

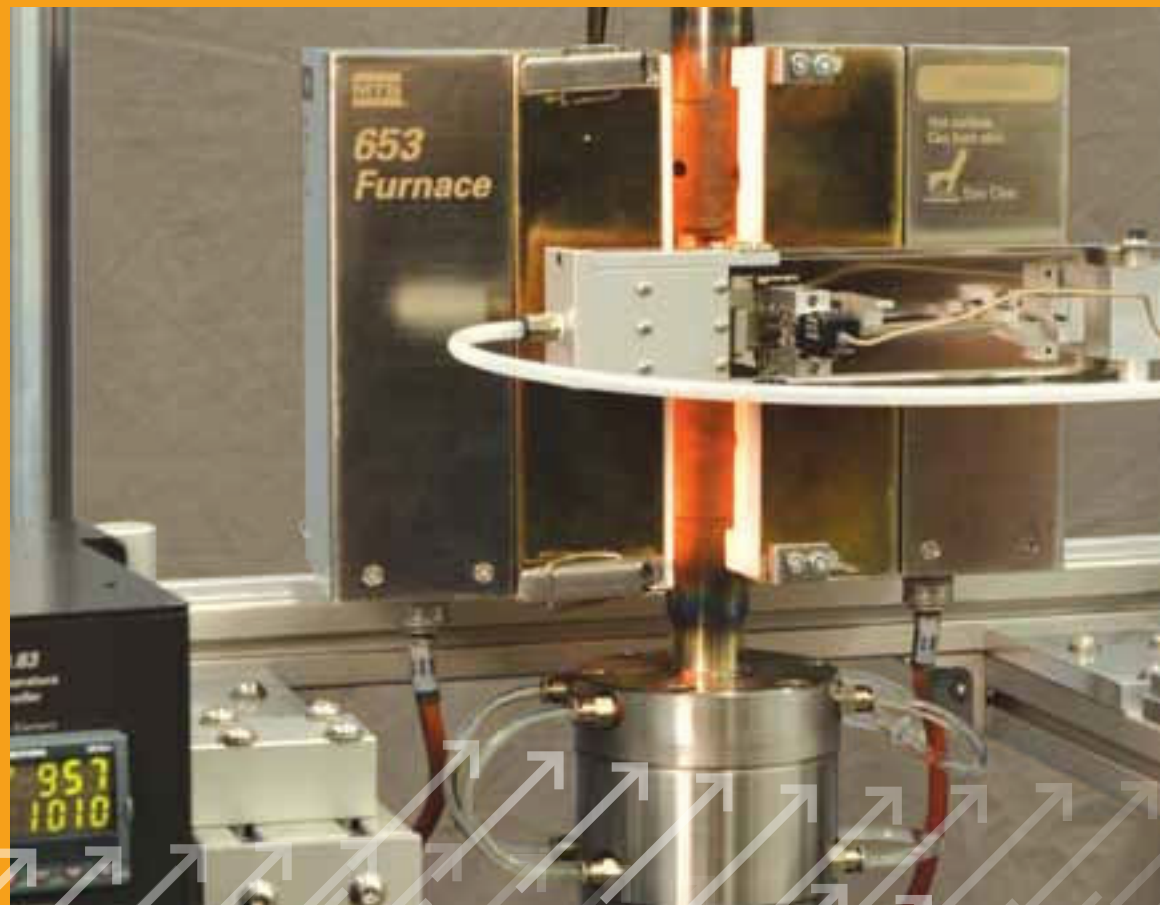


High-Temperature Materials Testing Solutions

be certain.

TO DEVELOP THE NEXT GENERATION OF ULTRA-EFFICIENT AIRCRAFT, AUTOMOBILES
AND POWER GENERATION SYSTEMS, RESEARCHERS WORLDWIDE TURN TO MTS
FOR HIGH-TEMPERATURE MATERIALS TESTING SOLUTIONS. THE REASON IS CLEAR:
OUR COMBINATION OF ADVANCED TECHNOLOGY, COMPLEX SYSTEMS INTEGRATION
EXPERTISE, AND DEEP INDUSTRY EXPERIENCE REMAINS UNMATCHED.

LET US HELP YOU PURSUE YOUR IDEAS WITH SPEED AND CONFIDENCE.



Enabling breakthroughs in advanced research

To achieve significant advances in aircraft, automobile and power generation efficiency, materials researchers are developing lighter, stronger materials that withstand higher temperatures for longer periods. MTS high-temperature materials testing solutions are critical to these efforts. Engineered to empower innovation in high-temperature testing labs, these sophisticated solutions keep pace with the rapidly evolving demands of applied materials science.

3

Confidence

High-temperature materials testing labs routinely run tests that have never been performed before. In these situations, it is essential to trust your entire approach, from the equipment to the methodology to the data you collect. As a premier global supplier of mechanical test and simulation solutions, MTS is uniquely qualified to help you conduct testing programs with confidence and certainty. Our high-temperature testing solutions leverage decades of collaboration with industry pioneers and innovative technologies proven to deliver accurate, repeatable results. We bring specialized expertise in complex systems integration, and we offer unrivaled service, support and consulting to keep your confidence intact.



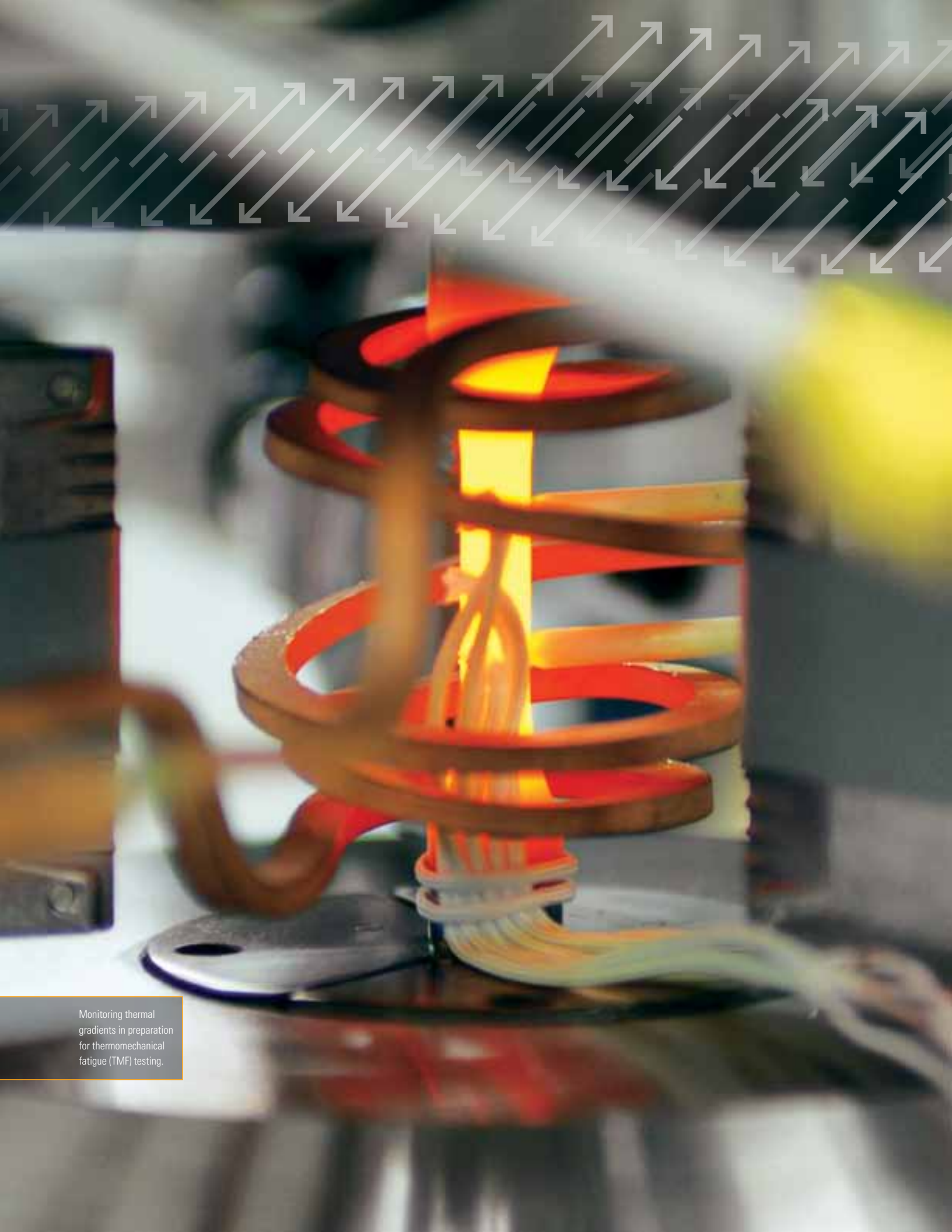
High temperature Low-Cycle Fatigue (LCF) test setup.

Time-to-Test

Advanced development programs depend on a highly orchestrated schedule. Labs must prepare tests quickly, perform studies correctly the first time, and generate meaningful results within a narrow window of opportunity. MTS brings sophisticated technology and expertise to help materials researchers define needs efficiently, formulate a solution and start running tests in as little time as possible. We offer expert test consulting and application support, which is especially important for taking on new challenges. Our offerings include application-specific solutions that are validated to meet specific standards, as well as a complete selection of high-performance components. We also offer guidance for unique or custom applications. In addition, the MTS global service team provides efficient installation, integration and comprehensive training.

Adaptability

During the next decade researchers will demand more extreme temperatures, higher forces and simulations with greater fidelity. Labs must prepare to adjust quickly and efficiently as testing needs evolve. MTS high-temperature materials testing solutions offer a truly viable testing platform for today and tomorrow. Durable and versatile load frames, highly scalable digital controls, and continuously upgraded software create a lasting foundation that protects your investment and eliminates the risk of replacing equipment every time your test needs change. MTS service and support is also vital for configuring new applications and maximizing uptime.



Monitoring thermal gradients in preparation for thermomechanical fatigue (TMF) testing.

Push the boundaries of high-temperature testing

MTS is dedicated to improving and advancing materials testing. We have made critical investments to develop sustainable, globally compliant hardware and software platforms designed to support affordable, high-performance testing for decades to come. This is especially significant in high-temperature test labs, where MTS solutions enable researchers to explore new ideas quickly and confidently, driving innovation to unprecedented heights.

5



MTS is the ideal partner for testing new materials that optimize the efficiency of turbines, boilers and fluid distribution equipment in a wide variety of power plants.

SOLUTIONS FOR NEW AND ESTABLISHED LABS

As a mentor for new labs, MTS can help you quickly acquire the right equipment and establish new capabilities, as well as reduce the learning curve for project teams — all while minimizing risk. Drawing on decades of hands-on experience, we offer a valuable resource for labs that are struggling with turnover, as well as labs in emerging, high-growth markets where ramp-up time is short and margin for error is small.

For well-established labs, MTS helps fine-tune the accuracy, speed and flexibility of current test environments, in addition to supplying high-quality components and providing service and support. We can also serve as a highly qualified partner for exploring new areas of materials testing. We intimately understand the nuances of proven and pioneering test applications, and we welcome the opportunity to investigate new issues with you and engage in discussions about the future of high-temperature testing.

Electrical power generation

For suppliers of electrical power generation equipment and components, energy efficiency is a distinct competitive advantage. Utilities eagerly await the turbines, boilers, and fluid distribution systems that will produce more power from the same footprint while reducing emissions. Raising energy efficiency beyond current limits, however, depends on perfecting nickel-based superalloys and other materials that can withstand prolonged exposure to extremely high operating temperatures. MTS solutions make it fast and easy to acquire accurate high-temperature material property data, whether you manufacture gas or steam turbines, boilers for nuclear, coal-fired or oil- and gas-fueled power plants, or piping, valves and pressure vessels. Our testing solutions drive characterization and analysis that will help you develop materials that allow higher operating temperatures, increasing durability and extending equipment life.



MTS high-temperature materials testing solutions are integral to the development of ceramic matrix composites and other materials that will spur a new generation of high-efficiency jet engine turbines.

Aerospace

Manufacturers of aircraft and space vehicles are focused on improving the fuel efficiency of turbine-powered jet engines. Increasing the efficiency of its fleet by even a small percentage, for example, would help an airline save billions of dollars in operating costs over time. To make this happen, new turbines must run hotter and require less cooling, which means disks, housings, blades and nozzles must be fabricated from or coated with materials that perform reliably at high temperatures for extended periods. MTS solutions help researchers characterize these superalloys, ceramic matrix composites and ceramic coatings with precision and repeatability. We understand the complexities of these tests, which typically require analysis of material behavior under exacting mechanical loads in high-temperature environments, and incorporate multiple methods of correlated data acquisition.

Automotive

In the automotive industry, improving fuel economy requires multiple approaches, from reducing weight to achieving more efficient combustion. High temperature materials testing is vital to this endeavor. No matter where they are used in the vehicle, materials must withstand intense thermal cycling under normal operating conditions. New engine materials that allow hotter combustion must perform well under thermal and mechanical stress. Hybrid and electric vehicles offer new challenges as well, such as managing the heat generated by larger batteries. MTS testing solutions help address all of these needs with the speed and accuracy vehicle manufacturers demand.

A full spectrum of high-temperature testing solutions

MTS offers a broad and expanding portfolio of high temperature materials testing solutions to help both developing and established labs address an evolving spectrum of standard and unique test requirements.

Application-specific testing solutions

High-temperature materials testing often requires complex, demanding mechanical setups that must meet rigorous standards and specific performance metrics. For developing labs especially, configuring and integrating these setups can prove time-consuming, expensive and risky. To help overcome these challenges, MTS has established a selection of testing solutions, each engineered to provide an economical, low-risk means for establishing a high-temperature testing capability quickly and confidently.

MTS testing solutions are available for a growing list of high-temperature (up to 1000° C) materials tests, including High-Cycle Fatigue (HCF), Low-Cycle Fatigue (LCF), Thermomechanical Fatigue (TMF) and more. The product of decades

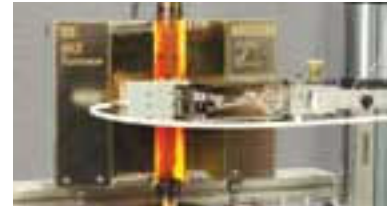
of MTS materials testing expertise and technology leadership, each tightly integrated standard solution comprises:

- » A compact, easy-to-use subsystem of heating/cooling equipment, grips and fixtures, and extensometer; validated to support testing to a specific industry standard and specimen geometry
- » Full-featured MTS TestSuite™ software with standards-compliant test templates
- » High-performance MTS Landmark® test system, featuring robust Model 370 servohydraulic load frame and versatile and FlexTest® controls
- » Clean, quiet SilentFlo™ hydraulic power unit (HPU)

Thermal subsystems



Thermomechanical Fatigue (TMF)



Low-Cycle Fatigue (LCF)



High-Cycle Fatigue (HCF)



Turnkey standard system

Premium-quality components

For established test labs as well as developing test labs seeking to fine-tune existing systems, improve test efficiency or take on new testing challenges, MTS offers a complete portfolio of premium-quality system components engineered for high temperature materials testing. This offering includes a wide array of load frame systems, including MTS Landmark Servo-Hydraulic, MTS Criterion Static Hydraulic, MTS Criterion Electromechanical. Accessories specifically designed for high-temperature materials testing complete the portfolio, allowing you to configure the ideal system for any test application, from the ordinary to the highly experimental.

HIGH-TEMPERATURE FURNACES

Ideal for tension, compression, bend, cyclic fatigue and fracture testing, these furnaces feature a center-split design for simple fixture and specimen access. We also offer compact induction systems for quick, controlled heating and cooling in TMF and related applications.

HIGH-TEMPERATURE EXTENSOMETERS

Made to withstand high-temperature testing with induction heaters or furnaces, best-in-class MTS extensometers offer unmatched quality. They deliver exceptional accuracy that meets or exceeds ASTM requirements.

HIGH-TEMPERATURE GRIPS

Choose from a variety of grips for different tests, specimen types and budgets. Hot grips are constructed of high-temperature superalloys to extend into the heated zone of the furnace. We also offer cold (water-cooled) and warm grips.

Custom-engineered solutions

For more specialized high-temperature materials testing challenges — such as temperatures that exceed 1000° C, unusual test environments or unique performance requirements — MTS collaborates directly with researchers to develop innovative, custom-engineered solutions. We have extensive experience implementing advanced applications and highly complex configurations. With this unique expertise, MTS can ensure load frames, extensometers, furnaces, heating elements and other components are tightly integrated, working in sync and performing as expected. This enables your team to generate precise temperatures at the correct time for a specific test profile as well as ensure accurate measurement of thermal gradients.

Outstanding service and support

The MTS global team of service, support and consulting professionals is the largest and most experienced of its kind. We offer complete lifecycle management services for all your high-temperature materials testing systems, enabling you to achieve maximum productivity and uptime, as well as develop and deploy new test programs rapidly. Our complete service offering includes:

- » Expert test consulting and application support
- » Advanced systems integration expertise
- » System installation
- » Training and leading-edge setup/operations guidance
- » Routine maintenance and spare parts
- » Accessories and software upgrades
- » Lifetime system protection



Planar biaxial system
with torque

Learn more today

Contact us for more information about how MTS can help you optimize your high-temperature materials testing capabilities.



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