

ETMT SYSTEM

Testing Miniaturized Specimens with Direct Resistance

Instron Electro-Thermal Mechanical Testing System (ETMT) is a compact table-top testing system that is developed to perform accelerating high-temperature research. The system is capable of achieving fatigue loading rates up to 1000 N/s with heating and cooling rates of 200°C/s and 100°C/s respectively. The system is designed for full reverse stress loading to 3000 N and is supplied with a direct resistance heating system capable of delivering specimen temperatures of up to 1500°C.

FEATURES

- Dynamic loading up to 3 kN (0.7 kip)
- Nominal grip separation is set at either 16 mm (0.6 in) or 40 mm (1.6 in), with an actuator stroke of ± 5 mm (0.2 in)
- Heating and cooling rates of 200°C/s and 100°C/s respectively
- Direct resistance heating via direct current through specimen capable of reaching temperatures of up to 1500°C, providing a parabolic temperature profile
- Temperature control with R, S or K-type thermocouple attached to the center of the specimen
- Low integrity enclosure for simple gas purging
- Optional configuration of a high integrity enclosure for operation under air, vacuum or back-filled gas purge, with a facility for inert gas built-in
- Optional turbo molecular pump for added performance in creating a vacuum
- Measurement of mechanical properties, physical properties, and microstructural stability under thermal exposure of specimens with cross-sections down to 2 mm by 1 mm
- High precision twin LVDT strain measurement system
- Mechanical alignment fixture AlignPRO is supplied to provide better system alignment
- Accommodates both round and flat specimens with the same fixture, with the option of steel or brass fixture for different thermal and electrical conductivity
- Horizontal mounting option
- 19" rack-mounted control unit for a packaged solution
- Compatible with standard Instron software including Console, WaveMatrix™ 2, Bluehill Universal® and TMF



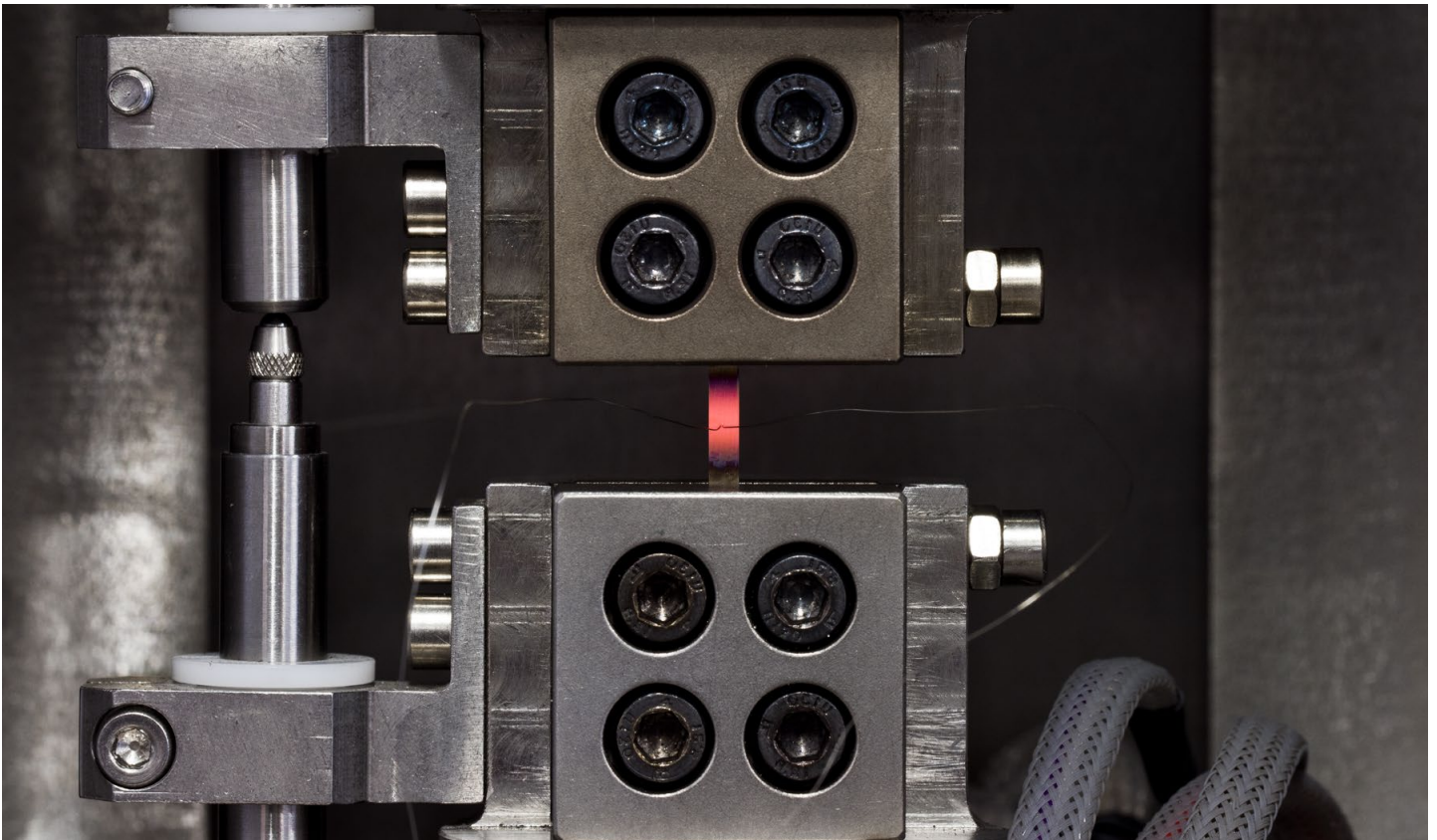
CONTROLLER AND SOFTWARE

Instron ETMT testing system is supplied with FastTrack 8800MT digital controller, which is capable of running static and high-frequency dynamic tests. The 8800MT controller is integrated into the ETMT system features SCM modules for control of the axial loading axis and the DC direct resistance heating system, and provides support to Instron software such as Console, Bluehill Universal and WaveMatrix 2.

ELECTRO-THERMAL MECHANICAL TESTING

Testing of high-temperature alloys has been notoriously difficult, they are often expensive, consist of rare materials and are extremely difficult to machine. Seeing the need for a corresponding testing machine that can accurately characterize their material properties, Instron has developed the original concept of an Electro-Thermal Mechanical Testing System (ETMT) in conjunction with National Physical Laboratory (NPL) over 10 years ago and has now brought the ETMT onto the ElectroPuls platform, offering an integrated ETMT system that is designed to test miniaturized test piece at elevated temperature.

Over the last 10 years, users of Instron ETMT have made great progress into exploring its applications further and developed new test methods that utilize the unique features of the ETMT, while providing feedback to Instron for innovation of new features. Understanding how material properties of miniaturized test piece will translate to a real size sample is of utmost importance in validating the data generated by the ETMTs. In light of that, a good practice guide has been produced for the ETMT systems that sheds light onto the investigations ETMT users have conducted and how they impact ETMT's prospective users, making ETMT more accessible to new users.



WHY CHOOSE INSTRON?

The Instron ETMT system is a highly configurable system and can be customized to suit many applications. The Instron ETMT system can measure a range of physical and mechanical properties, including tensile, compression, creep, low cycle fatigue (LCF) and thermomechanical fatigue (TMF) properties of materials. In addition, it has determined resistivity, thermal expansion coefficients and phase transformations in a variety of materials including steels, titanium alloys and intermetallic alloys.

Instron ETMT system offers a competitive alternative to traditional hydraulic machines for testing miniature specimens in materials such as nickel-based super-alloys, hard metals (e.g. tungsten carbide) and lead-free solders. Instron ETMT system's use of miniaturized test piece has helped shorten development cycles of new alloys and test the remnant life of used components, minimizing running cost and investigating component lifespan.

BENEFITS

- Testing of miniaturized specimen opens the opportunity to cost saving and testing methods that are far less efficient with other machines, including property distributions in heterogeneous materials and testing in controlled atmospheres or vacuum
- Fast and accurate direct resistance heating and water cooling of fixtures controlled by the ETMT control unit, with specimen heating and cooling rates of up to 200°C/s and 100°C/s respectively, and a maximum specimen temperature dependent on material (up to 1500°C)
- Multiple strain measurement options, including high precision twin LVDT, extended ceramic high-temperature extensometer and digital image correlation (DIC) techniques
- Centralized 19" rack-mounted control unit, offering an integrated solution to all controls and data acquisition of the system, with good visual access to test piece for DIC opportunities
- Accommodates both round and flat specimens with the same fixture, with the option of steel or brass grip heads for different thermal and electrical conductivity
- AlignPRO mechanical fixture allows accurate horizontal, vertical and angular alignment of the test piece, which is especially important in miniaturized testing



MODIFICATION FOR MINIATURIZED TESTING

Instron ETMT system is designed to test miniaturized specimens, and components are specifically designed to ensure that the system is future-proof and the tests are customizable, based on your applications and testing needs.

- Fixture insert that accommodates flat or round specimens
- Range of small gauge length extensometers and DIC camera for strain measurement
- 3 kN load capacity E3000 ElectroPuls

ATMOSPHERE ENCLOSURE

Instron ETMT system offers a low integrity enclosure for simple gas purging or a high integrity enclosure which allows vacuum evacuation with subsequent gas back-filling, opening opportunities to testing under vacuum or back-filled gas purge with facility for inert gas supply built in.

- Low integrity Perspex enclosure for simple gas purging
- High integrity enclosure allows the ETMT to operate under vacuum or back-filled gas purge
- Optional turbo molecular pump for better performance

TRIED AND TESTED INSTRON SOFTWARE

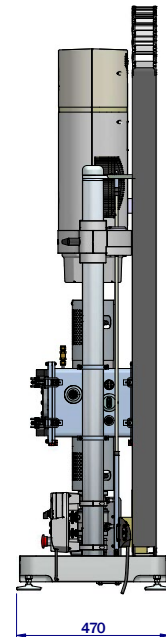
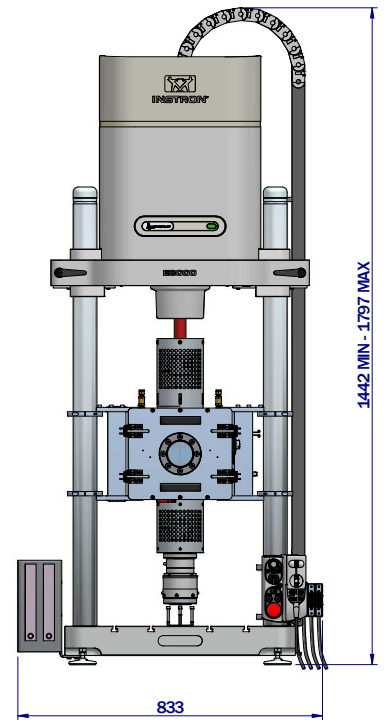
Instron ETMT system offers an integrated 19" controller that makes the system compatible with all standard Instron software, providing the same and consistent user experience to operators and no extra training will be needed to utilize this software.

- Bluehill Universal®
- WaveMatrix™ 2
- TMF

FRAME SPECIFICATIONS

| | | |
|--|--|------------|
| Daylight Opening (Maximum Between Table and Crosshead) | mm | 861 |
| | in | 33.6 |
| Dynamic Load Capacity | kN | ±3 |
| | kip | ±0.7 |
| Specimen Length | mm | 56 or 80 |
| | in | 2.2 or 3.1 |
| Grip Separation | mm | 16 or 40 |
| | in | 0.6 or 1.6 |
| Actuator Stroke | mm | ±5 |
| | in | ±0.2 |
| Configuration | Twin-column with actuator in upper crosshead | |
| Lifts and Locks | Electrically powered lifts with manual lever clamps | |
| Load Cell | Patented ₁ Dynacell Fatigue-Rated Load Cell Mounted to Upper Crosshead with Capacity to Suit Actuator | |
| Load Weighing Accuracy | ±0.5% of Indicated Load or ±0.005% of Load Cell Capacity (1-100%), Whichever is Greater | |
| Operating Environment | +10 to +38°C (+50 to +100°F) with 10 to 90% Humidity Non-Condensing | |
| Frame Stiffness (At 1 m Daylight) | kN/mm | 40 |
| Frame Weight (Approximate guidance only) | kg | 453 |
| | lb | 999 |

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