

# **A**DDITIVE **M**ANUFACTURING

## Fluid Power Solutions



we create for you



## New Technology

### Additive Manufacturing in hydraulics

Aidro, an Italian hydraulic systems developer, has incorporated Additive Manufacturing (or Metal 3D Printing) into its manufacturing processes, to create a new generation of hydraulic solutions and to overcome the limits of conventional hydraulic components.

This new technology allows to produce fast prototypes and spare parts, functional products with the following advantages:

- lightweight and space saving
- complex geometries at no extra cost
- better performances thanks to the optimization of the internal channels, curved shapes and elimination of 90° intersection angles, absence of auxiliary caps and plugs
- fast lead time

Additive Manufacturing starts from metal powder particles that are melted using a high power laser in sequential ultra-thin layers, creating functional hydraulic 3D parts.



from  
Traditional production



- 75% weight reduction
- 1/4 size dimension



to  
Metal 3D printing

# 3D metal printing

## Activities

### Design

new hydraulic products with complex geometries and re-design of traditional hydraulic parts to reduce weight, space saving, consolidate multiple parts into one. Dedicated softwares, FEM, fatigue analysis and stress test.



### Production

with our metal 3D printer machine, a wide range of high quality metals is available such as Stainless Steel, Aluminum, Inconel, Maraging steel.



### Testing

on material properties, pressure resistance, mechanical and micro-structural properties, functional test.



### Measurement

dimensional control by 3D scan and reverse engineering.

### Fast Prototyping

with metal 3D printing the lead time is short, as 1-2 weeks. Compared to casting mold, a 3D printed prototype is more convenient in term of cost and timing.



### Post Treatments

heat treatment of 3D metal printed parts, surface finishing.

### CNC finishing

with our flexible vertical machining center, we provide the machining of cavities, surfaces and parts of the 3D printed products that require a finishing.



hydraulic solutions



## Solutions Center for

Additive Manufacturing in hydraulics



Aidro has established a Solutions Center for Additive Manufacturing in Hydraulics enabling AM specialists to design new hydraulic components and bring them to life with metal 3D printing technology.

Aidro has chosen the metal power bed fusion technology called Direct Metal Laser Sintering (DMLS or SLM), which guarantees a high quality of materials and very good mechanical properties of the printed parts. The Solution Center oversees the entire process, from design to production and testing.

Finite Element Method (FEM) analysis is conducted, as well stress tests. Functional tests and mechanical properties analysis are done, as well as fatigue test on request.

Research and tests in collaboration with



**POLITECNICO**  
MILANO 1863

In order to produce a 3D printed hydraulic solution, Aidro offers a wide range of high quality metal powders:

### **Stainless steel (AISI316L)**

is characterized by having good corrosion resistance and mechanical properties. This is widely used for hydraulic special applications, such as oil&gas, off-shore and marine.

### **Aluminum (AlSi10Mg, F357)**

offers good strength, hardness and dynamic properties and it is also used for parts subject to high loads. It is ideal for applications that require good thermal properties and reduced weight.

### **Maraging Steel**

is known for possessing superior strength and toughness without losing malleability.

The hydraulic parts made from this steel are easily machinable after the 3D printing process.

### **Inconel (625, 718)**

is a heat and corrosion resistant nickel alloy characterized by having high tensile, creep and rupture strength. Components in this type of nickel alloy have typically excellent fatigue and thermal-fatigue values.

# 3D metal printing

## 3D Printed Products

### Hydraulic Valve Block

- weight reduction
- space saving
- high customization



### Heat Exchanger

- high performances in small size
- possibility to combine multiple parts into one
- integration of functions



### Hydraulic Spool

- feasibility of geometric forms impossible with traditional machining
- ability to combine multiple parts into one
- better performance than the traditional manufacturing



### High Pressure Hydraulic Manifold

- good mechanical properties
- performances optimization
- curved internal channels
- absence of auxiliary caps and plugs



### Small Hydraulic Manifold

- free design and complex geometries
- compactness
- reduced size
- fast prototyping



hydraulic solutions



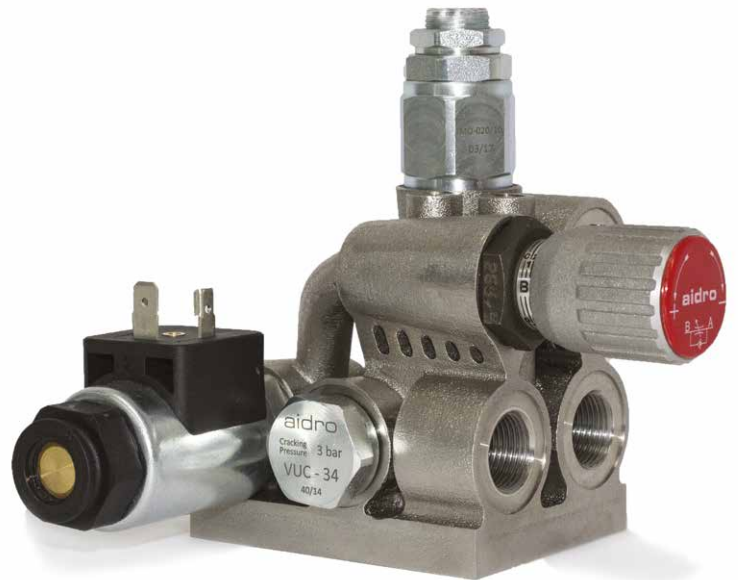
## HYDRAULIC VALVE BLOCK

This is a 3D printed hydraulic valve block for controlling a single-acting cylinder.

The traditional hydraulic block has been redesigned with a different and innovative design approach: start from the required function, choose the valves and components and then design the connecting channels, as you wish.

The main objective is to reduce the mass of the component whilst retaining its robustness.

The internal channels of the valve block are optimized to a better flow and space savings, while the potential for leakage is removed because auxiliary drillings are no longer necessary.



### 3D printing advantages:

---

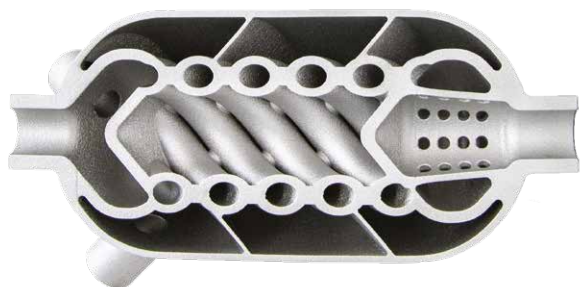
- Freedom to design
- Possibility to produce complex geometries
- High customization
- Space saving



## HEAT EXCHANGER

Additive manufacturing is suitable for the re-design and production of Heat Exchanger. In the photos there are two examples of water-oil heat exchangers made with Additive Manufacturing in Aluminum (AlSi10Mg).

The main advantages are the weight reduction and the compactness compared to the traditional heat exchanger. With Additive Manufacturing it is possible to improve the performance thanks to innovative shapes.



### 3D printing advantages:

- High performances in small size
- Possibility to combine multiple parts into one
- 1/5 size dimension
- 85% weight reduction



from  
Traditional production  
10,8kg

to  
Metal 3D printing  
1,5kg

## PRESSURE REDUCING VALVE BODY

The additive manufacturing allows a high reduction of the weight, thanks to the less consumption of material.

Aidro has produced a valve body with the external walls as the traditional product, but internally it is hollow: weight saving is 40%.

The second example is a redesigned valve body, in which the material has been removed where not necessary: the final weight has been reduced by 60%.

The pressure tests have demonstrated the same results as the traditional valves.



### 3D printing advantages:

---

- Weight reduction
- Possible choice between high performing materials
- Optimized performances



Traditional production



Weight reduction 40%



Weight reduction 60%





## HYDRAULIC SPOOL

This spool has been redesigned in order to be 3D printed with new holes forms, such as oval holes and square holes.

These shapes are impractical with traditional manufacturing, in particularly with CNC machining, while with additive manufacturing complex geometries are now feasible.

Indeed, with the new holes forms, the idea is to increase the passing area of oil inside the spool, allowing lower pressure drop. Therefore, the new design with additive manufacturing offers an higher performance.

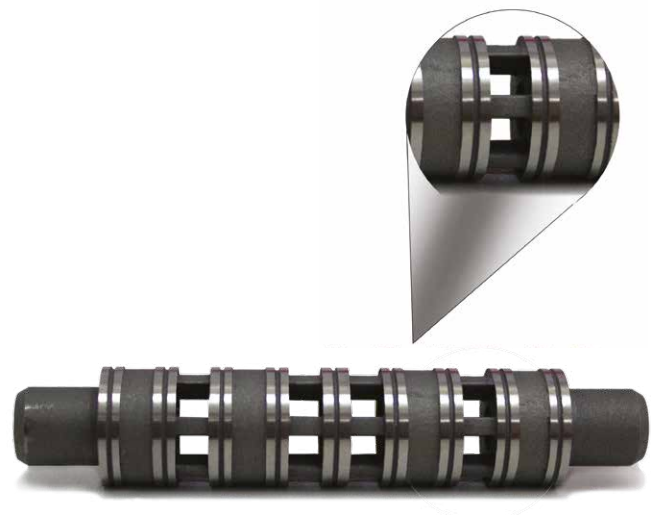
Moreover, with the ability to build complex geometries, we have consolidated more components into one piece and our 3D printed spool is one single part. This allows to simplify the manufacturing process and reduce assembly time.



### 3D printing advantages:

---

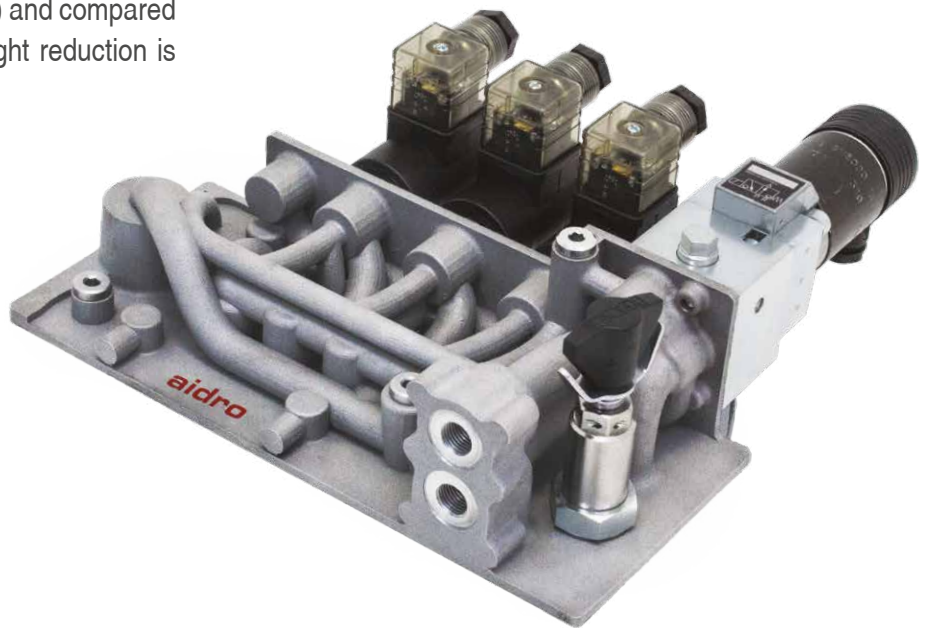
- Feasibility of geometric forms impossible with traditional machine
- Ability to combine multiple parts into one
- Possible better performance than the traditional manufacturing



## HIGH PRESSURE HYDRAULIC MANIFOLD

This 3D printed Hydraulic Manifold is designed for high pressure (700 bar).

The material is Aluminum (AlSi10Mg) and compared to the conventional manifold the weight reduction is 75%.



### 3D printing advantages:

- Optimized performances, thanks to curved channels and no more 90 degrees intersection angles
- Good material properties (similar to metal bars)
- Lightweight solutions
- High pressure resistance (700 bar)



from  
Traditional production  
5 kg



to  
Metal 3D printing  
1,3 kg

## BANKABLE HYDRAULIC MANIFOLD

With metal 3D printing the manifold can be multiplied providing more functionalities.

The modular conception of valves allows to easily tailor the blocks to specific requirements.



### 3D printing advantages:

---

- Feasibility of geometric forms impossible with traditional machine
- Possible better performance than the traditional manufacturing
- Ability to combine multiple parts into one
- 75% weight reduction
- 1/2 size dimension



from  
Traditional production



to  
Metal 3D printing

# aidro

hydraulics & 3D printing

Operative Address and Warehouse:

aidro s.r.l.

Via Prati Bassi 36- 21020 Taino (VA) Italy

Phone: +39 0331 960250 - Fax: +39 0331 960075

email: [aidro@aidro.it](mailto:aidro@aidro.it)



member of:



Copyright © 2017- Aidro srl

# 3D metal printing hydraulic solutions