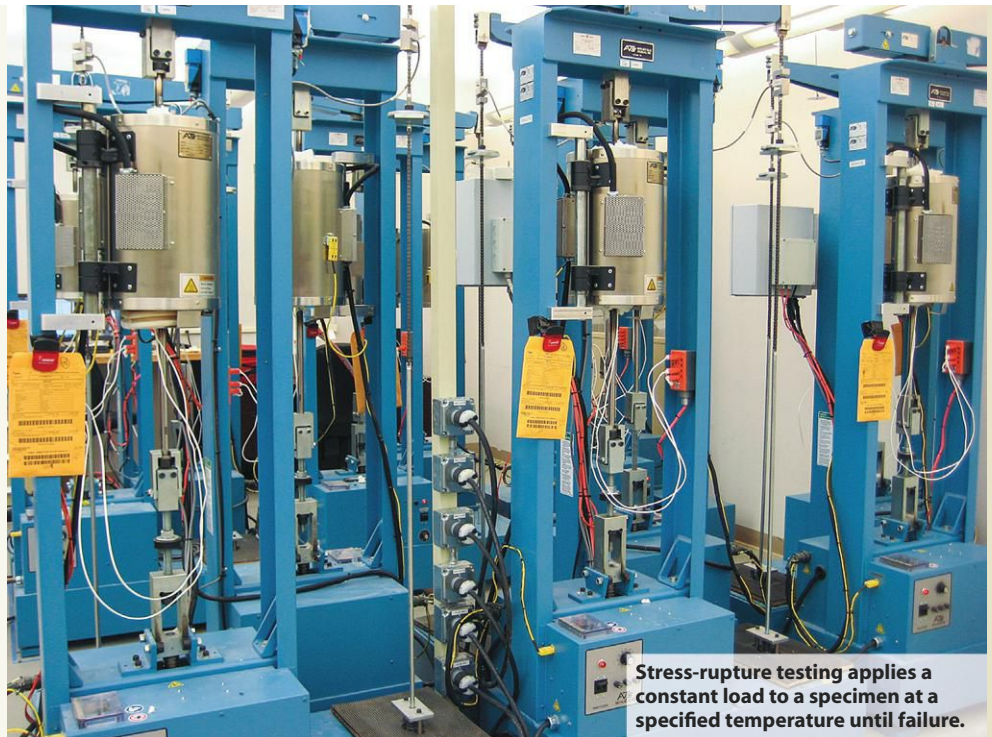


FAQs About Testing Forged Metal Parts

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Stress-rupture testing applies a constant load to a specimen at a specified temperature until failure.

A review of some frequently asked questions (FAQs) about the commercial testing of forgings can help you learn about the types of destructive and nondestructive tests and which ones are necessary for your products. Some tips are offered on what to look for in selecting a testing service provider.

Metal testing is a common step in the production process when providing forged metal parts to original equipment manufacturers (OEM). Testing is often necessary to verify the integrity of raw materials, heat treatments and finished parts and to fulfill compliance obligations. Ensuring that forged parts have passed testing requirements and are ready to move to the next level in the supply chain can be challenging, especially when faced with the OEM's tight deadlines or an increase in demand for the parts you produce.

How can you be sure to keep up? The best way is to understand your metal testing options and work with a reputable testing partner that will provide the service, support and turnaround times you need.

Here are some frequently asked questions and answers that can help you make sound choices when ordering testing for forged metal parts.

What type of testing should I use on my forged parts?

Both destructive and nondestructive test methods are used to evaluate forged metal parts. Destructive testing techniques generally verify mechanical properties, material composition or structure, whereas nondestructive methods identify flaws and inconsistencies. As the names imply, the part will be damaged or

destroyed by cutting and/or breaking during destructive testing, while nondestructive testing does not harm the part.

Generally, the OEM or lead company in the supply chain will provide specifications for your forged products. Specifications include requirements for mechanical, physical or chemical properties and/or other safety, quality or performance criteria. They also identify the specific methods of destructive or nondestructive testing that must be performed in order to determine if the requirements are met.

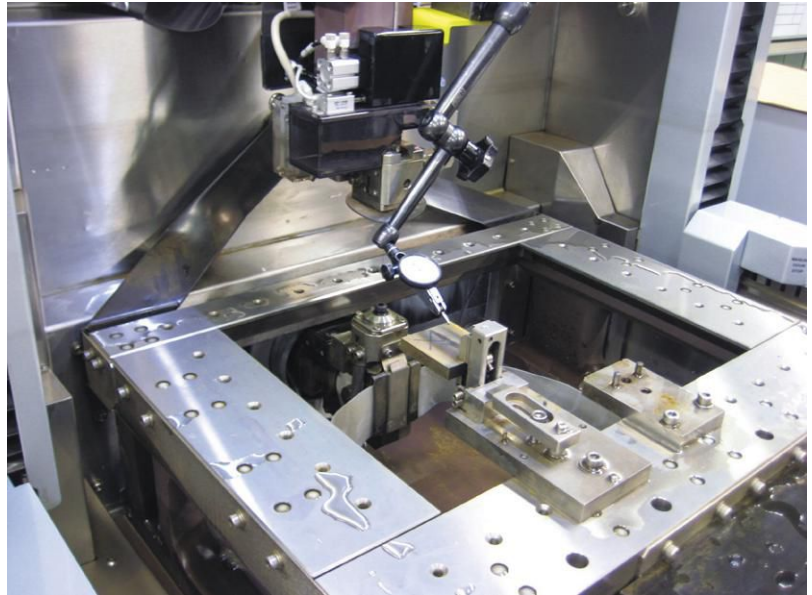
The most frequently specified methods used for testing forged parts include the following.

Destructive Test Methods

- Fracture toughness determines how well a material can resist the growth of a crack under a steadily increasing load.
- Low-cycle and high-cycle fatigue testing measures the ability of materials to withstand the application of repeated load cycles over time.
- Fatigue crack growth evaluates the safety and reliability of materials by subjecting samples with a pre-existing crack to repeated loading and unloading.
- Tensile testing subjects a metal sample to tension until the part fails. This test is used to assess tensile strength, yield strength and ductility.
- Stress-rupture testing applies a constant load to a test



Grain-size evaluation of Inconel 718 at 100X magnification using a light optical microscope.



Electrical discharge machining (EDM) is used for blanking, extracting and notching specimens for testing.

specimen at a specified temperature until failure in order to evaluate the effects of long-term stress on a material.

- Creep testing is used to evaluate a sample's creep properties when it is subjected to a prolonged tensile load at a constant temperature.
- Charpy impact determines the toughness or impact strength of a material. This test measures the amount of energy absorbed by the material while fracturing notched specimens at a series of temperatures.
- Metallography typically uses microscopy to provide important information about the structure and properties of metal samples.
- Chemistry determines qualitative and/or quantitative information about the elemental composition of materials.

Nondestructive Test Methods

- Ultrasonic testing can locate internal and external defects in testing materials using short pulses of high-frequency sound waves.
- Radiographic testing is a highly effective method for uncovering subsurface defects by penetrating solid materials with X-rays and creating images that are viewed by an inspector.
- Liquid-penetrant testing uses a fluorescent or visible-dye penetrant to identify

surface-breaking flaws.

- Magnetic-particle inspection is a very sensitive testing method used to find defects on the surface of materials that have been coated with fine iron-oxide particles and magnetized.

What should I consider when choosing a testing lab?

Researching the number of years in business and the reputation of the test lab is a good starting point. Reviewing the history of the company can also provide insight into its stability and dedication to quality in the testing business. Is the lab under original ownership, or has it changed hands over the years? Are the owners close to the business and involved in the day-to-day decisions?

Ideally, your lab should be a trusted testing partner, helping you get the answers you need, save time and meet deadlines. You might also consider how labs stack up against each other in the following areas.

Technical Qualifications

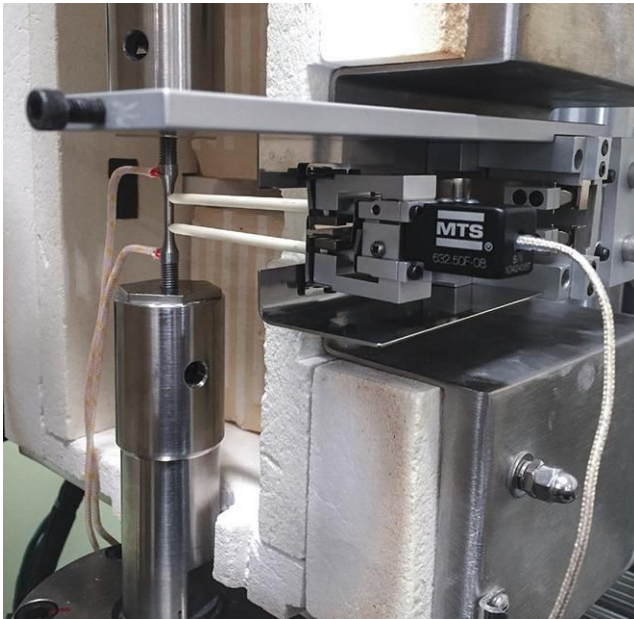
Your testing provider should have the qualifications and resources to help you ensure the safety, reliability and integrity of your finished part. How comprehensive is the lab's quality program and procedures? Does the test lab have a dedicated team of technical experts who can assist you and answer your questions? Can you tour the facility to see how orders are processed, meet the staff and watch equipment in use?

Turnaround Times

Test labs generally have a standard turnaround time to perform each of their services. You should be able to find out if their standard turnaround will meet your needs. Can orders be expedited if necessary?

Full-Service Capabilities

More than one type of test is often required to complete an order, and samples or specimens must be prepared for destructive testing. When you need fast turnaround,



Elevated-temperature, low-cycle fatigue test

you don't want to lose time having your parts sent to multiple facilities to complete your order. Does the lab have in-house machining capabilities to prepare all specimens or samples needed for your testing? Can the provider perform all of your testing in one location?

Capacity

If you are anticipating sales growth and a growing need for testing, a suitable testing partner should be able to accommodate your increasing order volume without jeopardizing response time. Do they continually invest in expanding equipment and facility capacity to meet their customers' growing needs?

Service and Support

When you need answers or a status update, you'll want easy access to the information. Does the lab have an experienced team that is easily accessible and devoted to customer service? Will you have online access to your order status, results and certificates?

How do I know the testing laboratory is qualified and reliable?

Accreditations and customer approvals are key indicators of a supplier's qualifications and expertise. They show a commitment to quality and help give you peace of mind.

In order to earn an accreditation and most customer approvals, the lab would have been successfully audited by an accrediting body, prime contractor or other manufacturer. The accreditation process examines the lab's quality system and validates that it meets certain industry-accepted standards. An extensive list of customer approvals demonstrates a laboratory's ability to meet the quality requirements of these companies.

What sample size do I need for testing?

The required sample size will depend on the type of material, the types of tests being performed and often the specifications. Your test lab will be able to tell you the amount needed to complete your order.

To save time and money, choose a testing provider that has an on-site machine shop and is experienced in preparing all types of specimens and samples for destructive testing. A top-notch vendor will have the expertise to work with customers to design cut plans and layouts for the extraction of test specimens from complex forging shapes.

How long does it take to perform metal testing on forged parts?

Turnaround time depends on the number of pieces to be tested, the type of testing and the test lab. Standard turnarounds generally range from a few days up to 15 days or more.

Your lead time can significantly increase if your provider cannot perform all of the required testing and machining at one location. If they don't have the interest or ability to invest in new infrastructure and equipment to help support their customers' growing businesses, you may find that turnaround times will suffer. Providers may offer expedited service when tighter deadlines require faster turnaround.

What information does the testing lab need to quote an order?

The laboratory will need all pertinent details about your order to provide an accurate quote, including:

- Type of testing services
- Applicable specifications or requirements
- Quantity of parts to be inspected
- Description of material
- Location of the area to be inspected
- Part drawing or dimensions

Conclusion

Test labs come in all shapes and sizes. Some specialize in metals while others provide services for a variety of materials. Some provide a wide-range of testing methods in a number of categories, yet some concentrate on one or just a few categories of testing but are part of a larger network of labs.

Now that you know more about the testing of forged metal parts, the key is finding a testing partner that fits your priorities. If you have questions not covered in this article, you will have a source for the information you need. ♦

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