

Unlocking the secret to reliable leather test results: The importance of proficiency testing in establishing metrological traceability

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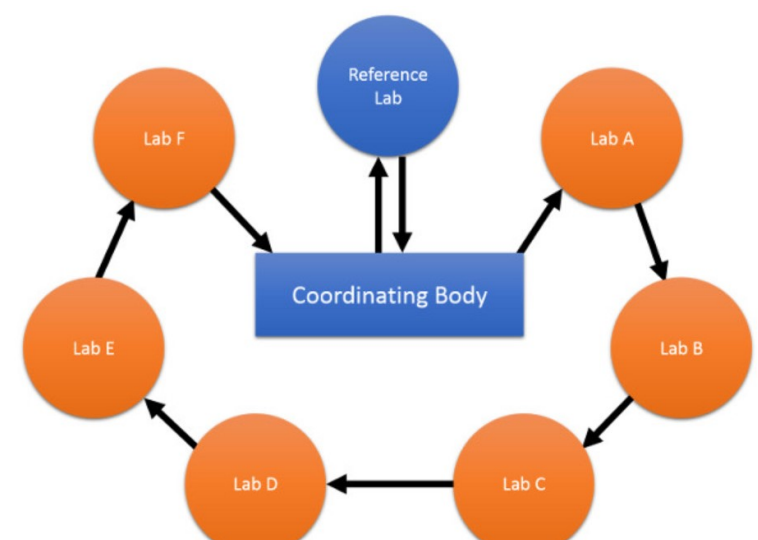
Introduction

Measurement results are used to make decisions which could affect health, safety, and even court proceedings! Thus, results need to be reliable and accurate, and this can be achieved through method validation, uncertainty evaluation and metrological traceability.

Proficiency testing (PT) is the evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons [ISO 17043]. PT is a tool used to ensure validity of laboratory results.



Metrological traceability (MT) is a "property of a measurement result whereby the result can be related to a reference through a documented unbroken chain of calibrations, each contributing to the measurement uncertainty [VIM]."



Leather is a material made from the skin of an animal by tanning or a similar process employed in footwear, furniture, automotive products etc.



East Africa Community (EAC) PT scheme - leather

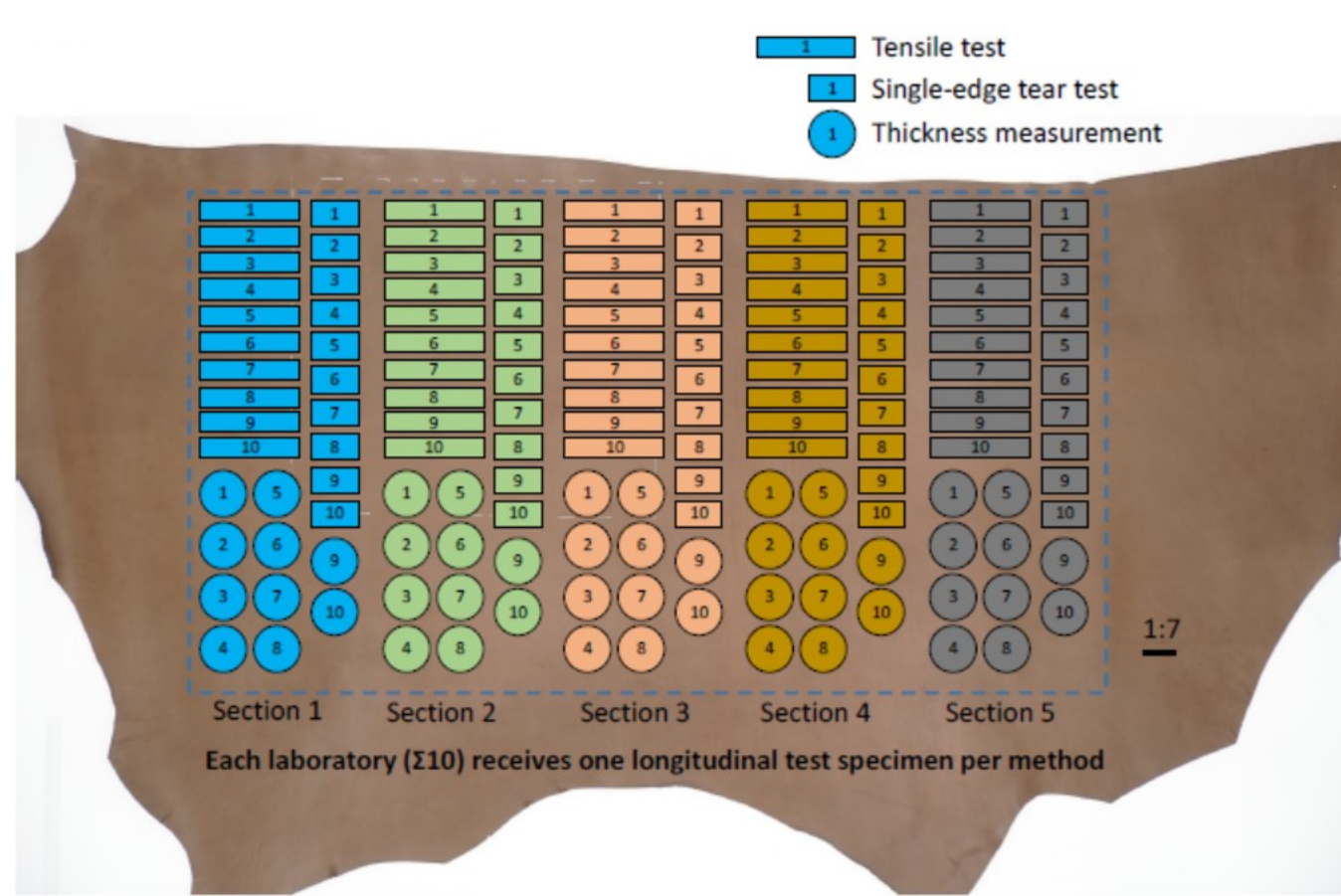
Provider: KEBS in conjunction with FILK Germany

Objective

- Parameters and methods:
 - Thickness – ISO 2589
 - Tensile test – ISO 3376
 - Single edge tear test – ISO 3377-1
- Determination of precision data (repeatability & reproducibility)
- Statistical data analysis:
 - Precision - ISO 5725-2
 - Homogeneity – ISO 13528
 - Outlier evaluation – Mandel, Grubbs I/II, Cochran
 - Suitability assessment of laboratory – z-score analysis

Test concept

- Number of participants, p = 10
- 3 kind of material samples:
 - Leather 1 – upholstery leather (UL), black
 - Leather 2 – shoe upper leather (SL), brown
 - Leather fibre material (LFM), anthracite
- Sampling & sample preparation by FILK, distribution & dispatch by KEBS
- Leather sampling according to ISO 2418 (parallel to the backbone)



Measurand and measurement procedure

- Analyte - Leather fibre material
- Measurand - Single edge tear
- Units - N
- Target uncertainty - ±0.1N
- Measurement procedure – ISO 3371 -1

A rectangular test piece specimen partially slit from one short edge is pulled so that a tear is propagated from the end of the slit. Mean force exerted during separation of the test piece is recorded.

- Sample conditioned for 48 h at normal room conditions 23 ± 2°C & 50 ± 5%RH
- Thickness measured to the nearest 0.01mm as per ISO 2589-1
- Length between jaws – 50 mm

a) Model equation - $tear\ force = \frac{F}{t} * l$



Validation of ISO 3377-1

1. General

- ☐ Analysts – competent
- ☐ Equipment – tensile machine, thickness gauge, meter rule have valid calibration
- ☐ Environment – normal conditions controlled

2. Validation parameters performance

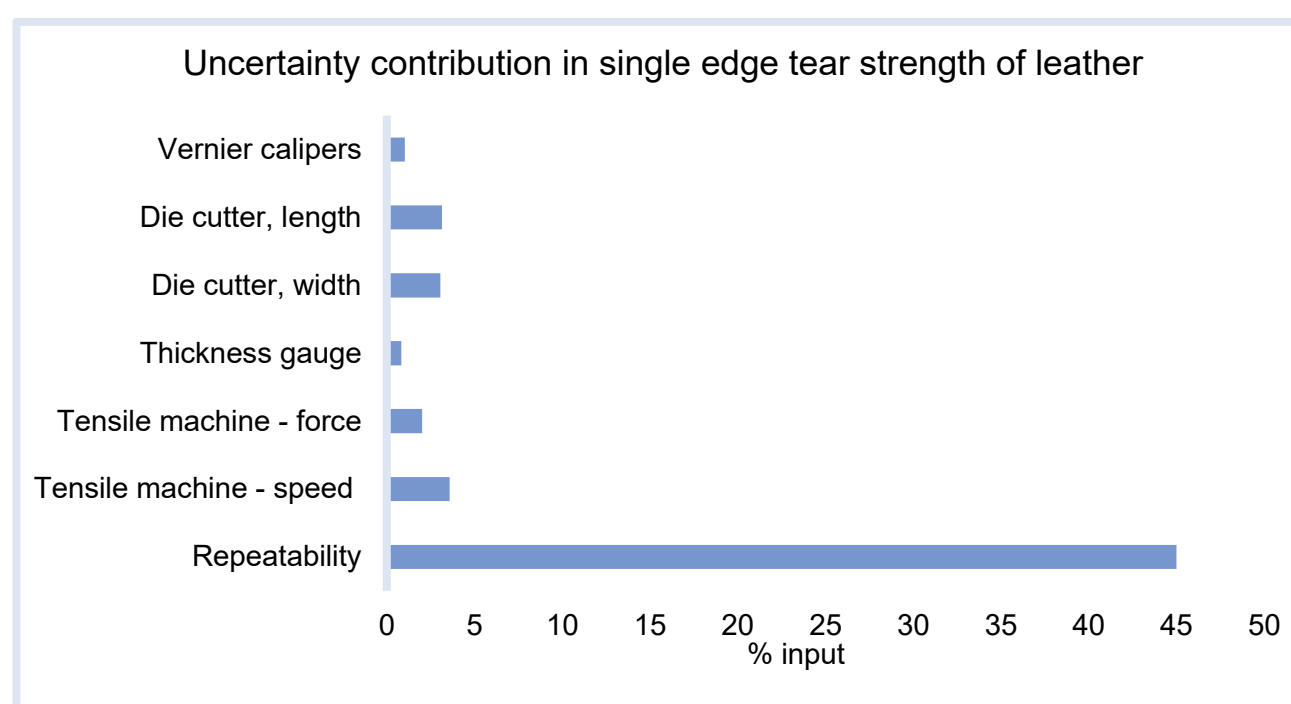
SN	Characteristic	What was analysed	Results	Acceptance criteria	Remarks
1	Trueness	PT sample	90%	80-120%	Ok
2	Within laboratory precision (repeatability)	Trueness	2.79N	5N	Ok
3	Between laboratories precision (reproducibility)	Trueness	8.29N	10N	Ok
4	Bias	Trueness	-1.5%	2%	Ok

3. Evaluation of measurement uncertainty

a) Input quantities

- Tensile load
- Thickness gauge
- Meter rule
- Die cutter

b) Uncertainty



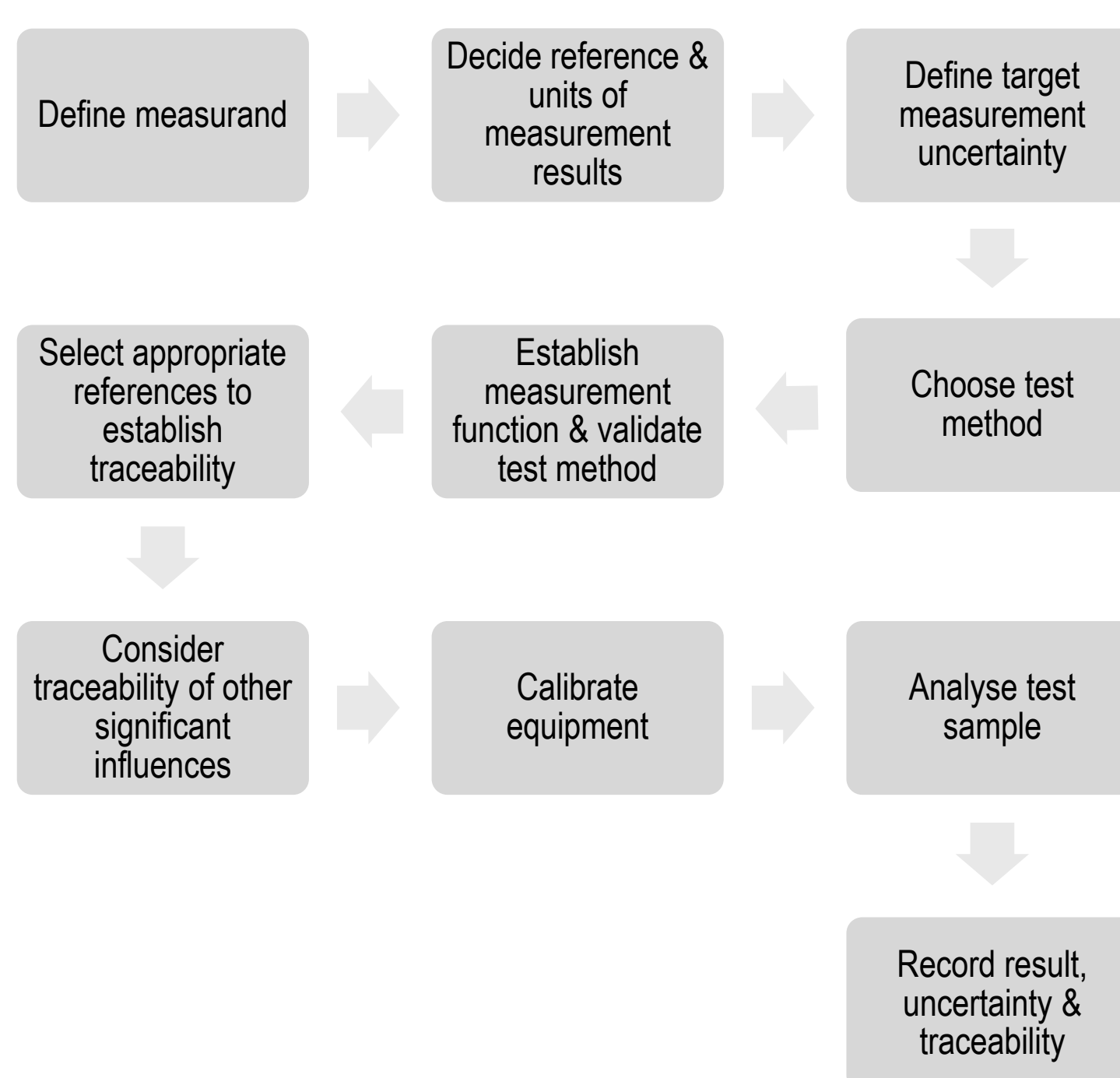
Expanded uncertainty @95% confidence level is ±0.6N

4. Conclusion

Method is fit for purpose

Activities required to establish metrological traceability

Basic steps for achieving metrological traceability:



Traceability shown by the laboratory

KEBS Polymer laboratory evidence to demonstrate traceability for single edge tear test of leather is shown below:

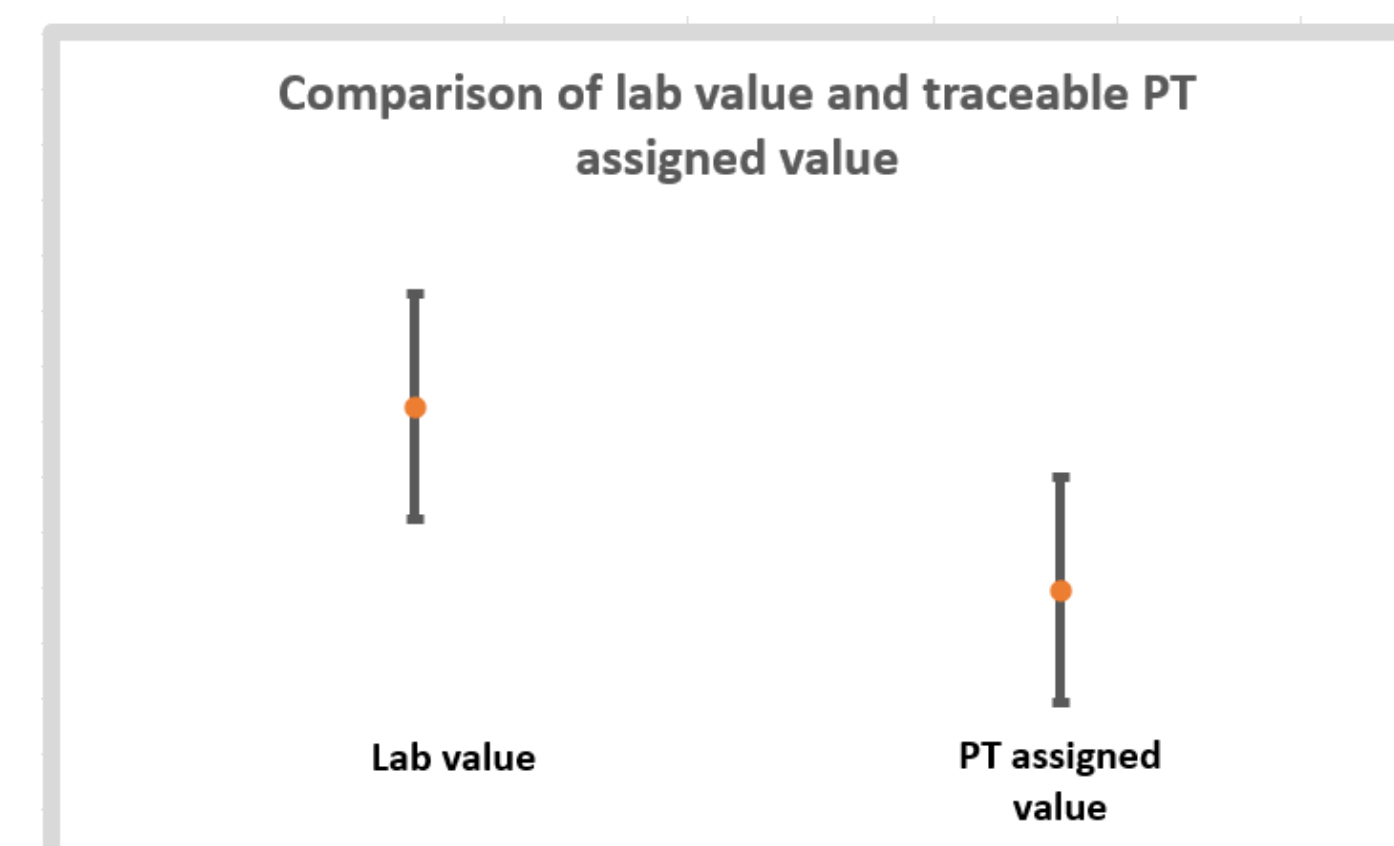
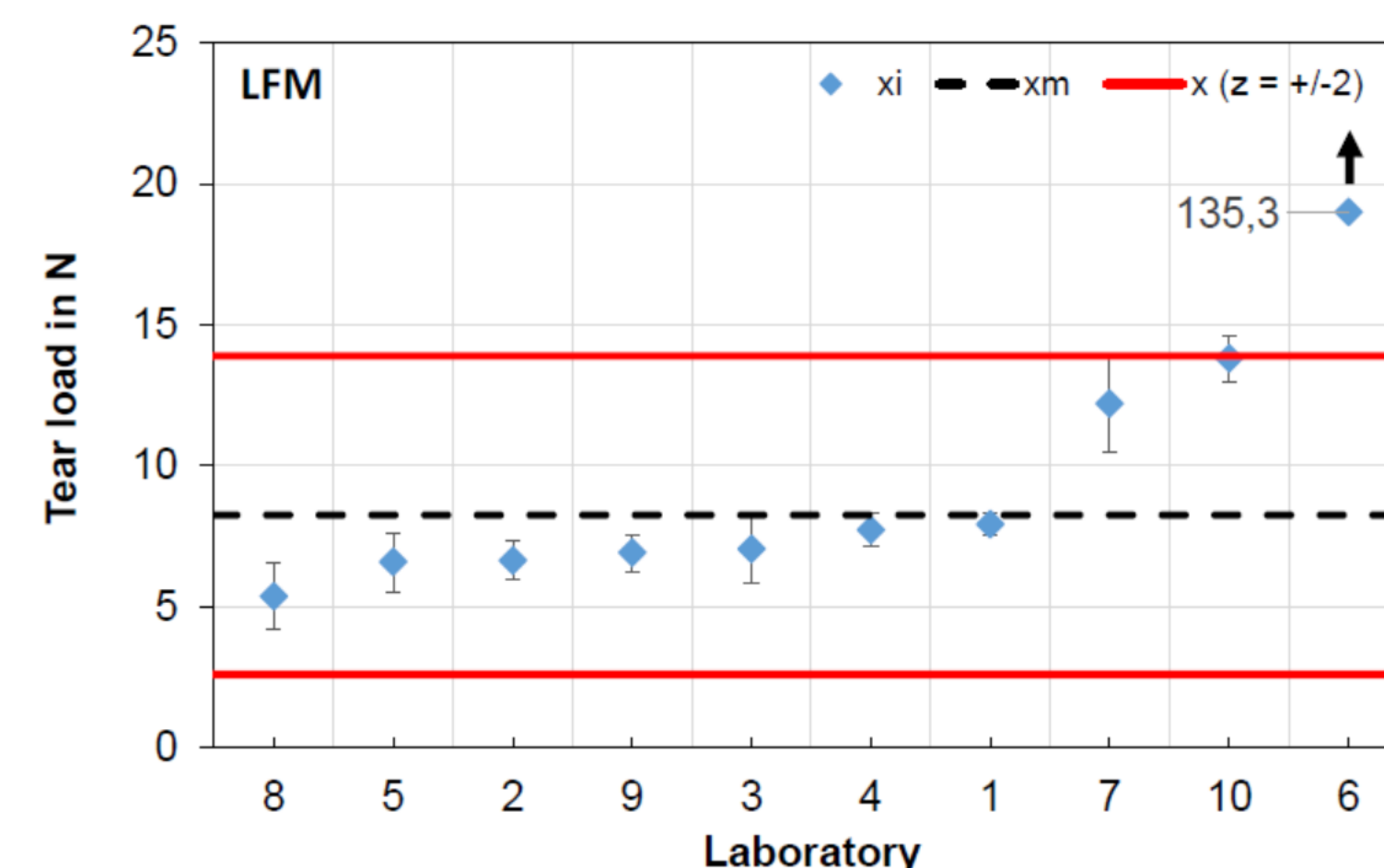
- Force exerted**
valid calibration certificate of the mass piece with stated uncertainty
- Length and width of sample**
calibration certificate of the die cutter with stated uncertainty
- Sample thickness**
valid calibration certificate of thickness gauge with stated uncertainty
- Conditioning**
valid calibration certificate of climate chamber and data logger with stated uncertainty
- Length of jaws**
valid calibration certificate of steel rule/ vernier callipers with stated uncertainty
- PT results**
degree of equivalence of lab value and traceable assigned value

Traceability statement

Leather single edge tear results are traceable to the SI unit of force, i.e., N through calibration by the National Metrology Institute of Kenya (KEBS) - a signatory to CIPM MRA with registered CMCs for force measurements in BIPM KCDB. KEBS is also accredited in force calibration by Dakks, an ILAC MRA signatory.

Evaluation of results of the PT scheme

The results of participants were analyzed using the statistical procedure of ISO 5725-2. Results were evaluated based on reference value, obtained from reference measurements independently from results of participants. Z-score was used to evaluate participant's performance.



Conclusion

EAC leather PT offered a feasible way for Polymer Laboratory to establish equivalence of leather single edge tear results with other participants. This is important in determining fitness for purpose for ISO 3371-1 an essential step in demonstrating metrological traceability.

Candidate certified reference materials (CRMs), whose metrological traceability can be demonstrated, can be provided as PT materials to enhance the quality and traceability of measurement results in the EAC region for leather and leather products. This will assist in facilitating trade through reduction of technical barriers.

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References

Metrological Traceability in Chemical Measurement
A guide to achieving comparable results in chemical measurement
2nd Edition in English

Eurachem A FOCUS FOR ANALYTICAL CHEMISTRY IN EUROPE
CITAC

Metrological Traceability of Analytical Results
A guide to achieving comparable results in analytical chemistry
2nd Edition in English

INTERNATIONAL STANDARD ISO/IEC 17043
Conformity assessment — General requirements for proficiency testing

ISO 17025
General requirements for the competence of testing and calibration laboratories

HOW TO CALCULATE MEASUREMENT UNCERTAINTY IN 7 STEPS

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