

Application News

Tensile Test according ISO 6892-1 using the long-range extensometer MFX 500-B

Lukas Schmitz¹, Edgar Scharton²
¹Shimadzu Deutschland GmbH, ²Shimadzu Europa GmbH

User Benefits

- ◆ Complete integration of the long extensometer MFX 500-B with control via the TrapeziumX-V testing software
- ◆ Large measurement range for precise determination of properties up to fracture
- ◆ Suitable for testing according to ISO 6892-1 Method A and Method B

Introduction

For many applications, automatic longstroke extensometers have an advantage over clip-on extensometers. These sensors are in direct mechanical contact with the sample and, unlike most clip-on extensometers, can be used to measure displacement of the test piece up to fracture. Additionally, the measurement arms of these extensometers are automatically attached and removed.

This article describes testing according to ISO 6892-1 Method B using a Shimadzu universal testing machine of type AGX-V 300 kN and the automatic longstroke extensometer MFX 500-B.

Benefits of automatic longstroke extensometer MFX 500-B

The tactile longstroke extensometer MFX-500B offers the following benefits:

- Ideally suited for strain control in tensile testing
- Large measurement range for determining properties up to fracture - including brittle materials (e.g., cast high-strength steel or CFRP).
- Automatic attachment and removal of the measuring arms
- High measurement resolution
- Control of the MFX 500-B via testing software Trapezium X-V - No manual control is required.

Test

In addition to many different samples tested with the extensometer MFX 500-B, reference steel test pieces with known material date are evaluated in this application. Two different test specimens differing in shape and steel grade are tested.

Figure 1 Longstroke Extensometer MFX 500-B



Test Piece

Figure 2 Test piece geometry according to 6892-1

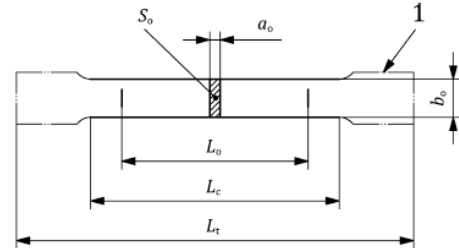


Table 1 Test piece geometry according ISO 6892-1

| | | Geometry 1 [mm] | Geometry 2 [mm] |
|-------|-----------------------|-----------------|-----------------|
| a_0 | Original thickness | 15 | 1 |
| b_0 | Original width | 25±1 | 20±1 |
| L_c | Parallel length | 220 | 120 |
| L_0 | Original gauge length | 200 | 80 |

Test Conditions

The samples are conditioned at 19 °C and 26% humidity. The tests are conducted under the same conditions.

Table 2 System

| | |
|--------------|---------------|
| System | AGX-V2 300 kN |
| Loadcell | 300 kN |
| Fixtures | 300 kN MWGs |
| Extensometer | MFX 500-B |
| Software | Trapezium X-V |

Table 3 Test method ISO 6892-1 Method B

| | |
|------------------|--------------------------|
| Testing speed: | ISO 6892-1 Method B |
| V1 (up to Rp) | 30 MPa · s ⁻¹ |
| V2 (up to At) | 0,006 s ⁻¹ |
| Test Environment | 19 °C and 26% humidity |

■ Results

The results for both test piece geometries show stable values of strain measurement with low standard deviations.

Table 4 Results of test piece geometry 1

| Name | ReH [N/mm ²] | ReL [N/mm ²] | Rm [N/mm ²] | At [%] |
|---------|--------------------------|--------------------------|-------------------------|--------|
| Probe 1 | 392,9 | 362,9 | 535,9 | 19,5 |
| Probe 2 | 395,9 | 360,7 | 537,7 | 19,5 |
| Probe 3 | 395,9 | 362,3 | 539,5 | 19,4 |
| Average | 394,9 | 362 | 537,7 | 19,5 |
| s | 1,7 | 1,1 | 1,8 | 0,1 |

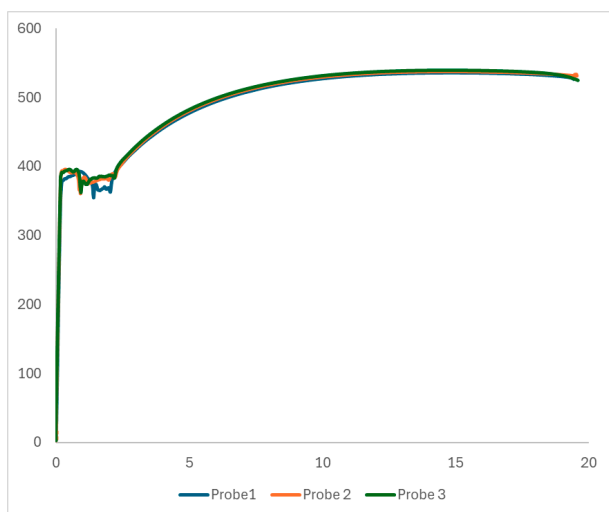
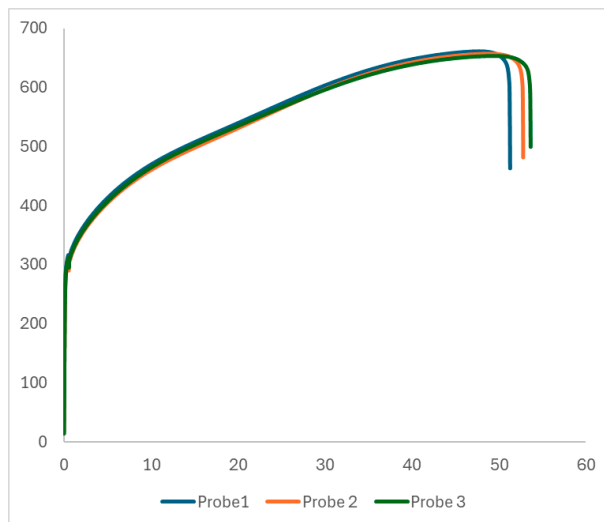


Table 5 Results of test piece geometry 2

| Name | Rp 0,2 [N/mm ²] | Rm [N/mm ²] | At [%] |
|---------|-----------------------------|-------------------------|--------|
| Probe 1 | 302,3 | 661,0 | 51,2 |
| Probe 2 | 295,5 | 656,9 | 52,7 |
| Probe 3 | 298,6 | 353,2 | 53,6 |
| Average | 298,8 | 657 | 52,5 |
| s | 3,4 | 3,9 | 1,2 |



■ Conclusion

The longstroke extensometer MFX 500-B showed accurate and stable values for strain measurements. The results of the yield point at 2% strain and the fracture strain correspond with the literature values for this material and with the values obtained using other strain gauges. Furthermore, the conducted experiments and the results obtained, demonstrate the complete and fully automated integration of the system into the testing machine and its software. All requirements of ISO 6892-1 regarding strain control are met with this package.

■ The Package

☐ Universal Testing Machine

AGX-V Series

☐ Accessories

MFX 500-B

Isolated PIO Unit

Counter Unit + Connection Cable MFX

Analog Output + Connection Cable MFX

MFX 500-B ROM Version

Manual Wedge Grips MWG (Depending on test piece)

☐ Software

Trapezium X-V 2.0.0 MFX

<References>

- 1) DIN EN ISO 6892-1: 2020-06

AGX und TRAPEZIUM are trademarks of Shimadzu Corporation in Japan and/or other countries.



SHIMADZU Europa GmbH,
www.shimadzu.eu

SHIMADZU Deutschland GmbH,
www.shimadzu.de

For Research Use Only. Not for use in diagnostic procedures.

This publication may contain references to products that are not available in your country. Please contact us to check the availability of these products in your country.

The content of this publication shall not be reproduced, altered or sold for any commercial purpose without the written approval of Shimadzu. See <http://www.shimadzu.com/about/trademarks/index.html> for details.

Third party trademarks and trade names may be used in this publication to refer to either the entities or their products/services, whether or not they are used with trademark symbol "TM" or "®".

Shimadzu disclaims any proprietary interest in trademarks and trade names other than its own.

The information contained herein is provided to you "as is" without warranty of any kind including without limitation warranties as to its accuracy or completeness. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication. This publication is based upon the information available to Shimadzu on or before the date of publication, and subject to change without notice.