

TOLERANCE TABLE

DIMENSION (mm)	MIMECRISA	EPMA (ISO 2768)	INVESTMENT CASTING (D2 P690:2010)	FLATNESS 0.4% of maximum length of the flat surface ALIGNMENT AND CONCENTRICITY Min. 0.1 mm 0.4% of maximum dimension PERPENDICULARITY Min. 0.1 mm 0.5% WALL THICKNESS Min. 0.4 mm ANGULAR ± 30° INTERNAL RADII Min. R0.2 SURFACE ROUGHNESS (without tumbling) Ra < 1.6
<1.5	±0.03			
<3	±0.04	±0.05	±0.12	
3-6	±0.05	±0.06	±0.12	
6-9	±0.06	±0.075	±0.14	
9-12	±0.07	±0.075	±0.17	
12-15	±0.08	±0.075	±0.17	
15-20	±0.10	±0.15	±0.17	
20-25	±0.12	±0.15	±0.20	
25-30	±0.15	±0.15	±0.20	
30-45	±0.18	±0.25	±0.30	
45-60	±0.24	±0.25	±0.30	
>60	±0.5%	±0.5%		

MIM PART (Optimum Feature):

Length:

< 100 mm (< 150 mm on request).

Length/width ratio:

< 5 (for optimum tolerances).

Weight:

Optimum: 0.5-50 grams
(range: 0.10-150 grams /outside on request).

Optimum wall thickness:

1-6 mm (range: 0.5-15 mm).

Batches:

> 5000 for standard MIM part.

High Strength:

As porosity is not interconnected and densities are 96-98 % of solid (see table of materials enclosed).

General Tolerances:

±0.5% (see table).

Heat Treatment and surface treatment:

Almost all are available on casted parts or machined parts from solid.

Remarks: Tighter tolerances can be achieved for a few critical dimensions by improving design with MIMECRISA and by adjusting mould and MIM process.

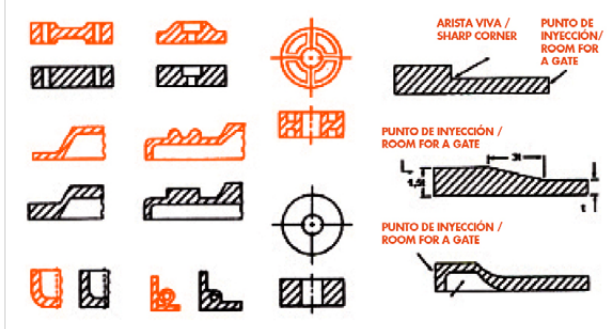
Close tolerance and not optimum design (too long / wide ratio or big wall thickness differences) can need secondary operations.

REGLAS DE DISEÑO DESIGN RULES

Any shape that can be produced in thermoplastic materials by injection moulding can be produced by MIM. There are certain limitations when designing the part and its mould.

- **Uniform wall thickness**, or at least gradual transitions to avoid distortion, internal stress, voids, cracks and sink marks. (Otherwise segregation of the powder and binding system can be produced by poor feedstock flow into the mould).
- **Reduce material excess**, improving tolerances and saving material to reduce cost.
- **Reduce stress concentrations** by using through holes, ribs and radius (>0.2 mm in internal or external corners. Avoiding sharp internal corners and notches will increase the strength of the part.
- **Allow free space for a gate**, consider where it can't be placed, because it will leave a mark. Please state if a positive or negative mark is acceptable to avoid unnecessary additional costs.
- **Place the parting line** in a non critical area as it will leave a mark (best in external corners). Holes are best places parallel or perpendicular to this line.
- **Ejection of the part** from the mould cavity. If possible, include a draft angle or taper from 0.5° to 2° parallel to the ejection axis. Allow a free place for ejector pins as they will leave a witness mark.
- **Design a flat surface to facilitate sintering**. Parts are placed on metal sheets when debinding and sintering. A flat side will allow processing without external support. Where this is not possible, there is a wide range of special holders available to avoid distortion of the part during its processing.
- **External undercuts/threads** should be placed on parting lines and on a small flat area. Internal undercuts/threads are usually not recommended because of their high cost.
- **Bosses and stud well sized**, their diameters should be smaller than the thickness of the surrounding walls. They shouldn't be longer than five times the thickness of the walls.
- **Fine details are allowed: Letters, logos, cavity numbers, serrations and knurled surfaces**. Not acceptable placing of the following to be discussed:
 - Parting line - Gate
 - Ejector pin marks

RECOMENDACIONES PARA EL DISEÑO DESIGN RECOMMENDATIONS



- NO RECOMENDADO / NOT RECOMMENDED
- RECOMENDADO / RECOMMENDED