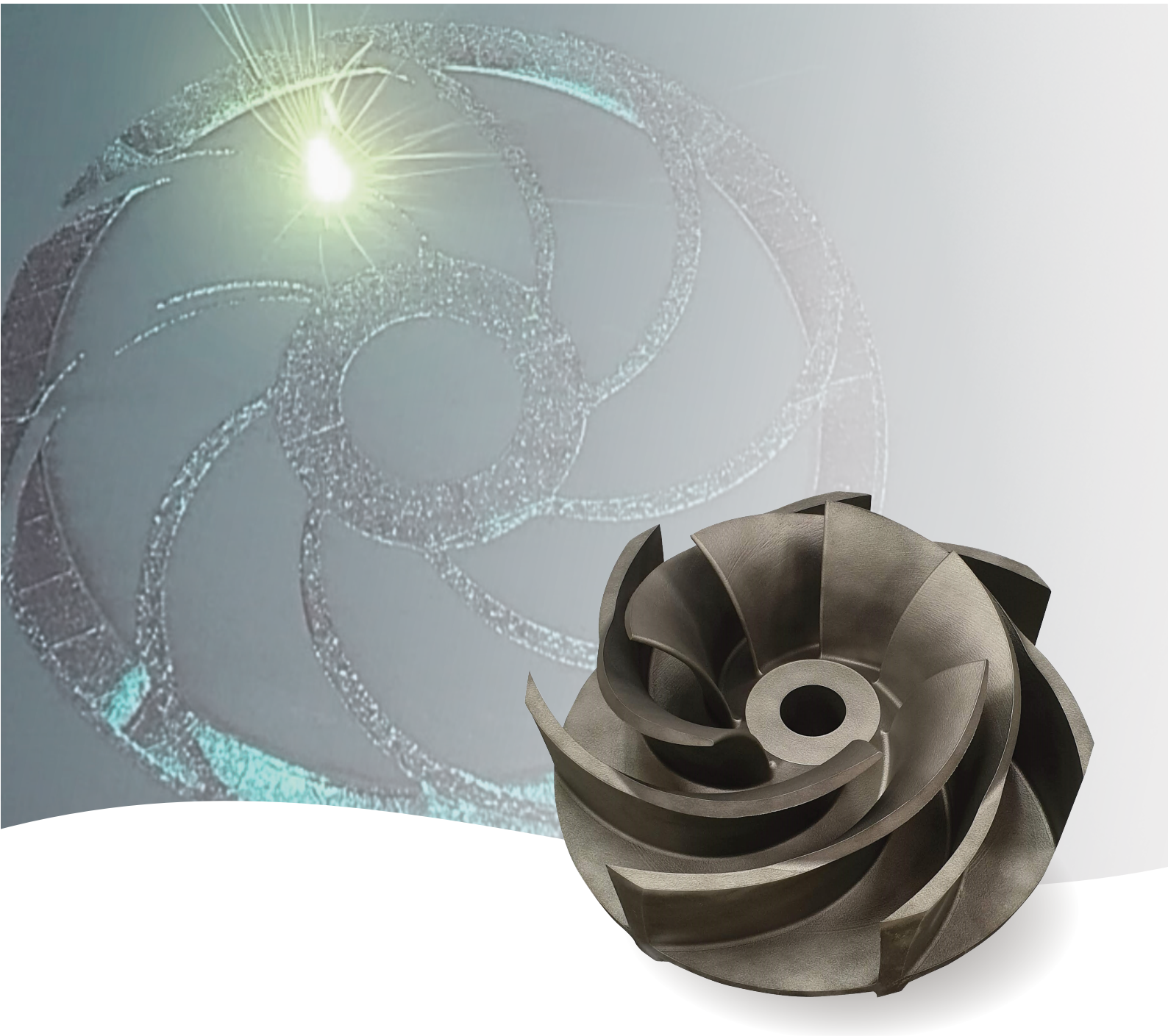




## **Additive Manufacturing** **Fast, high-quality alternative to casting** **for production impeller orders**



*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

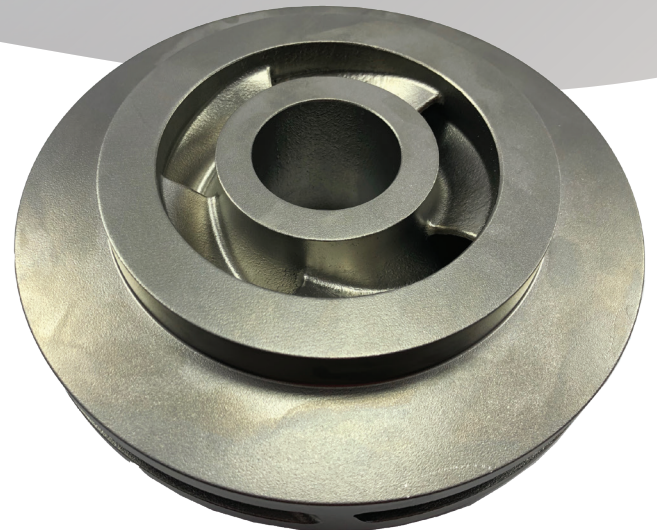
When shorter lead times matter, Flowserve can meet your requirements for impellers and other pump components with additive metal manufacturing. It's a high-quality alternative to cast components for production orders.

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.

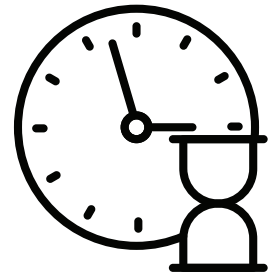
### Target applications

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.



® Inconel is a registered trademark of the International Nickel Co., Inc.



## 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

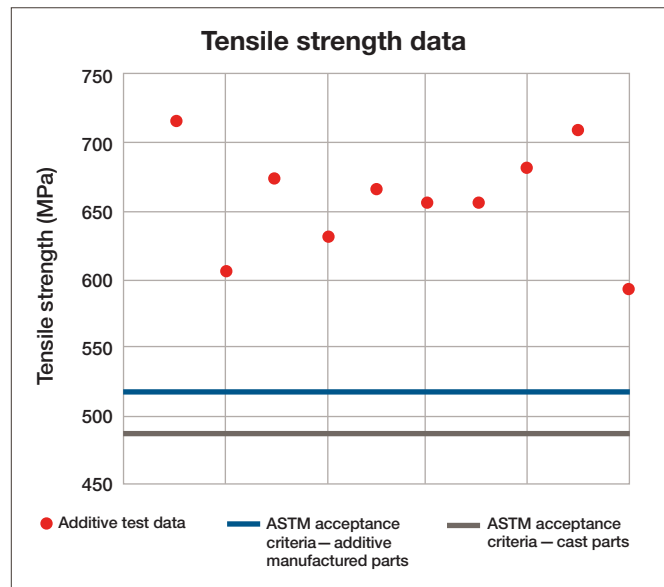
- Up to 400 mm (16 in.)

### 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

### Headquarters

Flowserve Corporation  
Irving, Texas 75039-5421 USA  
Telephone: +1 937 890 5839

### USA and Canada

Flowserve Corporation  
North America Parts Group  
Moosic, PA 18507 USA  
+1 570 451 2200

### Europe, Middle East, Africa

Flowserve Worthington Srl  
Via Rossini 90/92  
Desio (Milan), Italy  
+39 0362 6121

### Asia Pacific

Flowserve Pte Ltd.  
Singapore 637345  
+65 6775 3003

SEFLY000434-00 (EN/A4) March 2022

Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, this Flowserve product is designed to perform its intended function safely during its useful life. However, the purchaser or user of Flowserve products should be aware that Flowserve products might be used in numerous applications under a wide variety of industrial service conditions. Although Flowserve can provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation, and maintenance of Flowserve products. The purchaser/user should read and understand the Installation Instructions included with the product, and train its employees and contractors in the safe use of Flowserve products in connection with the specific application.

While the information and specifications contained in this literature are believed to be accurate, they are supplied for informative purposes only and should not be considered certified or as a guarantee of satisfactory results by reliance thereon. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding any matter with respect to this product. Because Flowserve is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice. Should any question arise concerning these provisions, the purchaser/user should contact Flowserve Corporation at any one of its worldwide operations or offices.

©2022 Flowserve Corporation. All rights reserved. This document contains registered and unregistered trademarks of Flowserve Corporation. Other company, product, or service names may be trademarks or service marks of their respective companies.