MIM PARTS CONCEPTION GUIDE METALLURGISTS & MAKERS SINCE 1995





THE DIRECT MANUFACTURING COMPANY

Materials : A metal is defined by its composition and its microstructure. The former is linked to the chemical elements used to create the metal powders. There are no significant differences between MiM metallurgy and others on that point, except that usually MiM composition is particularly clean due to the use of gas atomized powders.

The latter depends on the metallurgical route and powder metallurgy is quite specific here and exhibits fully isotropic and fine grain annealed structure with no residual stresses.

Alliance-MiM manufactures several stainless steels, low alloy steel, pure titanium, superalloys and ceramics, as displayed on the data sheets.

Dimensional and shape accuracy :

Dimension	Tolerance	Dimension Smaller than 5 mm ²	Flatness <u>+</u> 0.03 mm
Smaller than 5 mm From 5,01 to 15 mm From 15,01 to 25 mm From 25,01 to 30 mm From 30,01 to 35 mm From 35,01 to 45 mm From 45,01 to 50 mm From 50,01 to 55 mm From 55,01 to 60 mm	 ± 0,03 mm ± 0,05 mm ± 0,1 mm ± 0,15 mm ± 0,2 mm ± 0,25 mm ± 0,3 mm ± 0,35 mm ± 0,4 mm 	From 5,01 to 15 mm ² From 15,01 to 25 mm ² Superior to 25 mm ²	± 0,05 mm ± 0,1 mm ± 0,15 mm
		Dimension Smaller than 5 mm From 5,01 to 15 mm From 15,01 to 25 mm Superior to 25 mm	Symmetry, concentricity ± 0,03 mm ± 0,05 mm ± 0,1 mm ± 0,15 mm

Roughness : Ra between 1 and 2 microns depending upon materials.





Engineering defines final product cost. Manufacturing and the plant are not making the price of the product, we consider the plant as the test method of engineering, thus parts design has to be carefully achieved.



Dimensions :

Minimum wall thickness : **0,3mm** length / wall thickness ratio better : **under 5** maximum section : **1cm²** Minimum section for titanium : **2mm²** maximum wall thickness : **10mm**

RULES

Gating, split plane, ejectors



Demoulding and drafts

- Parts design needs to allow demoulding
- Drafts are needed to avoid deformations and cracks
- Above 2 mm height, we recommend 0,5°/face



Radiuses : As much as possible to improve mould filling and reduce local stresses





Shape improvement : Flat area on a cylinder where the slit plane rests or a recess around the gate allows us to sinter without reworking the part.







STANDARD TECHNOLOGY

4 PARTS MACHINED

+ DRILLING + WELDING



MONOBLOC PART

This MiM technology allows us to create monobloc part





super detailled titanium housing

In order to lower creeping during sintering, the reference surface needs to be as flat and as large as possible.

Good (one line)

If the part has no flat reference surface, a support is needed.

Secondary operation on the green part

Allows us to achieve shapes not possible directly with a tool, to remove the gating, and to easly create a multiversion easily and to deep



Heat Treatment

All heat treatments are possible.

Assembly

engrave.

Co-sintered assembly **Furnace crimping** Mechanical assembly (bolts and nuts) Laser welding (pay attention to material compatibility) Gluing Brasing, not in house but possible on MiM parts depending on composition and corrosion resistance needed.









Poor (one point)





Finishing

Mass polishing Hand polishing Sand blasting Laser marking Mechanical engraving Lacquering **PVD** (not in house) Electroplating (not in house)

How does MiM compare with other technologies

	МІМ	Machining	Lost wax casting	Forging-stamping
Metallurgy			6	
Creativity		66		6
Accuracy			S	66
Features (split planes etc.)			A state of the	₿.
Tool cost	6	6666	66	66
Lead time (prod)	666	6666	66	6
Productivity	0000	4	666	666



A product does not exist until control plan has not been agreed. Control method defines quality.

It is mandatory to bear in mind that MiM products are sometime more complex to measure than machined parts due to geometrical variations and complexity.

Thus, datum have to be clearly identified early in the development.

We do not recommend 3D measuring machines especially for small parts or on pure MiM parts due to squareness and flatness discrepancies. 3D machines are ok on machined areas or big parts. We do not recommend the use of shadow graphs or optical measuring machines on areas with drafts.



ALL RULES USED TO DESIGN PLASTIC PARTS ARE VALID WITH MIM

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