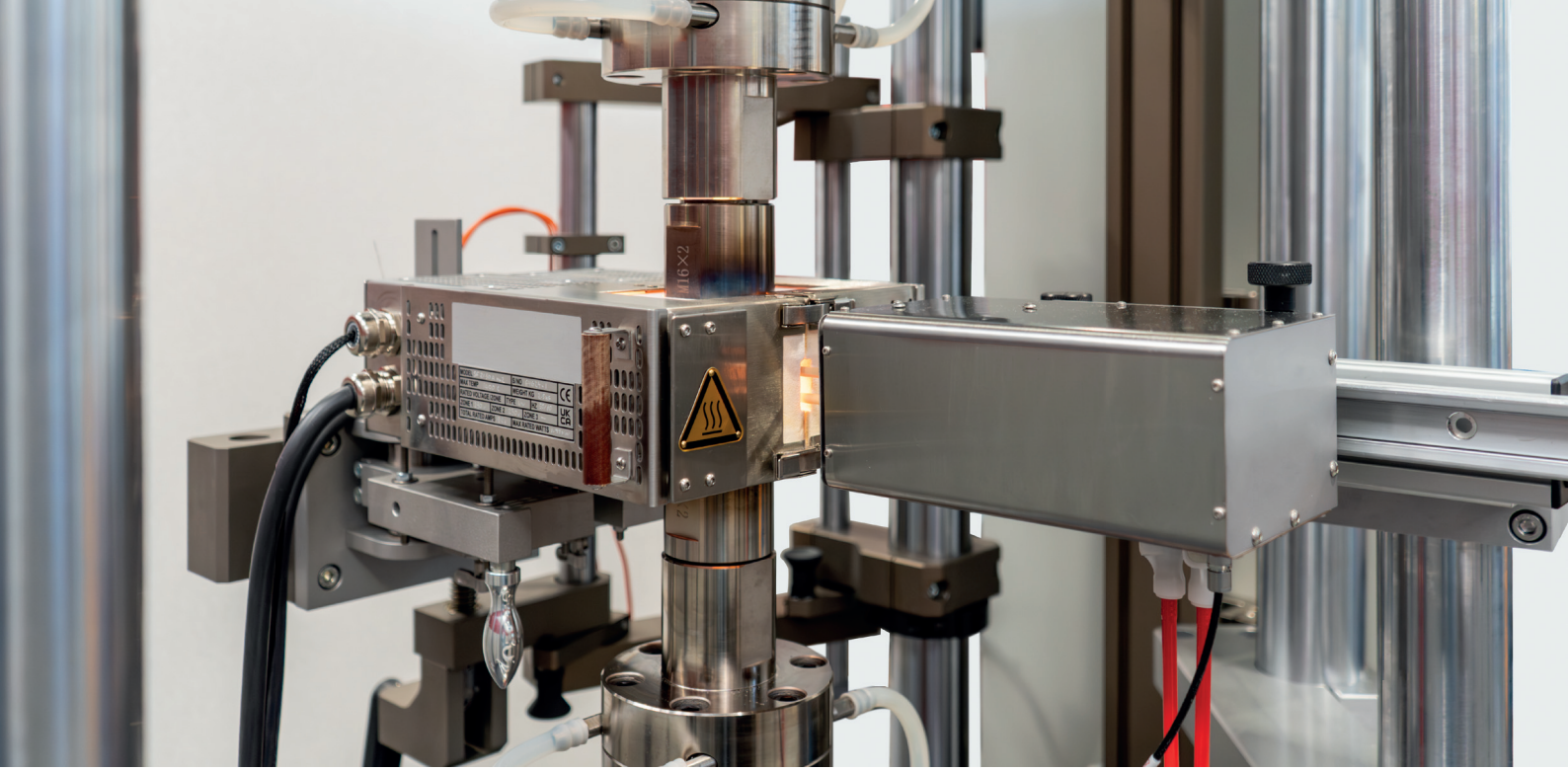


Determination of low cycle fatigue strength in high temperatures

# Low Cycle Fatigue Testing acc. to ASTM E606, ISO 12106

Zwick / Roell


# Determining Low Cycle Fatigue Strength up to +1,000°C with Kappa SS-CF

**The low cycle fatigue (LCF) test according to ASTM E606 and ISO 12106 is a fatigue test in which a cyclic load is simulated until failure. The test is normally performed at constant elevated temperatures.**

**Materials that are subjected to extreme thermal and mechanical loads can only be designed within the range of their low cycle fatigue, i.e. up to a maximum of $10^5$ load changes. Prime examples include turbine blades and discs used in aircraft engines and stationary turbines for power-generation. In addition the LCF test is used on exhaust gas turbochargers, exhaust manifolds and other similar components. In these components, designed notches (e.g. blade-disc connections) are subjected to strain-induced plastic cyclic deformation, which sooner or later leads to cracking.**

**The patented Kappa SS-CF is ideal for advanced fatigue tests for cyclic applications in the low frequency range up to 2 Hz and temperatures up to +1,000°C.**

**Challenges:**

- Precise specimen alignment: misalignment can lead to buckling or bending of the sample which results in incorrect strain measurements and inaccurate fatigue life determination
- Stable and precise temperatures: avoiding temperature overshoot especially while first heating up is essential to maintain material properties throughout the test
- Accurate and repeatable strain measurement and control: most LCF tests run in strain control and constant strain rates are the basis for reliable testing
- Standard-compliant and repeatable test results: the high complexity of LCF testing requires appropriate user expertise to ensure reliable results
- System stability: long test durations with cyclic loading over thousands of cycles are required

**Electromechanical creep testing machine:**

- The patented electromechanical machine is ideal for precise material fatigue testing (LCF and CF) with variable cyclic mechanical load.
- The backlash-free zero crossing during cyclic tensile and compression loading allows for very precise control of the test force and test speed.
- Manually adjustable crosshead enables maximum flexibility of testspace-height.
- With the precise crosshead guidance and adjustable alignment fixture, standard-compliant axial alignment can be ensured in accordance with ISO 23788 and NADCAP.
- The electromechanical drive technology enables cost-efficient, low-noise and low-maintenance operation.

**Specimen gripping and alignment:**

- Gripping of specimen outside the furnace with hydraulic specimen grips.
- Alignment fixture especially for alternating load tests increase lateral stiffness.

**Specimen tempering and controlling:**

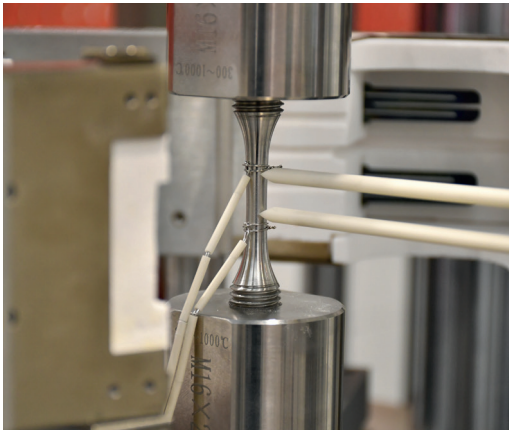
- The specimen is heated locally without overshooting up to +1,000°C.
- The temperature on the specimen is automatically and precisely controlled in the whole temperature range without influence by the user.
- The furnace and specimen temperatures are documented in testXpert R throughout the entire test sequence.

**Strain measurement:**

- Contacting side-entry extensometer measures strain precisely in class 0.5 acc. to ISO 9513.

**testXpert R:**

- testXpert Research is ideal for strain-controlled determination of low cycle fatigue strength.
- Immediate testing with minimal training effort – intuitive operation enables both beginners and experienced users to work efficiently from day one.
- Easy test configuration with the intelligent wizard of testXpert. It shows the user which test parameters must be configured and automatically checks all entries for plausibility.



*Contacting side-entry extensometer*

*Cycles force (top) and cycles strain (bottom)*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