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INTER-VERIFICATION OF THE PERSONNEL BY THE STANDARD TEST METHOD ACCORDING TO THE REQUIREMENTS OF THE ISO/IEC 17025:2017 STANDARD

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Abstract

In the Material Testing Laboratory, the standard test methods are applied, for which the verification is carried out. Verification of the methods is achieved through the inter-verification of the personnel and equipment within the laboratory itself, with a mandatory prior calibration of the equipment. The laboratory owns its own reference material with defined characteristics, which is used to control the reproducibility of the standard test method results. This paper provides an analysis of the inter-verification of the personnel on a device for alternating bending according to the method: Metal materials - Wire - Testing by alternating bending SRPS ISO 7801:2011. The results of repeated tests on the mentioned device showed the acceptability of the results with the applied test method.

Keywords: *ISO/IEC 17025:2017, alternating bending device, personnel inter-verification*

1. INTRODUCTION

The Material Testing Laboratory of the Mining and Metallurgy Institute Bor is accredited for testing the metallic materials, with an emphasis on wire testing from the steel ropes for haulage facilities in mining, cable cars, elevators, etc. It complies with the requirements of the new version of the ISO/IEC 17025:2017 standard.

One of the requirements of the standard is under point 7 Process requirements; 7.7 Ensuring the validity of the results; 7.7.1 The laboratory must have a procedure for monitoring the validity of the results. The data obtained must be recorded in such a way that trends are noticeable and where practicable, the statistical techniques must be applied to review the results. This monitoring must be planned, reviewed and must include, where appropriate, but not limited to the following: the use of reference or quality control materials, use of check standards or working standards with control charts, intermediate checks of measuring equipment, repeat tests or calibration using the same or different methods, review of reported results, interlaboratory tests, etc.

In order to meet these requirements, the Laboratory has a plan for inter-validation of equipment and personnel, which in our case is carried out twice a year according to specific instructions for which there are mandatory records. Inter-validations of equipment are performed for all accredited methods within the Material Testing Laboratory [2]. The personnel and equipment competency verification period may be shortened or extended depending on the capability of personnel.

The accreditation body of Serbia checks the accredited laboratories every year to see if they work in accordance with the requirements of the ISO/IEC 17025:2017 standard. There

are also the big risks, and non-compliance of accredited laboratories can lead to the loss of accreditation.

This paper provides an analysis of the inter-validation of the personnel on the device for alternating bending according to the method: Metallic materials - Wire - Testing by alternating bending SRPS ISO 7801:2011

2. EXPERIMENTAL

Inter-verification of the personnel for alternating bending the steel wire is performed according to the method: Metal materials - Wire - Test by alternating bending SRPS ISO 7801:2011 [4], according to the plan and program of verification for six months, in the Material Testing Laboratory.

The own reference material with precisely defined characteristics is used for inter-verification of the personnel: metal wire rope construction 1x37+FC/1-2023, wire thickness: 2.25mm +/- 0.03mm, and nominal tensile strength 1570 N/mm^2.

Testing of the test tube on a device for alternating bending was performed on a manually straightened sample, under the following test conditions:

Radius of cylindrical supports, r (mm):	7.5mm
Bending speed per second:	1
Diameter of a guide opening (mm):	3.0 mm
Distance h (mm):	25 mm
Criterion for test completion:	bending test to break

3. RESULTS AND DISCUSSION

In a function of verification, the reproducibility of the results of test methods, an inter-verification of the personnel and equipment is used according to the prescribed instructions in the Material Testing Laboratory, which is conducted twice a year. The goal is to verify the competence of the personnel, as well as the correctness and precision of equipment, with the prior calibration of the same by verification the results, obtained by the standard test methods. The test results, obtained after one such verification of the standard test method, along with their statistical processing, are shown in Table 1.

Table 1. *Test results of the own reference material samples on the alternating bending device*

Ordinal number	Measured wire diameter d, mm	Number of alternating bends
1	2.26	22
2	2.26	21
3	2.26	22
4	2.26	23
4	2.26	19
6	2.26	20
$\bar{x}$	2.26	21.16
Sr		1.47

The difference between the maximum and minimum values for the obtained number of alternating bends to break (x_{max}- $x_{min,}$), is compared with the critical interval for n=6 tests at the 95% confidence level.

The critical interval is calculated according to the formula 1:

$$CR_{0.95}\ (n) = f(n)\ s_r \quad (1)$$

where:

n – number of repeated tests

s_r – standard deviation

f(n) – factor for critical interval; the values are given in Table 2

Table 2. *Factors for critical interval f(n) [5]*

n	f(n)	n	f(n)	n	f(n)	n	f(n)
2	2.8	14	4.7	25	5.2	37	5.4
3	3.3	15	4.8	26	5.2	38	5.5
4	3.6	16	4.8	27	5.2	39	5.5
5	3.9	17	4.9	28	5.3	40	5.5
6	4.0	18	4.9	29	5.3	45	5.5
7	4.2	19	5.0	30	5.3	50	5.6
8	4.3	20	5.0	31	5.3	60	5.8
9	4.4	21	5.0	32	5.3	70	5.9
10	4.5	14	4.7	33	5.4	80	5.9
11	4.6	22	5.1	34	5.4	90	6.0
12	4.6	23	5.1	35	5.4	100	6.1
13	4.7	24	5.1	36	5.4		

For n=6, the factor for critical interval is 4.0.

If the calculated critical interval is greater than the difference between the maximum and minimum test values (x_{max}- $x_{min,}$), the results of the test method are acceptable.

For this standard test method, by sample testing of own reference material, by alternating bending, the obtained results are:

Critical interval $CR_{0.95}\ (n) = f(n)\ s$	4 *1.47 = 5.88
Conclusion	(x_{max}- x_{min}) = 23 - 19= 4 The calculated critical interval is greater than the difference between the maximum and minimum determination values (x_{max}- x_{min}), confirming the acceptability of the results obtained by the applied test method.
	5.88 > 4

4. CONCLUSION

Applying the ISO/IEC 17025:2017 standard, the Material Testing Laboratory has a procedure to ensure the validity of the results. The procedure includes an inter-validation of the equipment and personnel for the device for alternating testing of metallic materials, regardless of the fact that the equipment is not subject to calibration.

This paper provides an analysis of the inter-validation of the personnel on the device for alternating bending according to the method: Metallic materials - Wire - Testing by alternating bending SRPS ISO 7801:2011. The own reference material with precisely defined characteristics is used for reproducibility of the results

The results of repeated tests show that the calculated critical interval is greater than the difference between the maximum and minimum test values (x_{max}- $x_{min,}$), what confirms that the results of the applied test method are acceptable.

The presented analysis shows that according to the requirements of the ISO/IEC 17025:2127 standard, the executor (technician) is competent to perform testing the metal materials on the device for alternating bending using the given method, thus confirming the competence of the Laboratory for this type of testing.

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