METAL INJECTION MOLDING

Design Guidelines

Accompanying DSB's expansive sintering capacity on the production floor, the New Technology Center houses a state-of-the-art automated molding facility to drive efficient Metal Injection Molding (MIM) operations for your most complex metal components.

MATERIAL AVAILABILITY

Material options for MIM include but are not limited to the below:

- 17-4 PH
- SS 304
- 4140
- S7
- SS 316L
- SS 420
- 4605

Various other standard materials are available, along with engineered custom grades. DSB offers low temperature materials and precious metals for the MIM process as well.

Expect material properties to be aligned with or exceed the MPIF Standard 35 for Metal Injection Molding.

Note: Consult w/ DSB engineers and metallurgists for custom material options.

GENERAL TOLERANCES

- **Basic Dimensions: As sintered**
  - General rule of thumb is ± 0.5% of nominal feature size. Features less than 0.25" DSB can hold ± 0.001".
- **GD&T-Position: As sintered**
  - 0.004" for a length up to 0.40"
  - 0.008" for a length up to 0.80"
  - For features with a length 1.25" and beyond consult the DSB Engineers for as sintered tolerance
- **GD&T-Flatness: As sintered**
  - 0.002" for a length up to 0.40"
  - 0.004" for a length up to 0.80"
  - For features with a length 1.25" and beyond consult the DSB Engineers for as sintered tolerance
- **MIM plus Machining**
  - Any feature on a MIM part can be finish machined to meet drawing dimensions. Consult w/ DSB for details on the tightest achievable tolerance.

Note: Other GD&T callouts are dependent on part configuration in the tool, consult w/ DSB for details on achievable tolerances as sintered.

PART WEIGHT

- **Weight Range**
  - Less than 1 gram to over 100 grams

Note: The sweet spot for MIM part weight is typically from 1 to 30 grams

WALL THICKNESS FOR MIM COMPONENTS

- **Minimum Wall Thickness**
  - 0.020" for a length up to 0.400"
  - 0.030" for a length up to 2.000"
  - 0.040" for length going beyond 2.000"
- **Maximum Wall Thickness**
  - Roughly 0.30" or about 8mm

Note: Ideal wall thickness is about 0.040" to 0.160" or 1mm to 4mm

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MIM SURFACE ROUGHNESS

- **As Sintered**
  - Roughly 1.0 - 1.2 micrometer Ra (Or up to ~50 microinch Ra)
- **Plus Finishing**
  - Roughly 0.8 – 0.9 micrometer Ra (Or up to ~36 microinch Ra) or less

Note: Additional surface finishing techniques can bring the surface roughness even lower as needed.

ADDITIONAL GENERAL DESIGN GUIDELINES FOR MIM

- **General Design Principles**
  - In general, the same design principles used for plastic injection molding will apply for MIM. If the part can be molded with plastic, it can be molded with metal with help from DSB. E.g. undercuts, grooves, assembly consolidations, ribs, etc.
- **Corner Radius**
  - Recommended to use 0.003" minimum, 0.005" minimum for inside radii. Using a large corner radius where feasible helps for the molding and sintering process. Sharper radii can be achieved through secondary machining.
- **Tooling Features**
  - Certain features from the MIM tooling may be present on the parts, including gate, parting line and ejector pin marks. DSB will indicate such tooling features during the quoting process.
- **Flat Surfaces**
  - Design with a flat surface when possible for ease of sintering.
- **Uniform Wall Thickness**
  - Uniform wall thickness is preferred, but not required. Consider coring out thick areas.
- **Others**
  - Several features can be produced in the MIM tool, such as logos, text, texturing, and threads up to a length of 0.20".

Note: Any additional questions on design for MIM can be answered by the engineers at DSB.

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