

Metal Injection Molding

Metal Injection Molding is a process by which metal components are manufactured to net shape by injection molding a powdered metal feedstock. Subsequent to molding, the binders are removed and the components are sintered in a controlled atmosphere.

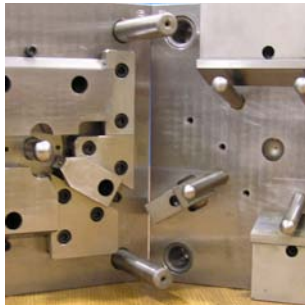
Metal Injection Molding benefits include:

- Manufacturing of complex geometries to net or near net shape.
- Ability to fill thin walls and core out unnecessary areas.
- Opportunity to combine multiple components into one, reducing part and assembly costs.
- Cost reductions due to lower raw material consumption and fewer processing steps (as compared to other conventional manufacturing methods).



What Is Metal Injection Molding?

Metal Injection Molding combines the benefits of plastics injection mold and conventional powder metallurgy.



A mold is manufactured using standard injection mold making techniques.



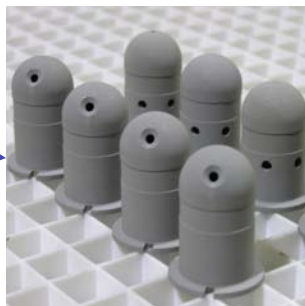
A moldable "feedstock" is compounded by blending fine metal powder with various binders.



Parts are molded using standard injection molding equipment & techniques.



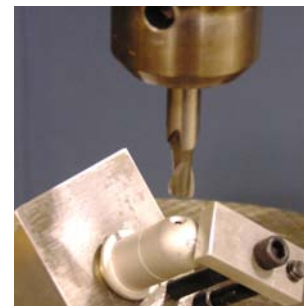
The above picture illustrates the change in size between the as molded and sintered states. This shrinkage of approximately 20% occurs as the metal powder fills the voids left behind by the extracted binders.



The binder is then removed from the molded part (methods vary based on binder system).



The debound parts are then sintered in a controlled atmosphere .

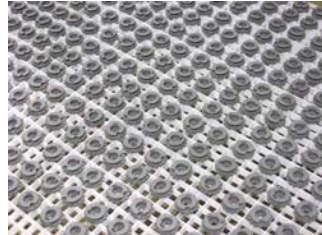


If required, post sintering processes are performed (machining, heat treating, or plating, etc.).

Why Use it?

Cost Savings:

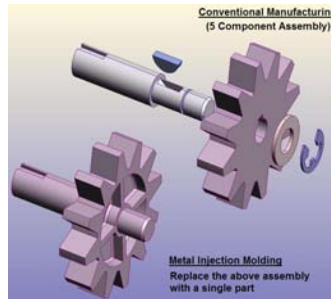
- For small, complex parts, metal injection molding is the lower cost alternative.



- The net shape or near net shape process reduces the consumption of raw materials and the need for costly secondary operations.
- Further cost savings are achieved through proper process capability and lean manufacturing initiatives.

Part Complexity:

- Reduce your part count and assembly costs by combining several existing components into one Metal Injection Molded part.



- Reduce part weight by coring out unnecessary sections. Given MIM's "additive" nature, part costs drop with part weight. Adding such cored features to a machined part would increase machining time, resulting in higher costs.

Design Flexibility:

- Metal Injection Molding has fewer constraints compared to other metal forming processes.



- The design freedoms of the plastics injection and the die casting worlds are now available for high melt temperature metals such as low alloy steels, stainless steels, nickel super alloys, and other exotic metals.
- Creative solutions that were once put aside due to the limitations in machining and casting are now possible thanks to metal injection molding.

Material Usage:

- Unlike machining and casting, MIM produces minimal scrap. The molded feedstock can be reground and recycled without affecting part quality.



- Ideal MIM components usually have a low effective density. Part weight is often much lower than the weight of raw material required to machine the same component from solid.
- The sample part in this picture has an effective density of 33%. In other words, if machined from a solid round bar, 67% of the material would need to be removed.

Design Tips

Metal Injection Molding allows for a high level of part complexity. If machined from solid, this connector would most likely be a two piece assembly.

Features such as keyways and alignment tabs can be easily included.

Engraved lettering or logos can be included. These features can be raised or recesses depending on customer requirements.

A parting line must be selected with all features drafted a minimum 1° away from this parting line (to allow part ejection). If the above limitation is not possible (such as cored holes not in the line of draw), slides or lifters can be included in the mold.

Chamfered lead-ins and rounded edges can be easily added to improve part function. These added features will not affect the part cost and are usually beneficial in reducing molded in stresses.

Allocations must be made for a gate blemish (usually located along the parting line). Injection gates can be trimmed flush after molding but will still be visible post sintering.

Allocations must be made for ejector pin blemishes. These ejector pin marks are usually recessed up to a maximum of 0.25mm.

Non-functional areas should be cored out to reduce part weight and maintain uniform wall sections. Constant walls reduce molded in stresses, ensure uniform shrinkage, and reduce the risk of post sintering distortion.

