

# Complete service life of 10<sup>10</sup> cycles ...

... within 6 days.  
The USF-2000A Mean Stress very high cycle fatigue testing system provides the most time- and cost-efficient test procedure for reliable service life data.

Within just 6 days instead of at least 1 year, the USF-2000A Mean Stress gives information and certainty about the loading capacity of metallic and other materials under different load ratios. Applying 20 kHz cycle frequency, it completes 10<sup>10</sup> cycle tests more than 60 times faster compared to 300 Hz.

For automotive, aerospace and railway applications in particular, the reliability of materials has to be predictable to

provide best quality and highest safety for consumers and peace-of-mind for manufacturers.

The USF-2000A Mean Stress generates stress amplitude in a specimen by resonating it with 20 kHz longitudinal wave oscillation. It measures 10<sup>9</sup> to 10<sup>10</sup> cycles fatigue strength, where it has been difficult or impossible to obtain data previously. Data for 10<sup>7</sup> cycles can be generated in about 10 minutes.

**Key features and key benefits**

- Suitable for long-life evaluation of materials, measured more than 60 times faster compared to 300 Hz

- (reaching 10<sup>10</sup> cycles within 6 days compared to 1 year with 300 Hz).
- Test conditions can be specified easily.
- Possible to generate high stress, e.g. for steels having the tensile strength of 1,000 MPa or higher.
- Detects and monitors fatigue mechanisms, micro-defects and inclusions.
- Low power consumption by utilizing resonance.
- No oil or cooling water required.
- Very compact testing system for different load ratios with a small footprint.
- Mean stress max 1.5 kN tensile force can be applied to the specimen during the test.



# 10<sup>10</sup> cycles in 6 days

SHIMADZU

Excellence in Science

Worldwide most efficient very high cycle fatigue testing system



# USF-2000A

## Mean Stress

Very High Cycle Fatigue Testing System

SHIMADZU

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# 10<sup>10</sup> cycles in 6 days



# Day 1

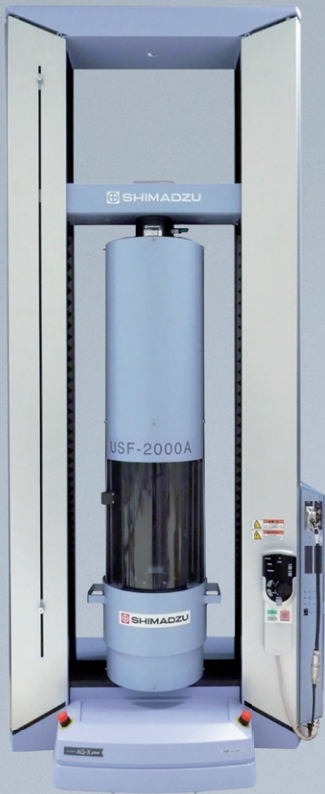
## Set up test

- Start material characterization by providing material name, Young's modulus and material density.
- Select test piece shape.
- Based on the settings, the software generates a technical drawing of the test piece automatically.
- FEM skills are not required.

## Start test

- After selecting the test-type between normal or intermittent driving, the test can be started.
- A specified oscillation and stop time (pulse-pause) ratio can be selected in the software. Supported by an air-cooling system, it avoids overheating of the sample.

On reaching the specified number of cycles or exceeding of fluctuation band of test frequency due to fatigue crack initiation, the test ends automatically.

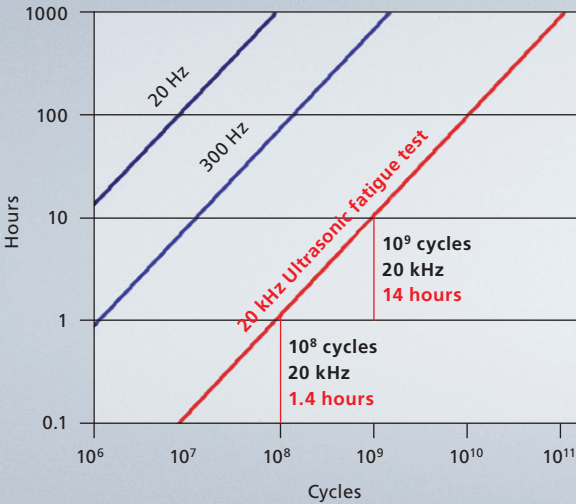


Very high cycle fatigue testing system

## USF-2000A Mean Stress

extended features at a glance

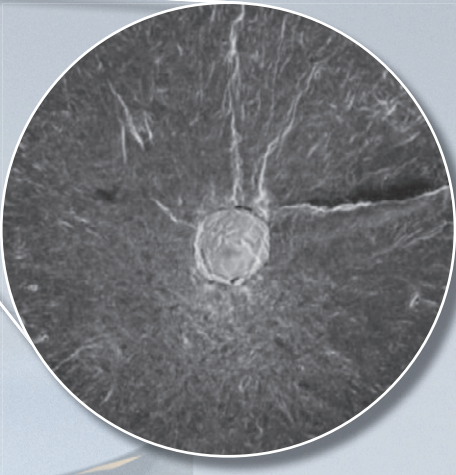
- 20 kHz  $\pm$  500 Hz test frequency
  - $10^9$  cycle test in 14 hours (compared to 39 days at 300 Hz)
  - $10^{10}$  cycle test in 6 days (compared to 365 days at 300 Hz)
- Range of test amplitudes 100 MPa  $\sim$  1,200 MPa (1,000 MPa grade steel tests are possible)
- $\pm$  50  $\mu$ m amplitude in end surface of horn (in standard configuration)
- $\pm$  10  $\mu$ m ...  $\pm$  50  $\mu$ m amplitude in end surface of horn (in Mean Stress configuration)
  - \* will change somewhat depending on the shape of the sample.
- Recreates fatigue failure appearance from micro-defects and inclusions in a short time
- Resonance technique reduces power consumption to 1/100 W compared to a conventional fatigue test
- Smallest table top system for VHCF testing at different load ratios available
- No oil or cooling water required
- Mean stress max 1.5 kN tensile force can be applied to the specimen during the test



Performance chart

# Day 6

- $10^{10}$  cycles fatigue test results are on hand.
- The software automatically generates the test report.



Fracture surface:  
crack initiation from  
subsurface



Learn more