

Performance of Round Robin

Round Robin

Quality of testing?

You can expect it, if you inspect it!



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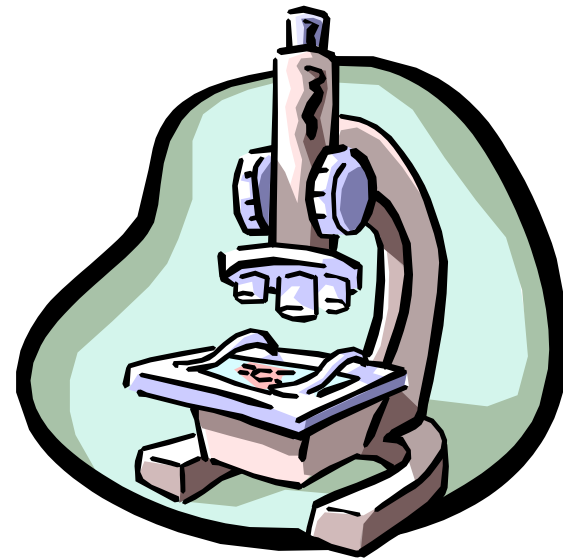
EN ISO 17025 / EN ISO/IEC 17025 / ISO-Guide 43-1

EN ISO 17025:

Participation in programmes to compare results of test-methods with other laboratories

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The “proficiency test” is a tool to determine the influence of parameters which may vary between individual laboratories, it does not represent a substitute for the calibration procedure, the use of calibrated equipment is taken for granted.



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Basics

- All tests shall be performed under repeatability conditions (same operator, same equipment, in a short intervall of time).
- Statistical evaluations possess a weakened explanatory force when few labs participate in the evaluation.
- Extremely biased results have to be investigated for possible errors.
- Results with a z-score of more than 10 are discarded to prevent an unnecessary distortion of the evaluation (check with participant) and to prevent a too „optimistic“ performance assessment of the other participants.
- Laboratory performance: expressed by laboratories bias (deviation of the lab-result from assigned value X ; X determined as a consensus value from participants, x^* : „robust average“

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Basics

- z-score: measure of the distance of an individual result from the mean, scale unit: standard deviation: gives a measure of the lab`s-performance.
- Identification of stragglers and outliers (Cochran`s and Grubb`s test); Grubb`s outlier: z-score > 2
- z-score > 2 denotes that the result of the respective lab deviates by more than $\pm 2\sigma$ from the accepted reference value for the proficiency assessment X . It is considered as a „warning signal“. Approx. 95% of all results may lie in the intervall of $X \pm 2\sigma$ if data is normally distributed.
- z-score of more than 3 shall be considered as an „action signal“
- Check for normal distribution of data by using the Anderson-Darling Test (after elimination of outliers)

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Basics

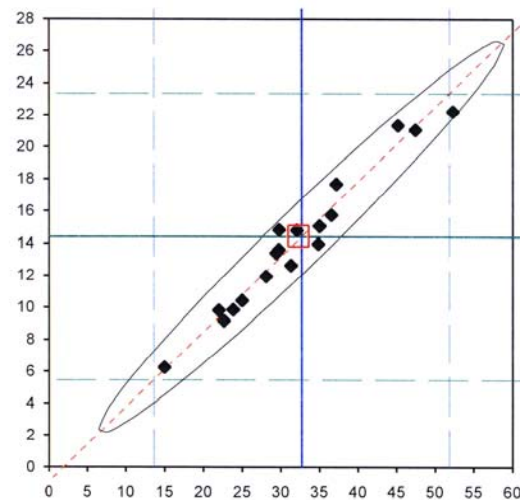
- Reliable information on the method accuracy and lab performance depends on the limit of participants (min. 7). Other conditions to be met: standard uncertainty u_x max. $0,3 \times s^*$, number of participants p^* min. 16, data comes from a normal distribution
- Calculation of repeatability and reproducibility: for utilization of the measurement uncertainty
- Evaluated reproducibility limit R matters when two independent test results are compared; generally two results shall be judged not to be different if they differ by less than R (important for estimation of measurement uncertainty MU).

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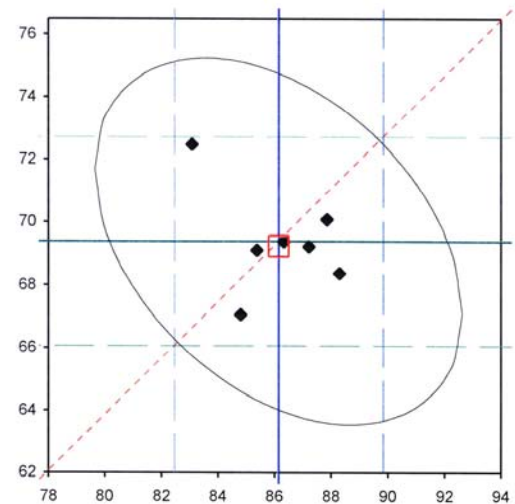
Basics

- Split level sampling for multiple check of test method accuracy as well as multiple check of the lab-performance; analysis of random vs systematic error: Youden plot (x-axis: level 1 response value / y-axis: level 2 response value).

Examples of different forms of the Youden plot:



Data set which exhibits a minimum random error and a strong influence of a systematic error



Data set which exhibits a strong influence of the random error

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ofi PTS 2008 – Test method: Abrasion resistance of rubber surface using Taber Abrader – ISO 5470-1



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Taber Abrader – ISO 5470-1 - Evaluation

- Test procedure
- Results submitted and calculated values
- Graphical presentation of the test results (line plot)
- Evaluation of the laboratory performance (Bar chart)
- Additional check of the test method accuracy (table)
- Youden plot (Scatter diagram)

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Test procedure

- Conditioning: 23°C/50%
- Taber Abrader: device acc. ISO 5470-1 (labs using devices acc. DIN 53754 had to adapt their device, device parameter had to be reported)

LabCodeNo.	3	26	33	37	112	167
Device compliance ^{a)}	ISO	DIN ^{b)}	DIN	DIN	ISO ^{b)}	ISO
Distance between rotation axes (wheel / specimen)	19,1 mm	19,1 mm	20 mm	not reported	20 mm	19,1 mm
ID of the nozzle	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	---	---	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Nozzle distance from the specimen	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	---	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Air pressure	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	---	---	<input checked="" type="checkbox"/>	---
Load	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Diameter of abrasive wheels	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Width of the abrasive wheels	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

^{a)} The testing device complies in its original state with ISO 5470-1 or with DIN 53754

^{b)} This may be an erroneous indication because the standard distance between rotation axes (wheel / specimen) is 20 mm in devices which comply with the requirements according to DIN, and 19,1 mm in devices which comply with the requirements according to ISO

^{c)} LabCodeNo. 167: air pressure may comply but it was not checked

- Test procedure acc. ISO 5470-1
- Expression of results acc. ISO 5470-1: mg/100 revolutions

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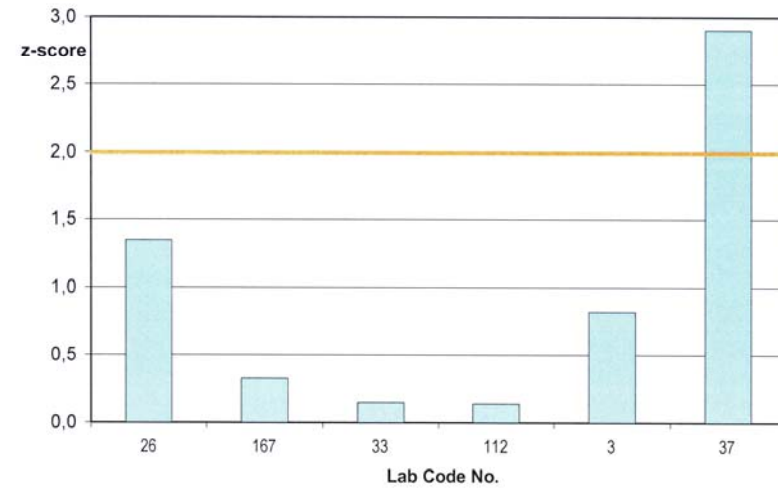
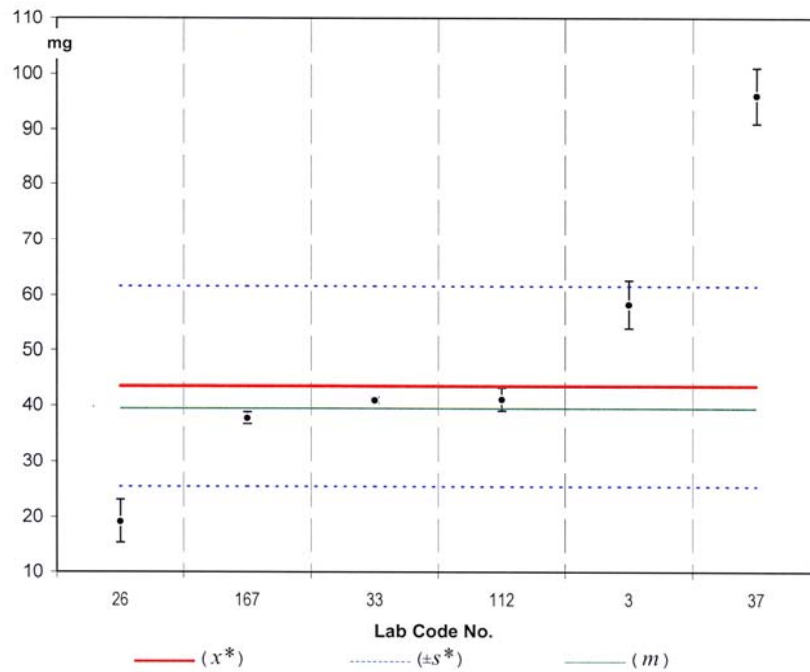
Accuracy of test method

Additional check of the test method accuracy			
Do the input data come from a normal distribution (when outliers found were eliminated) ? (The results listed below shall be considered as really justified only if the input data come from a normal distribution)			YES
General mean $\sum^n_i x_{ik} / \sum^n_i$	m	39,5	mg
Repeatability variance	s_r^2	7,9503733	
Repeatability standard deviation	s_r	2,81964	mg
Repeatability coefficient of variation	$CV\%_r$	7,144	%
Between-laboratory variance	s_L^2	189,7899611	
Between-laboratory standard deviation	s_L	13,77643	mg
Between-laboratory coefficient of variation	$CV\%_L$	34,905	%
Reproducibility variance s_R^2	$s_r^2 + s_L^2$	197,7403344	
Reproducibility standard deviation	s_R	14,06202	mg
Reproducibility coefficient of variation	$CV\%_R$	35,629	%
Repeatability limit	r	7,9	mg
Relative repeatability limit	r_{rel}	20	%
Reproducibility limit	R	39,4	mg
Relative reproducibility limit	R_{rel}	100	%
Number of participants included in the accuracy evaluation	p	5	
Number of tests included in the accuracy evaluation	\sum^n	10	

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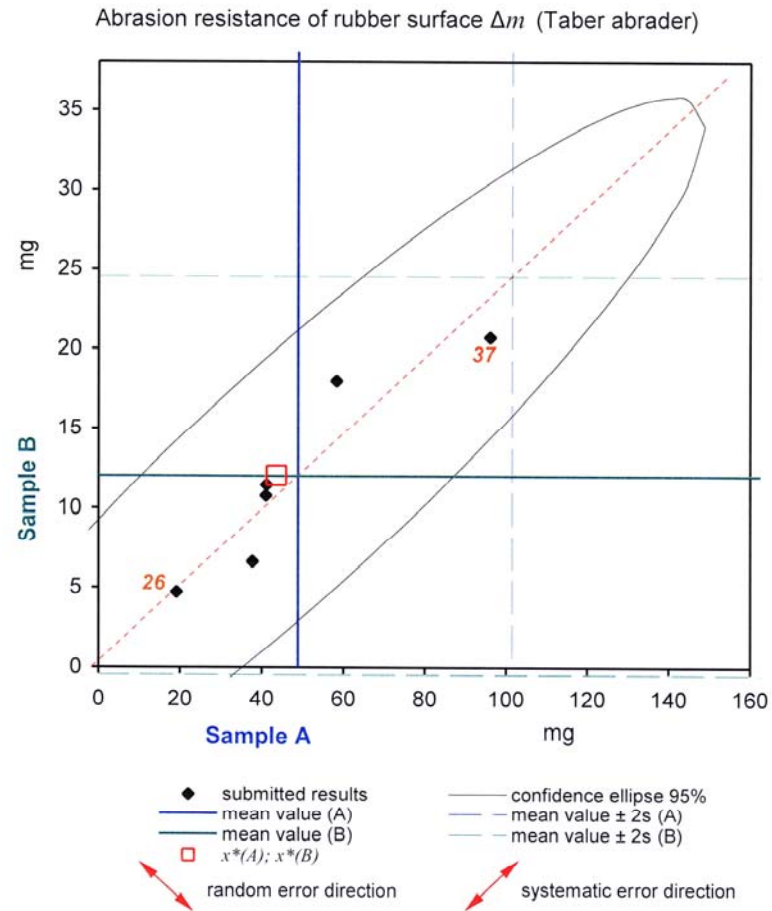
Performance of individual laboratory

Abrasion resistance of rubber surface Δm (using Taber abrader) - Sample A



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Youden plot confidence ellipse



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- **ofi PTS 2008; January – June 2008**
- 180 testing laboratories of 33 countries (from all continents)
- 80 test-methods were offered, mainly acc. to ISO- and EN-standard
- Material testing: plastic and rubber
- Product testing: geotextiles and geosynthetics, plastic pipes, surfaces and coatings, plastic films and packaging material, plastic sheeting, rigid foam and sound-insulating material, material for car interiors (testing for emissions)

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- **ofi PTS 2009**

Testing methods for sports surfaces?

