase output per cycle and reduce unit cost for stable, long-term demand.



8. When Is a Backup Mold or Duplicate Tool Necessary?

A backup mold, duplicate tool, or critical spare components should be considered when a single mold cannot meet capacity requirements or when mold downtime could create significant supply risk. Common situations include:

Capacity and mold life :
Demand exceeds the stable capacity of one mold, or the mold is approaching its design life while production must continue.

Supply continuity :
The part cannot be quickly replaced, and mold repair or unplanned downtime could disrupt production or delivery.

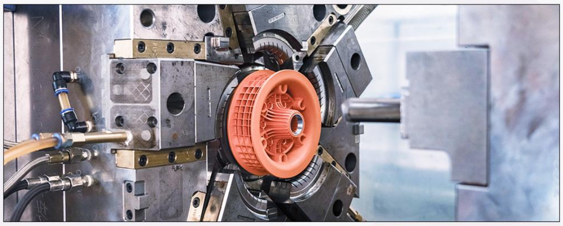
Regional production :
The same part must be produced in different factories or regions to support localized delivery and reduce supply risk.

A complete duplicate tool is not always necessary. If the main risks involve cores, cavities, slides, or hot-runner components, spare inserts and wear parts may be sufficient. Before production release, a duplicate tool should undergo a separate mold trial to confirm that part dimensions, appearance, and performance remain consistent with those produced by the original mold.

First Mold can draw on its manufacturing capabilities in China and Mexico to evaluate duplicate tooling, backup molds, and regional production strategies.

9. When Should Two-Shot Molding, Insert Molding, or Overmolding Be Considered?

These processes are suitable when multiple materials, colors, or preformed components must be integrated while reducing fastening, bonding, or secondary assembly:



- **Two-shot molding :** Two materials are injected sequentially in one molding cycle.
- **Insert molding :** Plastic is molded around a pre-positioned component.
- **Overmolding :** A secondary material is molded over an existing substrate.

They should be evaluated before tooling begins because they affect part design, materials, equipment, automation, and cost. For low-volume or evolving designs, conventional molding followed by assembly may be more flexible.

The following table provides a preliminary comparison:

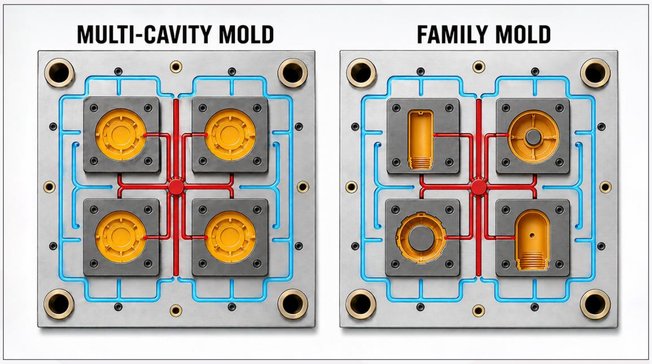
Comparison	Two-Shot Molding	Overmolding	Insert Molding
Material combinations	Rigid + rigid plastic; rigid plastic + soft material	TPE or TPU + rigid substrate	Plastic + metal, ceramic, or plastic insert
Bonding	Adhesion or mechanical interlock	Adhesion or mechanical interlock	Encapsulation, holes, knurls, or undercuts
Equipment	Multi-component machine and dedicated mold	Conventional machine; typically two-stage molding	Conventional machine with insert loading
Efficiency	Efficiency Generally higher	Lower due to secondary handling	Depends on insert loading
Key requirements	Material compatibility and transfer accuracy	Adhesion, cleanliness, and substrate heat resistance	Insert positioning, thermal expansion, and residual stress
Main advantage	Less handling and assembly	Added grip, sealing, cushioning, or insulation	Stronger connections with less assembly

10. When Is a Family Mold Appropriate?

A family mold produces different parts in one mold, such as an upper housing, lower housing, and battery cover. It can reduce tooling investment when the parts are required in fixed ratios.

Differences in part size, wall thickness, flow length, and cooling requirements may cause filling imbalance, warpage, or dimensional variation. Because all parts share the same molding conditions, individual dimensions are difficult to adjust independently.

Dedicated molds are preferable for high volumes or tight tolerances. For high-volume production of one part, a multi-cavity mold with identical cavities is generally more suitable.



The following table provides a preliminary comparison:

Comparison	Family Mold	Multi-Cavity Mold
Cavities	Different parts	Identical parts
Main purpose	Lower tooling investment	Higher output
Output	Parts in fixed ratios	Multiple identical parts per cycle
Flow and cooling	Harder to balance	Easier to balance
Dimensional control	Limited individual adjustment	Better cavity consistency
Best for	Matched parts, low–medium volumes	One part, medium–high volumes
Main risk	Demand imbalance and dimensional variation	Cavity-to-cavity variation

11. How Can Recycled Resin Be Used for Injection-Molded Parts?

Where product requirements permit, recycled resin may partially or fully replace virgin resin in housings, brackets, packaging components, and other suitable molded parts. The appropriate recycled content should be determined based on material source, part function, appearance requirements, and applicable regulations.

Before production, confirm:

- Resin grade, source, and recycled content
- Material properties, color, and lot-to-lot consistency
- Dimensional, cosmetic, mechanical, and functional requirements
- Required material documentation, traceability records, and certification scope

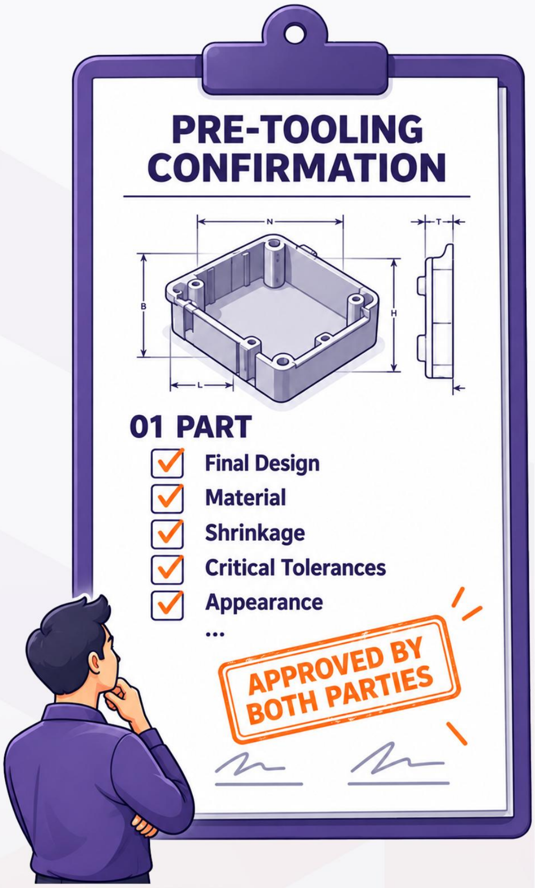
Recycled resin may differ from virgin resin in flow behavior, shrinkage, and color. Molding trials or pilot production may therefore be required to establish suitable process parameters and verify that the finished parts meet the acceptance criteria.

If Recycled Claim Standard (RCS) certification is required, the applicable recycled-content and supply-chain traceability documents should be verified. RCS supports recycled-content claims and chain-of-custody verification but does not replace part-performance or regulatory validation.

12. What should be agreed upon before mold manufacturing starts?

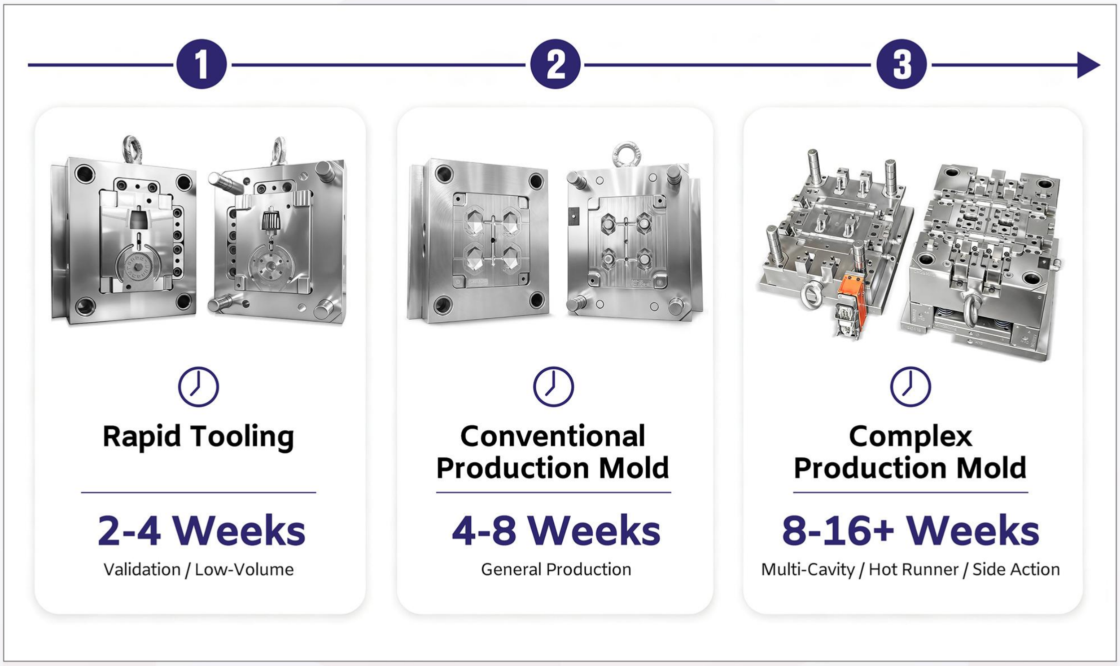
Before tooling begins, confirm the final design, material and shrinkage, critical tolerances, appearance, cavity count, tool material and life, machine compatibility, and sample acceptance criteria. Later changes may affect the mold structure, cost, and lead time.

At First Mold, mold ownership transfers to the customer after full payment. Shared mold bases and customer-specific cores and cavities are treated separately. Inactive molds are generally stored for three years before further instructions are requested. Routine maintenance and normal-wear repairs are free within the agreed mold life; design changes and abnormal damage are evaluated separately.



13. How long does it normally take to build an injection mold?

Mold lead time is generally calculated from the approval of the final product data and tooling design. Rapid tooling typically takes 2–4 weeks and is commonly used for design validation, bridge production, and low-volume manufacturing. Conventional steel production molds generally require 4–8 weeks, while multi-cavity, hot-runner, or complex side-action molds may require 8–16 weeks or longer.



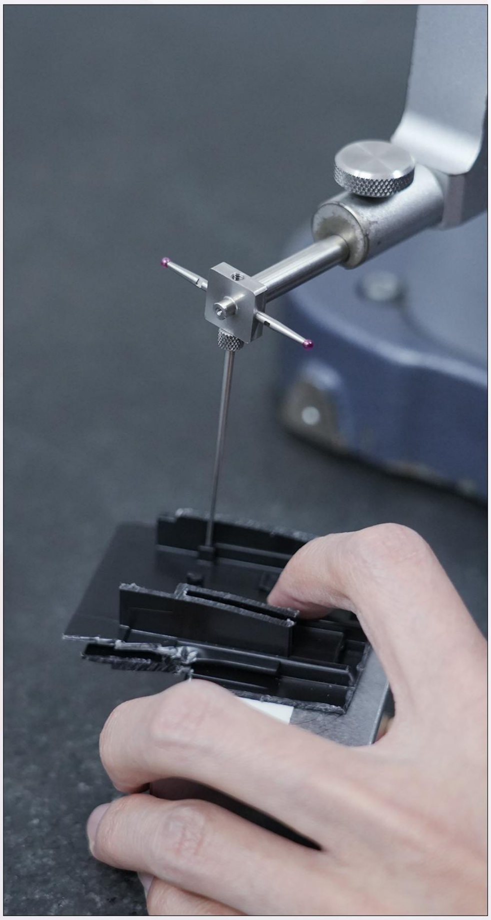
Additional time should be allowed after the initial mold trial for corrections, sample approval, and process validation. If the required number of molding cycles exceeds the agreed tool life, steel production tooling should be considered, or mold duplication and replacement should be planned in advance. Manufacturing defects under the agreed operating conditions are generally the mold maker’s responsibility. Design changes, abnormal damage, and repairs arising from materials or processes outside the agreed scope are evaluated separately.

SPI Mold Classes for Molds Below 400-Ton Clamping Force：

SPI Mold Class	Reference Mold Life (Molding Cycles)	Typical Application	Tool Construction and Materials
Class 101	＞1,000,000	High-volume production	Hardened tool steel with replaceable wear components
Class 102	≤1,000,000	Medium- to high-volume production	Hardened tool-steel cores and cavities
Class 103	< 500,000	Medium-volume production	Pre-hardened P20, 718H, or equivalent
Class 104	＜100,000	Low-volume production	Mild steel, aluminum, or pre-hardened steel
Class 105	＜500	Prototype production	Aluminum, soft steel, or prototype-grade materials

14. How Should Trial Samples Be Evaluated and Approved?

Trial samples should be produced using the specified material under documented and confirmed molding conditions. For multi-cavity molds, samples from each cavity should be identified separately and compared for critical dimensions, weight, appearance, and function. Evaluating only one cavity is insufficient.



Trial samples should be evaluated at three levels: appearance, dimensions, and function. Appearance inspection should cover sink marks, flash, gas marks, weld lines, and specified surface finishes such as polishing or texture. Dimensional verification should reference the 2D engineering drawing and the First Article Inspection (FAI) or full-dimensional inspection report, with particular attention to critical mating dimensions and geometric tolerances. Functional testing may include assembly, screw fastening, sealing, load, or drop testing, as applicable.

Once the samples meet the agreed appearance, dimensional, and functional requirements, they may be jointly signed and approved by the customer and manufacturer as Golden Samples. These samples serve as approved physical references for production appearance and assembly. Where acceptable appearance limits must be defined, separate Boundary Samples should be approved.

First Mold and the customer typically retain one approved sample set each, identified by part number, revision, cavity number, and approval date. These samples are used for first-piece and production inspections but do not supersede engineering drawings, dimensional specifications, or formal quality documents.

15. What Should Be Verified During a Mold Trial Beyond Producing Acceptable Samples?

Producing an acceptable-looking sample does not mean that the mold has been fully validated. A mold trial should also verify:

- **Process stability**
- **Mold movements**
- **Cavity balance**
- **Hot-runner performance**
- **Venting and cooling**
- **Continuous operation**

Trial records should document the resin, machine, key process parameters, identified issues, and corrective actions. Both part quality and mold operation must be approved before production validation.

Mold Trial Validation

Good Sample ≠ Validated Mold

Process Stability
Repestable ill, V/R, pressure cushion

Cavity Balance
Consistent short shot paltem, weight, dimensions

Cooling & Venting
No bums, air traps, leaks of hot spots

Mold Movements
Electors, slides, liiters, sensors run reliably

Hot Runner
Zones, heaters, thermocouples, valve pins work conectty

Continuous Run
Target cyole time, no flesh or unplanned stops

16. How Is the Required Injection Molding Machine Size Determined?

An injection molding machine should not be selected based on clamp tonnage alone. The following factors should also be evaluated:

- **Projected area and clamp force:**

Calculate the required clamp force from the total projected area of the parts and runner system, estimated cavity pressure, and an appropriate safety factor.
See: Clamping Force Calculation.

- **Shot capacity and screw size:**

The total shot weight includes all molded parts and the cold runner. It should generally represent 20%–80% of the machine's available shot capacity. If capacity is rated in polystyrene equivalent, apply the resin-specific density or conversion factor provided by the machine manufacturer.

- **Injection pressure and plasticizing capacity:**

The machine must provide sufficient pressure and injection rate to overcome losses through the nozzle, runner, gates, and cavities. Plasticizing and screw recovery must also be completed before the next cycle. See: Injection Speed and Injection Pressure.

- **Mold fit:**

The mold must fit within the tie-bar spacing, platen dimensions, and permitted mold-height range. Mounting holes, lifting clearance, and robot access should also be checked.

- **Opening and ejection strokes:**

The opening stroke must provide sufficient clearance for part and runner removal. Three-plate, unscrewing, and long core-pull molds require additional movement allowance. The ejection stroke must fully release the part from the core.

- **Machine interfaces:**

Confirm compatibility with the locating ring, nozzle, cooling connections, hot-runner control zones, and hydraulic or pneumatic core-pull systems.

An undersized machine may be unable to accommodate the mold or fill the cavities consistently. An oversized machine may result in low shot utilization, excessive resin residence time, and unnecessary energy and production costs. Final machine selection should consider the mold design, resin characteristics, and target cycle time.

17. Can a Validated Molding Process Be Transferred Directly to Another Machine?

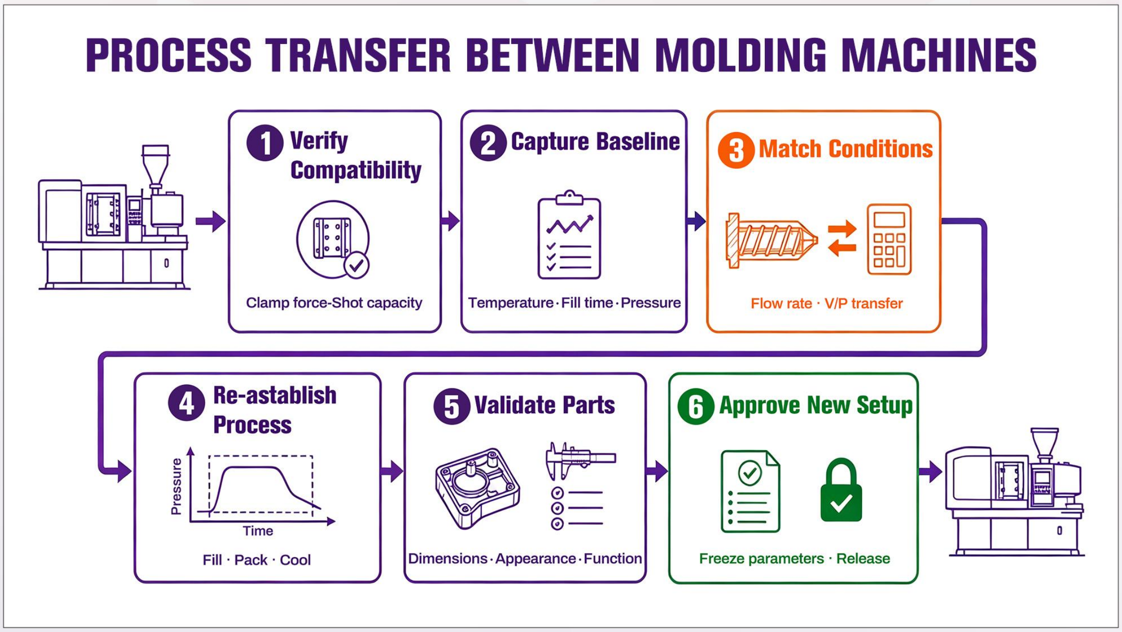
Machine settings cannot be copied directly. Even between machines of the same tonnage, differences in screw diameter, shot capacity, pressure calculation, plasticizing capacity, control response, and machine condition may produce different molding results.
Before process transfer, verify:

Machine and mold compatibility: Mold dimensions, clamp force, shot capacity, mold-opening and ejection strokes, nozzle interface, cooling connections, and hot-runner controls.

Actual process conditions:
Melt and mold temperatures, fill time, V/P transfer position, injection pressure, cushion, part weight, and cycle time.

Part revalidation:
After establishing new machine settings, conduct a continuous trial run and recheck part dimensions, appearance, weight, and functional performance.

Production on the new machine should begin only after the process and parts meet the original acceptance criteria.



18. How Is Consistent Part Quality Maintained During Production?

Long-term consistency requires control of CTQs and process trends, not final inspection alone. Key controls include:

Control plan:
Define CTQs, inspection methods, sampling frequency, control limits, and reaction plans.

Process-window control:
Document approved parameters and restrict unauthorized changes.

First-piece and in-process inspection:
Verify parts after startup or authorized changes, then inspect according to the control plan.

SPC monitoring:
Track critical dimensions, part weight, fill time, V/P transfer, peak pressure, and screw cushion.

Cavity-level tracking:
Monitor each cavity separately to identify localized variation.

Measurement-system verification:
Calibrate inspection equipment and use MSA or Gage R&R where required.

Abnormal trends should trigger the defined reaction plan. Any process adjustment must be authorized and verified.

19. How Should Nonconforming Parts Be Controlled and Traced?

When nonconforming parts are detected, release of the affected lot should be suspended immediately. Suspect parts must be identified and segregated to prevent mixing or unintended use. Traceability should extend from the last verified conforming inspection point through work-in-process, finished inventory, and shipped lots.

The investigation should review:

- Resin grade, material lot, drying conditions, and regrind ratio
- Molding machine, mold ID, cavity number, shift, and operator
- Process parameters, cycle time, and equipment alarm history
- First-piece, in-process, and outgoing inspection results
- Mold repair, machine maintenance, and process-change records

Affected parts should be sorted, reworked, accepted under concession, or scrapped as approved. Production may resume only after corrective actions are verified.

Responsibility should follow the confirmed root cause and agreed scope. Containment, traceability, disposition, and verification records should be retained.

20. How Should an Injection Mold Be Maintained During Production?

Mold maintenance directly affects part quality, operating stability, and service life. Maintenance programs are commonly divided into three levels based on accumulated molding cycles:

Routine maintenance : At each shift or before startup, inspect the parting surfaces, cavities, gates, ejector system, slides, cooling connections, and limit switches. Remove residue and contamination, and lubricate moving components as required. Before extended shutdown or storage, clean, dry, and protect the mold against corrosion**.**

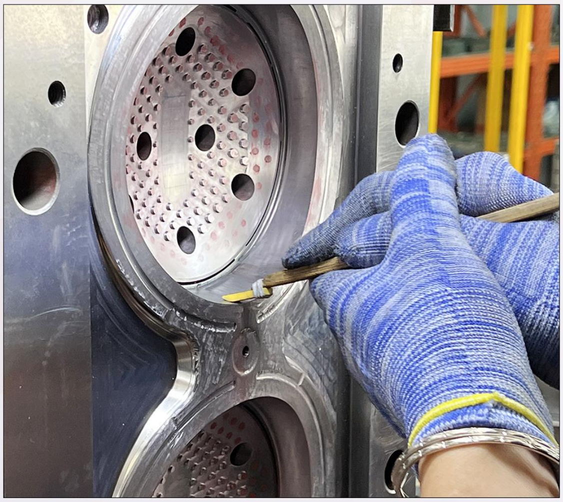
Periodic maintenance (every 20,000–50,000 cycles):

Clean the cavities, cores, and vents. Inspect ejector pins, sleeves, slides, lifters, guide components, and seals for wear. Check cooling-circuit flow, leakage, and blockage.

Major maintenance and overhaul (every 100,000 cycles or more):

Fully disassemble the mold, measure critical inserts, inspect the hot-runner, electrical, and mechanical systems, and replace components approaching their wear limits.

These intervals are general benchmarks and should be adjusted to the resin, mold complexity, operating conditions, and maintenance history. Records should be retained, and major repairs require mold trial and part approval before production resumes.



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Mold Making


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