

27th International Forum for Materials Testing

**-Inter laboratory test on metal tensile specimens-
New results from the last proficiency tests
presented by the example of an EA highlighted
proficiency test**

Ulm

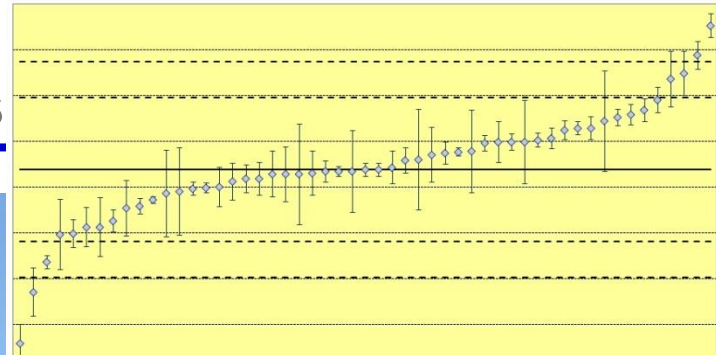
Tuesday, 16. October 2018

Dipl.-Ing. Christian Weißmüller / Christoph Sieg

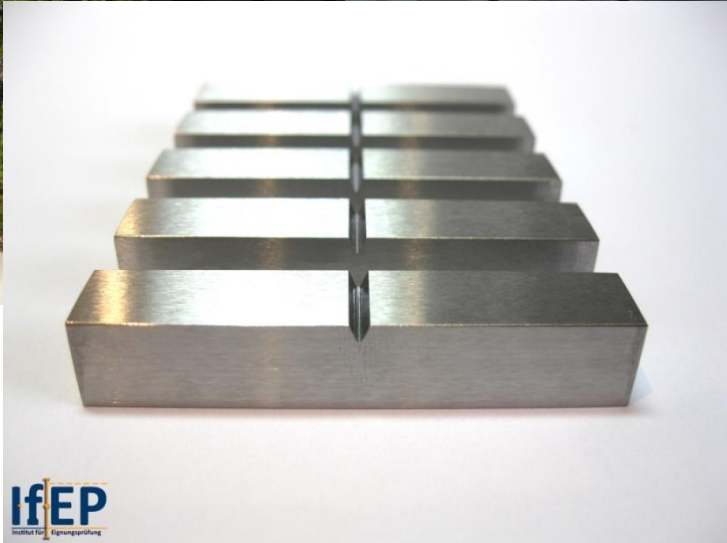


Since 2004

Eignungs



Since 2000; accredited 2005



Since 2008; accredited 2009

PT 1623: Tensile test reinforcement bars

- 6 x 1 000 mm BST 500, diameter 12 mm
- 76 labs
- 76 accredited
- Values: $R_{eH} / R_m / A / A_{gt} / m_E$

Table 1: Participants' locations

| | | | | | |
|---------|----|-------------|---|-------------|---|
| Austria | 22 | Greece | 1 | Serbia | 1 |
| Belarus | 1 | Italy | 4 | Slovenia | 3 |
| Belgium | 2 | Jordan | 1 | Spain | 6 |
| Estonia | 1 | Lithuania | 2 | Sweden | 5 |
| Finland | 1 | Malaysia | 1 | Switzerland | 4 |
| France | 2 | Netherlands | 2 | Turkey | 1 |
| Germany | 11 | Portugal | 5 | | |

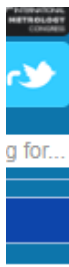
Information sheet EA highlighted Proficiency tests metal 2016

These proficiency tests were selected by the EA working group ILCs in Testing to monitor the international multi-lateral agreements. A summary of the results will be evaluated without disclosing the individual confidentiality of the participants. The EA working group ILCs in Testing highlights this proficiency test to its ABs. It is expected that the ABs strongly encourage and support their applicant and accredited laboratories to participate in this proficiency test in order to maximise the quality of relevant data.

Applications for this test will be accepted until May, 31st 2016

| | | |
|--|--------------------------|---|
| No. 1623 Tensile test Steel for the reinforcement | Test Standard: | EN ISO 15630-1, EN ISO 6892-1 |
| | Material: | 6 reinforcing bars for machining in laboratory |
| | Production of specimen: | By the participants |
| | Results to be submitted: | according to the test standard, additionally Young's Module and the Measurement Uncertainty (not evaluated) |
| | Assigned Value: | Consensus values calculated from the results of the participants |
| | Additional information: | Influence of manufacturing the specimen, statements of measurement uncertainty of the test method |
| | Participation fee: | Germany 310 €; other countries: + Delivery costs * estimated start FW 28/2016 |

* Costs exclusive of VAT; delivery costs, see www.ifep.eu



PT 1623: EA WG: ILC in testing

- IfEP is active since 2004
- 1623:
- Proposal 2015 in Geneva
- Accepted 2016 in London
- Results discussed 2017 in Athens

- GOAL: Ensure the comparability between the MLA members

PT 9 rein

ILC in Testing report review form

Review performed by: Frenz/Weißmüller/Lehmann

| | | | |
|---|--|----------------------|--|
| ILC code | 1102 | | |
| Part 1 | General description of the scheme (What kind of ILC is it?) | | |
| Title | Hardness Testing Rockwell HRC | | |
| Purpose of the ILC | Assessment of the performance of laboratories in the determination of hardness on 3 different levels | | |
| Test item | 10 sets of 3 certified reference hardness blocks each (high, middle and low) | | |
| Parameter tested | Hardness, error of testing machine and repeatability of testing machine | | |
| Test procedure used | ISO 6508-1, assessed according to ISO 6508-2 | | |
| Name of organiser | IfEP GmbH | | |
| Deadline for reporting the results and date of final report | Deadline: 15.02.2012 Final report: March 2012 (English version under review) | | |
| Overall number of participating laboratories | 101 | | |
| Number of participating laboratories per parameter | Parameter | Total number of labs | Number of Labs <u>accred.</u> by EA member |
| | Error low | 101 | 79 |
| | Repeatability low | 101 | 79 |
| | Error middle | 101 | 79 |
| | Repeatability middle | 101 | 79 |
| | Error high | 101 | 79 |
| | Repeatability high | 101 | 79 |

Review performed by: Frenz/Weißmüller/Lehmann

| | | | | | | |
|---|---|---|----|--|-----|------------------|
| ILC code | 1102 | | | | | |
| Part 1 | General description of the scheme (What kind of ILC is it?) | | | | | |
| Title | Hardness Testing Rockwell HRC | | | | | |
| Purpose of the ILC | Could the ILC be used for evaluating the effectiveness of the MLA? | 59 % MLA members, >50 % = can be used | | | | |
| Test item | | | | | | |
| Parameter tested | Performance of participants results | Satisfactory | | Questionable | | Not satisfactory |
| | Number | Total | EA | Total | EA | Total EA |
| | | 80 | 60 | --- | --- | 21 19 |
| Test procedure used | Expected performance level | <i>An amount 24% of not satisfactory results (EA Group) is rated as not acceptable. Compared to other pts it should be less than 10%.</i> | | | | |
| Name of organiser | | | | | | |
| Deadline for reporting the results and date of final report | Deadline: 10.02.2012 | Final report: March 2012 (English version under review) | | | | |
| Overall number of participating laboratories | 101 | | | | | |
| Number of participating laboratories per parameter | Parameter | Total number of labs | | Number of Labs <u>accred.</u> by EA member | | |
| | Error low | 101 | | 79 | | |
| | Repeatability low | 101 | | 79 | | |
| | Error middle | 101 | | 79 | | |
| | Repeatability middle | 101 | | 79 | | |
| | Error high | 101 | | 79 | | |
| | Repeatability high | 101 | | 79 | | |

PT 1623: Tensile test reinforcement bars

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PT 1623: Tensile test reinforcement bars: Homogeneity

- 29 Specimens
- Goal: SD R_m under 1 %

| | R_{eH} | R_m |
|--|----------|---------|
| Total mean \bar{x} | 557 MPa | 632 MPa |
| Relative standard deviation between the results s_s | 1,2 % | 0,6 % |

PT 1623: Tensile test reinforcement bars: Aquisition



PT 1623: Tensile test reinforcement bars: assessment criteria

| Specific values | R_{eH} in MPa | R_m in MPa | A in % | A_{gt} in % |
|-------------------------|--------------------|-----------------|-------------|------------------|
| X | 546,8 | 633,7 | 23,9 | 11,3 |
| $\hat{\sigma}$ | 13,6 | 9,9 | 0,9 | 1,3 |
| $u_X, k = 1, p = 68 \%$ | 1,9 | 1,4 | 0,2 | 0,2 |
| Z = -3 | 506,1 | 604,1 | 21,2 | 7,5 |
| Z = -2 | 519,7 | 613,9 | 22,1 | 8,8 |
| Z = 2 | 574,0 | 653,4 | 25,8 | 13,9 |
| Z = 3 | 587,5 | 663,2 | 26,7 | 15,2 |

PT 1623: Tensile test reinforcement bars: nIQR

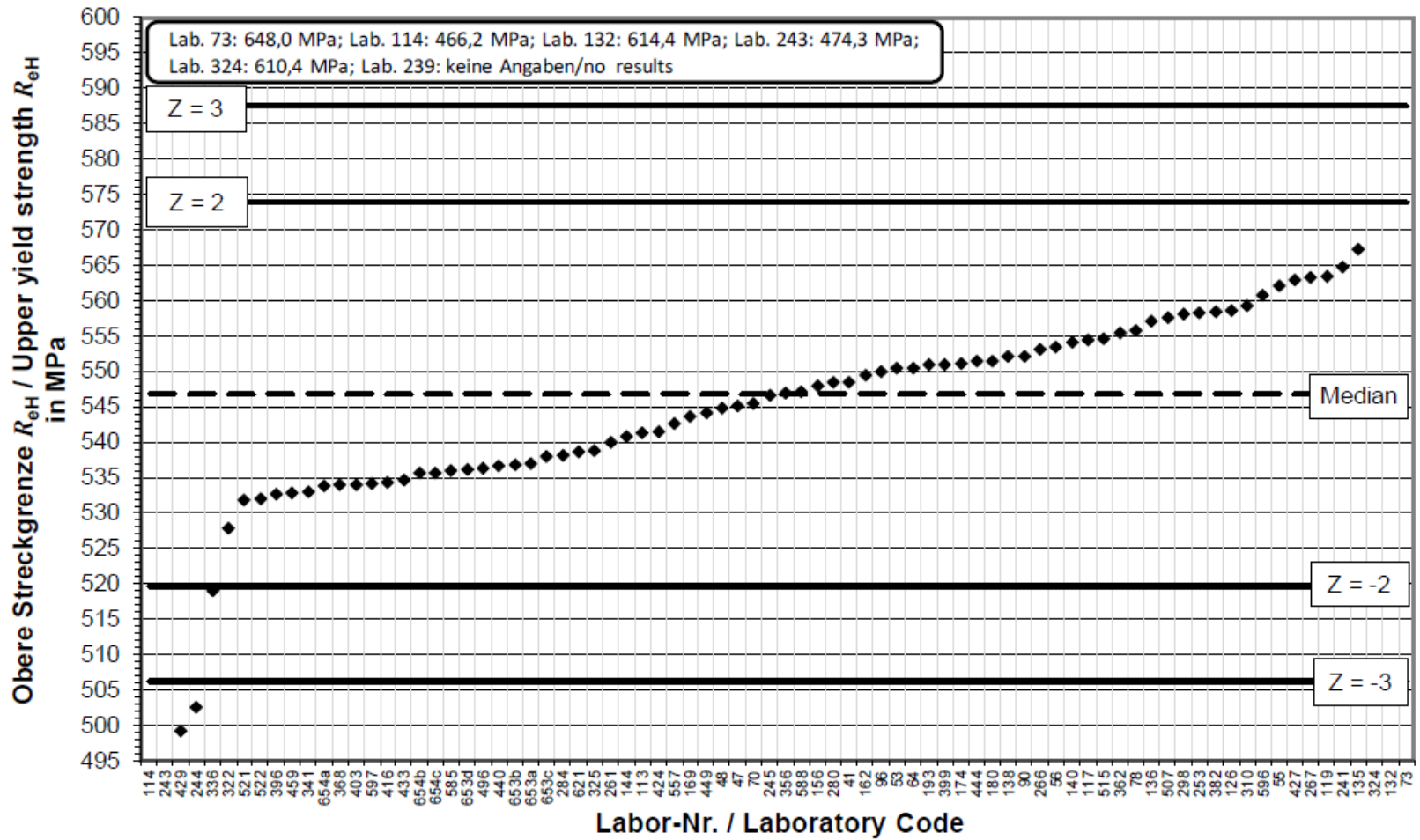


Bild A1: Obere Streckgrenze R_{eH} ; Mittelwerte aller Laboratorien
Figure A1: Upper yield strength R_{eH} ; mean values of all laboratories

PT 1623: Tensile test reinforcement bars: results

Table 10: Results of the proficiency test

| Specific value | Number of participants/ evaluated results | Results $ Z < 3$ |
|---|---|----------------------|
| Determination of the upper yield strength R_{eH} | 80 | 91 % |
| Determination of tensile strength R_m | 81 | 90 % |
| Determination of percentage elongation after fracture A | 30 | 93 % |
| Determination of percentage total extension at maximum force A_{gt} | 77 | 92 % |

PT 1623: Tensile test reinforcement bars: results

4.3 Percentage elongation after fracture A

Data from laboratories using an original gauge length $l_0 = 60$ mm were used only.
30 results were evaluated.

The laboratories listed in table 6 achieved an absolute Z-score of more than 2.

Table 6: Percentage elongation after fracture A : Deviation from assigned value;
list of the laboratories with a questionable / unsatisfactory result

| Lab.-Code | Deviation in % | Z-score | Assessment |
|-----------|-------------------|---------|------------|
| 70 | -1,9 | -2,1 | O |
| 96 | 3,0 | 3,2 | X |
| 245 | 9,3 | 10,1 | X |

O: questionable result
X: unsatisfactory result

The results of this specific test value are presented in graph form in figure A3,
appendix A.

PT 1623: Tensile test reinforcement bars: results: A

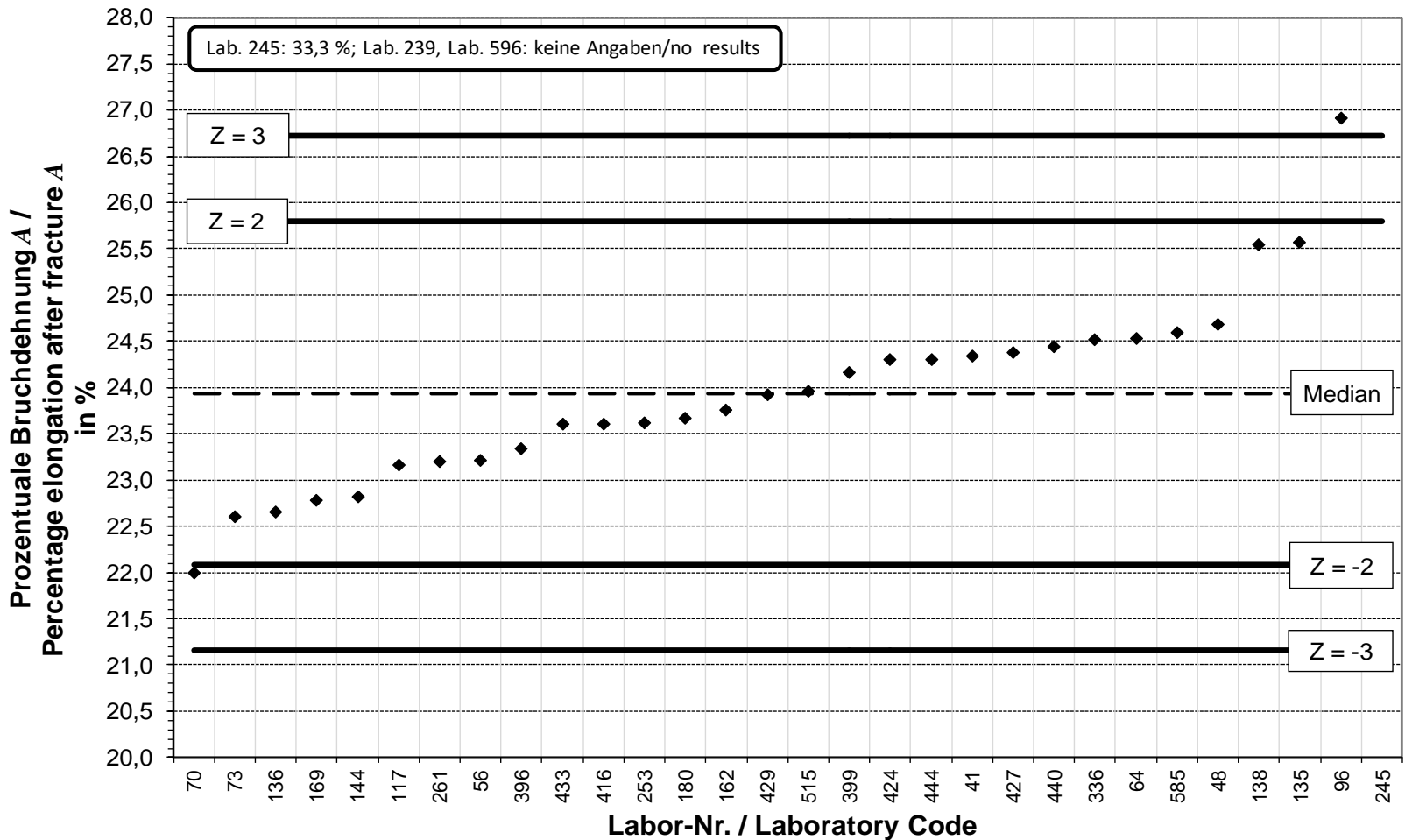


Tabelle 7: Bruchdehnung A : Angaben der Laboratorien mit abweichender Anfangsmesslänge

| Labor-Nr. | A in % | Anfangs- messlänge in mm | Labor-Nr. | A in % | Anfangs- messlänge in mm |
|-----------|-------------|--------------------------------|-----------|-------------|--------------------------------|
| 47 | 24,7 | 50 | 325 | 23,8 | 100 |
| 53 | 24,1 | 100 | 341 | 23,7 | 220 |
| 55 | 18,4 | 100 | 356 | 12,8 | 100 |
| 78 | 17,9 | 120 | 362 | 19,1 | 100 |
| 90 | 18,8 | kA | 368 | 14,5 | 300 |
| 113 | 24,4 | 225 | 382 | 18,2 | 120 |
| 114 | 27,2 | 25 | 403 | 24,1 | 100 |
| 119 | 24,5 | 50 | 449 | 25,0 | 100 |
| 126 | 17,9 | kA | 459 | 12,6 | 400 |
| 132 | 19,5 | 50 | 496 | 24,0 | 100 |
| 140 | 20,0 | 80 | 507 | 17,5 | 100 |
| 156 | 25,3 | 500 | 521 | 25,7 | 6 |
| 174 | 9,5 | 100 | 522 | 18,4 | 120 |
| 193 | 14,2 | 500 | 557 | 23,7 | 50 |
| 241 | 22,9 | 100 | 588 | 14,4 | 100 |
| 243 | 22,5 | 155 | 597 | 13,2 | 100 |
| 244 | 26,8 | 40 | 621 | 18,8 | 120 |
| 266 | 24,9 | 100 | 653a | 23,6 | 200 |
| 267 | 12,2 | 100 | 653b | 23,3 | 200 |
| 280 | 24,2 | 100 | 653c | 22,8 | 200 |
| 284 | 24,1 | 4 | 653d | 24,5 | 200 |
| 298 | 9,8 | 100 | 654a | 23,8 | 100 |
| 310 | 23,2 | 200 | 654b | 22,6 | 100 |
| 322 | 25,9 | 50 | 654c | 24,7 | 100 |
| 324 | 41,4 | 20 | | | |

EP 1623: ZA

- ISO 1563

For the determination of the elongation at break, the nominal diameter (d) shall be determined manually.

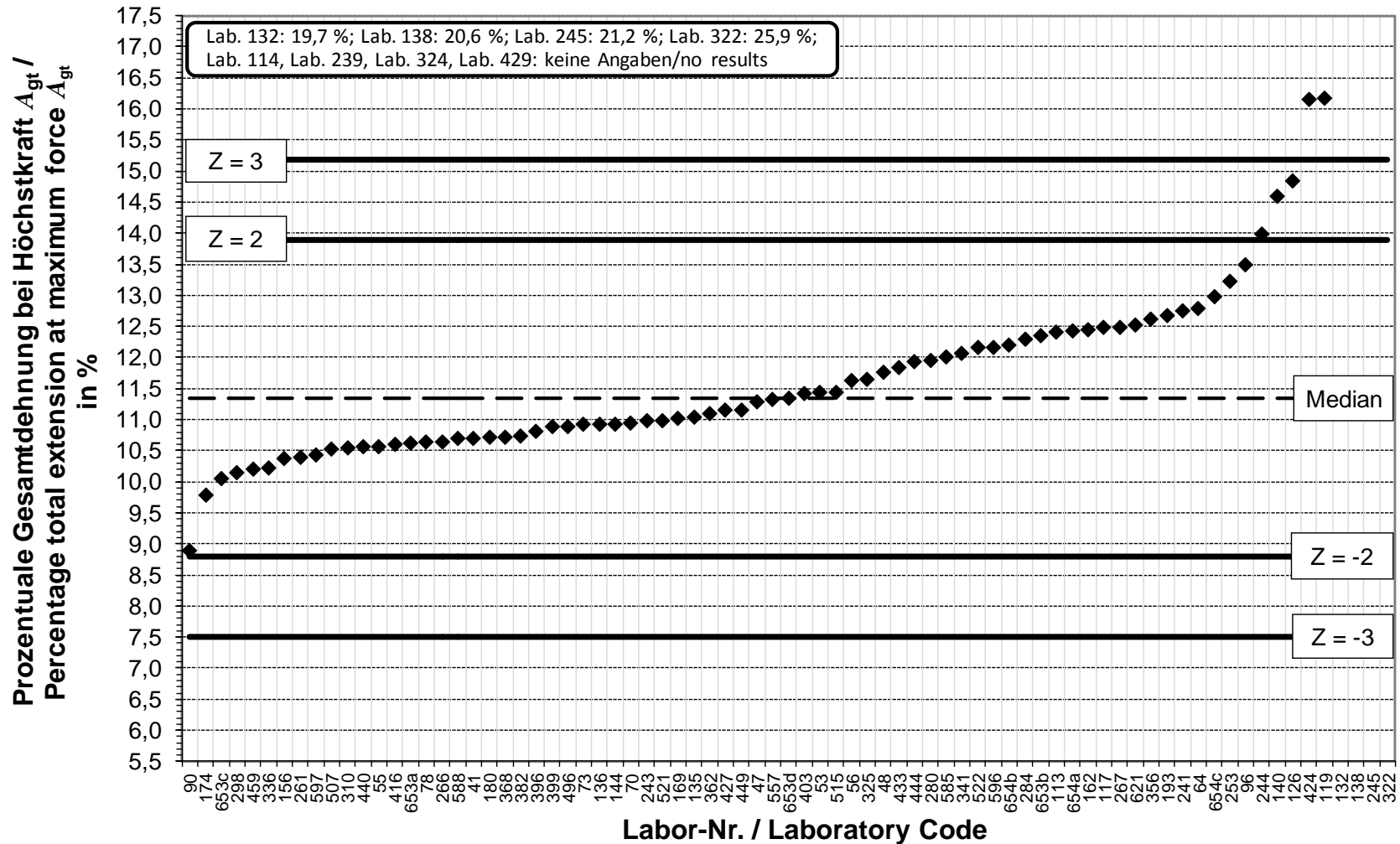
The measurement of the length of 100 mm, as is the greater) away from the grips and shall be determined manually.

In case of dispute, the

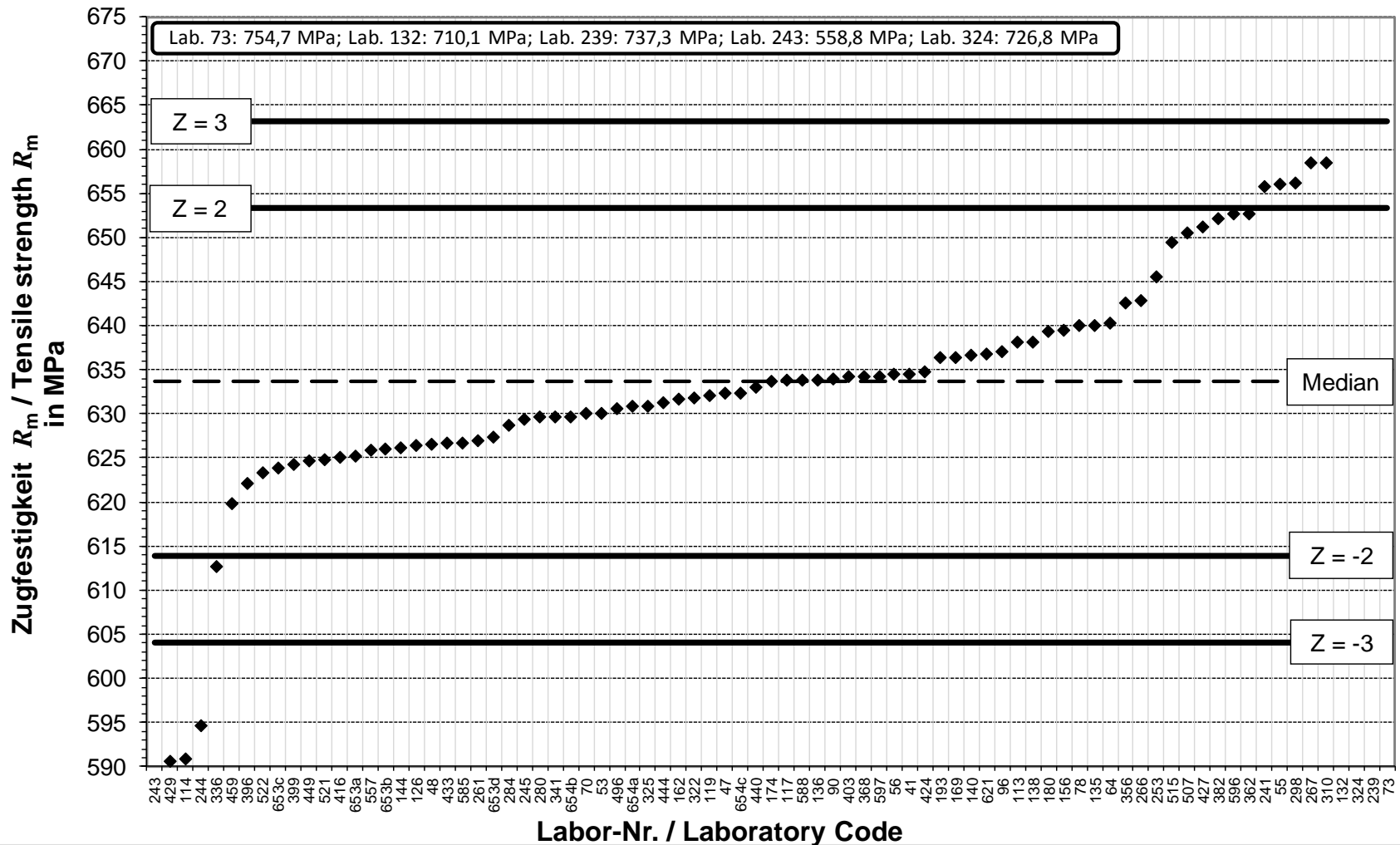
length shall be 5 times the nominal diameter in the case of dispute, A shall be determined manually.

The test piece shall be measured on a gauge of length 100 mm or $2d$ (whichever is greater) and shall be determined manually. See Figure 1.

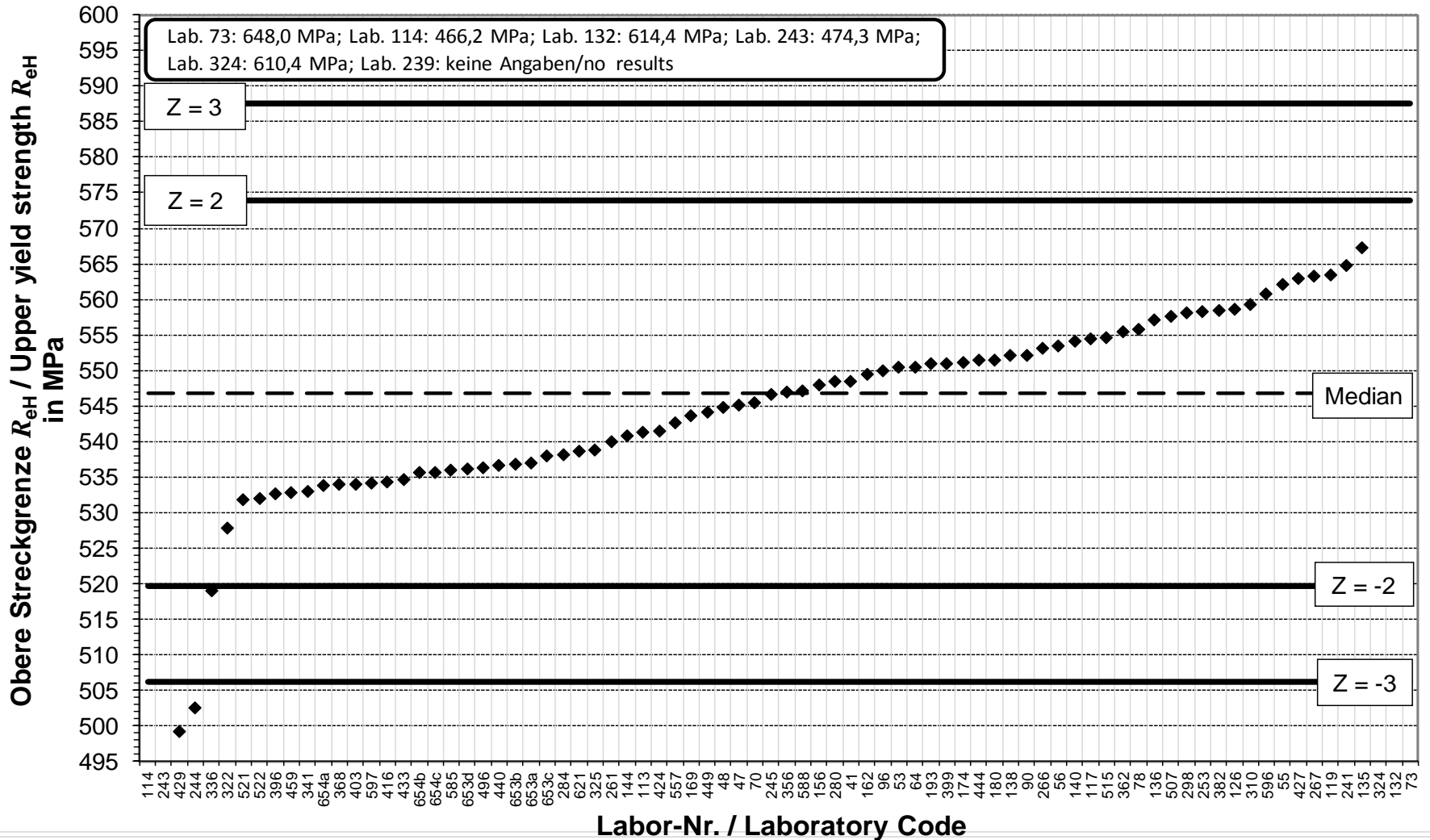
EP 1623: ZV Betonstahl: Results: A_{gt}



EP 1623: ZV Betonstahl: Results : R_m



EP 1623: ZV Betonstahl: Results : R_{eH}



Summary

- It is possible, but laborious to produce homogeneous specimens out of reinforcement steel,
- The evaluation of the value „Elongation“ show room of improvement in relation to rules given by the standard,
- All the other values show comparable results, however they will not be able support or confirm the MLA.



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the international database for
certified reference materials

