INDO-MIM®

COMPLEXITY SIMPLIFIED

MIM DESIGN GUIDELINES-REFERENCE DOCUMENT

/company/indo-us-mim-tec-pvt-ltd

/indomim

infohq@indo-mim.com

infous@indo-mim.com

infoeu@indo-mim.com

infocn@indo-mim.com

INDO-MIM®
COMPLEXITY SIMPLIFIED

MINIMUM WALL THICKNESS

Material	Minimum Wall Thickness
SS17-4PH / SS316	0.15 to up to 5mm length (0.006" up to 0.20" length)
	0.15 to 0.3mm Up to 10mm length (0.006" to 0.012" up to 0.20" length)
	>0.3mm Up to 20mm length (> 0.012" up to 0.80" length)
	≥0.5mm Up to 150mm length (>0.020" up to 6" length)
SS420	≥0.35mm Up to 20mm length (>.014" up to 0.80" length)
	≥0.5mm Up to 150mm length (>0.020" up to 6" length)
Titanium & F-75	≥0.5mm Up to 30mm length (>0.020" up to 1.18" length)
	≥0.75mm Up to 120mm length (> 0.030" up to 5.0" length)
Tungsten Carbide	≥0.3mm wall thickness (0.012" minimum)
	0.30mm to 0.40mm Up to 10mm length (0.012" ~ 0.016" up to 0.40" Length)
88% Ni	≥0.4mm Up to 15mm length (0.016" up to 0.60" length)
	≥0.5mm Up to 70mm length (0.020" up to 2.75" length)

Note : Maximum wall thickness ~ 8 mm (0.30"). Sweet spot is 1.0 ~ 4.0 mm (0.04" ~ 0.16")

DIMENSIONAL TOLERANCES

Condition	Dimensional Tolerances achievable
As sintered (no secondary finishing)	+/-0.3% of Basic dimension from 5mm to 150mm (0.20" ~ 6.0")
	+/-0.5% of Basic dimension Up to 5mm (0.20")
	All non-critical tolerance unspecified dimensions can follow ISO 2768-M
Hole Dimensions As MIM + Reaming	0.025mm up to Ø 5 mm hole (0.001" up to Ø 0.20")
	0.030mm up to Ø 5 mm to 12 mm hole (0.0015" on Ø 0.20" ~ Ø 0.50")
	0.040mm above Ø 10 hole (0.0016" above Ø 0.40")
Hole Dimensions As MIM + Reaming + Honing	Up to 0.012 mm for any diameter hole size (0.0005" on any diameter hole)
MIM + Machining	Any machining can be done on MIM parts to achieve the tolerances as per print specifications. Minimum tolerance achievable after machining is 0.012 mm (0.0005")

Note : To get maximum advantage of the MIM process stay within as MIMed tolerance where feasible.

WEIGHT RANGE FOR MIM COMPONENTS

	Weight Range	Type of molding machine
Minimum Part Weight	0.05 gms to 150gms	Regular MIM molding machine
	0.010gms to 0.05 gms	MIM Micro Molding Machine

MIM GEAR TOLERANCES

Gear Class	Gear tolerance achievable in MIM
AGMA 5.0	Up to Major Ø 50 mm (Major Ø 2.00")
AGMA 6.0	Up to Major Ø 20 mm (Major Ø 0.80")
AGMA 7.0	Up to Major Ø 10 mm (Major Ø 0.40")

INDO-MIM®
COMPLEXITY SIMPLIFIED

GEOMETRICAL DIMENSIONS & TOLERANCES

Criteria	Achievable tolerances as MIMed without secondary finishing
Flatness	≥0.05mm up to length of 10mm (0.002" up to length of 0.40")
	≥0.10mmup to length of 20mm (0.004" up to length of 0.80")
	≥0.15mm up to the length of 30mm (0.006" up to length of 1.20")
	≥0.2mm up to length of 50mm (>0.008" up to length of 2.00")
Straightness	≥0.040mm up to length of 10mm (0.0015" up to length of 0.40")
	≥0.075mm up to length of 20mm (0.003" up to length of 0.80")
	≥0.10mm up to the length of 30mm (0.004" up to length of 1.20")
	≥0.15mm up to length of 50mm (0.006" up to length of 2.00"
	≥0.30mm up to length of up to 100mm (>0.012" up to length of 4.00")
Position	≥0.10mm Up to 10mm length (>0.004" up to length of 0.40")
	≥0.20mm Up to 20mm length (>0.008" up to length of 0.80")
	≥0.3m Up to 30mm length (0.012" up to length of 1.20")
	≥0.40mm Up to 50mm length (0.016" up to length of 2.00")

Note: Other GD&T like symmetry, Cylindricity, Parallelism etc. are tool & dependent and dependant on product configuration. INDO-MIM can provide feedback on achievable as MIMed tolerances based on your prints.

DRAFT ANGLES CORE & CAVITY

Draft Angle	Feature Size
1° Min	For the Length between 10mm & 20mm (0.40" ~ 0.80")
2° Min	For the Length between 20mm & 30mm (0.80" ~ 1.20")
3° Min	For the Length between 30mm & 50mm (1.20" ~ 2.00")
4° Min	For the Length between 50mm & 100mm (1.20" ~ 4.00")

DRAFT ANGLES HOLE

Draft Angle	Hole Length
1° Min	For the Length between 10mm & 15mm (0.40" ~ 0.60")
2° Min	For the Length between 15mm & 20mm (0.60" ~ 0.80")
3° Min	For the Length between 20mm & 30mm (0.80" ~ 1.20")
4° Min	For the Length between 30mm & 40mm (1.20" ~ 1.60")
5° Min	For the Length between 40mm & 100mm (1.60" ~ 4.00")

CORNER RADIUS (SHARPNESS)

	SS17-4Ph	SS316	SS420	Titanium
As MIM	0.070mm min (0.003" min)	0.050mm min (0.002" min)	0.10mm min (0.004" min)	0.15mm min (0.006" min)

INDO-MIM®
COMPLEXITY SIMPLIFIED

SURFACE FINISH

Condition	Material wise Surface Roughness (Ra) Values			
Material	SS17-4Ph	SS316	SS420	Titanium
As Sintered	Up to 1.20 µm (Up to 48 µin)	Up to 1.00 µm (Up to 40 µin)	Up to 1.20 µm (Up to 48 µin)	Up to 1.60 µm (Up to 64 µin)
As Sintered + Glass bead blast	Up to 0.90 µm (Up to 36 µin)	Up to 0.80 µm (Up to 32 µin)	Up to 0.90 µm (Up to 36 µin)	Up to 1.20 µm (Up to 48 µin)
As Electro polished	Up to 0.70 µm (Up to 28 µin)	Up to 0.50 µm (Up to 20 µin)	Up to 0.80 µm (Up to 32 µin)	-----
As Magnetic tumbled	Up to 0.60 µm (Up to 24 µin)	Up to 0.50 µm (Up to 20 µin)	Up to 0.70 µm (Up to 28 µin)	Up to 1.00 µm (Up to 40 µin)

HARDNESS RANGE (MIM STAINLESS STEELS)

SS17-4Ph				SS316	SS420	Titanium
As Sintered	H900	H1025	H1100			
28HRc Max	36-41HRc	33-38HRc	28-33HRc	100HRB Max	42-48HRc	35HRc Max

Note : MIM Low alloy steels can be heat treated as per customer specifications within the capabilities of the materials.

PLATING/ COATING/ WELDING ETC.

Most MIM materials can be plated (electrolytic OR Electroless) , welded (Laser, Arc OR EB), mechanically worked (crimping or swaging etc.), coated (Teflon , Sodium Stearate etc.).
MIM materials (except Titanium) cannot be anodized.

Consult with INDO-MIM Engineers on specific details

GENERAL DESIGN GUIDELINE SUGGESTIONS

General Plastic Molding design principles apply. If you can mold it in plastic, INDO-MIM can mold the same in metal.
Uniform wall thickness where feasible, maximum wall thickness 8 mm (0.30”). Sweet spot is 0.04” ~ 0.15”.
Allow liberal corner radius , draft angle along the walls in the mold opening/ closing directions where feasible.
Where feasible, leave one flat surface for staging the part during sintering. Inside groves can be as molded with some limitations. Consult INDO-MIM engineers before finalizing design.
As molded logo, text/ numbers / surface texture feasible. 2D Matrix can be laser marked. Threads up to 5 mm size (0.20”) can be as sintered. Beyond 5 mm, threads need to be machined.

INDO-MIM®
COMPLEXITY SIMPLIFIED

MIM MATERIALS

Normal Application-Soft OR through Hardened

- MIM 4605
- MIM 4140
- MIM 4340

Normal Application-Soft OR Case Hardened

- MIM 8620
- MIM 9310
- MIM 4600
- MIM Fe+7%Ni

Wear Resistant Materials

- MIM 52100
- MIM S-7 (Tool Steel)
- MIM M2 (Tool Steel)
- MIM A2 (Tool Steel)

Applications that need fatigue strength

- MIM S-7
- MIM 9310
- MIM Fe+7%Ni

Consider HIPing if the fatigue loading is severe

High temperature applications

- MIM HK-30 (SS310)
- MIM XEV
- MIM SS 440C
- MIM Nimonic 90
- MIM T-400

Stainless Steels

- MIM SS 316
- MIM SS 420
- MIM 17-4PH
- MIM 440 A, B or C
- MIM Ni Free SS
- MIM F75
- Nitronic 60 (anti-galling)

Magnetic Materials

- MIM Fe+3%Si
- MIM 4600
- MIM Fe+50% Ni

Glass to Metal Seal materials

- MIM KOVAR
- MIM INVAR

Aerospace (HIPed)

- MIM Inconel 718 / 625
- MIM 17-4PH / SS 316
- Mar-M

Technical Ceramic

- Alumina 96% & 99.5 % Pure
- Zirconia Density
- YTZ

Tungsten Alloys

- Tungsten Carbide
- Tungsten Nickel Copper alloys

Custom alloys

INDO-MIM can develop any custom alloy. Aluminum, Zinc, Brass (any metal that melts below 1000 deg C) are not feasible through MIM)