ENDOLAB MECHANICAL ENGINEERING GMBH
Ahornweg 8
83083 Riedering
Germany
Phone +49 (0) 8031 23 13 23 0
Email mail@endolab.org
Web www.endolab.org

SAMPLE TEST REPORT

Proper document traceability and revision history is a must!

No.: 1234.567.891011.1213
Date: August 05, 2025
rev. 0

Test Material:	Traditional Bavarian Pretzel, REF “Brezn”
Test Method:	ISO 6820 - Wheat flour and rye flour — General guidance on the drafting of bread-making tests

Customer:	Testing Laboratory:
Bavarian Delicacies Ltd. Oktoberfeststr. 1 81543 Munich	EndoLab® Mechanical Engineering GmbH
Person responsible: A. Merkel	Person responsible: S. Kaddick, M.Eng.
	Signature: DIGITAL SIGNATURE S. Kaddick, project engineer
	Signature: DIGITAL SIGNATURE C. Findeiss, project engineer

Final reports received electronically are signed digitally.

ISO 17025 ACCREDITED LABORATORY

1 Objective

The purpose of the test described in this report was to determine the properties of a traditional Bavarian pretzel under static tension.

2 Materials

Date received: 06-Jun-2025

2 pcs. White Sausage, REF “Weißwurst”, LOT 001 (np/ns)[1,2]
3 pcs. Traditional Bavarian Pretzel, REF “Brezn”, LOT 001 (np/ns)[1,2]
1 pc. Mustard, REF “süßer Senf”, LOT 001 (np/ns)[1,2]
1 pc. Parsley, REF „Petersilie“, LOT 001 (np/ns)[1,2]

Complete and correct specimen identification is commonly checked by authorities!

A representative photographs of a test specimen is shown in Fig. 1. The test specimens were assigned for testing randomly.

Fig. 1: Representative photograph of the assembled test specimen. The specimen is indicated by a red arrow.

[1] Packaging information
op original package
sp simple individual package for each specimen
np no individual package for each specimen

Sterilization information
sr sterilized by radiation
seo sterilized by ethylene oxide
sgp sterilized by gas plasma
sa sterilized by steam
ns non-sterilized

[2] Information given by the customer and not labeled on the sausage/packaging.

Date: 05-Aug-2025 Signature:_____

3 Test Procedure

Test date: 06-Jun-2025

EndoLab is accredited to over 250 test procedures (unfortunately, none in bread-making)

3.1 Test Method

ISO 6820 (1985)	Wheat flour and rye flour — General guidance on the drafting of bread-making tests (not accredited)
ISO 17025 (2018)	General requirements for the competence of testing and calibration laboratories (accredited)

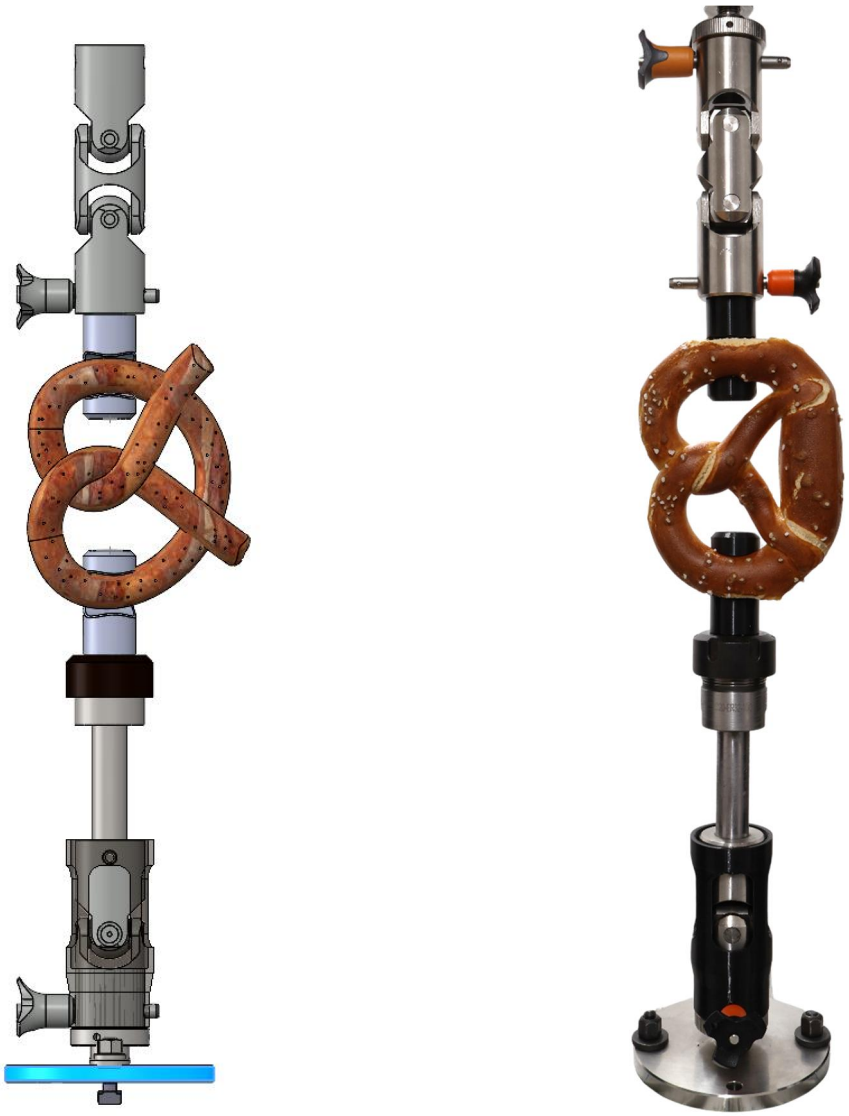
3.2 Test Equipment

#123: Knife, IKEA GmbH & Co. KG, Type VIMPELFISK, last calibration 05-Jun-2025, calibration interval 1 yr.
#234: Fork, IKEA GmbH & Co. KG, Type SEDLIG, last calibration 05-Jun-2025, calibration interval 1 yr.
#360: Universal testing machine frame, Instron, Type 5569A, last calibration n.a.
#362: Load cell, Instron, Type 2525-802, maximum range ± 1 kN, last calibration 08-Oct-2024, calibration interval 1 yr.
#363: Displacement transducer, Instron, Type 5569A, maximum range 1 212 mm, last calibration 10-Oct-2024, calibration interval 1 yr.

3.3 Test Description – Static Pretzel Tension Test

Three specimens were tested in static tension mode. The specimens were assembled according to the instructions provided by the customer.

The test setup used for the static tension test is shown in Fig. 2. Two product-specific fixtures were manufactured by EndoLab to be able to clamp the pretzel. Cardan joints were used on each side of the clamping to achieve a loading without lateral forces.



The devil is in the details when it comes to test setup design. The necessary degrees of freedom need to be carefully designed to ensure representative results.

Fig. 2: Schematic (left) and photograph (right) of the experimental set-up for the static tension test.

The static tension test was performed in ambient air at room conditions. A loading rate of 51 mm/min was used. The test parameters are listed in Tab. 1.

Tab. 1: Test parameters according to ASTM F1717 – static torsion test.

parameter	value
test block material	TPU
loading rate	51 mm/min
test environment	ambient air at room temperature

The yield and ultimate loads were calculated using the following analysis:
A linear regression of the initial linear portion of the load-displacement curve was determined and shifted by an offset. The yield point was determined as the intersection of the linear regression line and the load-displacement curve (point 2, Fig. 3). The gradient of the linear regression line was calculated between 2 to 4 N.

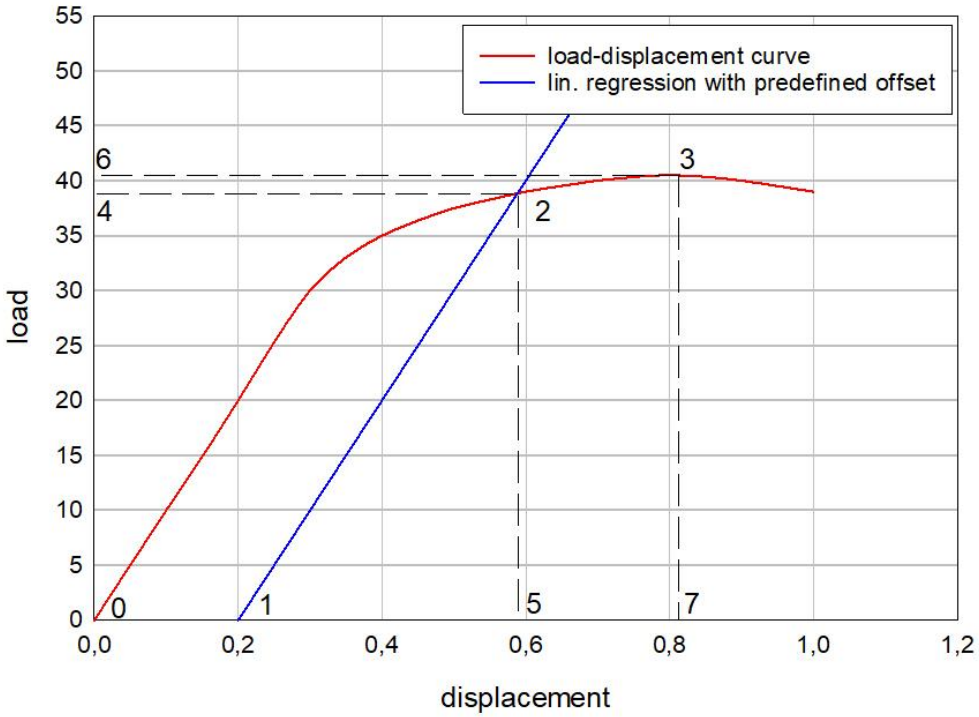


Fig. 3: Typical load versus displacement diagram.

yield load (point 4 in Fig. 3), the applied load required to produce a permanent deformation equal to the offset displacement.
offset displacement (point 0 to 1 in Fig. 4), offset on the displacement axis equal to 0,2% of the nominal active length (here: 142 mm x 0,002 = 0,284 mm).
yield displacement (point 5 in Fig. 3), the displacement at which a pretzel has a permanent deformation equal to the offset displacement.
ultimate load (point 6 in Fig. 3), the maximum load that can be applied to a pretzel.
ultimate displacement (point 7 in Fig. 3), the displacement associated with the ultimate load or ultimate moment.
stiffness, the slope of the initial linear portion of the load-displacement curve.

3.4 Deviations from the Standard

The following deviations from the standards were applied:

1) To ensure a rich taste, the pretzel was salted prior to testing

4 Results

The results of the static tension test are listed in Tab. 2. The load versus displacement curves are given in Fig. 4. All samples failed because of plastic deformation and subsequent fracturing of the pretzel (see Fig. 5 to Fig. 7). Representative microscope images of a fracture surface are shown in Fig. 8.

Tab. 2: Results of the static tension test.

specimen	yield load (N)	yield displacement (mm)	ultimate load (N)	ultimate displacement (mm)	stiffness (N/mm)
1.1	3,4	0,6	13,4	12,8	2,7
1.2	3,6	1,0	7,4	12,4	1,5
1.3	4,2	2,5	11,4	28,2	1,1
mean	**3,7**	**1,4**	**10,7**	**17,8**	**1,8**
SD	**0,4**	**1,0**	**3,1**	**9,0**	**0,8**

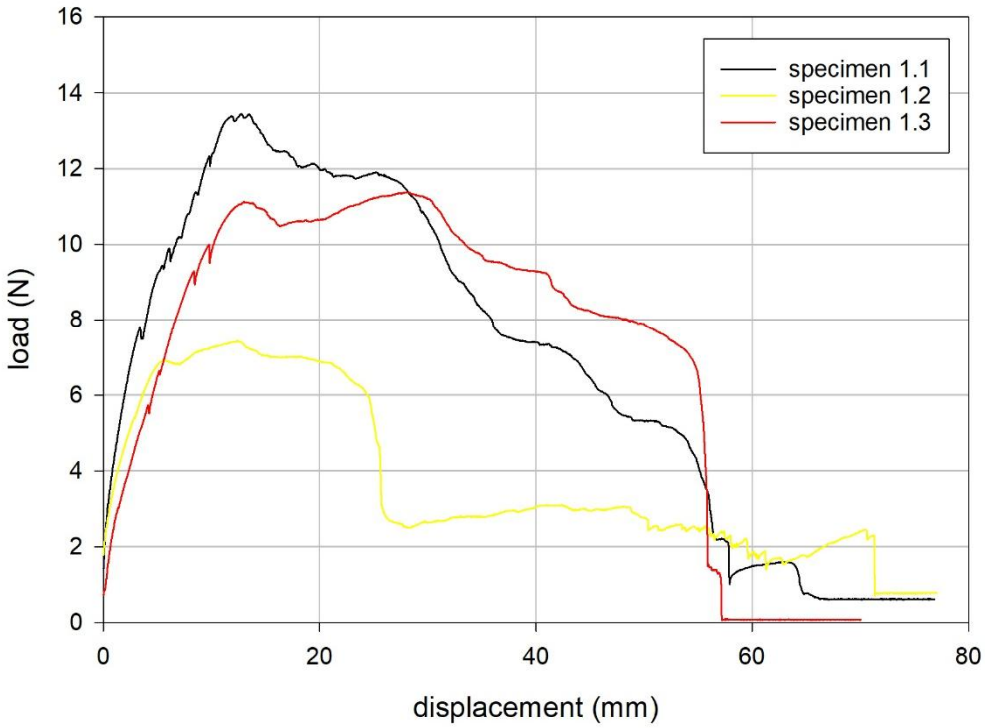


Fig. 4: Tensile load versus displacement curves.

High resolution, well-lit photographs are key so you can see what we see!

Fig. 5: Photograph of the observed failure mode. Plastic deformation and subsequent fracture of the pretzel – specimen 1.1.

Fig. 6: Photograph of the observed failure mode. Plastic deformation and subsequent fracture of the pretzel – specimen 1.2.

Fig. 7: Photograph of the observed failure mode. Plastic deformation and subsequent fracture of the pretzel – specimen 1.3.

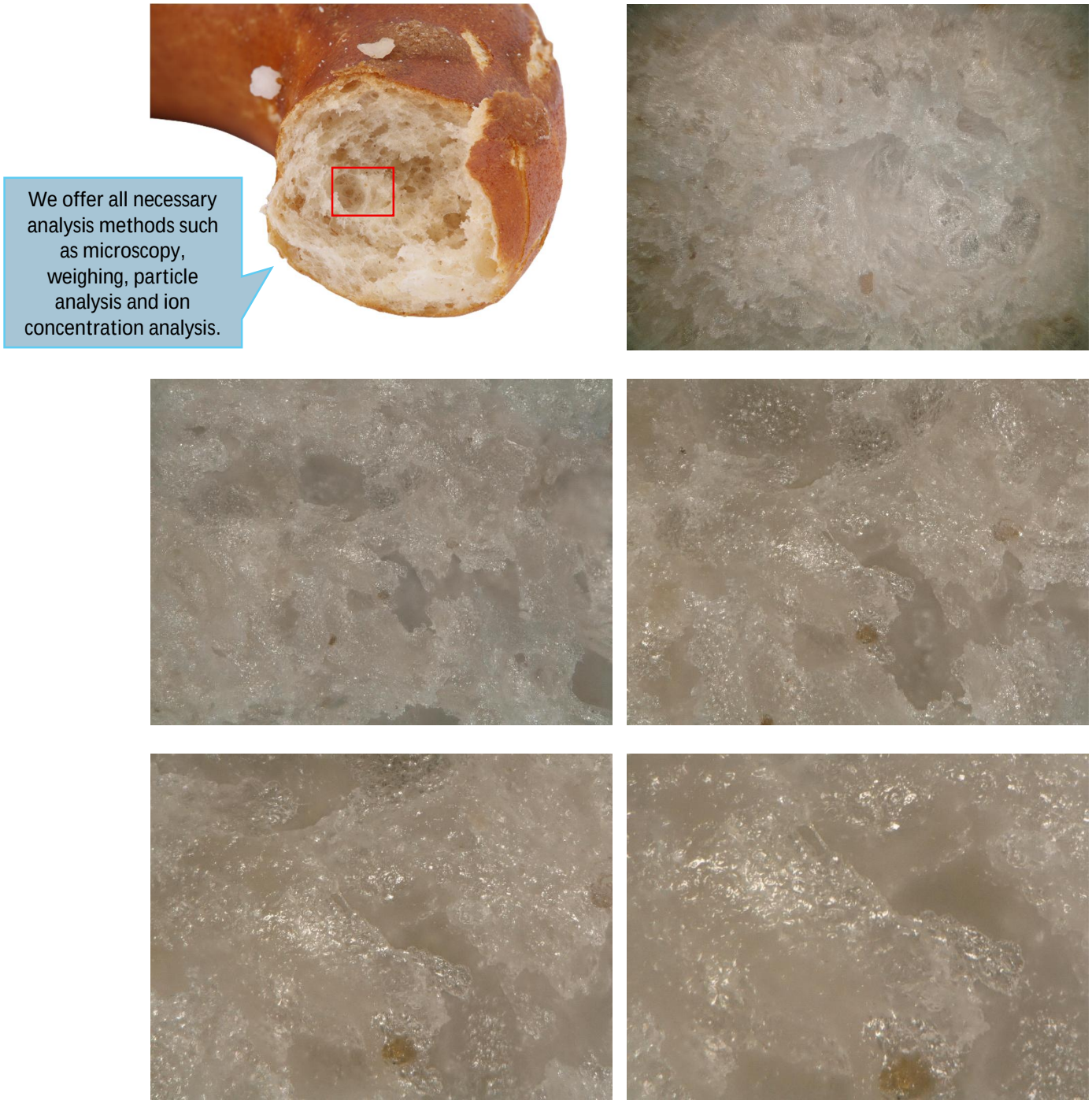


Fig. 8: Representative analysis of a fracture surface – specimen 1.1. Top left: macroscopic photograph indicating area of interest. Top right: micrograph (50x). Middle left: micrograph (100x). Middle right: micrograph (200x). Bottom left: micrograph (400x). Bottom right: micrograph (500x).

5 Subcontractors

-none-

6 Summary and Conclusion

In this test series the traditional Bavarian pretzel was tested in static tension tests.

Three specimens were tested in static tension mode. A mean yield load of 3,7 N (SD 0,4 N) at a mean yield displacement of 1,4 mm (SD 1,0 mm) was determined. A mean ultimate load of 10,7 N (SD 3,1 Nm) was determined at a mean displacement at ultimate load of 17,8 mm (SD 9,0 mm). A mean axial tensile stiffness of 1,8 N/mm (SD 0,8 N/mm) was calculated.

Permanent deformation of the pretzel and subsequent fracture were found as the failure mode after the static tension test.

A subsequent taste test was carried out. Please refer to test report number 1234.567.891011.1214.

Important Remark

This sample test report illustrates the key elements of a high-quality test report. It is intended to demonstrate the standards we apply to ensure transparency, traceability, and technical clarity in all our reports. The report is for illustrative purposes only.

All information has been compiled with care. Subject to change and potential errors.

General remarks:
Worst case analysis, implant size selection, production methods, and required confidence/reliability levels are the responsibility of the customer and, as such, were not taken into consideration by EndoLab® GmbH in the tests described in this report except as otherwise stated.
The values given in this test report have been rounded. All calculations were performed at full mathematical precision, and calculated values (such as regression data) may differ by a small fraction when using the abridged numbers given in the report.
A space has been used as the thousands separator, and a comma as the decimal separator.

Date: 05-Aug-2025 Signature:_____