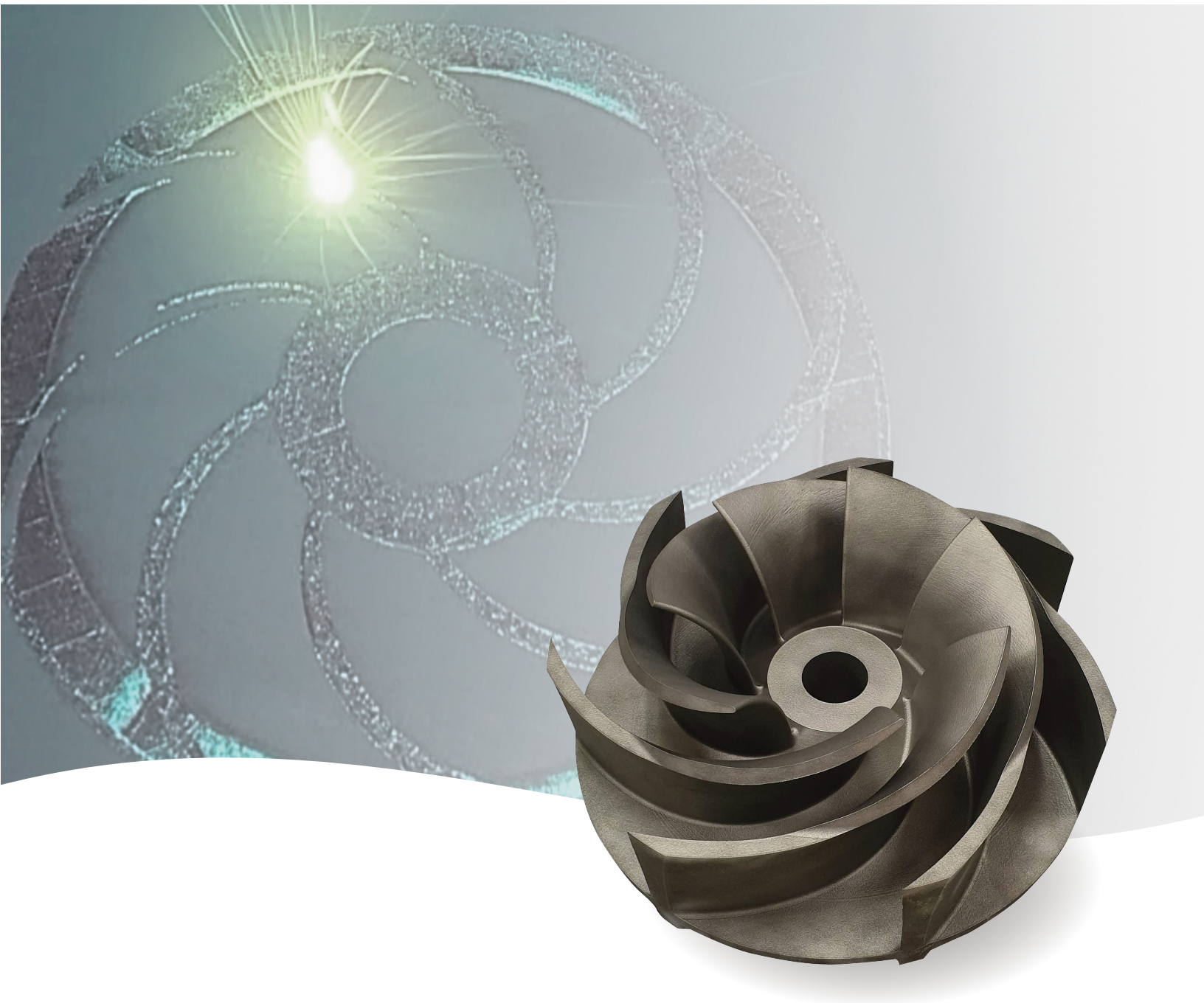




# **Additive Manufacturing**

**Fast, high-quality alternative to casting  
for production impeller orders**



*Experience In Motion*



### Key benefits

- Reduced lead times
- Improved on-time delivery
- Optimized inventory, as customers can reduce stock levels when replacement parts are manufactured on demand
- Upgraded designs can be produced without concern about pattern modifications
- Improved sustainability through an eco-friendly manufacturing process

## Metal printing enables shorter lead times for replacement pump parts

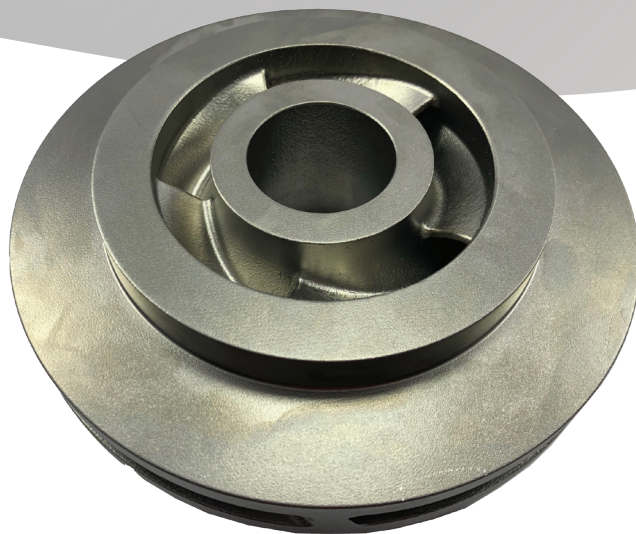
When shorter lead times matter, Flowserve can meet your requirements for impellers and other pump components with additive metal manufacturing. It's a high-quality alternative to cast components for production orders.

Advanced metal 3D printing technologies enable Flowserve to produce impellers in 316L stainless steel for oil and gas and a broad range of other industrial applications.

### Lead times as short as 4 weeks

Flowserve introduced its Additive Metal Manufacturing Program to meet customer needs for reduced lead times. Conventional casting takes an average of 8 to 20 weeks but can take significantly longer if the pattern is damaged or no longer available. With additive manufacturing, customers can get the components they need in as few as 4 weeks.

Not only is metal printing faster than casting, but high-quality parts can be ordered when replacements are needed. This enables customers to minimize their inventory of spare parts and thus reduce the total cost of ownership (TCO) of their pumps.



### Rigorous testing ensures quality

Flowserve ensures quality by following a rigorous technical and commercial qualification process aligned with API-20S. Material properties of additive parts meet or exceed ASTM standards.

### Target applications

Additive manufacturing is ideal for the production of aftermarket replacement impellers and other non-pressure components for pumps.

## Frequently asked questions (FAQs)

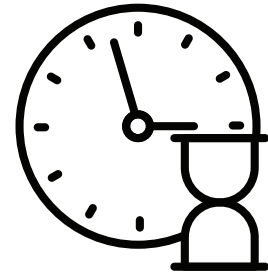
### ***What is the typical lead time?***

Standard lead time for a finished impeller less than 250 mm (10 in.) in diameter is 4 weeks; parts up to 400 mm (16 in.) can take longer.

### ***What materials are available?***

316L stainless steel is the standard material and can be used to replace or upgrade cast impellers made of cast iron or carbon steel.

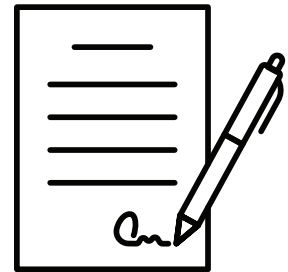
Flowserve is evaluating other materials such as Inconel® 718, CA6NM, 410 stainless steel, titanium Ti6Al4V-ELI and super duplex stainless steels. These metals will be added to the Additive Manufacturing Program once fully qualified.



### ***How much experience does Flowserve have with additive manufacturing?***

Flowserve's additive journey started more than 20 years ago with additive technologies utilized for rapid prototyping but also for production of patterns for traditional casting processes.

Flowserve continues to advance the company's additive capabilities and is leveraging its expertise for direct metal printing of pump components. Flowserve has successfully installed additive-manufactured parts at customer locations since 2019.



### ***Are Flowserve additive parts compliant with API-20S?***

Yes. Flowserve follows a rigorous technical and commercial qualification process that is aligned with API-20S and ensures that material properties meet or exceed their respective ASTM standards.



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## Initial additive manufacturing program

### Part types

- Impellers and other non-pressure containing replacement parts such as inducers for any pump

### Material

- 316L stainless steel

### Sizes

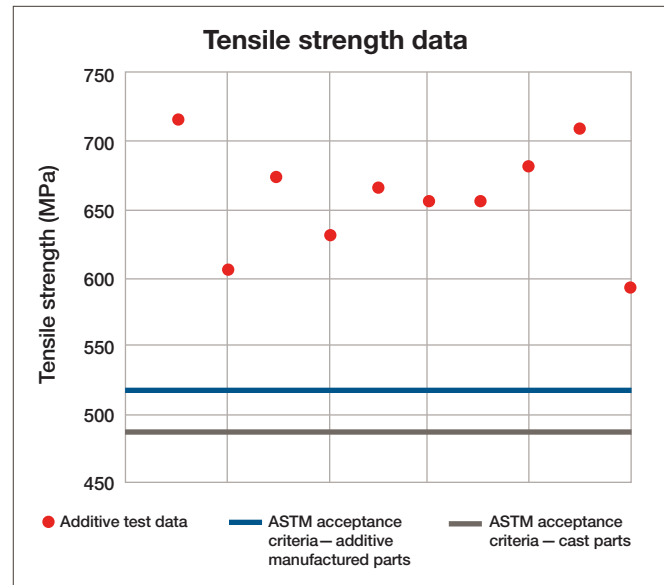
- Up to 400 mm (16 in.)

### Qualifications

- API-20S Additive Manufacturing in the Oil & Gas Industry
- ASTM F3184 Standard Specification for Additive Manufacturing Stainless Steel Alloy (UNS S31603) with Powder Bed Fusion

## Tensile strength test results

Parts produced with additive manufacturing processes by Flowserve far exceed the acceptance criteria in ASTM industry standards.



Source: Flowserve internal research

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